WILDLIFE AND HABITAT BASELINE STUDY FOR THE PROPOSED VANTAGE WIND POWER PROJECT, KITTITAS COUNTY, WASHINGTON

FINAL REPORT

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Invenergy

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1.0 INTRODUCTION

Invenergy, LLC is evaluating the feasibility of expanding wind power development in Kittitas County, Washington (Figure 1a). The Vantage Project will be south of the existing Wild Horse Wind Power Project, approximately 4 miles west of Vantage and north of Interstate 90, and is proposed to produce approximately 100 megawatts (MW). At this time, GE Wind Energy (GEWE) 1.5sle 60Hz wind turbines with a 1.5 MW power output are planned for this project. These GEWE turbines have a 77 meter rotor swept area (RSA), with a rotor hub height minimum and maximum of 65 and 85 meters, respectively; height dependent upon topographic wind capture advantage.

To predict project impacts on wildlife, Invenergy, LLC contracted Western Ecosystems Technology, Inc. (WEST) to conduct a wildlife and habitat baseline study. Study protocols were developed based upon WEST's experience with wildlife-wind turbine interactions at projects throughout the U.S. Additionally, protocols were developed by utilizing information collected at the Wild Horse Wind Project, and the information presented in the Critical Issues Analysis (Tetra Tech 2006). The Washington Department of Fish and Wildlife (WDFW) reviewed these protocols in January 2006 and slight modifications were made in early February 2006. The following document contains results of the 2006 baseline study, and an assessment of anticipated impacts to wildlife.

Overview of the Baseline Studies

The principal objectives of the baseline study for this proposed wind project are to: (1) document raptor nest density and location; (2) describe occurrence of any federal and state threatened, endangered, proposed, candidate, or sensitive-status fauna or flora and their potential habitat that may be affected by the project; (3) describe habitat types/ecotones in the general project area; (4) estimate any potential impacts to habitat and wildlife that could result from the construction and operation of the proposed wind energy project, and (5) identify potential project design and/or mitigation measures that could reduce negative impacts.

In addition to site-specific data, the baseline study uses existing information and results of studies conducted at other wind plants in the region. Data collected at existing wind plants have greatly enhanced the ability to estimate potential bird and bat mortality at proposed wind plants. For several wind power projects, standardized baseline data on avian use, raptor nesting, and habitat information have been collected in association with standardized post-construction (operational) monitoring, allowing comparisons of avian use to mortality. Additional information about species occurrence, or likely occurrence, in the vicinity of the proposed wind project was obtained from available agency databases and personal communications with wildlife agency personnel.

The Vantage study consisted of the following research components: 1) winter eagle surveys, 2) seasonal avian use surveys, 3) raptor nest surveys, 4) Federal and State sensitive wildlife and wildlife habitat surveys, 5) rare plant surveys, 6) vegetation and habitat mapping, 7) sage grouse surveys, and 8) general wildlife observations.

2.0 STUDY AREA

The project site is located in central Washington's Kittitas County, between the towns of Kittitas and Vantage (Figure 1a). More specifically, the project will be built on the open hills south of Whiskey Dick

Mountain, located approximately 10 miles east of Kittitas and immediately south of the Old Vantage Highway.

The project area is located within the Columbia Basin physiographic province, which lies within the rain shadow of the Cascade Range. The province is characterized by semi-arid conditions, with low precipitation, warm-to-hot dry summers, and relatively cold winters. Average annual temperature in the project area is approximately 47^{o}F and average annual precipitation is approximately 9 inches, of which 1.3 inches typically occurs from June through August (Franklin and Dyrness 1988). The site features moderate topographic relief and ranges in elevation from 400 to 6,864 feet (Figure 1b). Few intermittent/ephemeral drainages convey runoff from the site, and only one spring and seasonal shallow wetland appear to provide any water resource.

3.0 METHODS

3.1 Winter Eagle Driving Surveys

Driving transects to evaluate the numbers of wintering bald eagles and other birds and their movements in the project area were initiated in mid-February, 2006 and continued through early April. Surveys were conducted by driving and counting bald eagles, and other large birds along the old Vantage highway and local roads within the project area; ATV use was required occasionally. Surveyors drove a pre-determined route weekly, alternating between starting and ending locations. Surveys along the Columbia River from the town of Vantage and three and half miles south near the river were also conducted as part of the route. Surveys were conducted in the morning and evening hours, alternating each week.

If bald eagles or other species of interest were sighted (e.g., golden eagles, elk), they were assigned an observation number and GPS coordinates, distance, and direction to observation were recorded. Habitat, activity, and time of day were also recorded for each observation. Flight paths of eagles were mapped for as long as the bird was visible on 1:24:000 USGS quadrangle maps. Perch sites and evening roost sites were recorded if found. Bald eagles were recorded as adult or subadult, and juvenile if possible. Survey start and end locations, and total time spent surveying was also recorded.

3.2 Fixed-Point Surveys

The primary objectives of the fixed-point surveys are to (1) quantify and compare the general level of bird utilization and species composition within the project area with similarly collected information at nearby and other projects in the region for the purpose of predicting impacts, and (2) provide spatial and temporal information on avian use and compare with existing information on bird use to aid in siting facilities within the wind power project. Point counts (variable circular plots) were conducted on the project and reference areas using methods described by Reynolds *et al.* (1980). The points were selected to survey representative habitats and topography of the study site while also providing relatively even coverage with minimal overlap of surveyed area. All birds seen during point counts were recorded. Raptors and other large birds, species of concern, and species not previously seen on site that were observed between point counts were recorded; coordinates derived from GPS were also noted for species of concern.

Survey Plots

Eight plots were surveyed weekly for a year, each consisting of a 2,625-ft (800-m) radius circle centered on an observation point location (Figure 2). Landmarks and topographic map features were located to aid in identifying the 2,625-ft (800-m) boundary of each observation point. Observations of birds beyond the 2,625-ft (800-m) radius were recorded, but these observations were not included in standardized use estimates. Survey period at each point was 20 minutes long. All raptors and other large birds observed during the survey were assigned a unique observation number and plotted on a topographic map of the survey plot (Appendix B). Date, time, and weather information such as temperature, wind speed, wind direction, and cloud cover were recorded for each survey. Species, number of individuals, sex and age class (if identification was possible), distance from plot center when first observed, closest distance, height above ground, activity (behavior), flight direction, and habitat(s) were recorded for each bird observed. Flight or movement paths were mapped for all raptors and large birds and given the corresponding unique observation number. This mapped information, such as point of first observation and later flight path, was digitized for describing spatial use of the site.

Four instantaneous counts for raptors and large birds were made during each observation period. Instantaneous counts were made at the beginning and end of the observation period with two additional counts in between at quarterly intervals. An instantaneous count consists of a summary of birds present in and near the plot at a particular time. During the instantaneous count, the observer scanned the full survey plot recording all birds seen at that moment. For each raptor/large bird seen during an instantaneous count, the approximate height above ground and distance to the observer were recorded.

The behavior of all birds observed and the habitat in or over which the bird occurred was recorded. Behavior categories recognized include perched, soaring, flapping, flushed, circle soaring, flap/hover, gliding, and other (noted in comments). Habitats were recorded as winter wheat, stubble, plowed, riparian, deciduous tree or shrub, coniferous tree, sagebrush, shrub steppe, grassland, rock/rock outcrop, and other (noted in comments). Approximate flight height at first observation was recorded to the nearest meter or 5-meter increment and the approximate lowest and highest flight heights observed were also recorded. Any comments or unusual observations were noted in the comments section.

Observation Schedule

Sampling intensity was designed to document avian use and behavior by habitat and season within the project area. Surveys were conducted weekly from mid-March 2006 through mid-March 2007. Seasons are defined as spring, March 15 - May 31; summer, June 1- August 14; fall, August 15-October 31; and winter, November 1-March 14. Surveys were conducted during daylight hours and survey periods were varied to approximately cover all daylight hours during a season. To the extent practicable, each station was surveyed about the same number of times each season; however, the schedule varied in response to adverse weather conditions (e.g., fog), which may have caused delays and/or missed surveys.

Statistical Analysis

Species lists were generated by season including all observations of birds detected regardless of their distance from the observer. The number of birds seen during each point count survey was standardized to a unit area and unit time surveyed. The standardized unit time was 20 minutes and the standardized unit area was 0.78 mi^2 (2.01 km^2) (i.e., a 2,625 ft (800m) radius view-shed for each station). For example, if four raptors were seen during the 20 minutes at a point with a viewing area of 0.78 mi^2 (2.01 km^2), these data may be standardized to 4/0.78 = 5.13 raptors/mi^2 (1.98 raptors/km^2) in a 20-minute survey. For the standardized avian use estimates, only observations of birds detected within 2,625 ft (800m) of the observer were used. Estimates of avian use (expressed in terms of number of birds/plot/20-minute survey) were used to compare differences in avian use between 1) avian groups and 2) seasons.

Avian Diversity and Richness

The total number of species was calculated by season. The mean number of species observed per survey (i.e., per station per 20-minute survey) was tabulated to illustrate and compare differences in mean number of species per survey between seasons.

Avian Flight Height/Behavior

The flight height recorded was used to estimate percentages of birds flying below, within and above the rotor swept area (RSA). The zone of collision risk used was 82-446 ft (25-136 m) above ground level (AGL).

Avian Exposure Index

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

$$R = A*P_f*P_t$$

Where A = mean relative use for species *i* (observations within 2,625 ft (800 m) of observer) averaged across all surveys, P_f = 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 = proportion of all flight height observations of species *i* within the zone of collision risk. This index does not account for differences in behavior other than flight characteristics (i.e., flight heights and percent of birds observed flying), does not account for the ability of birds to successfully pass through the rotor, and P_t is an overestimate of the proportion of flight heights within the true zone of collision risk, since it uses the maximum lower and upper end of the possible rotor heights for different turbine and tower characteristics.

Avian Flight Patterns and Behavior

Maps of flight paths of raptors and other species of concern were generated to illustrate patterns in flight paths and behaviors.

Data Compilation and Storage

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

Quality Assurance/Quality Control (QA/QC)

QA/QC measures were implemented at all stages of the study, field surveys, data entry, and during data analysis and report writing. At the end of each survey day, each observer was responsible for inspecting his or her data forms for completeness, accuracy, and legibility. Periodically data forms were reviewed by others to ensure completeness and legibility; any problems detected were corrected. Any changes made to the data forms were initialed and dated by the individual making the change.

A sample of records from the electronic files was compared to the raw data forms and any errors found were corrected. Any irregular codes detected, or any data suspected as questionable, was discussed with the observer and study team leader. All changes made to the raw data were documented for future reference. Any errors or suspect data identified in later stages of analysis were traced back to the raw data forms, and appropriate changes in all steps made.

3.3 Rare Plant Surveys

Rare plant surveys were conducted by trained botanists during peak flowering and/or fruiting periods when target species are best identified. Study corridors included proposed turbine strings and a 164-ft (50-m) buffer, based upon an April 2006 facility layout which lacked access roads, collector lines, substation, O&M facility, and laydown areas. During the survey, botanists followed meandering transects, effectively zigzagging back and forth across the survey corridor. Botanists maintained a list of all vascular plants encountered, and made informal collections of unknown species for later identification using *Flora of the Pacific Northwest* (Hitchcock and Cronquist 1973). Additional information collected included general plant associations, land use patterns, unusual habitats, and photographs of habitat types and representative individual plants.

Target Species

For the rare plant survey, the target species included all plant taxa listed as 'Endangered' or 'Threatened' by the U.S. Fish and Wildlife Service (USFWS) under the Endangered Species Act (ESA) that potentially occur in the project area. In addition, taxa that have been formally proposed or are candidate species for federal listing, or taxa listed as 'species of concern' that potentially occur within the project area were also considered as target species. The 'species of concern' status is an unofficial status for species that appear to be in jeopardy, but information is insufficient to support listing. Target species also included all plant taxa defined as 'Endangered', 'Threatened', 'Sensitive', Review', or 'Extirpated' by the Washington Natural Heritage Program (WHNP) that potentially occur within the project area. The WHNP, part of the WDNR, maintains the most complete database available for state-listed species. Taxa meeting the above criteria were targeted by the investigation to determine their presence or absence within the study area. Determinations of status for rare plant species were based on information provided by the USFWS and the WNHP's list of tracked plant species (WNHP 2005a).

Prefield Review

As part of the investigation, a review of available literature and other sources was conducted to identify the rare plant species potentially found within the project area. As per Section 7(c)(1) of the ESA, a letter was sent to the USFWS requesting a list of federally listed taxa that have potential to occur within the project area. In addition, the WNHP was contacted to obtain element occurrence records for any known rare plant populations in the project vicinity. To supplement the information provided by the above agencies, a number of other sources were consulted. These sources provided additional information such as habitat preferences, morphological characteristics, phenologic development timelines, and species ranges. Sources included taxonomic keys and species guides (USFWS, 2001; Cronquist et al. 1977; Hitchcock and Cronquist, 1973) and online databases of common and rare plant species (WHNP 2005b; USDA, 2006).

Using data collected during the pre-field review, a list of rare plant species potentially occurring in the project area was compiled (Table 1). Habitat preferences and identification periods were derived from the literature for each potential species. Using this information, along with topographic maps of the project area, a field survey plan was developed to guide the timing and intensity of the field surveys.

Field Investigation

Pedestrian surveys for rare plant species were conducted on April 27 and from June 10-14, 2006. Surveys were performed by qualified WEST botanists, including Kurt Flaig, Susan Komarek, and Jay Jeffrey. The surveys were timed to locate as many target species as possible, particularly those most likely to occur in the affected habitats (sagebrush steppe and grassland). The survey was accomplished by conducting meander pedestrian transects, zigzagging back and forth across the survey corridor. The intensity of the pattern, and the speed at which the surveyor walked, was variable, and depended upon the structural complexity of the habitat, the visibility of the target species, and the probability of sensitive species occurrence in a given area. In habitats of low visibility with a high probability of sensitive species occurrence, a tighter grid pattern was walked. Care was taken to thoroughly search all unique features and habitats encountered with high probability of occurrence of sensitive species. A GPS unit showing the survey boundaries and turbine locations was used for navigation, in addition to aerial photographs and 7.5' U.S.G.S topographic maps of the site. A list of vascular plant species encountered during the rare plant surveys was maintained (Appendix A).

3.4 Habitat Mapping

Vegetation in the Project area was mapped according to "habitat types," which are considered to be generally recognizable assemblages of plant species that occur in a pattern across the landscape. Habitat types were determined based on visual assessment of dominant plant species. Commercially available black and white high-resolution digital aerial photography was used for the habitat mapping. The habitat types were mapped during the spring and early summer of 2006. Initially, roads in and around the Project area were driven in order to correlate habitat types with the signature (color, shading, texture) on the aerial photos. Each habitat type was mapped based on either visual observation of the habitat from a road or high point, or by walking the boundaries of the habitat. Due to the scale of the aerial photos used, fine-scale intermingling in transition areas and small inclusions of one habitat type within another was not be shown. Available literature on the vegetative communities of eastern Washington was consulted during development of the habitat map. The mapped boundaries of each habitat type was digitized using ArcView™.

3.5 Raptor Nest Surveys

The search for raptor and large bird nests within the Project area included an approximate 2-mile buffer (Figure 1c and 5). Surveys were conducted from a helicopter with one observer on 25 March, 2006. Search paths were recorded with a real-time differentially-corrected Trimble Trimflight III Global Positioning System (GPS) at 5-second intervals; coordinates as Universal Transverse Mercator, UTM, NAD27. In addition to raptor nests, other notable wildlife observations were made.

Nest searches were conducted by searching habitat suitable for most aboveground nesting species, such as cottonwood, ponderosa pine, tall shrubs, and cliffs or rocky outcrops. During surveys, the helicopter was flown at an altitude of tree-top level to approximately 250 ft (76m) aboveground. If a nest was observed, the helicopter was moved to a position where nest status and species present 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. Those distances varied depending upon nest location and wind conditions. Data recorded for each nest location included species occupying the nest, nest status (inactive, bird incubating, young present, eggs present, adult present, unknown or other), nest substrate (pine, oak, cottonwood, juniper, shrub, rocky outcrop, cliff or power line), number of young present, time and date of observation and the nest location (recorded with both a handheld GPS and the differentially-corrected unit).

3.6 Threatened, Endangered, and Sensitive (TES) Species

A list of state and federally protected species that potentially occur within the project area was generated to assess the potential for impacts to these species (Table 2). Species were identified based on the WDFW Species of Concern list, which includes state listed endangered, threatened, sensitive and candidate species; and the USFWS, Central Washington Ecological Services office list of Endangered, Threatened, Proposed, Candidate and Species of Concern for Kittitas County.

Information about occurrence of these species in the Project area is based largely on the following resources:

- Habitat mapping and predicted distribution from Washington State Gap Analysis Program (GAP) project;
- WDFW Priority Habitats and Species (PHS) records for the project area and a buffer or approximately 5 miles;
- Washington Natural Heritage Program (WNHP)
- Breeding Bird Atlas of Washington State, Location Data and Predicted Distributions (Smith et al. 1997);
- Baseline field studies being conducted on site (this report); and
- Other published literature where available.

TES species surveys focused on shrub-steppe obligate species such as sage sparrow, sage thrasher, burrowing owl, sage grouse, and white-tailed and black-tailed jackrabbits. Areas within 305 meters (1000 feet) of the centerline of the proposed turbine corridors were surveyed for special status/sensitive wildlife two times between May 1 and June 30, 2006. Surveys consisted of walking transects spaced approximately 50 meters apart, and were conducted from dawn to no later than 12:00 PM with wind speeds not consistently exceeding 15 MPH. Surveys were rotated among proposed turbine areas so that at least one or two of the visits occurred before 9:00 AM. All sage grouse and sage grouse scat, if any, were recorded as to location and condition. All observations were recorded using GPS and/or 1:24,000 scale topographic maps and later mapped using GIS. Notes on habitat and condition were also recorded. Observations of other wildlife such as amphibians, reptiles, small mammals, and raptors were also recorded.

3.7 Sage Grouse Surveys

LEKS

Sage grouse lek surveys follow methods used at the Yakima Training Center (YTC).

Ground: Four ground surveys were conducted from 5 March through 15 April, 2006. Routes were established along existing roads within the project in conjunction with eagle driving surveys. An observer drove the route and stopped every half-mile or less to search the surrounding area with binoculars while listening for displaying grouse. A parabolic mic was used to aid in audible detection. Optics utilized were binoculars with a power of 10 and spotting scopes with power of no less than 32. Surveys were conducted during a half-hour before sunrise to 1.5 hours after sunrise. Surveys were conducted without precipitation, winds ≤ 15 mph, and visibility ≥ 5 miles.

Aerial: One helicopter survey was conducted on 25 March, 2006, after coordinating with YTC survey results (i.e., conducted survey when YTC active lek attendance was high). The survey was conducted at no greater than 40 feet above- ground and at an approximate speed of 40 MPH. The helicopter was flown along transects spaced no greater than 1/8 mile in potential habitat within 2 miles of the project area (Figure 1c). However, transects were deviated from in order to thoroughly survey areas that appeared more suitable to lekking grouse (e.g., Figure 5).

Nesting and Brood Rearing

Sensitive species walking surveys (see section 3.6 methods above) were used for documenting presence or absence of sage grouse using the Project area for nesting and brood-rearing. In addition to May and June surveys, one additional sage grouse survey was conducted in mid-July focusing on brood detection. General assumptions are as follows: mid to late March is peak female attendance at leks, nesting and incubation is 3-4 weeks from peak, mean hatch date is around May 28-June 1, brood-rearing is approximately 10 weeks from hatch, and successful broods disperse around 600 meters during the brood-rearing period (Connelly et al. 2004). Weather patterns may shift these general dates by a few weeks.

3.8 Incidental/In-transit Wildlife Observations

All wildlife species of concern, uncommon species, and big game observed while field observers were conducting various surveys were recorded on incidental/in-transit data sheets. Data recorded with incidental observations included GPS coordinates, observation number, date, time, species, number, sex/age class, height above ground, and habitat.

4.0 RESULTS

4.1 Eagle Use Study

Species Observed

Eight surveys were conducted between February 17 through April 7, 2006. Five AM surveys were conducted between February 17 and March 29 in order to capture the survey window for potential lekking behavior by sage grouse. Three PM surveys were conducted March 8, 24, and April 7. Bald eagle(s) were observed during every survey on the Columbia River, but none were observed on site or anywhere between the site and the Columbia River eagles. Except for one subadult/juvenile bald eagle, all river observations were of one or both of two adults documented nesting and incubating in a tree south of Vantage (Figure 4; description below). One adult golden eagle was observed perched on rock outcrop of Hult Butte on March 1 and March 16, 2006, prior to installation of a meteorological tower. Other incidental eagle observations are noted in section 4.8.

Nesting Activity

WDFW was notified on March 6, 2006, stating that nesting activity had been observed:

*"…On the first date I observed an adult BAEA on a large nest in a poplar tree on the Columbia River shore (maps attached), a little later I noted a second adult perched within 15 meters of this location. At this time I was uncertain if this may have not been a scavenged great horned owl or red-tailed hawk nest. On the second survey date I again observed an adult BAEA on the nest with a second adult perched within 30 meters of the nest. Later the same day when driving past after completing the survey route, an adult BAEA was observed flying to and landing on the nest with nesting material (twigs in talons). We are conducting winter eagle driving surveys weekly through early April. I will be out there again later this week. I don't know if this is a historic nest that you already know about, if it has been successful in the past, or if it is a new nesting effort. I do know that the Ellensburg Boat Club has their boat ramp just south of I-90, and that the nest area may receive other disturbance by anglers or recreational boaters. Therefore, WEST and INVENERGY thought it important to contact you ASAP. The potential nest location is approximately 6.75 miles east of the nearest *proposed* wind turbine string (map attached)…."*

4.2 Avian Use Study

Species Abundance and Composition

A total of 59 avian species were identified during the avian point count surveys, aerial raptor nest survey, in-transit travel, and incidentally while conducting other field tasks at the Project site (Table 3 and Table 17). Forty-six species of birds were observed during point count surveys at the 8 stations. Over the course of the study, 843 groups comprised of 1,893 individual birds were recorded. The numbers of birds observed by species are presented in Table 4; only those within the circular survey plot were used to statistically derive use and composition estimates. The number of species observed was higher in the spring (29) than in fall (28), summer (20), or winter (19) (Table 5). Avian richness (defined as number of species per survey) was higher in the summer (3.73) than in spring (3.23), winter (1.56), or fall (1.49) (Table 5). The mean number of birds observed per survey was much higher in the spring (10.86) than in summer (9.23), winter (5.05), or fall (3.83) (Table 5). High spring use was primarily due to large numbers of horned larks (61 groups of 203 individuals) as well as white-crowned sparrows (5 groups of 141 individuals).

In winter, passerines were the most abundant group (3.77/survey), followed by waterbirds (0.96), upland gamebirds (0.17) and raptors (0.15) (Table 6). Similarly, passerines comprised 74.6% of all birds observed, followed by waterbirds (18.9%), upland gamebirds (3.38%), and raptors (2.93%). Avian groups most frequently occurring were passerines (77.76% of surveys), raptors (13.64%), buteos (5.68%), and falcons (5.68%) (Table 6). Species with the highest use in winter were horned lark (1.99/survey), common raven (1.06), unidentified duck (0.682), Canada goose (0.273), European starling (0.218), California quail (0.17), and black-billed magpie (0.148) (Table 7). American kestrel was the most abundant raptor species in the winter (0.057/survey), followed by red-tailed hawk (0.034), rough-legged hawk (0.034), bald eagle (0.011) and golden eagle (0.011) (Table 7). Individual species most frequently observed during winter surveys were horned lark (38.6% of surveys), European starling (6.98%), northern shrike (6.82%), sage sparrow (6.82%), and western meadowlark (4.55%) (Table 8).

In spring, passerines were the most abundant group (10.54/survey), followed by raptors (0.29) and buteos (0.20) (Table 6). Passerines comprised 96.43% of all birds observed, followed by raptors (2.63%) and buteos (2.63%). Avian groups most frequently occurring were passerines (96.43% of surveys), raptors (21.43.%), buteos (14.29%), and other birds (3.57%). Species with the highest use in spring were horned lark (3.63/survey), white-crowned sparrow (2.52), mountain bluebird (0.911), Brewer's sparrow (0.750), sage thrasher (0.68) and sage sparrow (0.52) (Table 7). Red-tailed hawk was the most abundant raptor species in the spring (0.16/survey), followed by golden eagle (0.04), rough-legged hawk (0.04), northern harrier (0.02), prairie falcon (0.02), and sharp-shinned hawk (0.02). Individual species most frequently observed during spring surveys were horned lark (85.7% of surveys), sage thrasher (46.4%), sage sparrow (32.1%), common raven (30.4%), Brewer's sparrow (26.8%), vesper sparrow (16.1%), and red-tailed hawk (10.7%) (Table 8.

In summer, passerines were the most abundant group (8.74/survey), followed by raptors (0.40), buteos (0.23) and falcons (0.15) (Table 6). Passerines comprised 94.74% of all birds observed, followed by raptors (4.32%), buteos (2.52%), and falcons (1.58%). Avian groups most frequently occurring were passerines (97.6% of surveys), raptors (25.3%), buteos (19.5%), upland gamebirds (6.55%), and northern harriers (6.25%). Species with the highest use in summer were horned lark (3.78/survey), Brewer's sparrow (1.32), sage thrasher (0.96), sage sparrow (0.90), unidentified sparrow (0.39), common raven (0.28), red-tailed hawk (0.23), and western meadowlark (0.21) (Table 7). Red-tailed hawk was the most abundant raptor species in the summer (0.23/survey), followed by American kestrel (0.13), northern harrier (0.02), and prairie falcon (0.02). Individual species most frequently observed during summer surveys were horned lark (81.9% of surveys), sage thrasher (62.8%), Brewer's sparrow (54.5%), sage sparrow (45.8%)and common raven (19.4%) (Table 8).

In fall, passerines were the most abundant group (3.53/survey), followed by waterbirds (0.96), upland gamebirds (0.17), raptors (0.14) and falcons (0.08) (Table 6). Passerines comprised 92.12% of all birds observed, followed by raptors (3.53%), upland gamebirds (2.72%), and falcons (2.17%). Avian groups most frequently occurring were passerines (86.46% of surveys), raptors (10.42%), falcons (7.29%), and upland gamebirds and doves/pigeons (3.13%). Species with the highest use in fall were horned lark (2.68/survey), white-crowned sparrow (0.30), Brewer's sparrow (0.13), California quail (0.10), and American kestrel (0.07) (Table 7). American kestrel was the most abundant raptor species in the summer (0.07/survey), followed by red-tailed hawk (0.02), Cooper's hawk (0.01), northern harrier (0.01), prairie falcon (0.01), and sharp-shinned hawk (0.01). Individual species most frequently observed during fall surveys were horned lark (76.0% of surveys), white-crowned sparrow (11.5%), Brewer's sparrow (9.38%), and American kestrel (6.25%) (Table 8).

Flight Behavior

During the study, 352 flocks comprised of 1,067 birds were observed flying during point count surveys (Table 9). For all species combined, 80.8% of all flying birds observed were below the rotor-swept height (<25 m), 19.1% were within the rotor-swept height (25 – 125 m), and 0.09% were above the rotor-swept height (>125 m) (Table 9). For groups with at least 10 observations of flying flocks, those most often observed flying within the turbine rotor-swept height were buteos (73.9%), raptors (53.1%), falcons (35.7%), and passerines (9.52%). For all flying raptors combined, 53.1% were observed flying within the rotor-swept height. For identified species with at least 10 observations of flying flocks, those most often observed at rotor-swept heights when flying were red-tailed hawk (85.7%), common raven (39.4%), black-billed magpie (21.0%), and horned lark (5.4%) (Table 10).

Turbine Exposure Index

Based on our exposure index, species with the highest probability of turbine exposure were unidentified duck (0.21), common raven (0.13), horned lark (0.09), Canada goose (0.08), red-tailed hawk (0.04), and unidentified passerine (0.03) (Table 11). This analysis may provide insight into what species might be the most likely turbine casualties. However, this index only considers relative probability of exposure based on use, proportion of daily activity budget spent flying, and flight height of each species. It does not take into consideration varying ability among species to detect and avoid turbines, habitat selection, and other factors that may influence exposure to turbine collision; therefore, the actual risk may be lower or higher than indicated by these data. For example, in the Altamont Pass WRA in California, mortality among the five most common species was not related to their abundance. American kestrels, red-tailed hawks, and golden eagles were killed more often than predicted based on abundance and turkey vultures and common ravens were killed less often (Orloff and Flannery 1992). Similarly, at the Tehachapi Pass WRA in California, common ravens were found to be the most common large bird in the WRA, yet no fatalities for this species were documented during intensive studies (Anderson et al. 1996).

Spatial Use by Raptors

Raptor use was similar across sample stations except station 8 which had slightly higher use (Figure 9a). This is in part attributed to higher American kestrel use at this location (Figure 9f). Nearby telephone poles and lines may have provided additional perching opportunities thereby increasing use at this station. The few eagle observations exhibited no topographic affinity or use of slope updrafts for hunting, and appeared to be just traveling through the area. Buteo and falcon use was widespread across the project (Figures 9d and 9f, respectively). No observations were made of eagles or other raptors using a particular area of the project for scavenging of livestock remains or garbage near the county dump area. Other spatial use by raptors by survey station may be found in Figures 9a-g. In general, raptor use was widespread and exhibited no affinity to any given landscape feature.

4.3 Habitat Mapping

Seven habitat classifications were delineated within development corridors of the project: shrub-steppe dense (2147.1 acres), shrub-steppe moderate (1428.0 acres), shrub-steppe sparse (1501.4 acres), bunchgrass grassland (106.0 acres), lithosol (79.5 acres), lithosol/shrub-steppe sparse (111.8 acres), and developed (109.3 acres) (Figure 6). The project area is located within the Columbia Basin physiographic province, which lies in the rain shadow of the Cascade Range. The province is characterized by semi-arid conditions, in which the majority of precipitation occurs during the relatively cold winters. As a result of these climatic conditions, shrub-steppe is the primary habitat that evolved in the region.

Shrub-steppe habitat within the project development area was classified using three categories based on relative spatial density of the shrub layer, including dense, moderate and sparse. Habitat mapped as shrub-steppe dense was composed of shrub cover greater than 60 percent, shrub-steppe moderate featured between 30 and 60 percent shrub cover, and shrub-steppe sparse habitat supported less than 30 percent shrub cover. In general, areas with a dense shrub layer occurred on slopes and flats with deep soils and were dominated by big sagebrush and some antelope bitterbrush. Areas supporting moderate shrub cover were found in similar topographic positions but typically featured slightly shallower soils. These areas were dominated by big sagebrush and stiff sagebrush. Shrub-steppe sparse habitat typically occurred on shallower soils on ridgetops and knolls and was composed of stiff sagebrush and various buckwheats (Figure 6). Bunchgrass grassland habitat featured few to no shrub species and was dominated by bunchgrasses including bluebunch wheatgrass (*Pseudoroegneria spicatum*), Sanberg's bluegrass (*Poa secunda*), needle-and-thread grass (*Hesperostipa comata*), and Idaho fescue (*Festuca idahoensis*).

Lithosol and lithosol/shrub-steppe sparse communities were mapped along many of the exposed ridgetops and knolls within the project site. These communities occur on shallow, rocky substrates and feature floristically unique vegetation communities. Within the project site, the two communities were composed of a variety of buckwheats (*Eriogonum* spp.), lomatiums (*Lomatium* spp.), stiff sagebrush (*Artemisia rigida*), purple sage (*Salvia dorrii*), antelope bitterbrush, Hood's phlox (*Phlox hoodii*), and several of the grass species listed above. The lithosol/shrub-steppe sparse community differed only in that it supported a greater percentage of stiff sagebrush and big sagebrush. In addition, hedgehog cactus (*Pediocactus simpsonii* var. *robustior*), a Washington State 'Review' list species, was encountered within many of the areas mapped as lithosols.

One area in the northwestern portion of the project site where the county landfill and radio facility occur was mapped as developed (Figure 6).

4.4 Rare Plant Surveys

No USFWS or Washington State Endangered, Threatened, Proposed, or Candidate plant species were encountered during the field surveys. One plant species on the Washington State 'Review' list, hedgehog cactus, was detected in the survey area. Species on the review list are of potential concern within the state, but are in need of additional field work before a status can be assigned. The Review designation carries no legal requirement for protection; however, WNHP personnel are interested in tracking occurrences of Review species to aid in the assignment of status. A total of 7 subpopulations of hedgehog cactus were found within the project site (Figure 6). All of the subpopulations occurred in lithosol habitats, and were typically observed along the rim of ridgetops and knolls throughout the site. Associated species observed with the cactus, comprising relatively low vegetation cover, included stiff sagebrush, big sagebrush, round-headed desert buckwheat, buckwheat, and Sandberg's bluegrass. Subpopulations ranged in size from 10 to 50 individuals, and were composed of plants growing individually or in clumps of up to six individuals. The majority of the plants encountered were either in flower or fruit. A list of all vascular plant species observed and identifiable during the rare plant surveys is included in Appendix A.

4.5 Raptor Nest Surveys

Three active red-tailed hawk nests, a great-horned owl, and a common raven nest were observed during the aerial surveys (Figure 5). Raptor nest density for this project is 0.05/mi^2. This is much lower than almost all other wind facilities with similar open landscapes (Table 15). The common raven nest is close to a proposed turbine string, located in a radio facility tower. None of the raptor nests will be impacted by the proposed project.

4.6 Threatened, Endangered, and Sensitive (TES) Species

The USFWS lists 30 wildlife species as threatened or endangered within the state of Washington. Of these, 6 are terrestrial wildlife species and occur within Kittitas County including marbled murrelet, northern spotted owl, grizzly bear, bald eagle, gray wolf, and Canada lynx. Of these 6, only the bald eagle is likely to occur within the vicinity of the Vantage project site (Erickson et al. 2003). Although the bald eagle was recently delisted under the Endangered Species act, it is still addressed in section 5.9. Furthermore, the State of Washington lists 36 threatened or endangered wildlife species. Of these, the ferruginous hawk (*Buteo regalis*) and greater sage-grouse (*Centrocercus urophasianus*) are the only species recently documented to occur in the vicinity of the Vantage project site (Erickson et al. 2003). Several other sensitive status species have the potential to occur on the project area (Table 2).

Development corridors were surveyed twice between 23 May and June 16, 2006. A third survey was conducted on 23-26 July, 2006, primarily focused on sage grouse detection. During the May-June period, 94 sage thrashers (45 first survey), 90 sage sparrows (50 first survey), 6 loggerhead shrikes (4 first survey), and 4 white-tailed jack rabbits were observed (Figure 7). Total numbers likely represent repeated counts of same individual.

4.7 Sage Grouse Surveys

An aerial lek survey covered the project area with a 2-mile buffer and was conducted on March 25, 2006 (Figure 5). The survey was conducted between 0530 and 0730 hours, with wind less than 8 MPH and no precipitation. No sage grouse or sage grouse sign were seen at the Vantage project during either the aerial lek survey or walking ground surveys (see TES species surveys above). Additional early morning surveys were conducted during 2006 February-March eagle surveys; again, no sage grouse were observed. The Project has low canopy cover of sagebrush on top of ridges with a very rocky substrate, with less big sagebrush and more stiff sagebrush. More mature big sagebrush occurs as inclusions in the draws and low-elevation slopes with deeper soil. No sage grouse sign was observed in these habitats during TES surveys. Cover is largely lacking and apparently open exposed areas are not used by lekking sage grouse.

4.8 Incidental/In-transit Observations

In addition to species detected during point counts, other bird species and faunal groups observed during all other travel and surveys on-site are presented in Table 17. Sensitive status species include the following: loggerhead shrike (6), golden eagle (3), sage thrasher (3), sage sparrow (1), burrowing owl (1), and common loon (1). Bald eagle survey results are reported in section 4.1. All other sensitive species except common loon are discussed in section 5.9. The common loon observation was made on the Columbia River during eagle surveys, use of the site by this species is anticipated to be quite rare.

Least chipmunks were noted often, and a few locations were documented as having Townsend’s ground squirrels (*Spermophilus townsendii nancyae*). Two short-horned lizards were also observed during avian point counts.

5.0 DISCUSSION AND IMPACT ASSESSMENT

Evaluation Criteria

Impacts to avian and bat species are expected to occur from the proposed project. Measured use of the site by avian species in addition to mortality estimates from other existing wind plants is used to predict mortality of birds and bats from the project. For example, use of the site by raptors is relatively low compared to other wind plants and mortality estimates of raptors from other “newer generation” wind plants are relatively low (e.g. < 0.10 raptors per MW/year for Stateline Wind Project, < 0.06 raptors/MW/year for Foote Creek Rim wind plant, Wyoming)). Therefore mortality estimates for raptors from the project are expected to be very low. Post construction monitoring is proposed to validate mortality predictions and monitor the actual level of mortality from the project.

Other impacts include direct loss of habitat due to project facilities, and indirect impacts such as disturbance and displacement from the wind turbines, roads and human activities. Both construction (e.g., blasting) and operations impacts are discussed. Potential impacts are discussed for shrub steppe habitats, rare plants, birds, bats, big game, other mammals, reptiles and amphibians, and fish. Discussion of potential impacts to unique species including State and Federal listed species is also included.

5.1 Shrub-steppe Habitat and Obligate Species

Shrub-steppe habitat is designated as a WDFW priority habitat. WDFW currently has no priority habitats mapped within the project area. Section 4.3 describes shrub-steppe categories and mapped locations for the proposed Vantage project based upon this investigation. The Vantage shrub-steppe and grassland habitats are currently perpetually disturbed with sheep and cattle livestock grazing, random fragmentation from cross country road grading, biosludge deposition sites, and several communication towers. Nevertheless, the biological surveys conducted in this investigation documented several notable shrub-steppe obligate species breeding within the project area: sage sparrow, sage thrasher, and loggerhead shrike. All three of these species are state candidate species for listing (addressed in section 5.9).

Habitat loss is the primary reason for the decline or regional extirpations of many shrub-steppe obligate species. West of the Rocky Mountains and throughout the arid Pacific Northwest, there has been loss and degradation of shrub-steppe habitats. In 2001, it was estimated that over 60% of shrub-steppe habitats were lost in eastern Washington within the Columbia Basin, with loss due to wildfires continuing (Wisdom, USDA, pers. comm.). Over the past century, more sagebrush and riparian habitat is burned with each passing decade (Campbell, BLM, pers. comm.). Much of the permanent loss of shrub-steppe habitat is attributed to the tilling practices involved with cultivated agriculture, where loamy and sandy deep soils are available to maximum crop production. Most of the shrub-steppe obligate bird species - sage sparrow, Brewer's sparrow, sage thrasher, loggerhead shrike – are associated with deep soil shrub-steppe habitats in lieu of shallow soil shrub-steppe habitats. Therefore, deep soil shrub-steppe areas are considered critical habitat for shrub-steppe obligate bird species. In much of the Columbia Basin, the best condition shrub-steppe is small fragments. However, large areas of less quality shrub-steppe can still have high value. For instance, large patch areas are highly correlated with sage sparrows (Vander Haegen, WDFW, pers. comm.). Poole (1992) documented that the density of nesting shrikes was highly variable, which was attributed to differences in habitat quality. The nesting density at the Hanford site (U.S. Department of Energy) was 12-19 times greater than in other shrub-steppe habitats in eastern Washington, and that nesting habitat there appeared to be saturated. The quality of the relatively undisturbed shrub-steppe habitat at this site (Hanford) was high compared to other sites. Most remaining shrub-steppe in Washington has been converted to agriculture, and what hasn't been converted is dominated by steep slopes, poor soils, and has been modified by fires or fire suppression, livestock grazing, introduction of exotic species, and habitat fragmentation.

Overgrazing of rangeland can have a negative impact on nesting grassland birds by reducing nesting habitat, brood-rearing habitat, and foraging habitat. However, several individuals in Pruitt (2000) mention that properly regulated grazing can be potentially beneficial to certain species such as shrikes. Long-term research on the impacts of livestock grazing was recommended. Shrub-steppe obligate species are addressed in more detail in section 5.9. Mitigation options are presented in section 5.10.

5.2 Rare Plants

During the Vantage rare plant surveys, no federally-listed 'Endangered', 'Threatened', 'Proposed' or 'Candidate' plant species were found, nor were any Washington state-listed 'Endangered', 'Threatened', or 'Sensitive' plant species found in the survey area. One Washington State 'Review' plant species was found, the hedgehog cactus (*Pediocactus simpsonii*). This species is listed in Review Group 1, meaning more research is needed before assigning a more definitive status. This species appears to be common in the region, and was documented to be relatively widespread during Wild Horse Project vegetation surveys (Lack et al. 2003). The hedgehog cactus populations found within the project area are located in lithosolic habitats. These habitats are well represented within the project area, interspersed among sagebrush steppe and grassland habitats.

Construction: Impacts to cactus may occur in development areas (Figure 6) if not marked and avoided, or physically translocated. The Wild Horse Project successfully translocated hedgehog cactus from areas that were to be impacted by turbines or other facility features (Jennifer Diaz, PSE, pers comm.)**.**

Operations: No impacts to cactus are anticipated after road and facility construction.

5.3 Birds

Avian habitats on the Project area are primarily shrub-steppe, mixed scrub, and lithosol. Water resources are extremely limited on site, Poison spring to the far west of the project provides the only substantive water supply. The Project's location along the east flank of the Cascades places it within possible migration corridors of several bird species. Given the limited riparian and other important stopover habitat (water bodies), use by migratory birds is likely low. It would be expected that areas further to the east along and closer to the Columbia River would be more important to migrating birds, including songbirds, waterfowl and raptors.

Potential impacts to birds using the study area include fatalities from collision with wind turbines or from construction equipment, loss of habitat, disturbance to foraging and breeding behavior, collision with overhead power lines, and electrocution. Project-related human activity could alter bird behavior and cause displacement during the construction phase of the Project, and the post-construction density of turbines and facilities on the developed portion of the site may alter avian use.

Construction: Wind plant construction may affect birds through loss of habitat, potential fatalities from construction equipment, and disturbance/displacement effects from construction and human occupation of the area. Potential mortality from construction equipment on site is expected to be quite low. Equipment used in wind plant construction generally moves at slow rates (e.g., cranes) or is stationary for long periods. The risk of mortality from construction to avian species is most likely limited to potential destruction of a nest with eggs or young for ground and shrub nesting species when equipment initially disturbs the habitat. Disturbance type impacts can be expected to occur if construction activity occurs near an active nest or primary foraging area. Birds displaced from these areas may move to areas with less disturbance, however, breeding effort may be affected and foraging opportunities altered during the life of the construction. No disturbance impacts to raptor nests are anticipated.

Operations: Substantial data on avian mortality at operational windplants are currently available (e.g., Erickson et al. 2001, Erickson et al. 2004, Young et al. 2006). Outside of California and based on the 2001 summary (Erickson et al. 2001), diurnal raptor fatalities composed only 2% of wind plant-related fatalities. Passerines (excluding house sparrows and European starlings) were the most common collision victims, composing 82% of the 225 fatalities documented. No other group (e.g., raptors, waterfowl) composed more than 5% of fatalities. Of 841 avian fatalities reported from California studies (>70% from Altamont Pass, CA) in Erickson et al. (2001), 39% were diurnal raptors, 19% were passerines (excluding house sparrows and European starlings), and 12% were owls. Non-protected birds including house sparrows, European starlings, and rock doves composed 15% of the fatalities. Other avian groups generally made up less than 10% of fatalities.

Because of differences in rotor swept area, and similarly nameplate MW output among turbines included in mortality studies, fatality rates are presented both in terms of estimated number of fatalities/MW/year and fatalities/turbine/year. The estimated number of fatalities/MW/year is used as the basis for predicting impacts of the project. This MW approach assumes that the fatality rates are approximately proportional to the MW nameplate of the turbine, which yields results similar to assuming fatality rates are proportional to the turbine's rotor swept area. Although some research suggests that larger turbines with slower rpm's and larger ground clearance may be safer for some bird groups such as raptors (e.g., Smallwood and Thelander 2004). However, this relationship for different sizes of newer generation turbines has not been clearly defined. Therefore, assuming fatality rates are proportional to a turbine's MW nameplate is considered a conservative approach for estimating impacts.

For all avian species combined, estimates of the number of bird fatalities per MW per year from individual studies have ranged from 0 at Searsburg, VT, and Algona, IA sites (Kerlinger 1997, Demastes and Trainer 2000, respectively) to approximately 10 (7.7/turbine/year) at the Buffalo Mountain, TN site (Nicholson et. al. 2003). The overall U.S. average number of avian collision fatalities is 2.19/turbine/year, or approximately 3/MW/year (Erickson et. al. 2001).

Project and turbine characteristics of six Pacific Northwest regional wind facilities where standardized fatality monitoring has been conducted are described in Table 12. Average fatality estimates from these projects for all birds have ranged from 0.6 to 3.6 fatalities/turbine/year or 0.9 to 2.9 fatalities/MW/year (Table 13). The only species representing more than 10% of the documented fatalities has been horned lark, the most commonly observed species at all of these facilities during daytime use surveys (Table 14). Using baseline data for these projects, overall estimated bird use was not high relative to other open habitat project sites in the U.S., suggesting that mortality estimates observed at these projects provide a strong basis for predicting mortality impacts for the Vantage Project. The following addresses background information and wind facility operations impact assessment for raptors, passerines, and waterbirds.

5.3.1 Raptors

The Altamont Pass Wind Resource Area (APWRA) has had a history of high raptor mortality (Orloff and Flannery 1992, Smallwood and Thelander 2004). The APWRA consists of approximately 5000 mostly small (<200 kW) older wind turbines located in a 60 square mile area. Approximately 500 – 1300 raptors are estimated to be killed annually at this site (Orloff and Flannery 1992, Smallwood and Thelander 2004) based on estimates of approximately 1 to 2.2 raptor fatalities/MW/year. The most common raptors killed include red-tailed hawks, American kestrels, burrowing owls, golden eagles, and barn owls. Until just recently, the largest operating turbines were 330-kW turbines, with rotor diameters of 33 m. Wind turbine design has changed significantly since the first large wind plants were developed in California such as those in the APWRA. Turbines are now typically installed on tubular steel towers instead of lattice towers and without open platforms at the top of the tower, eliminating perching and nesting opportunities for raptors and other birds. Raptors and ravens commonly nest on turbines within the APWRA. No observations have been made of raptors perched on the new turbine types during studies at Foote Creek Rim (WY) (Johnson et al. 2000a), Buffalo Ridge (MN) (Johnson et al. 2000b), Vansycle (OR) (Erickson et al. 2000), Hopkins Ridge (Young et al. 2007) and Stateline (OR/WA) (Erickson et al 2004), suggesting that new turbines are not a perch attractant for birds.

Collisions with wires and electrocutions have been a common source of mortality at Altamont Pass (CA) (Orloff and Flannery 1992) and other older wind projects, whereas electrical collection lines between turbines in new-generation wind plants are typically buried underground to eliminate perching opportunities, collisions with wires, and electrocutions. Overhead lines within new wind plants are typically designed to be raptor safe from electrocution and anti-perching devices are often installed (e.g., Stateline Wind Project, OR/WA, Nine Canyon Wind Project, WA).

Turbines are much larger, with blades moving at fewer revolutions per minute (rpm) and are therefore presumably more visible than blades on the smaller older turbines. For example, the blades of the 1.5-MW turbines installed at the Klondike (OR) wind plant turn at approximately 20 rpm's, contrasted to greater than 60 rpm's for the Kenetech 56-100 downwind turbine, the most common turbine at the Altamont Pass (CA) wind plant. Blade tip speeds are similar for both new generation and old generation wind turbines. While relationship between blade tip speed and mortality is unknown, it is presumed that rpm's play a factor in avian mortality due to decreasing ability to distinguish blades and blade position as rpm's increase.

Raptor mortality has been much lower at all new generation wind projects in the U.S compared to the APWRA. The highest reported raptor fatality rate at new generation wind projects occurred at the facility in Solano County, California. The High Winds Project is a 162-MW facilty consisting of 91 1.8-MW turbines located in an area with very high raptor use estimates compared to the APWRA, especially for American kestrels. Raptor mortality estimates of approximately 0.3/MW/year have been reported based on preliminary data, with most of mortality consisting of American kestrels. Overall raptor use at High Winds is estimated to be higher than estimated at APWRA overall (1.5 to approximately 2 times), and 7 times higher for American kestrels.

A recent study within the APWRA suggested lower overall raptor mortality at newer wind turbines (WEST 2006). A repowering project which included the replacement of old turbines with newer Vestes 660 kw turbines was completed in 2005. Fatality studies conducted at these new turbines suggested approximately 30-50% lower raptor mortality at the new turbines compared to the estimates from the remaining older turbines in the APWRA (WEST 2006).

Mean raptor use at the Project site is relatively low (< 0.3/20- min survey) compared to several other wind plants in the U.S that have been surveyed using similar methods, and much lower than both the High Winds Facility (3.5/20-min survey) and the APWRA (~2.3/20 min survey) (Figure 7). Projects in the region consistently observe red-tailed hawk, American kestrel, northern harrier, and wintering rough-legged hawks as the most abundant raptor species.

Raptor nest density within the Vantage site and a 2-mile buffer was 0.05/mi^2, which is much lower than the average raptor nest density for other representative proposed and existing wind facilities in mixed-habitat landscapes (Table 15). At Klondike I, Oregon, raptor nest density was also 0.15 per square mile within 5 miles of the Klondike facility area (which overlaps with much of the Facility area), but no raptor mortality was documented during a 1-year fatality monitoring study (Johnson et al., 2003b). At Buffalo Ridge, Minnesota, raptor nest density was also 0.15 per square mile, and the only documented raptor mortality over a 6-year period was a single red-tailed hawk (Osborn et al., 2000; Johnson et al., 2002b). Raptor nest density at the large Stateline wind facility on the Oregon-Washington border was 0.21 per square mile and raptor mortality was estimated to be 0.09 raptor fatalities per MW per year, consisting primarily of red-tailed hawks and American kestrels. Raptor nest density for the 41-MW Combine Hills wind facility, adjacent to Stateline, was estimated to be 0.24 per square mile, and no raptor fatalities were documented the first year of operation (D. Young pers. comm., 2005; Young et al., 2005). Raptor nest density for the recently permitted Hopkins Ridge wind facility in Columbia County, Washington, was 0.43 per square mile, and that site has seen the highest raptor mortality in the region (0.14 per MW per year). Raptor nest densities are also available for other wind facilities in the region, including Condon, Oregon (0.06 per square mile), Nine Canyon, Washington (0.03 per square mile), and Zintel Canyon, Washington (0.08 per square mile). Very few raptor fatalities have been documented at those smaller facilities (one rough-legged hawk at Condon; an American kestrel and a short-eared owl at Nine Canyon).

Given the information on raptor use and nesting density at this and other projects, the habitat and topographic characteristics of the site, and relevant mortality data from nearby projects, raptor fatality rates are anticipated to be low (< 0.1/MW/year). We expect the majority of the fatalities of diurnal raptors to consist of red-tailed hawks and American kestrels. Aside from great horned owls, red-tailed hawks and American kestrels have the largest estimated raptor population sizes in North American (979,000 and 2,175,000, respectively; Millsap and Allen 2006). Monitoring results from the Wild Horse Project for 2007 will provide additional data for raptor fatality predictions in this eastern Kittitas region.

5.3.2 Passerines/Songbirds

Passerines, often referred to as songbirds, have been the most abundant avian fatality at wind plants outside California often composing more than 80% of the total avian fatalities (Erickson et al. 2001, Erickson et al. 2002). Passerines are also the most commonly observed birds during point count surveys at all of these sites. Both migrant and resident passerine fatalities have been observed.

Songbird mortality at operating wind projects in eastern Oregon and Washington has been reasonably consistent. Horned larks have been the most commonly observed resident songbird fatality at agriculture and grassland projects in the Pacific Northwest (Table 14), and have been the most abundant songbird observed during point count surveys at these sites. Based on the U.S. Geological Survey's Breeding Bird Survey (BBS) data, horned larks are likely one of the most common birds in the Columbia Plateau. Otherwise, no other resident songbird species has composed a large proportion of the fatalities observed at the projects in the Pacific Northwest.

Studies of nocturnal migration at several wind plants suggest that the mortality compared to the number of birds passing through the area is low (Johnson et al. 2002, Mabee and Cooper 2002, McCrary et al. 1984). In much of the West, songbirds appear to migrate across a broad front, except in unique topographic situations such as coastlines, and large river valleys or riparian corridors. In the Pacific Northwest, nocturnal migration has been studied at the Stateline Wind Project on the Oregon/Washington border (Mabee and Cooper 2002), as well as some small sampling effort at the Nine Canyon Wind Project in Washington. The Stateline study was designed to monitor waterfowl, shorebird, and passerine movements during two fall migration seasons (2000 and 2001) and one spring migration seasons (2001). Marine radar was used to study nocturnal bird migration at two stations: one near the existing Vanscycle Wind Project near the southeastern end of the Stateline project area, and one to the north of the project area in Washington. The northern and southern stations had very similar passage rates, suggesting broad front movements throughout the project site.

There have been numerous events recorded at communication structures that document up to several hundred avian fatalities in one night, while there have been only two events reported, both reasonably small, at U.S. wind generation facilities. Fourteen fresh nocturnal migrating passerine fatalities were observed at two adjacent turbines during a single search at the Buffalo Ridge wind project in Minnesota during spring migration (Johnson et al. 2002). Approximately 25-30 nocturnal migrating passerine fatalities were observed at three turbines and a well-lit substation at the Backbone Mountain, WV facility during one or two nights of foggy weather (Kerns and Kerlinger 2004). The data suggest that sodium vapor lamps at the substation were the primary attractant, since fatality locations were correlated with the location of the substation, and the other turbines away from the substation had few fatalities documented the morning after the event. After the lights were turned off at the substation, no events occurred.

Tall, lighted structures are suspected of attracting nocturnal migrating birds, especially during inclement weather (Kerlinger 2000). Lighting at communication towers, where larger mortality events have been documented, is typically different than lighting at wind turbines. Communication towers commonly have more than one light location on a tower, while wind turbines have only one location for the light (on top of the nacelle, per FAA requirements). Communication towers often have one red pulsating or flashing light on the top of the tower, and several solid red lights at various heights1. Communication tower lighting may be more of an attractant than wind turbine lighting (Kerlinger 2004), but research and data are limited. No large measured differences in nocturnal migrant fatality rates have been documented between wind turbines that are lit with aircraft obstruction lighting and unlit turbines. At the Stateline (OR/WA) Wind Project, observed fatality rates at lit turbines were slightly higher than at unlit turbines,

[1] Recent FAA lighting regulations released in 2005 for wind turbines favor solid red lighting during the night, and white lights with some strobe during the day. Wind projects are to be "outlined" with lighting rather than every turbine being lighted.

although none of the differences were statistically significant (p>0.10) (Erickson et al. 2004). Similar results were found at the Nine Canyon wind project, which has the same lighting characteristics (red-flashing at night) but on larger and taller turbines than Stateline turbines (Erickson et al. 2003b). The Buffalo Ridge wind project showed a similar result for turbines similar in size to Stateline, although lighting types differ (i.e., steady-burning red incandescent; Johnson et al. 2002). Buffalo Ridge wind project Phase I turbines were not lit, whereas Phase II turbines had approximately every other turbine lit with solid red lights (approximately 70 of 143 turbines). Six of the 138 Phase III turbines along the outer boundary of the site were lit with solid red lights. No statistical differences were found between lit and unlit turbines.

Based on mortality observed at other operating wind projects located in similar landscapes (Erickson et al. 2004, Erickson et al. 2003b, Johnson et al. 2003, Young et al 2005, 2007), an approximate range of 1.0 to 2.75 songbird fatalities/MW/year are predicted for the Project. The largest number of fatalities will likely be horned larks, a common grassland songbird. No other species (migrant or resident) is anticipated to make up a large proportion of the fatalities, based on the patterns of results of other regional studies. No impacts to threatened or endangered songbird species are anticipated.

5.3.3 Waterfowl and Other Waterbirds

Wind plants with year-round waterfowl use have shown the highest waterfowl mortality, although levels of waterfowl/waterbird mortality appear insignificant compared to use of the sites by these groups. Two Canada goose fatalities were documented at the Klondike I wind plant, OR, although several Canada geese flocks were observed during preconstruction surveys (Johnson et al. 2003). Few Canada goose fatalities have been observed at U.S. wind projects (Erickson et al. 2004).

The recently constructed Top of Iowa Windfarm, comprised of 89 turbines with tip heights of 97.5 meters (320 feet), is located in cropland between three Wildlife Management Areas (WMAs) with historically high bird use, including migrant and resident waterfowl, shorebirds, raptors, and songbirds. During a recent study, approximately 1 million total goose-use days and 120,000 total duck-use days were recorded in the WMAs during the fall and early winter, yet no waterfowl fatalities were documented during concurrent and standardized wind project fatality studies (Koford and Jain 2004).

Similar findings were observed at the Buffalo Ridge Wind Project in southwestern Minnesota (Johnson et al 2000b), which is located in an area with relatively high waterfowl/waterbird use and some shorebird use. Some large flocks of snow geese, and Canada geese and mallards were the most common waterfowl observations. Five of the 55 fatalities observed during the fatality studies were waterfowl, including 2 mallards, 2 American coots, and 1 blue-winged teal. One herring gull, one pied-billed grebe, and one killdeer were the only other waterbird fatalities found.

Canada geese and one unidentified flock of ducks were the only waterfowl observed flying over the Project area (Figure 9b) . Other migrant species may also fly over the Project area, however overall use of the site is predicted to be very low due to the predominant shrub-steppe habitat lacking stopover or foraging opportunities. Waterfowl mortality on average is expected to be very low. The possibility exists for a rare event involving several individuals of a flock colliding with wind turbines given unusual weather circumstances. However, this would have negligible effects, if any, on the Pacific population of Canada geese (exhibiting an increasing trend over the last decade, USFWS 2003).

5.3.4 Displacement Effects

The presence of wind turbines may alter the landscape so as to change wildlife habitat use patterns, thereby displacing wildlife from areas near turbines. Several studies have been conducted in the U.S. looking at the potential displacement effects on birds; however most of the studies focused on grassland bird and raptor species (e.g., Leddy et al. 1999, Erickson et al. 2004, Osborn et al. 1998). "Displacement" means that birds tend to avoid an area. However, avoidance of an area may not imply impacts on population parameters such as population size, and such impacts have not been documented. While displacement effects have been documented for some species/groups in U.S. and Europe, there is little information on whether displacement effects have any real impacts on population parameters such as population size and reproduction.

Avian baseline studies of the Foote Creek Rim (FCR), WY wind plant conducted in 1994 and 1995 documented mountain plovers (*Charadrius montanus*)[2] in the proposed development area. Construction of the Foote Creek Rim Wind Plant began in the fall of 1997. Phase I of the wind plant project as identified in the BLM Environmental Impact Statement was construction of turbines in several units on the southern end of Foote Creek Rim. Development of Phase I of the wind plant took place between 1997 and 2000 during which four construction units were completed totaling 133 turbines. This wind plant is located in shortgrass prairie habitat on a mesa topographic feature with a relatively flat top and steep sloping sides. Habitat on top of Foote Creek Rim is suitable for mountain plovers which prefer flat areas with a prevalence of bare ground and short vegetation. Transect surveys to census mountain plovers were conducted on an annual basis through 2004.

In 1995, the estimated mountain plover population size for the Foote Creek Rim wind plant was approximately 60 individuals. The estimated population size declined through 1999 to 18 individuals when only 39 total observations of mountain plovers were made during the surveys. After 1999, the estimated population size in the wind plant rose slowly to 36 during the 2003 and 2004 field seasons when 89 and 66 total plovers were observed, respectively. The period of plover population decline on Foote Creek Rim (1995-1999) also corresponds with the wind plant construction period (1998-2000). It is unknown whether plovers were simply displaced from the rim due to the construction activity or if the population in the area was experiencing a decline in numbers. The initial impression is that the low population on Foote Creek Rim from 1998-2000 followed by a steady recovery was related to displacement during construction of the wind plant and subsequent habituation to the facility by plovers. However, it is hard to separate potential displacement type effects from a broader decline in the mountain plover population. The Foote Creek Rim population appeared to be declining prior to the initiation of construction. Also, declines in other regional populations (southeast Wyoming - northeast Colorado) suggest a larger species-wide or regional decline during the decline observed at Foote Creek Rim.

Based upon European research summaries, displacement impacts on breeding waterbirds, shorebirds, and waterfowl have been less than impacts on non-breeding birds. European studies suggest variable levels of disturbance for feeding and roosting birds (Spaans et al. 1998). Based on this European summary, the authors concluded that with the exception of lapwings, black-tailed godwits, and redshanks, species used areas for breeding that were close to the wind farms. In general, the displacement effects (areas with reduced densities) rarely exceeded 100 m for breeding birds. During the non-breeding season many bird species of open landscapes avoided approaching wind parks closer than a few hundred meters, and this avoidance behavior was especially noted for waterfowl and shorebirds. Displacement effects of up to 600 m from wind turbines (reduced densities) have been reported for some waterfowl species (e.g., pink-footed goose *Anser brachyrhunchus*, and European white-fronted goose). However, a study in the U.S. did not document such a large scale displacement impact. Based on preliminary analysis at the large Top of Iowa wind facility, no large scale displacement of Canada geese was apparent based on counts and behavior observations of geese in areas with and without turbines (Koford and Jain 2004).

[2] The U.S. Fish Wildlife Service proposed listing mountain plover as a threatened species under the Endangered Species Act in February 1999 (USFWS 1999). Prior to this time, mountain plover had been included on the USFWS list of *candidate* species. In 2003, the USFWS found that listing mountain plover as threatened was not warranted and the proposed rule was withdrawn stating that the threats to the species as identified are not as significant as earlier believed, and the plover is now not listed.

At a large wind plant on Buffalo Ridge in Minnesota, the abundance of shorebirds, waterfowl, upland gamebirds, woodpeckers, and several groups of passerines was found to be statistically significantly lower at survey plots with turbines than at plots without turbines. There were fewer differences in avian use as a function of distance from turbines, however, suggesting that the area of reduced use was limited primarily to those areas within 100 meters of the turbines (Johnson et al. 2000b). Some portion of these displacement effects is likely to be the result of direct loss of habitat near the turbine for the turbine pad and associated roads. These results are similar to those of Osborn et al. (1998), who reported that birds at Buffalo Ridge avoided flying in areas with turbines. Also at Buffalo Ridge, Leddy et al. (1999) found that densities of male songbirds were significantly lower in Conservation Reserve Program (CRP) grasslands containing turbines than in CRP grasslands without turbines. Grasslands without turbines and portions of grasslands located at least 180 meters from turbines had bird densities four times greater than grasslands located near turbines. Reduced avian use near turbines was attributed to avoidance of turbine noise and maintenance activities and reduced habitat effectiveness because of the presence of access roads and large gravel pads surrounding turbines (Leddy 1996, Johnson et al. 2000b).

Preliminary results from the Stateline (OR/WA) Wind Project suggest a relatively small-scale impact of the wind facility on grassland nesting passerines, with a large portion of the impact due to direct loss of habitat from turbine pads and roads and temporary disturbance of habitat between turbines and road shoulders (Erickson et al. 2004). Horned larks appeared least impacted, with some suggestion of displacement to grasshopper sparrows, although sample sizes were limited.

Some indirect impacts to birds in shrub-steppe habitat are anticipated. Given that displacement effects have been relatively low at other projects (reduced densities <100 m from turbines/roads), indirect impacts are anticipated to be low, however will involve sensitive species such as sage thrashers and sage sparrows (Figure 6).

5.4 Big Game

The Vantage project area receives some year-round use by mule deer, and infrequent use by elk. No concentrations of elk or mule deer were observed during winter or at any other time of year on the Project. During the 25 March, 2006, aerial sage grouse lek and raptor nest survey, one group of 31 elk and three groups of 35 mule deer were observed within the project area and 2-mile buffer. The elk and mule deer groups were observed north of the Vantage highway, i.e., north of the proposed Project area (Figure 3). Elk scat has been observed on the Project, indicating infrequent use. Few mule deer observations were made during avian use surveys (Table 17). Wintering elk forage on native grass species such as Sandberg’s bluegrass, which greens up with fall and spring rains, while mule deer typically utilize more shrub species. The Project is grazed heavily by cattle and sheep, especially during the spring season grassland green-up period, limiting the availability of high-quality forage to big game species. Overall, big game use of the site in winter and during other seasons appears relatively low.

WDFW have expressed concern over potential effects of wind project development and operation on wintering big game. Winter is a crucial period of time for the survival of many big game species. Severity of winter and availability of forage are important factors related to over-winter survival (Reeve and Lindzey 1991). Increases in human activity from vehicles and other sources and habitat fragmentation, depending on the levels, are postulated to affect over-winter survival (Stephenson et al. 1996, Brown 1992). The Project is located adjacent to habitats designated by WDFW as winter range for mule deer and elk, specifically the Project is located south of WDFW priority wintering habitat and the Quilomene migration corridor. The Quilomene elk winter range is approximately 83,000 acres in size and winters approximately 1500-2000 elk. The Quilomene mule deer winter range is approximately 40,000 acres in size and winters approximately 700-800 deer. The project area is not located within the high density deer sub-area of Quilomene mule deer winter range which winters 100-200 deer. This area begins north and east of the Wild Horse project, and extends down to the Columbia River. The project area is also not located within the Quilomene primary winter range, a sub-area of the Quilomene winter range, which winters approximately 500 elk.

Construction: Elk and mule deer are expected to be temporarily displaced from the site due to the influx of humans and heavy construction equipment and associated disturbance (e.g., blasting). Construction related disturbance and displacement is expected to be limited to the 9-12 month construction period. Most heavy construction is expected to take place during the summer months, minimizing construction disturbance to wintering big game. In addition, construction will likely not take place in severe winters, when big game impacts may be of most concern. Following completion of the Project, the disturbance levels from construction equipment and humans will diminish significantly and the primary disturbances will be associated with operations and maintenance personnel, occasional vehicular traffic, and the presence of the turbines and other facilities.

Operations: There is little information regarding wind project effects on big game. At the Foote Creek Rim wind project in Wyoming, antelope observed during raptor use surveys were recorded year round (Johnson et. al. 2000a). The mean number of antelope observed at the six survey points was 1.07 prior to construction of the wind farm and 1.59 and 1.14/survey the two years immediately following construction, indicating no reduction in use of the immediate area. Mule deer and elk also occurred at Foote Creek Rim, but their numbers were so low that meaningful data on wind farm avoidance could not be collected. A more recent study regarding interactions of elk populations with operating wind farms was recently conducted by David Walter in conjunction with the Rocky Mountain Elk Foundation, the Oklahoma Department of Wildlife Conservation, Nature Works, and the Oklahoma Cooperative Fish and Wildlife Research Unit (Walter et al. 2004). The study found no evidence that operating wind turbines have a measurable impact on elk use of the surrounding area. The operating Wild Horse wind facility has numerous observations of elk near operating wind turbines (WEST biotechnicians, pers. comm..). These observations have noted elk behavior of non-alarm or distress and include resting, grazing, and walking.

There are published studies of big game winter use related to other human developments such as oil and gas. Indirect impacts associated with human activity or development has been documented with elk (e.g., Lyon 1983, Wisdom et al. 1986, Czech 1991, Morrison et al. 1995, Rowland et al. 2000) and mule deer (e.g., Rost and Bailey 1979, Easterly et al. 1992, Merrill et al. 1994, Sawyer et al. 2004). In south-central Montana, Van Dyke and Klein (1996) documented elk movements through the use of radio telemetry before, during, and after the installation of a single oil well within an area used year round by elk. Drilling activities during their study ceased by November 15, however, maintenance activities continued throughout the year. Elk showed no shifts in home range between the pre and post drilling periods, however, elk shifted core use areas out of view from the drill pad during the drilling and post drilling periods. Elk also increased the intensity of use in core areas after drilling and slightly reduced the total amount of range used. It was not clear if the avoidance of the well site during the post-drilling period was related to maintenance activities or to the use of a new road by hunters and recreationists. The authors concluded that if drilling activities occupy a relatively small amount of elk home ranges, that elk are able to compensate by shifting areas of use within home ranges.

A study by Rost and Bailey (1979) found that wintering mule deer and elk avoided areas within 656 ft (200m) of roads in eastern portions of their Colorado study area, where presumably greater amounts of winter habitat were present. Road avoidance was greater where roads were more traveled. Only mule deer showed a clear avoidance of roads in the western portion of their study area, where winter range was assumed to be more limiting. Mule deer also showed greater avoidance of roads in shrub habitats versus more forested areas. The authors concluded that impacts of roads depended on the availability of suitable winter range away from roads, as well as the amount of traffic associated with roads.

Oregon radio-telemetry studies of elk and mule deer have been conducted in a large fenced experimental research area. Results of spring studies (April – early June) suggest that elk habitat selection may be negatively related to traffic and other human disturbance (Johnson et al. 2000c). Mule deer habitat selection appeared to be related to elk distribution, with mule deer avoiding areas used by elk. Traffic and roads did not appear to be an important factor in spring distribution of mule deer (Wisdom et al. 2002). Distances moved by elk tended to increase as a function of increased use by humans, including ATV use, hiking, and horseback riding. The same was true for mule deer, but the response was less than that of elk (Wisdom et al. 2002). In western Wyoming, a multi-year GPS/radio-telemetry study suggests that winter mule deer habitat selection and distribution patterns have been affected by natural gas development, specifically by road networks and well pads (Sawyer et al. 2004).

We are aware of no studies that have documented population level impacts. Most of the studies have focused on displacement of big game, but have not determined whether these displacement effects result in any significant population level effects such as decreases in survival. Due to the lack of data regarding the potential impacts of energy development on big game, it is difficult to predict with certainty the effects of the Project on wintering mule deer and elk. While human related activity at wind turbines during regular maintenance will be dramatically less than during the construction period, it is not known if human activity associated with regular maintenance activity will exceed tolerance thresholds for wintering elk and mule deer. The Project may decide to participate with a large contiguous-rangeland livestock grazing management plan that currently exists north of Old Vantage Highway and east to the Columbia River. This plan relies upon the cooperation of various landowners and is designed to support and expand optimal forage production and improve wildlife habitat. This Project area has historically been overgrazed, coordination with WDFW and Wild Horse project personnel may provide ideas for mitigating impacts to wintering big game habitat and wildlife habitat in general. If rangeland enhancement occurs for the project as part of permitting conditions and/or habitat mitigation strategies, the above big game literature review applies to the potential of the Project becoming more suitable to wintering big game.

5.5 Bats

Due to the current lack of understanding of bat communities in North America, the species and relative abundance of bats occurring in the project area are difficult to determine. Little is known about bat species distribution, but several species of bats could occur in the Project area based on the Washington GAP project and inventories conducted on the Hanford Site, Arid Lands Ecology Reserve (ALE) located in Benton County to the south (Table 16). The potential for bats to occur is based on migratory patterns and key habitat elements such as food sources, water, and roost sites. Prominent wetlands and/or riparian areas are lacking on the proposed site, except for Poison Spring which is approximately 1.5 miles west of the nearest turbine string (Figure 3). Drainage areas with old growth big sage brush and bitterbrush may provide important foraging areas. Biosludge sites may also provide potential foraging sites due to possible higher insect loads; diurnal use by foraging swallows and horned larks was observed during fixed point avian surveys. Locations of biosludge sites in reference to turbine string locations should be taken into consideration.

Construction: Impacts to bats or bat habitat on the site are unlikely during construction**.**

Operations: Bat casualties have been reported from most windpower facilities where post-construction fatality data are available. Reported estimates of bat mortality at windpower facilities have ranged from 0.01 – 47.5 per turbine per year (0.9 – 43.2 bats/MW/year) in the U.S. with an average of 3.4 per turbine or 4.6 per MW (NWCC 2004). Most of the bat casualties at windpower facilities to date are non-hibernating migratory species that conduct long-distance migrations between summer breeding and wintering areas, namely the hoary bat, eastern red bat and silver-haired bat (Johnson 2005). A recent report documented from 25–38 bat fatalities per turbine during a 6 week study period at windpower facilities in West Virginia and Pennsylvania. Most of the species killed were eastern red bat, hoary bat, and eastern pipistrelle (Kerns et al. 2005). The West Virginia and Pennsylvania sites are located on prominent forested ridges in the Appalachian Mountains. A large number of hoary and silver-haired bats (532) were also found at a southern Alberta, Canada wind farm in 2005. Unlike the eastern U.S. wind farms with high bat mortality, the Alberta facility is in open grasslands and cropfields, although it is adjacent to foothills along the Rocky Mountains and may be in a bat migration corridor (Rowland 2006). The causes of the relatively high number of migratory bat deaths at windpower facilities are not well understood (Johnson 2005). Kerns et al. (2005) hypothesized that bats may have been attracted to turbines by ultrasound emissions, ephemeral increases in food sources, or bats may have investigated turbines for roosting sites or to glean insects from turbine blades. Researchers also theorized that clearings made in the forest for turbines and roads may have created attractive foraging areas for bats (Kerns et al. 2005).

Unlike the West Virginia and Pennsylvania sites, the proposed project area does not contain topographic features that may funnel migrating bats and is lacking large tracts of forest cover. The proposed project is not located near any large, known bat colonies, thus the majority of bat casualties are likely to be migrants. The proposed project will likely result in the mortality of some bats; however, fatality levels are not expected to reach those observed in the eastern U.S. or Alberta. Existing projects in Washington and Oregon have reported bat mortality near the low end of the national range (i.e., less than 3 bats/turbine/yr). At the Vansycle Ridge Wind Project in Oregon, bat mortality was estimated at 0.74 bats per turbine for the first year of operation (Erickson et al. 2000). At the Klondike Windpower Project, bat mortality was estimated at 1.16 bat fatalities per turbine per year (Johnson et al. 2003). At the Stateline Windpower Project, bat mortality was estimated at approximately 1 to 2 bat fatality per turbine per year (Erickson et al. 2004) from July 2001 through December 31, 2002. At the Nine Canyon Wind Project, bat mortality was estimated at approximately 3 bat fatalities per turbine per year (Erickson et al. 2003). Bat mortality patterns at wind plants in Washington and Oregon have followed patterns similar to the rest of the country. Over 90% of the mortality documented at wind projects in these open habitat projects has been hoary and silver-haired bats. The other mortalities have consisted of occasional big brown bats, little brown bats, and some unidentified bats. The hoary bat is a non-hibernating migratory species with the widest distribution of any bat in North America, ranging from just below the Canadian tree line to South America (Shump and Shump 1982). They are solitary bats that roost primarily in deciduous trees (Barbour and Davis 1969, Nordquist 1997) and occasionally in coniferous trees (Gruver 2002). Silver-haired bats are also migratory (Izor 1979, Kunz 1982, Barclay *et al.* 1988). Historically, silver-haired bats were also believed to be strictly solitary tree bats, but recent studies have documented maternal colonies of silver-haired bats (Barclay *et al.* 1998). Virtually all of the mortality at wind power sites has occurred in late summer and early fall, during the fall migration period for hoary and silver-haired bats.

Although potential future mortality of migratory bats is difficult to predict, an estimate can be calculated based on levels of mortality documented at other wind plants. Using the estimates from other wind plants, operation of the proposed project could result in approximately 1 to 3 bats per MW per year or 100 to 300 bat fatalities per year. Actual levels of mortality are unknown and could be higher or lower depending on regional migratory patterns of bats, patterns of local movements through the area, and the response of bats to turbines, individually and collectively. Bat mortality estimates for the Wild Horse Project will be available in 2008.

5.6 Other Mammals

Overall mammal diversity is low for the Project due to the lack of substantial riparian areas. However, least chipmunks, Townsend ground squirrels, and coyotes are known to occur on the Project. The construction of turbine pads and roads, and vehicle traffic has the potential to crush individual small mammals within burrows or moving about above ground. Overall, total impacts to habitat will be limited and no significant impacts to populations of these species are expected to occur as a result of this Project.

5.7 Reptiles and Amphibians

Twenty-seven species of reptiles and amphibians occur in Kittitas County and could be present in the project area. Short-horned lizards were observed within the Project area. Other reptiles that may likely occur in the project site include snakes such as the yellow-bellied racer, gopher snake, and Northern Pacific rattlesnake. Amphibian and aquatic reptile habitat is limited within the Project area. Many amphibians migrate short distances during spring or fall breeding periods to and from suitable wetlands and during fall dispersal of juveniles. No migration corridors for reptiles or amphibians are known to be present in the Project area.

Construction: Impacts to reptiles and amphibians on site through loss of habitat and direct mortality of individuals may occur in construction zones. Provided best management practices are employed on site and compliance with applicable permits regarding runoff and sediment control is maintained, no amphibians should be affected by construction or operation of the project. The level of mortality to reptiles on site associated with construction would be based on the abundance of species on site. Some mortality may be expected with common slow-moving reptiles that may occur on site such as short-horned lizards and rattlesnakes. Reptiles that are dormant or using burrows or rock crevices for cover within development corridors may be vulnerable. Excavation for turbine pads, roads, or other Project facilities could kill individuals in underground burrows or rock refuges or hibernacula. While above ground, snakes are likely mobile enough to be less vulnerable to construction equipment, however, short horned lizards do not move fast over long distances and rely heavily on camouflage for predator avoidance. Some individual lizard fatalities can be expected from vehicle activity.

Operations: No impacts to amphibians are anticipated during operations. Impacts to reptiles during operation are likely limited to some potential direct mortality due to vehicle collisions. While above ground, yellow bellied racers and other snakes are likely mobile enough to escape most vehicles, however, short horned lizards do not move fast over long distances and rely heavily on camouflage for predator avoidance. Some lizard fatalities may occur from vehicle activity. Post construction monitoring for avian and bat fatalities should also document reptile use within turbine study plots. Snake and lizard observations have been made at other regional wind facilities and populations appear to persist in close association with operating wind turbines.

5.8 Fish

Based on available information, no fish occur in the project area. Provided best management practices are employed on site and compliance with applicable permits regarding runoff and sediment control is maintained, no fish should be affected by construction or operation of the project.

5.9 Threatened, Endangered, and Sensitive (TES) Species

No impacts to federally threatened or endangered species are anticipated from the project. Bald eagle was recently removed from the federal threatened and endangered species list, but is still discussed below.

5.9.1 Bald Eagle

Only one bald eagle observation was reported by Erickson et al. (2003) for the Wild Horse baseline study. This winter observation was about 1.5 miles southeast of the proposed project, of an adult flying high over Whiskey Creek. One bald eagle nest was documented 6.75 miles from the nearest turbine string (Figure 4). Based on extremely low use of the project area by bald eagles (Figure 9e), impacts to the species are considered negligible. No bald eagle fatalities have been observed at other wind projects, and many have estimated bald eagle use much higher than this Project (Erickson *et al.* 2001). Although the risk is low, the potential exists for bald eagle fatalities during operation of the Project. The status of bald eagle in the Project area and range-wide is not expected to change due to the Project. Bald eagle populations have been increasing exponentially over the past decade and USFWS has recently de-listed this species from the Endangered Species Act, although this species is still protected through the Bald and Golden Eagle Protection Act. Bald eagle populations in Washington and throughout North America will likely continue to increase during and after the project is constructed.

5.9.2 Golden Eagle

Erickson et al. (2003) reported low use year-round by golden eagles for the Wild Horse baseline study. No active nests were documented during 2006 aerial surveys, or during any other surveys conducted on site. Golden eagles have nested historically within two miles of the proposed project area. Overall use of the proposed project area by golden eagles is relatively low (Table 7) compared to other wind plants where golden eagle fatalities have been documented. The project is in the northern area of the Great Basin Bird Conservation Region (BCR) which has a population estimated to be approximately twice the size of populations in all three other BCRs east of the cascades (Good et al. 2007). While the potential exists for golden eagles to collide with turbines at the proposed facility, overall risks to golden eagle populations are considered low and only a few individuals, if any, are expected to collide with turbines over the life of the project.

5.9.3 Sage Sparrow, Sage Thrasher, and Loggerhead Shrike

Sage sparrows, sage thrashers, and loggerhead shrikes are shrub-steppe obligate species that breed within the proposed project area. Most of the large mature sagebrush and other shrub habitats within the project area occur on the sides of ridges and in drainages, while most turbines will be located on ridge tops lacking dense shrub habitats. Observations of breeding individuals indicate that sage sparrows generally do not fly within the rotor-swept-area (Table 10; see also Erickson et al. 2003). Sage thrashers were documented in this study to fly within blade height 20% of the time (Table 10). The potential exists for migrating and dispersing individuals to collide with turbines. Displacement effects from operations may occur with these species. However, the majority of proposed turbines are located in sparse shrub-steppe or lithosols. Many of the 2006 sage thrasher, sage sparrow, and loggerhead shrike observations were away from proposed permanent facilities (Figures 6 and 7; see 5.3.4 ‘Displacement Effects’ section above). Overall impacts to sage sparrow and sage thrasher populations are considered negligible, with only small potential displacement effects and collision fatalities being rare.

A review of the loggerhead shrike is provided as a case example to illustrate the dependence of shrub-steppe obligate species on shrub-steppe, as well as provide the general timing of occurrence and seasonal sensitivity (being similar among sage sparrows and sage thrashers):

The following review of western loggerhead shrikes (*Lanius ludovicianus gambeli*) and factors affecting their life history and population status are based upon the work of Jewett et al. (1953), Ehrlich et al. (1988), Littlefield (1990), Knopf and Smith (1992), Hall and Snow (1994), Pruitt (2000), Lindenmayer and Fischer (2006), Marshall et al. (2006), and LOSH (2007). In Washington, the western loggerhead shrike is listed as a “state candidate”. In some cases the population is sustainable, and protective measures are being implemented; in others, the population may be declining and improved protective measures are needed to maintain sustainable populations over time.

In the western U.S., loggerhead shrike breeding habitat is associated with shrub-steppe, desert scrub, and pinyon-juniper woodlands (Lefranc 1997 *in* Pruitt 2000). Western loggerhead shrikes in the Pacific

Northwest are more of a shrub-steppe obligate species, dependent upon large shrubs or small trees for breeding and nesting. Loggerhead shrikes in the eastern U.S. exhibit adaptation to nesting in urban/suburban habitats (e.g., residential yards, parks university campuses, cemeteries, housing developments, golf courses; Pruitt 2000). In contrast, western shrikes appear less likely to nest in suburban settings. Sagebrush nesting shrikes tend to be shy and somewhat inconspicuous, and do not readily nest near human habitations (Woods 1995 *in* Pruitt 2000). Habitats used by breeding loggerhead shrikes in agricultural landscapes (e.g., pastures, hayfields, CRP) are created by human-induced changes in native vegetative communities; these habitats must be "maintained" to remain suitable for shrikes. In contrast, shrub-steppe habitats are more permanent communities and likely represent one of the historic core areas of the species, prior to European settlement (Fraser and Luukkonen 1986, Cade and Woods 1997 *in* Pruitt 2000). High densities observed by Poole (1992) and Woods (1995) in relatively undisturbed shrub-steppe habitats suggest that these are high quality breeding habitats for loggerhead shrikes.

The western loggerhead shrike occurs in the Columbia Basin during spring through summer, and regularly in winter but with rare observations. In general, mid-March through mid-September is the time period for migration, breeding, and brood-rearing. Early migrants appear in February. Male shrikes select breeding territories in late winter through early spring. Mid-April through August is considered the seasonality and sensitive period. Nest initiation peaks in mid-April. Clutch size ranges from 5-8 eggs. Few successful breeding pairs attempt a second brood in the Columbia Basin (Marshall et al. 2006).

Male shrikes show high nesting territory fidelity, being even more pronounced than many other passerine bird species. However, this may be biased toward smaller fragmented habitats, i.e., in larger contiguous tracts of suitable habitat site fidelity may be much less as nesting habitat is less limited. Regardless, fragmented smaller habitat patches are more common as compared to the Hanford or Yakima military training center sites; likely two of the most notable large remaining contiguous tracts of shrub-steppe ecosystems in the Pacific Northwest.

5.9.4 Greater Sage-Grouse

The Project area is south of the Colockum Wildlife Management Area, yet considered within the recovery zone of the sage grouse management unit (Stinson et al. 2004). The Colockum management unit primarily provides connectivity between the Yakima Training Center sage grouse population and the Douglas County population. No sage grouse or leks were observed during sage grouse surveys in March and April, 2006 within and surrounding the Wild Horse project. No sage grouse, sage grouse scat, or leks were observed during other surveys and travel on the Vantage site for the entire study year. The nearest known active lek is approximately 7 miles south on the Yakima Training Center. Sage grouse have historically been observed north of the Project area, especially in fall and winter. Broods have been observed in that area, suggesting some historical nesting may have occurred somewhere not far from the Project. Presence of young broods at the Foote Creek Rim Wind Project suggests nesting has occurred somewhere near wind turbines, although the nesting location relative to the wind project is not known (WEST, R. Good, pers. comm.).

The proposed project is not expected to negatively impact nesting habitat for sage grouse. Given expansive intact shrub-steppe habitat surrounding the proposed project and existing Wild Horse project, the project should not impact connectivity between Douglas County populations and the Yakima and Kittitas County populations. The project is currently disturbed with heavy grazing and fragmented with cross country graded roads, county landfill, biosludge deposition sites, and several communication towers.

5.9.5 Peregrine Falcon

The nearest known peregrine eyrie is located approximately 6.5 miles from the Wild Horse project area. No peregrine falcon eyries were located during 2002-2003 or 2006 raptor nest surveys. Cliff habitat is not present within two miles of the project area. Most suitable peregrine falcon nesting habitat is located along the Columbia River and it is unlikely that peregrine falcons will nest within two miles of the project area. Use of the project area by peregrine falcons is likely limited to rare dispersal events or occasional individuals migrating or hunting within the project area. No peregrine falcon observations have been made in the project area. There is a very low risk over the life of the project that an individual peregrine falcon will collide with turbines.

5.9.6 Burrowing Owl

Burrowing owl breeding areas have been designated by the WDFW 3-4 miles southeast of the Wild Horse project area. The potential exists for breeding burrowing owls to occur within the project area. However, only one burrowing owl was observed during spring near a biosludge site, apparently foraging on insects associated with the sludge deposit. This area was scrutinized several times without any additional sightings. No sightings were observed during any survey, in particular the intensive ground surveys. Considering the lack of sightings within the project area, burrowing owls likely occur only occasionally within the project area, and no impacts to burrowing owl populations are expected.

5.9.7 Other Bird Species

The potential range of several other species listed as candidates under the Washington Endangered Species Act overlap with the proposed project, including ferruginous hawk, flammulated owl, merlin, northern goshawk, sharp-tailed grouse, common loon, western grebe, Lewis' woodpecker, white-headed woodpecker, and Vaux's swift (Table 2). The potential exists for these species to occur within the project area, however use of the project area is expected to occur very rarely during migration or dispersal events. The potential exists for a few individuals of each species to collide with turbines over the life of the project. Impacts to populations of these species are not anticipated.

5.9.8 Mammals

The Project occurs within the potential range of several species of federally and state protected mammals, which are unlikely to occur within the Project area due to habitat constraints and/or uncertain population status in Washington. These species include Townsend's big-eared bat, long-legged myotis, and long-eared myotis. These species are not expected to occur within the Project area and no impacts to these species are likely to occur.

Both the white-tailed and black-tailed jackrabbits have been documented within Kittitas County, and suitable habitat for these species is present in the Project area. The potential exists for individuals to be killed by vehicles on roads, and some suitable habitat for these species will be lost to turbine pads and road construction. Limits on vehicle speeds within the Project will minimize the potential for road kills, and the permanent loss of suitable habitat is relatively small. Overall, impacts to these species should be minimal.

Suitable habitat for three bat species, which are listed as federal species of concern, is present within the Project area: fringed myotis, small-footed myotis and Yuma myotis. However, only general descriptions of habitat requirements and potential distribution are available for the three species. Very little is known concerning the ecology of the three species, making it even more difficult to accurately predict potential impacts to these species. To date, we are unaware of any documented fatalities of these species at wind projects within the U.S.

Merriam's shrew has been documented within Kittitas County, suitable habitat for this species is quite limited within the Project area. The potential also exists for the brush prairie pocket gopher to occur within the project area. Shallow-soiled sparse shrub-steppe and lithosols of the proposed development area limit the potential for these species to be impacted. Assuming these species are present within the Project development area, the construction of turbine pads and roads, and vehicle traffic has the potential to crush individuals within burrows or moving about above ground. Overall, total impacts to habitat are small and no significant impacts to populations of these species are expected to occur as a result of this Project.

5.9.9 Reptiles and Amphibians

The proposed project area occurs within the potential range of the striped whipsnake, sharptail snake, western toad, and Columbia spotted frog. There is very little suitable habitat for amphibians or aquatic reptiles (e.g., turtles) in the study area. None of these sensitive status reptiles or amphibians were documented on the project site and no impacts are anticipated.

5.10 Potential Mitigation Strategy Options

Permanent direct habitat impacts (i.e., from Facility footprint) that cannot be avoided or minimized will be mitigated by the use of standards and methods that are in compliance with WDFW's mitigation guidance document, or use an alternative approach with WDFW's advisement and agreement. Mitigation approaches may follow one or more of the following strategies, or be used as initial means of communication and negotiations with WDFW:

- **Mitigation Option A:** One agreed upon lump sum of money will be dispersed from the Applicant to WDFW to be used at their discretion for research or other natural resource issues.
- **Mitigation Option B:** In lieu of direct habitat mitigation, a study will be designed and funded by the Applicant in order to provide data toward answering a natural resource question. For example, avian displacement by wind turbines and facility operations or specific research aimed at understanding bat wind turbine interactions and potential avenues for avoiding or minimizing bat mortality at wind facilities.
- **Mitigation Option C:** Direct funding, implementation, and monitoring of conversion of tilled agricultural land to high quality wildlife habitat such as shrub-steppe. The conservation approach is similar to that deployed under the CRP, and the term would be for the life of the Facility.
- **Mitigation Option D:** Direct funding, implementation, and monitoring of rangeland enhancement where such land management tools may include reseeding deep soiled areas, installing water catchments , "guzzlers", for wildlife, and planting shrubs in drainage spring seep sites (if available). Another example is the use of livestock exclosures or fencing to exclude livestock from riparian/shrub-steppe habitats, potentially creating a higher quality shrub-steppe with additional understory cover, forage, and old growth sagebrush.
- **Mitigation Option E:** Secure and maintain a permanent high-quality off-site wildlife habitat tract of land as a conservation bank. The term to be the life of the project or other agreed upon time period.

All of the options assume that the Applicant may establish an agreement with a willing landowner to pursue mitigation objectives.

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Table 1. Rare plant target species for which surveys were conducted on the proposed Vantage Wind Energy Facility site, spring season 2006.

Scientific Name/ Common Name	Flowering/ Fruiting Period	Status	Habitat	Species Encountered (Yes/No)
Agoseris elata Tall agoseris	June-August	S	Meadows, open woods, and exposed rocky ridgetops	No
Anemone nuttalliana Pasque flower	May-August	S	Prairies to mountain slopes, typically on well-drained soils	No
Astragalus arrectus Palouse milk-vetch	April-July	S	Grassy hillsides, sagebrush flats, river bluffs, and openings in ponderosa pine and Douglas fir forests	No
Astragalus columbianus Columbia milk-vetch	March-June	SOC/T	Sagebrush steppe	No
Astragalus misellus var. pauper Pauper milk-vetch	April-mid June	S	Open ridgetops and slopes	No
Camissonia pygmaea Dwarf evening-primrose	June-August	T	Unstable soil or gravel in steep talus, dry washes, banks and roadcuts	No
Camissonia scapoidea Naked-stemmed evening primrose	May-July	S	Sagebrush desert, typically in sandy, gravelly areas	No
Collomia macrocalyx Bristle-flowered collomia	Late May-early June	S	Dry, open habitats	No
Corydalis aurea Golden corydalis	May-July	R1	Varied habitats, moist to dry and well-drained soils	No
Cryptantha rostellata Beaked cryptantha	Late April-mid June	S	Very dry microsites within sagebrush steppe	No

Table 1 (continued). Rare plant target species for which surveys were conducted on the proposed Vantage Wind Energy Facility site, spring season 2006.

Scientific Name/ Common Name	Flowering/ Fruiting Period	Status	Habitat	Species Encountered (Yes/No)
Cyperus bipartitus Shining flatsedge	August-September	S	Streambanks and other wet, low places in valleys and lowlands	No
Delphinium viridescens Wenatchee larkspur	July	SOC/T	Moist meadows, moist microsites in coniferous forest, springs, seeps, and riparian areas	No
Eatonella nivea White eatonella	May	T	Dry, sandy or volcanic areas within sagebrush-steppe	No
Erigeron basalticus Basalt daisy	May-June	C/T	Crevices in basalt cliffs on canyon walls	No
Erigeron piperianus Piper's daisy	May-June	S	Dry, open places, often with sagebrush	No
Hackelia hispida var. *disjuncta* Sagebrush stickseed	May-June	S	Rocky talus	No
Iliamna longisepala Longsepal globemallow	June-August	S	Sagebrush steppe and open ponderosa pine and Douglas fir forest	No
Lomatium tuberosum Hoover's desert-parsley	March-early April	SOC/T	Loose talus and drainage channels of open ridgetops within sagebrush steppe	No
Mimulus suksdorfii Suksdorf's monkey-flower	Mid April-July	S	Open, moist to rather dry places in sagebrush steppe	No
Nicotiana attenuata Coyote tobacco	June-September	S	Dry, sandy bottom lands, dry rocky washes, and other dry open places	No
Oenothera cespitosa ssp. *cespitosa* Cespitose evening-primrose	Late April-mid June	S	Open sites on talus or other rocky slopes, roadcuts, and the Columbia River terrace	No

Table 1 (continued). Rare plant target species for which surveys were conducted on the proposed Vantage Wind Energy Facility site, spring season 2006.

Scientific Name/ Common Name	**Flowering/ Fruiting Period**	**Status**	**Habitat**	**Species Encountered (Yes/No)**
Pediocactus simpsonii var. *robustior* Hedgehog cactus	May-July	R1	Desert valleys and low mountains	Yes
Pellaea breweri Brewer's cliff-brake	April-August	S	Rock crevices, ledges, talus slopes, and open rocky soils	No
Penstemon eriantherus var. *whitedii* Fuzzytongue penstemon	May-July	R1	Dry open places	No
Phacelia minutissima Least phacelia	July	SOC/S	Moist to fairly dry open places	No
Pyrrocoma hirta var. *sonchifolia* Sticky goldenweed	July-August	R1	Meadows and open or sparsely wooded slopes	No
Silene seelyi Seely's silene	May-August	SOC/T	Shaded crevices in ultramafic to basaltic cliffs and rock outcrops, and among boulders in talus	No

Federal Status:
LT = Listed Threatened. Likely to become endangered
C = Candidate species. Sufficient information exists to support listing as Endangered or Threatened
SOC = Species of Concern. An unofficial status, the species appears to be in jeopardy, but insufficient information to support listing

State Status:
E = Endangered. In danger of becoming extinct or extirpated in Washington
T = Threatened. Likely to become Endangered in Washington
S = Sensitive. Vulnerable or declining and could become Endangered or Threatened in the state
R1 = State Review Group 1. Taxa for which there is insufficient data to support listing in Washington as Threatened, Endangered, or Sensitive

Table 2. Species of special status documented as occurring or potentially occurring within the vicinity of the Vantage Project area.

Group/Species	Status[a]	Notes
Mammals		
black-tailed jack rabbit (*Lepus californicus*)	SC	Documented as occurring near the project area. This species may occur within the project area due to presence of shrub-steppe habitat.
white-tailed jack rabbit (*Lepus townsendi*)	SC	Documented as occurring near the project area. This species may occur within the project area due to presence of shrub-steppe habitat.
brush prairie pocket gopher (*Thomomys talpoides douglasi*)	SC	Project occurs within the potential range of the species. No individuals have been documented near the project area.
Merriam's shrew (*Sorex merriami*)	SC	Project occurs within the potential range of the species. No individuals have been documented near the project area.
Townsend's big-eared bat (*Coryhorhinus townsendii*)	SC	Project occurs within the potential range of the species. No individuals have been documented near the project area.
Amphibians and Reptiles		
Columbia spotted frog (*Rana luteiventris*)	SC	The proposed project area occurs within the potential range for the species. Impacts to wetlands and springs on the project are not anticipated and no impacts to the species are anticipated.
western toad (*Bufo boreas*)	SC	The proposed project area occurs within the potential range for the species. Impacts to wetlands and springs on the project are not anticipated and no impacts to the species are anticipated.
sharptail snake (*Contia tenuis*)	SC	The proposed project area occurs within the potential range for the species. No impacts are anticipated, see section 5.9.
striped whipsnake (*Masticophis taeniatus*)	SC	The proposed project area occurs within the potential range for the species. No impacts are anticipated, see section 5.9.
Raptors		
bald eagle (*Haliaeetus leucocephalus*)	ST FT	See section 5.9.
golden eagle (*Aquila chrysaetos*)	SC	See section 5.9 (also 4.6 and 4.8).
peregrine falcon (*Falco peregrinus*)	SS	See section 5.9.
burrowing owl (*Athene cunicularia*)	SC	See section 5.9.
ferruginous hawk (*Buteo regalis*)	ST	This species is considered a rare migrant and potential breeder within the project area. No ferruginous hawks were observed during 2002-2003 Wild Horse avian use study (Erickson et. al 2003a). No impacts to the species are anticipated.
merlin (*Falco columbarius*)	SC	Two merlin observations were made during the 2002-2003 Wild Horse avian use study (Erickson et al 2003a). The species is considered a rare transient through the project area and is not likely to breed within the project area. No impacts are expected.

Table 2 (continued). Species of special status documented as occurring or potentially occurring within the vicinity of the Vantage Project area.

Group/Species	Status[a]	Notes
flammulated owl (*Otus flammeolus*)	SC	The proposed project occurs within the potential range of flammulated owls. Suitable habitat is lacking within the Project area. Low potential exists for this species to collide with turbines, likely involving a migrant. Only one flammulated owl has been documented as a fatality at wind plants within the U.S. (Erickson et al. 2001).
northern goshawk (*Accipiter gentiles*)	SC	Two observations of two individuals were made within the Wild Horse project area during winter of 2002 – 2003 (Erickson et al 2003a). No observations were made for this species on the Vantage Project, and no impacts to this species are anticipated.
Grouse		
sage grouse (*Centrocercus urophasianus*)	ST	See section 5.9.
sharp-tailed grouse (*Tympanuchus phasianellus*)	ST	The WDFW has one record of a sharp-tailed grouse sighting from 1981 approximately 4 – 6 miles from the Wild Horse project. No sharp-tailed grouse were observed during surveys. It is very unlikely this species occupies the proposed project area and no impacts are expected.
Waterbirds / Waterfowl		
common loon (*Gavia immer*)	SS	Common loons are considered a rare migrant through the project area. One loon was observed during eagle surveys on the Columbia River, however no impacts to this species are anticipated.
western grebe (*Aechmophorus occidentalis*)	SC	Western grebes are considered a rare migrant through the project area. No grebes were observed during surveys, impacts are considered unlikely.
Songbirds		
Lewis' woodpecker (*Melanerpes lewis*)	SC	The proposed project occurs within the potential range of the Lewis' woodpecker. Suitable habitat is lacking within the Project area. No Lewis' woodpeckers were observed during surveys, but individuals may migrate through the area. Impacts are unlikely.
white-headed woodpecker (*Picoides albolarvatus*)	SC	The proposed project occurs within the potential range of the Lewis' woodpecker. Suitable habitat is lacking within the Project area. No observations of this species were made during surveys, but individuals may migrate through the area. Impacts are unlikely.
loggerhead shrike (*Lanius ludovicianus*)	SC	See section 5.9 (also 4.6 and 4.8).
sage sparrow (*Amphispiza belli*)	SC	See section 5.9 (also 4.6 and 4.8).

Table 2 (continued). Species of special status documented as occurring or potentially occurring within the vicinity of the Vantage Project area.

Group/Species	Status[a]	Notes
sage thrasher (*Oreoscoptes montanus*)	SC	See section 5.9 (also 4.6 and 4.8).
Vaux's swift (*Chaetura vauxi*)	SC	The proposed project area occurs within the potential range of the Vaux's swift. No individuals were observed during surveys. The potential exists for migrating individuals to collide with turbines, however, the overall risk to the species is considered low.

[a] FE Federal Endangered,
FT Federal Threatened
FC Federal Candidate
FSC Federal Species of Concern
SE State Endangered
ST State Threatened
SC State Candidate

Table 3. List of avian species observed during fixed-point surveys on the Invenergy Vantage Project site.

Species/Group	Scientific Name	Species/Group	Scientific Name
Canada goose	*Branta canadensis*	mountain bluebird	*Sialia currucoides*
killdeer	*Charadrius vociferus*	northern shrike	*Lanius excubitor*
American kestrel	*Falco sparverius*	rock wren	*Salpinctes obsoletus*
bald eagle	*Haliaeetus leucocephalus*	ruby-crowned kinglet	*Regulus calendula*
Cooper's hawk	*Accipiter cooperii*	sage sparrow	*Amphispiza belli*
golden eagle	*Aquila chrysaetos*	sage thrasher	*Oreoscoptes montanus*
northern harrier	*Circus cyaneus*	savannah sparrow	*Passerculus sandwichensis*
prairie falcon	*Falco mexicanus*	Say's phoebe	*Sayornis saya*
red-tailed hawk	*Buteo jamaicensis*	tree swallow	*Tachycineta bicolor*
rough-legged hawk	*Buteo lagopus*	vesper sparrow	*Pooecetes gramineus*
sharp-shinned hawk	*Accipter striatus*	violet-green swallow	*Tachycineta thalassina*
American goldfinch	*Carduelis tristis*	western bluebird	*Sialia mexicana*
American pipit	*Anthus rubescens*	western meadowlark	*Sturnella neglecta*
American robin	*Turdus migratorius*	white-crowned sparrow	*Zonotrichia leucophrys*
barn swallow	*Hirundo rustica*	yellow-rumped warbler	*Dendroica coronata*
black-billed magpie	*Pica pica*	California quail	*Callipepla californica*
Brewer's blackbird	*Euphagus cyanocephalus*	mourning dove	*Zenaida macroura*
Brewer's sparrow	*Spizella breweri*	common nighthawk	*Chordeiles minor*
brown-headed cowbird	*Molothrus ater*	northern flicker	*Colaptes auratus*
common raven	*Corvus corax*	unidentified duck	
dark-eyed junco	*Junco hyemalis*	unidentified buteo	
European starling	*Sturnus vulgaris*	unidentified raptor	
horned lark	*Eremophila alpestris*	unidentified passerine	
house finch	*Carpodacus mexicanus*	unidentified sparrow	
loggerhead shrike	*Lanius ludovicianus*	unidentified hummingbird	

Table 4. Avian species observed while conducting fixed-point surveys (March 16, 2006 – March 6, 2007) on the Project Site.[a]

	Spring		Summer		Fall		Winter		Grand Total	
Species/Group	# obs.	# groups	# obs.	# groups	# obs.	# groups	# obs.	# groups	# obs.	# groups
Waterfowl	**0**	**0**	**0**	**0**	**0**	**0**	**88**	**4**	**88**	**4**
Canada goose	0	0	0	0	0	0	28	3	28	3
unidentified duck	0	0	0	0	0	0	60	1	60	1
Shorebirds										
Killdeer	0	0	0	0	0	0	1	1	1	1
Raptors	**17**	**17**	**20**	**19**	**13**	**13**	**20**	**20**	**70**	**69**
Accipiters	*1*	*1*	*0*	*0*	*2*	*2*	*0*	*0*	*3*	*3*
Cooper's hawk	0	0	0	0	1	1	0	0	1	1
sharp-shinned hawk	1	1	0	0	1	1	0	0	2	2
Buteos	*12*	*12*	*12*	*11*	*2*	*2*	*11*	*11*	*37*	*36*
red-tailed hawk	9	9	12	11	2	2	3	3	26	25
rough-legged hawk	3	3	0	0	0	0	4	4	7	7
unidentified buteo	0	0	0	0	0	0	4	4	4	4
Northern Harriers										
northern harrier	1	1	1	1	1	1	0	0	3	3
Eagles	*2*	*2*	*0*	*0*	*0*	*0*	*3*	*3*	*5*	*5*
bald eagle	0	0	0	0	0	0	1	1	1	1
golden eagle	2	2	0	0	0	0	2	2	4	4
Falcons	*1*	*1*	*7*	*7*	*8*	*8*	*5*	*5*	*21*	*21*
American kestrel	0	0	6	6	7	7	5	5	18	18
prairie falcon	1	1	1	1	1	1	0	0	3	3
Other Raptors										
unidentified raptor	0	0	0	0	0	0	1	1	1	1

Table 4 (continued). Avian species observed while conducting fixed-point surveys (March 16, 2006 – March 6, 2007) on the Project Site.[a]

	Spring		Summer		Fall		Winter		Grand Total	
Species/Group	# obs.	# groups	# obs.	# groups	# obs.	# groups	# obs.	# groups	# obs.	# groups
Passerines	**590**	**193**	**417**	**203**	**339**	**159**	**351**	**199**	**1697**	**754**
American goldfinch	2	1	0	0	0	0	2	2	4	3
American pipit	0	0	0	0	3	2	0	0	3	2
American robin	6	3	0	0	3	2	2	2	11	7
barn swallow	0	0	9	6	4	3	0	0	13	9
black-billed magpie	9	5	9	5	2	2	14	13	34	25
Brewer's blackbird	2	1	4	2	0	0	0	0	6	3
Brewer's sparrow	42	15	63	32	12	11	0	0	117	58
brown-headed cowbird	2	1	4	2	0	0	0	0	6	3
common raven	27	20	13	10	1	1	112	77	153	108
dark-eyed junco	6	3	0	0	3	3	0	0	9	6
European starling	3	1	0	0	0	0	19	10	22	11
horned lark	203	61	181	54	257	102	175	73	816	290
house finch	0	0	0	0	5	2	0	0	5	2
loggerhead shrike	1	1	2	1	0	0	0	0	3	2
mountain bluebird	51	4	7	2	5	3	0	0	63	9
northern shrike	0	0	0	0	2	2	6	6	8	8
rock wren	0	0	0	0	1	1	0	0	1	1
ruby-crowned kinglet	0	0	0	0	4	3	0	0	4	3
sage sparrow	29	20	43	28	2	1	8	8	82	57
sage thrasher	38	33	46	43	1	1	0	0	85	77
savannah sparrow	3	2	0	0	1	1	0	0	4	3
Say's phoebe	1	1	1	1	0	0	0	0	2	2
tree swallow	0	0	0	0	0	0	2	1	2	1
unidentified passerine	1	1	1	1	0	0	7	3	9	5
unidentified sparrow	0	0	18	6	1	1	0	0	19	7
vesper sparrow	11	9	6	6	0	0	0	0	17	15
violet-green swallow	2	1	0	0	0	0	0	0	2	1
western bluebird	2	1	0	0	0	0	0	0	2	1

Table 4 (continued). Avian species observed while conducting fixed-point surveys (March 16, 2006 – March 6, 2007) on the Project Site.[a]

	Spring		Summer		Fall		Winter		Grand Total	
Species/Group	# obs.	# groups	# obs.	# groups	# obs.	# groups	# obs.	# groups	# obs.	# groups
western meadowlark	8	4	10	4	1	1	4	4	23	13
white-crowned sparrow	141	5	0	0	29	15	0	0	170	20
yellow-rumped warbler	0	0	0	0	2	2	0	0	2	2
Upland Gamebirds										
California quail	0	0	3	3	10	3	15	1	28	7
Doves										
mourning dove	0	0	0	0	4	3	0	0	4	3
Other Birds	**2**	**2**	**1**	**1**	**2**	**2**	**0**	**0**	**5**	**5**
common nighthawk	0	0	1	1	0	0	0	0	1	1
northern flicker	1	1	0	0	2	2	0	0	3	3
unidentified hummingbird	1	1	0	0	0	0	0	0	1	1
Overall	**609**	**212**	**441**	**226**	**368**	**180**	**475**	**225**	**1893**	**843**

[a] All individuals included even those outside the 800m viewing shed.

Table 5. Mean use, mean # species/survey, total number of species, and total number of fixed-point surveys conducted by season and overall for the Project site.

Season	Number of Visits	Mean Use[a]	# Species/ Survey[b]	# Species	# Surveys Conducted
Spring	7	10.857	3.232	29	56
Summer	6	9.226	3.726	20	47
Fall	12	3.833	1.490	28	96
Winter	11	5.050	1.562	19	87
Overall	36	6.470	2.223	46	286

[a] # observations per 20-minute survey
[b] mean number of bird species observed during each 20-minute survey

Table 6. Mean use, percent composition and percent frequency of occurrence for avian groups for the Invenergy Vantage Project site.

Species/Group	Mean Use (#/20 min. survey)				Group Composition (%)				% Frequency			
	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
Waterbirds	0.000	0.000	0.000	0.955	0.00	0.00	0.00	18.90	0.00	0.00	0.00	2.27
Shorebirds	0.000	0.000	0.000	0.011	0.00	0.00	0.00	0.23	0.00	0.00	0.00	1.14
Raptors	0.286	0.399	0.135	0.148	2.63	4.32	3.53	2.93	21.43	25.30	10.42	13.64
Accipiters	0.018	0.000	0.021	0.000	0.16	0.00	0.54	0.00	1.79	0.00	2.08	0.00
Buteos	0.196	0.232	0.021	0.068	1.81	2.52	0.54	1.35	14.29	19.05	2.08	5.68
Northern Harriers	0.018	0.021	0.010	0.000	0.16	0.23	0.27	0.00	1.79	2.08	1.04	0.00
Eagles	0.036	0.000	0.000	0.023	0.33	0.00	0.00	0.45	3.57	0.00	0.00	2.27
Falcons	0.018	0.146	0.083	0.057	0.16	1.58	2.17	1.13	1.79	6.25	7.29	5.68
Passerines	10.536	8.741	3.531	3.766	97.04	94.74	92.12	74.57	96.43	97.62	86.46	77.76
Upland Gamebirds	0.000	0.065	0.104	0.170	0.00	0.71	2.72	3.38	0.00	6.55	3.13	1.14
Doves/Pigeons	0.000	0.000	0.042	0.000	0.00	0.00	1.09	0.00	0.00	0.00	3.13	0.00
Other Birds	0.036	0.021	0.021	0.000	0.33	0.23	0.54	0.00	3.57	2.08	2.08	0.00
Overall	10.857	9.226	3.833	5.050	100.00	100.00	100.00	100.00				

Table 7. Avian species observed within 800m of the observer and estimated mean use (#/20-minute survey) on the Project site (March 16, 2006 – March 6, 2007).

Large Birds							
Spring Species/Group	Use	Summer Species/Group	Use	Fall Species/Group	Use	Winter Species/Group	Use
common raven	0.482	common raven	0.280	California quail	0.104	common raven	1.060
black-billed magpie	0.161	red-tailed hawk	0.232	American kestrel	0.073	unidentified duck	0.682
red-tailed hawk	0.161	black-billed magpie	0.188	black-billed magpie	0.021	Canada goose	0.273
golden eagle	0.036	American kestrel	0.125	red-tailed hawk	0.021	California quail	0.170
rough-legged hawk	0.036	California quail	0.065	common raven	0.010	black-billed magpie	0.148
northern harrier	0.018	northern harrier	0.021	Cooper's hawk	0.010	American kestrel	0.057
prairie falcon	0.018	prairie falcon	0.021	northern harrier	0.010	red-tailed hawk	0.034
sharp-shinned hawk	0.018			prairie falcon	0.010	rough-legged hawk	0.034
				sharp-shinned hawk	0.010	bald eagle	0.011
						golden eagle	0.011
						killdeer	0.011

Table 7 (continued). Avian species observed within 800m of the observer and estimated mean use (#/20-minute survey) on the Project site (March 16, 2006 – March 6, 2007).

Small Birds

Spring		Summer		Fall		Winter	
Species/Group	Use	Species/Group	Use	Species/Group	Use	Species/Group	Use
horned lark	3.625	horned lark	3.780	horned lark	2.677	horned lark	1.989
white-crowned sparrow	2.518	Brewer's sparrow	1.318	white-crowned sparrow	0.302	European starling	0.218
mountain bluebird	0.911	sage thrasher	0.961	Brewer's sparrow	0.125	sage sparrow	0.091
Brewer's sparrow	0.750	sage sparrow	0.896	house finch	0.052	unidentified passerine	0.080
sage thrasher	0.679	unidentified sparrow	0.393	mountain bluebird	0.052	northern shrike	0.068
sage sparrow	0.518	western meadowlark	0.208	barn swallow	0.042	western meadowlark	0.045
vesper sparrow	0.196	barn swallow	0.193	mourning dove	0.042	American goldfinch	0.023
western meadowlark	0.143	mountain bluebird	0.146	ruby-crowned kinglet	0.042	American robin	0.023
American robin	0.107	vesper sparrow	0.125	American pipit	0.031	tree swallow	0.023
dark-eyed junco	0.107	Brewer's blackbird	0.083	American robin	0.031		
European starling	0.054	brown-headed cowbird	0.083	dark-eyed junco	0.031		
savannah sparrow	0.054	loggerhead shrike	0.042	northern flicker	0.021		
American goldfinch	0.036	unidentified passerine	0.024	northern shrike	0.021		
Brewer's blackbird	0.036	common nighthawk	0.021	sage sparrow	0.021		
brown-headed cowbird	0.036	Say's phoebe	0.021	yellow-rumped warbler	0.021		
violet-green swallow	0.036			rock wren	0.010		
western bluebird	0.036			sage thrasher	0.010		
loggerhead shrike	0.018			savannah sparrow	0.010		
northern flicker	0.018			unidentified sparrow	0.010		
Say's phoebe	0.018			western meadowlark	0.010		
unidentified hummingbird	0.018						
unidentified passerine	0.018						

Table 8. Avian species observed within 800m of the observer and estimated frequency of occurrence on the Project site (March 16, 2006 – March 6, 2007).

Large Birds							
Spring		Summer		Fall		Winter	
Species/Group	%	Species/Group	%	Species/Group	%	Species/Group	%
common raven	30.36	common raven	19.35	American kestrel	6.25	common raven	52.60
red-tailed hawk	10.71	red-tailed hawk	19.05	California quail	3.13	black-billed magpie	13.64
black-billed magpie	8.93	black-billed magpie	8.33	black-billed magpie	2.08	American kestrel	5.68
golden eagle	3.57	California quail	6.55	red-tailed hawk	2.08	red-tailed hawk	3.41
rough-legged hawk	3.57	American kestrel	4.17	common raven	1.04	rough-legged hawk	2.27
northern harrier	1.79	northern harrier	2.08	Cooper's hawk	1.04	bald eagle	1.14
prairie falcon	1.79	prairie falcon	2.08	northern harrier	1.04	California quail	1.14
sharp-shinned hawk	1.79			prairie falcon	1.04	Canada goose	1.14
				sharp-shinned hawk	1.04	golden eagle	1.14
						killdeer	1.14
						unidentified duck	1.14

Table 8 (continued). Avian species observed within 800m of the observer and estimated frequency of occurrence on the Project site (March 16, 2006 – March 6, 2007).

Small Birds

Spring		Summer		Fall		Winter	
Species/Group	%	Species/Group	%	Species/Group	%	Species/Group	%
horned lark	85.71	horned lark	81.85	horned lark	76.04	horned lark	38.64
sage thrasher	46.43	sage thrasher	62.80	white-crowned sparrow	11.46	European starling	6.98
sage sparrow	32.14	Brewer's sparrow	54.46	Brewer's sparrow	9.38	northern shrike	6.82
Brewer's sparrow	26.79	sage sparrow	45.83	barn swallow	3.13	sage sparrow	6.82
vesper sparrow	16.07	unidentified sparrow	13.39	mountain bluebird	3.13	western meadowlark	4.55
mountain bluebird	7.14	barn swallow	12.80	mourning dove	3.13	unidentified passerine	3.41
western meadowlark	7.14	vesper sparrow	10.42	ruby-crowned kinglet	3.13	American goldfinch	2.27
white-crowned sparrow	7.14	western meadowlark	8.33	American pipit	2.08	American robin	1.14
dark-eyed junco	5.36	Brewer's blackbird	4.17	American robin	2.08	tree swallow	1.14
American robin	3.57	brown-headed cowbird	4.17	dark-eyed junco	2.08		
savannah sparrow	3.57	mountain bluebird	4.17	house finch	2.08		
American goldfinch	1.79	unidentified passerine	2.38	northern flicker	2.08		
Brewer's blackbird	1.79	common nighthawk	2.08	northern shrike	2.08		
brown-headed cowbird	1.79	loggerhead shrike	2.08	yellow-rumped warbler	2.08		
European starling	1.79	Say's phoebe	2.08	rock wren	1.04		
loggerhead shrike	1.79			sage sparrow	1.04		
northern flicker	1.79			sage thrasher	1.04		
Say's phoebe	1.79			savannah sparrow	1.04		
unidentified hummingbird	1.79			unidentified sparrow	1.04		
unidentified passerine	1.79			western meadowlark	1.04		
violet-green swallow	1.79						
western bluebird	1.79						

Table 9. Flight height characteristics by avian group during fixed-point surveys for the Project site.

Group	# flocks flying	# birds flying	% birds flying	Relation to rotor-swept height		
				below	within	above
Waterbirds	4	88	100.00	0.00	100.00	0.00
Shorebirds	1	1	100.00	0.00	100.00	0.00
Raptors	48	49	70.00	44.90	53.06	2.04
Accipiters	3	3	100.00	66.67	33.33	0.00
Buteos	22	23	62.16	26.09	73.91	0.00
Northern Harriers	3	3	100.00	100.00	0.00	0.00
Eagles	5	5	100.00	40.00	40.00	20.00
Falcons	14	14	66.67	64.29	35.71	0.00
Other Raptors	1	1	100.00	0.00	100.00	0.00
Passerines	295	924	54.45	90.48	9.52	0.00
Upland Gamebirds	0	0	0.00	N/A	N/A	N/A
Doves/Pigeons	2	3	75.00	100.00	0.00	0.00
Other Birds	2	2	40.00	50.00	50.00	0.00
Overall	352	1067	56.37	80.79	19.12	0.09

Table 10. Flight height characteristics by avian species during fixed-point surveys for the Project site.

Species	# flocks flying	# birds flying	% birds flying	Relation to rotor-swept height below	within	above
unidentified duck	1	60	100.00	0.00	100.00	0.00
Canada goose	3	28	100.00	0.00	100.00	0.00
unidentified passerine	3	7	77.78	0.00	100.00	0.00
bald eagle	1	1	100.00	0.00	100.00	0.00
common nighthawk	1	1	100.00	0.00	100.00	0.00
killdeer	1	1	100.00	0.00	100.00	0.00
unidentified raptor	1	1	100.00	0.00	100.00	0.00
red-tailed hawk	13	14	53.85	14.29	85.71	0.00
prairie falcon	3	3	100.00	33.33	66.67	0.00
rough-legged hawk	7	7	100.00	42.86	57.14	0.00
Brewer's blackbird	3	6	100.00	50.00	50.00	0.00
American goldfinch	3	4	100.00	50.00	50.00	0.00
sharp-shinned hawk	2	2	100.00	50.00	50.00	0.00
unidentified buteo	2	2	50.00	50.00	50.00	0.00
common raven	73	104	67.97	60.58	39.42	0.00
American kestrel	11	11	61.11	72.73	27.27	0.00
golden eagle	4	4	100.00	50.00	25.00	25.00
black-billed magpie	13	19	55.88	78.95	21.05	0.00
sage thrasher	5	5	5.88	80.00	20.00	0.00
European starling	8	17	77.27	82.35	17.65	0.00
barn swallow	9	13	100.00	92.31	7.69	0.00
horned lark	129	480	58.82	94.58	5.42	0.00
white-crowned sparrow	6	144	84.71	100.00	0.00	0.00
mountain bluebird	5	52	82.54	100.00	0.00	0.00
sage sparrow	9	21	25.61	100.00	0.00	0.00
Brewer's sparrow	9	17	14.53	100.00	0.00	0.00
unidentified sparrow	5	13	68.42	100.00	0.00	0.00
dark-eyed junco	4	7	77.78	100.00	0.00	0.00
brown-headed cowbird	2	4	66.67	100.00	0.00	0.00
mourning dove	2	3	75.00	100.00	0.00	0.00
northern harrier	3	3	100.00	100.00	0.00	0.00
northern shrike	3	3	37.50	100.00	0.00	0.00
tree swallow	1	2	100.00	100.00	0.00	0.00
violet-green swallow	1	2	100.00	100.00	0.00	0.00
American robin	1	1	9.09	100.00	0.00	0.00
Cooper's hawk	1	1	100.00	100.00	0.00	0.00
savannah sparrow	1	1	25.00	100.00	0.00	0.00
unidentified hummingbird	1	1	100.00	100.00	0.00	0.00
vesper sparrow	1	1	5.88	100.00	0.00	0.00

Table 10 (continued). Flight height characteristics by avian species during fixed-point surveys for the Project site.

Species	# flocks flying	# birds flying	% birds flying	Relation to rotor-swept height below	within	above
western meadowlark	1	1	4.35	100.00	0.00	0.00
American pipit	0	0	0.00	N/A	N/A	N/A
California quail	0	0	0.00	N/A	N/A	N/A
house finch	0	0	0.00	N/A	N/A	N/A
loggerhead shrike	0	0	0.00	N/A	N/A	N/A
northern flicker	0	0	0.00	N/A	N/A	N/A
rock wren	0	0	0.00	N/A	N/A	N/A
ruby-crowned kinglet	0	0	0.00	N/A	N/A	N/A
Say's phoebe	0	0	0.00	N/A	N/A	N/A
western bluebird	0	0	0.00	N/A	N/A	N/A
yellow-rumped warbler	0	0	0.00	N/A	N/A	N/A
Overall	352	1067	56.37	80.79	19.12	0.09

Table 11. Mean exposure indices calculated by species observed during fixed-point surveys at the Project site.

Species	Overall mean use	% flying	% flying within RSA	Exposure Index
unidentified duck	0.208	100.00	100.00	0.208
common raven	0.468	67.97	39.42	0.125
horned lark	2.835	58.82	5.42	0.090
Canada goose	0.083	100.00	100.00	0.083
red-tailed hawk	0.087	53.85	85.71	0.040
unidentified passerine	0.032	77.78	100.00	0.025
black-billed magpie	0.115	55.88	21.05	0.013
European starling	0.077	77.27	17.65	0.010
American kestrel	0.063	61.11	27.27	0.010
Brewer's blackbird	0.021	100.00	50.00	0.010
rough-legged hawk	0.017	100.00	57.14	0.010
American goldfinch	0.014	100.00	50.00	0.007
prairie falcon	0.010	100.00	66.67	0.007
barn swallow	0.046	100.00	7.69	0.004
sage thrasher	0.296	5.88	20.00	0.003
sharp-shinned hawk	0.007	100.00	50.00	0.003
bald eagle	0.003	100.00	100.00	0.003
common nighthawk	0.003	100.00	100.00	0.003
killdeer	0.003	100.00	100.00	0.003
golden eagle	0.010	100.00	25.00	0.003
white-crowned sparrow	0.590	84.71	0.00	0.000
Brewer's sparrow	0.407	14.53	0.00	0.000
sage sparrow	0.285	25.61	0.00	0.000
mountain bluebird	0.219	82.54	0.00	0.000
western meadowlark	0.080	4.35	0.00	0.000
unidentified sparrow	0.069	68.42	0.00	0.000
vesper sparrow	0.059	5.88	0.00	0.000
American robin	0.038	9.09	0.00	0.000
dark-eyed junco	0.031	77.78	0.00	0.000
northern shrike	0.028	37.50	0.00	0.000
brown-headed cowbird	0.021	66.67	0.00	0.000
mourning dove	0.014	75.00	0.00	0.000
savannah sparrow	0.014	25.00	0.00	0.000
northern harrier	0.010	100.00	0.00	0.000
tree swallow	0.007	100.00	0.00	0.000
violet-green swallow	0.007	100.00	0.00	0.000
Cooper's hawk	0.003	100.00	0.00	0.000
unidentified hummingbird	0.003	100.00	0.00	0.000

Table 11 (continued). Mean exposure indices calculated by species observed during fixed-point surveys at the Project site.

Species	Overall mean use	% flying	% flying within RSA	Exposure Index
California quail	0.098	0.00	N/A	N/A
house finch	0.017	0.00	N/A	N/A
ruby-crowned kinglet	0.014	0.00	N/A	N/A
American pipit	0.010	0.00	N/A	N/A
loggerhead shrike	0.010	0.00	N/A	N/A
northern flicker	0.010	0.00	N/A	N/A
Say's phoebe	0.007	0.00	N/A	N/A
western bluebird	0.007	0.00	N/A	N/A
yellow-rumped warbler	0.007	0.00	N/A	N/A
rock wren	0.003	0.00	N/A	N/A
unidentified buteo	N/A	50.00	50.00	N/A
unidentified raptor	N/A	100.00	100.00	N/A

Table 12. Facility and Turbine Characteristics of Six Regional Wind Energy Facilities Where Fa tality Monitoring Studies are Underway or Have Been Conducted						
	Facility Size		Turbine Characteristics			
Pacific Northwest Wind Facility	No. of Turbine s	No. of MW	RD (m)	Tip Height (m)	RSA m2	MW per Turbine
Stateline, Oregon-Washington	454	300	47	74	1735	0.66
Vansycle, Oregon	38	25	47	74	1735	0.66
Klondike, Oregon, Phase I	16	24	65	100	3318	1.50
Hopkins Ridge, Washington	83	150	70	107	5027	1.8
Nine Canyon, Washington, Phase I	37	48	62	91	3019	1.30
Nine Canyon, Washington, Phase II	12	20	62	91	3019	1.30
Combine Hills, Oregon	41	41	61	84	2961	1.00

Table 13. Pacific Northwest Regional Annual Fatality Estimates on Per Turbine and Per MW Nameplate Bases for All Birds and for All Raptors1				
	Bird Fatality Rates		Raptor Fatality Rates	
Pacific Northwest Wind Facility	No. per Turbine	No. per MW	No. per Turbine	No. per MW
Stateline, Oregon-Washington	1.9	2.9	0.06	0.09
Vansycle, Oregon	0.6	1.0	0.00	0.00
Klondike, Oregon, Phase I	1.4	0.9	0.00	0.00
Nine Canyon, Washington, Phase I	3.6	2.8	0.07	0.05
Combine Hills, Washington	2.6	2.6	0	0
Hopkins Ridge, Washington	2.2	1.2	0.22	0.14
Average	2.1	1.9	0.06	0.05

Table 14. Number and Species Composition of Bird Fatalities Found at the Pacific Northwest Regional Wind Facilities

Species	Percent Composition	Number of Fatalities
Horned lark	35.2	128
Ring-necked pheasant	9.6	35
Golden-crowned kinglet	6.3	23
Chukar	4.7	17
Western meadowlark	4.1	15
European starling	4.1	15
Gray partridge	3.8	14
White-crowned sparrow	3.3	12
Red-tailed hawk	2.5	9
American kestrel	2.5	9
Unidentified passerine	2.2	8
Yellow-rumped warbler	1.6	6
Winter wren	1.4	5
Rock pigeon	1.4	5
Canada goose	1.1	4
Dark-eyed junco	1.1	4
Unidentified bird	1.1	4
House wren	0.8	3
Red-breasted nuthatch	0.8	3
Black-billed magpie	0.8	3
Northern flicker	0.8	3
Golden-crowned sparrow	0.8	3
Unidentified sparrow	0.5	2
Short-eared owl	0.5	2
Savannah sparrow	0.5	2
Ruby-crowned kinglet	0.5	2
Vesper sparrow	0.5	2
White-throated swift	0.5	2
Rough-legged hawk	0.5	2
Great blue heron	0.5	2
Red-winged blackbird	0.3	1
Ferruginous hawk	0.3	1

Table 14 (continued). Number and Species Composition of Bird Fatalities Found at the Pacific Northwest Regional Wind Facilities		
Species	Percent Composition	Number of Fatalities
Grasshopper sparrow	0.3	1
American pipit	0.3	1
Mallard	0.3	1
Swainson's thrush	0.3	1
Swainson's hawk	0.3	1
Spotted towhee	0.3	1
Lewis's woodpecker	0.3	1
American robin	0.3	1
Macgillivray's warbler	0.3	1
House finch	0.3	1
Virginia rail	0.3	1
American coot	0.3	1
Cooper’s hawk	0.3	1
Gray catbird	0.3	1
Northern harrier	0.3	1
Townsend’s warbler	0.3	1
Unidentified flycatcher	0.3	1
Total (47 species identified)	100.0	364
Total	100.0	287

Johnson et al., 2002b; Erickson et al., 2000, 2001, 2003, 2004, Young et al. 2006, Young et al. 2005

N = Non-native species.

Table 15. Estimated Raptor Nest Densities from Other Proposed and Existing Wind Facilities Located Primarily in Agricultural Landscapes.

Facility Site	Raptor Nest Density (#/mi2)							
	All Raptors	SWHA	RTHA	FEHA	GOEA	PRFA	GHOW	SSHA
Vantage, Washington	0.05	0.00	0.03	0.00	0.00	0.00	0.02	0.00
Biglow Oregon	0.15	0.04	0.08	0.00	0.00	0.00	0.02	0.00
Klondike III Oregon	0.16	0.04	0.08	0.00	0.00	0.00	0.04	0.00
Leaning Juniper, Oregon	0.41	0.18	0.16	0.03	0.00	0.02	0.02	0.00
Stateline Oregon-Washington	0.21	0.03	0.08	0.03	0.00	0.00	0.07	0.00
Nine Canyon, Washington	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zintel Canyon, Washington	0.08	0.04	0.02	0.02	0.00	0.00	0.00	0.00
Buffalo Ridge, Minnesota	0.15	0.07	0.06	0.01	0.00	0.00	0.02	0.00
Klickitat County, Washington	0.12	0.00	0.09	0.00	0.00	0.01	0.03	0.00
Combine Hills, Oregon	0.24	0.06	0.11	0.01	0.00	0.00	0.00	0.00
Columbia Hills, Washington	0.30	0.04	0.18	0.00	0.02	0.02	0.02	0.02
Ponnequin, Colorado	0.06	0.06	0.00	0.00	0.00	0.00	0.00	0.00
Hopkins Ridge, Washington	0.43	0.01	0.27	0.01	0.00	0.00	0.08	0.00
Maiden, Washington	0.18	0.05	0.04	0.03	0.00	0.03	0.02	0.00
Wild Horse, Washington	0.16	0.12	0.00	0.00	0.00	0.02	0.02	0.00
Kittitas Valley, Washington	0.09	0.09	0.00	0.00	0.00	0.00	0.00	0.00
Desert Claim, Washington	0.34	0.23	0.00	0.00	0.00	0.00	0.04	0.00
Average	0.19	0.07	0.07	0.01	0.00	0.01	0.02	0.00

Table 16. Potential occurrence of bat species in the Project area.

Common Name and Scientific Name	Typical Habitat	Expected Occurrence in Project Area	Occurrence Documentation
California bat *Myotis californicus*	Generally found in open habitats where it forages along tree edges, riparian areas, open water; roosts in cliffs, caves, trees	Possible; documented on ALE	WA GAP Analysis Project[a], 1999; England, 2000; Fitzner and Gray, 1991
small-footed myotis *Myotis ciliolabrum*	Varied arid grass/shrublands, ponderosa pine and mixed forests; roosts in crevices and cliffs; hibernates in caves, mines	Possibe; documented on ALE	WA GAP Analysis Project, 1999; England ,2000; West *et al.*, 1998, 1999
long-eared myotis *Myotis evotis*	Primarily forested habitats and edges, juniper woodland, mixed conifers, riparian areas; roosts snags, crevices, bridges, buildings, mines	Unlikely due to habitat; not documented on ALE	WA GAP Analysis Project, 1999; England, 2000; TNC, 1999
little brown bat *Myotis lucifugus*	Closely associated with water; riparian corridors; roosts buildings, caves, hollow trees; hibernates in caves	Possible; documented on ALE	WA GAP Analysis Project, 1999; England, 2000; West *et al.*, 1998, 1999
fringed myotis *Myotis thysanodes*	Primarily forested or riparian habitats; roosts buildings, trees; hibernates in mines and caves	Possible in suitable habitat; not documented on ALE	WA GAP Analysis Project, 1999; England, 2000; TNC, 1999
long-legged myotis *Myotis volans*	Coniferous and mixed forests, riparian areas; roosts caves, crevices, buildings, mines	Possible in suitable habitat; documented on ALE	WA GAP Analysis Project, 1999; England, 2000; Fitzner and Gray, 1991
yuma myotis *Myotis ymanensis*	Closely associated with water; varied habitats: riparian, shrublands, forests woodlands; roosts in mines, buildings, caves, bridges	Possible; documented on ALE	WA GAP Analysis Project, 1999; England, 2000; West *et al.*, 1998, 1999
hoary bat *Lasiurus cinereus*	Forested habitats, closely associated with trees; roosts in trees; migratory species	Possible in suitable habitat; probable migrant; documented on ALE	WA GAP Analysis Project, 1999; England, 2000; West *et al.*, 1998, 1999
silver-haired bat *Lasionycteris noctivagans*	Forested habitats; generally coniferous forests; roosts under bark; believed to be a migratory species	Possible in suitable habitat; probable migrant; documented on ALE	WA GAP Analysis Project, 1999; England, 2000; West *et al.*, 1998, 1999

Table 17. Wildlife observations recorded while traveling between fixed-point stations or during all other non-avian use surveys (including eagle, raptor nest, TES wildlife and plant species).

Species	# Obs.	# Groups
unidentified scaup	1900	3
unidentified duck	1666	4
unidentified waterfowl	800	1
mallard	570	2
Canada goose	180	4
American coot	150	1
unidentified gull	35	1
red-tailed hawk[a]	14	9
bufflehead	14	2
bald eagle[e]	13	11
northern pintail	9	1
American kestrel	8	7
northern shrike	8	5
loggerhead shrike	6	6
golden eagle	3	3
rough-legged hawk	3	3
sage thrasher	3	3
Say's phoebe	3	2
California quail	2	1
common raven	2	1
Bullock’s oriole	1	1
burrowing owl	1	1
common loon	1	1
horned grebe	1	1
northern harrier	1	1
sage sparrow	1	1
sharp-shinned hawk	1	1
unidentified shrike	1	1
western bluebird	1	1
Avian Subtotal	**5398**	**79**
least chipmunk	9	5
Townsends ground squirrel[b]	5	5
mule deer[c]	3	2
coyote	1	1
white-tailed jack rabbit[d]	1	1
Mammal Subtotal	**19**	**14**
short-horned lizard	2	2

[a] A possible nest observed.
[b] *Spermophilus townsendi nancyae*. Only two actual sightings. The other three were auditory only and could be an entire colony rather than a single individual.
[c] One group observed at station 2 and other group at station 6.
[d] Two white-tailed jack rabbit scat piles were observed which didn’t affect the subtotal.
[e] Total number influenced by repeat observations of nesting adults on Columbia River.

Figure 1a. Map of proposed Vantage Wind Facility turbine strings with 2-mi buffer, proximity to Wild Horse wind turbines, and various landmarks.

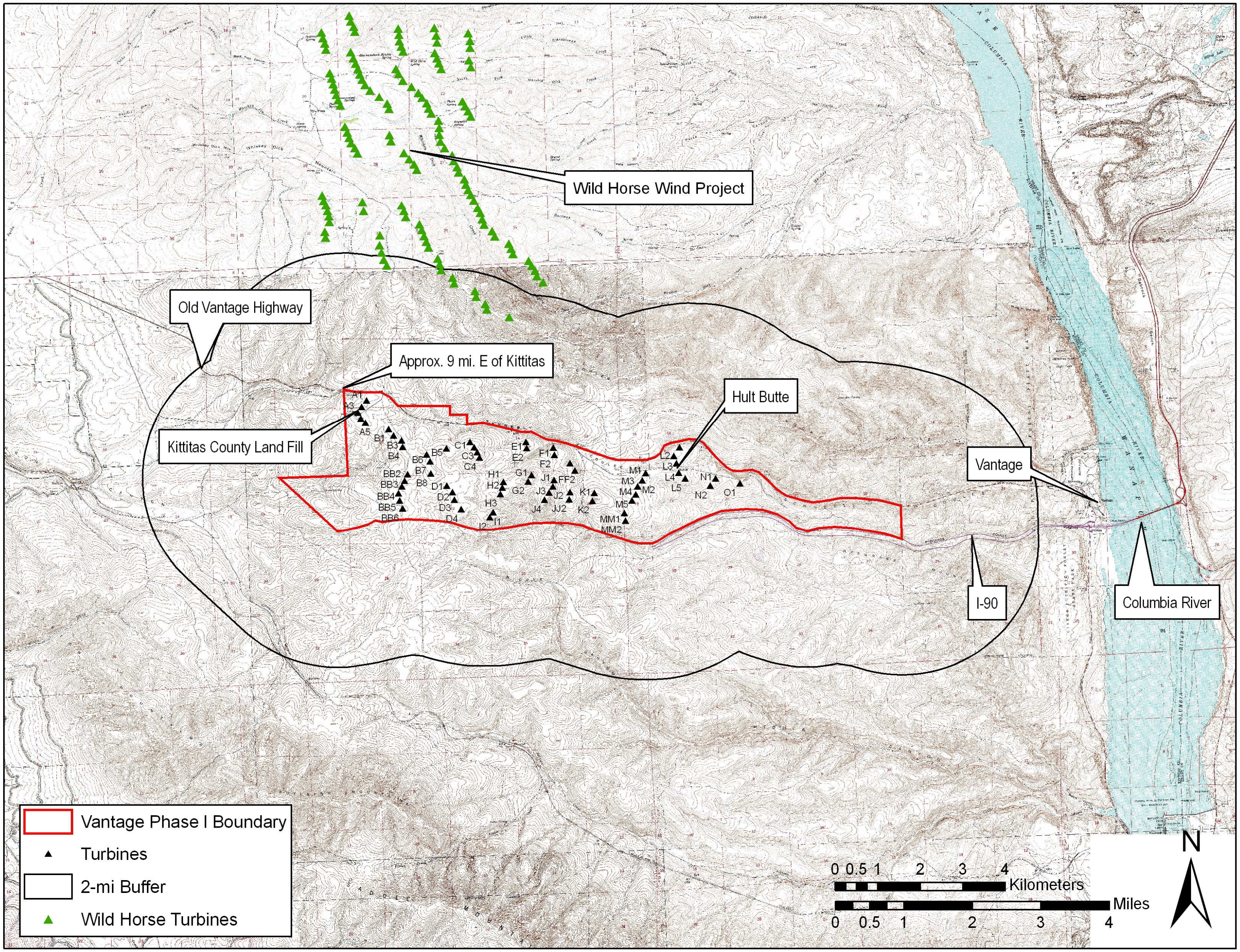


Figure 1b. Map of proposed Vantage Wind Facility turbine strings with 2-mi buffer, proximity to Wild Horse wind turbines, digital elevation model color-coding, and various landmarks.

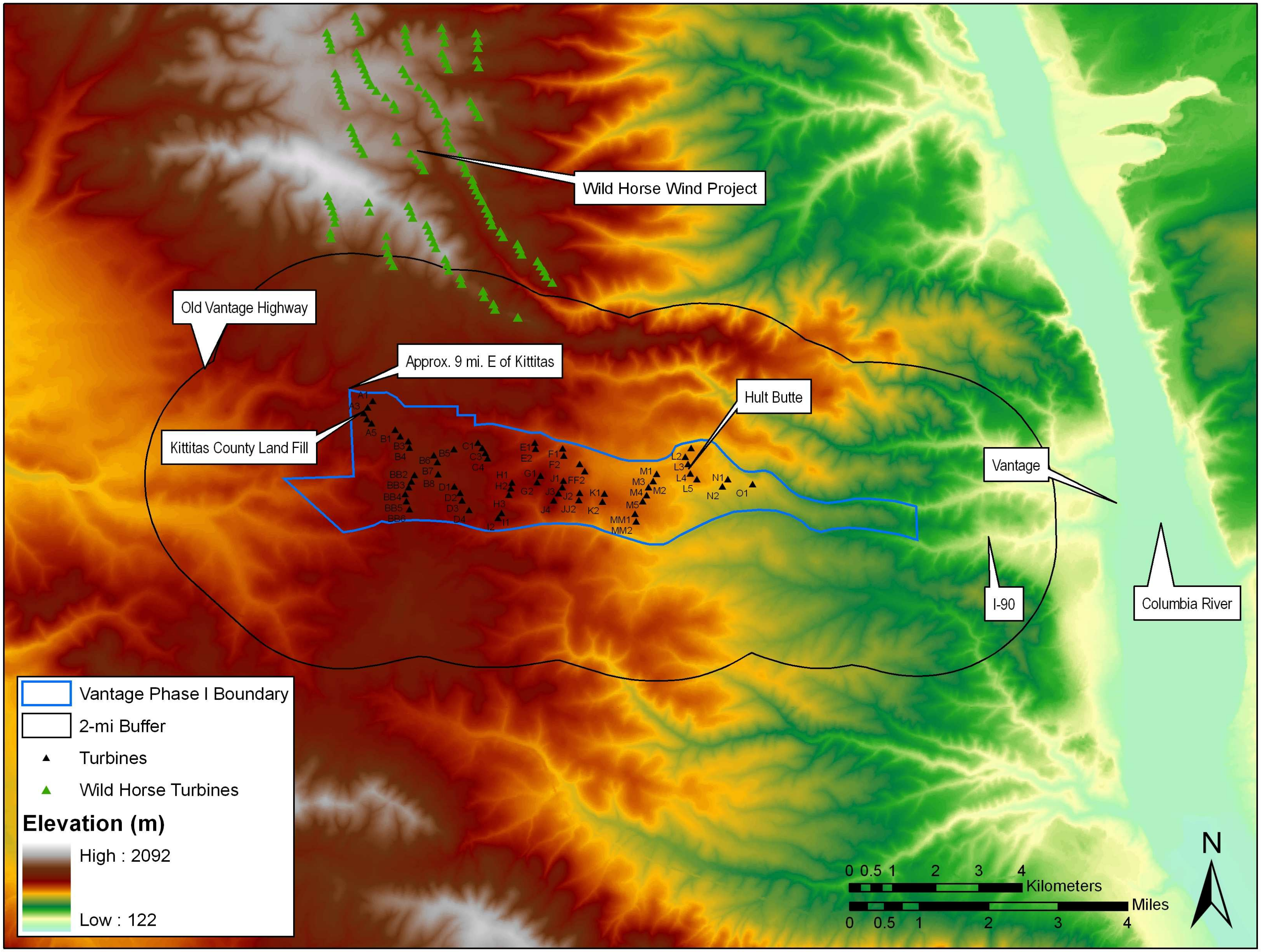


Figure 1c. Map of Vantage Wind project area with 2-mi area buffer. Quarter-mile aerial guidance transects were used for systematic raptor nest coverage, and 1/8th mile transect coverage of suitable habitat for sage grouse lek surveys.

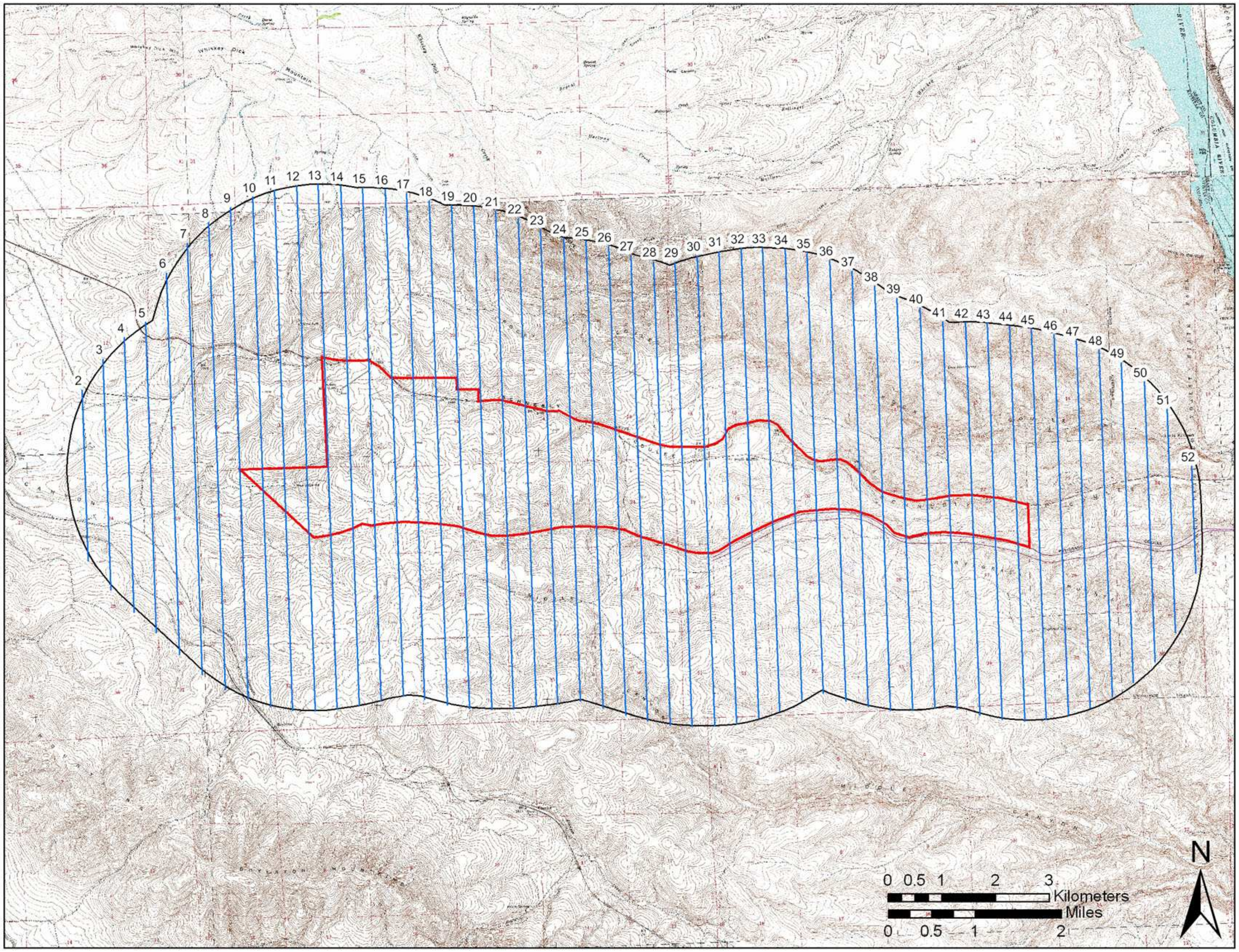


Figure 2. Location of Vantage Wind Power Project boundary and fixed-point avian observation stations with UTMs, NAD27 projection.

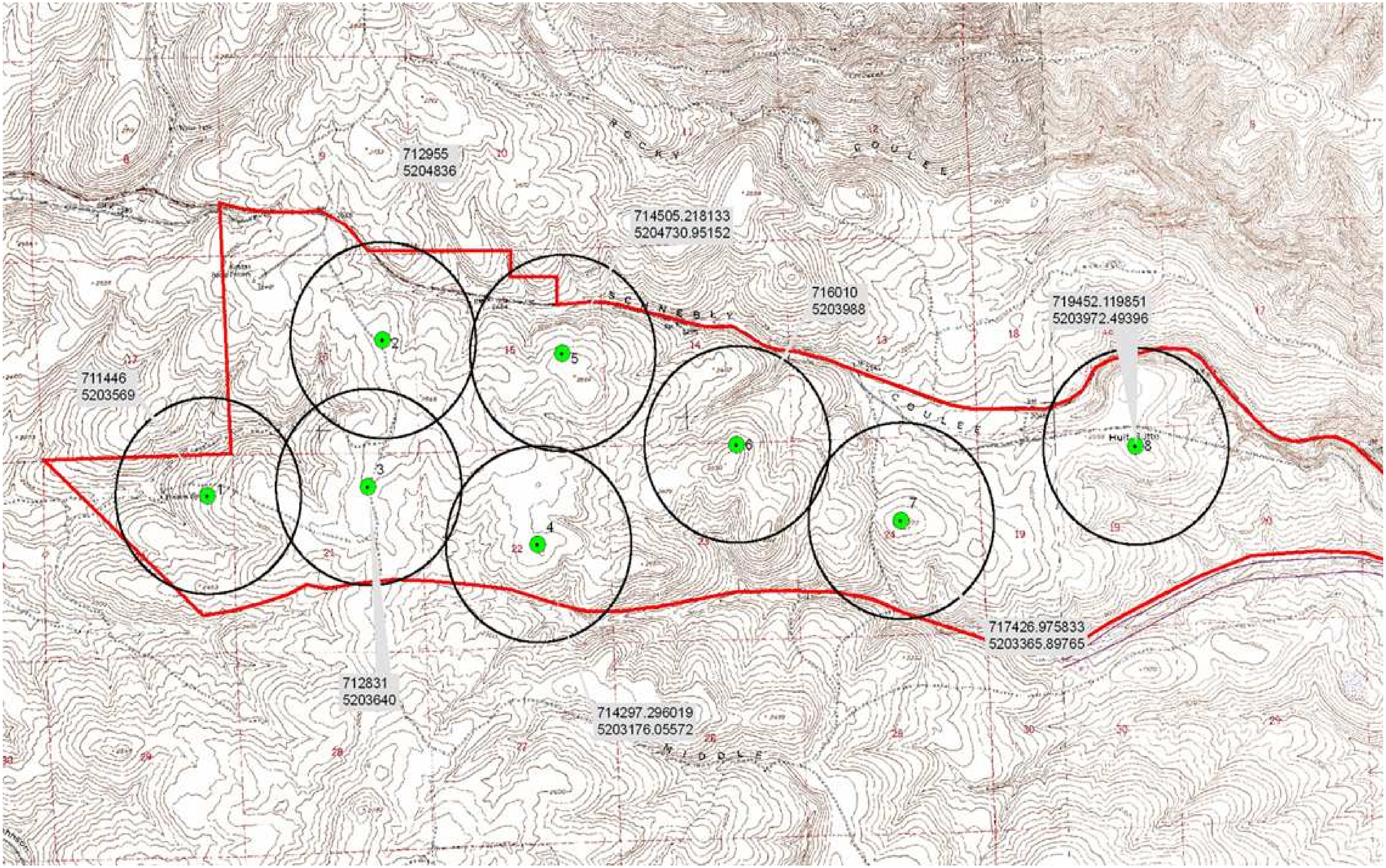


Figure 3. Raptor nests and big game located during 2006 aerial surveys of the proposed Vantage Wind Project development area.

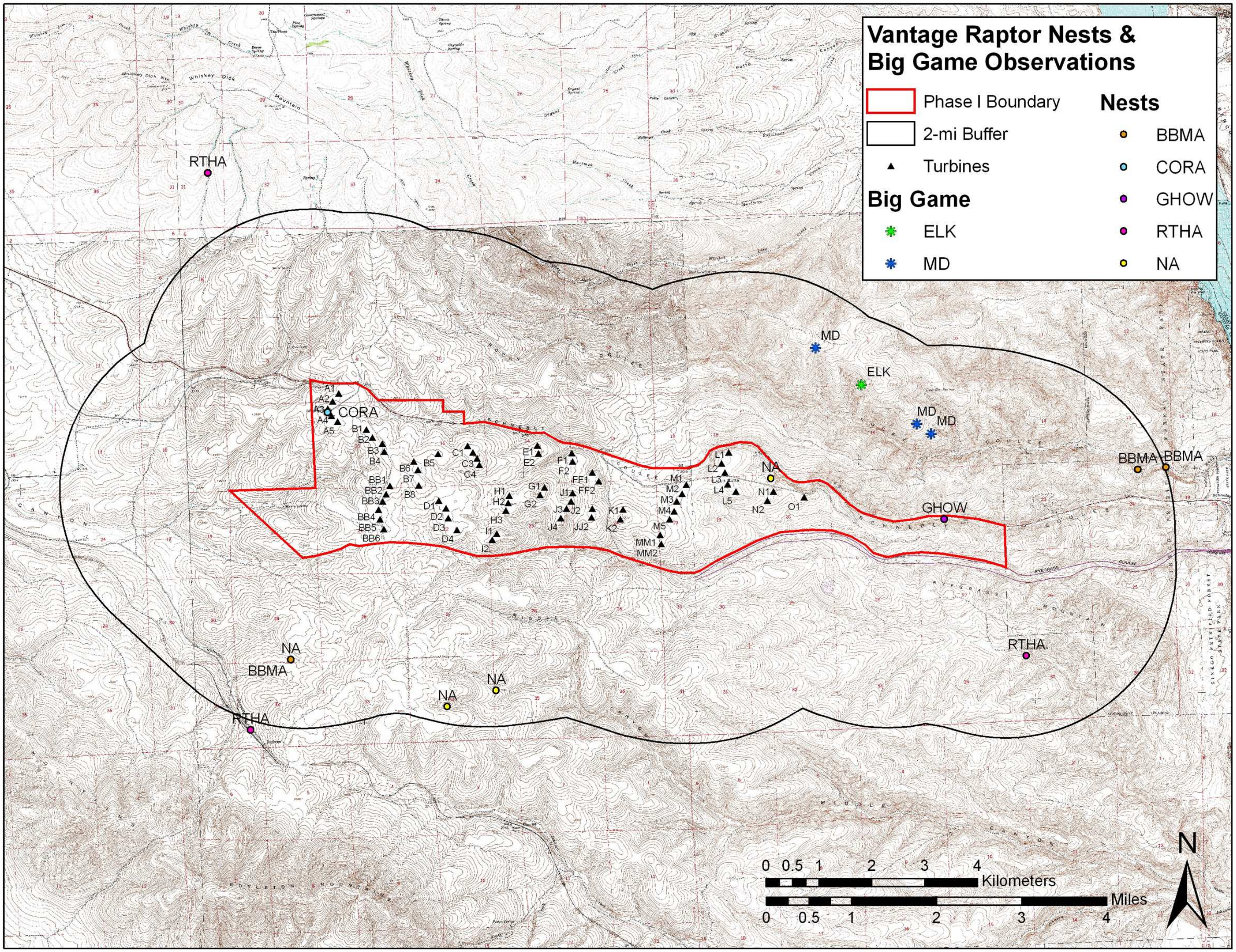


Figure 4. Vantage project and location of active 2006 bald eagle nest.

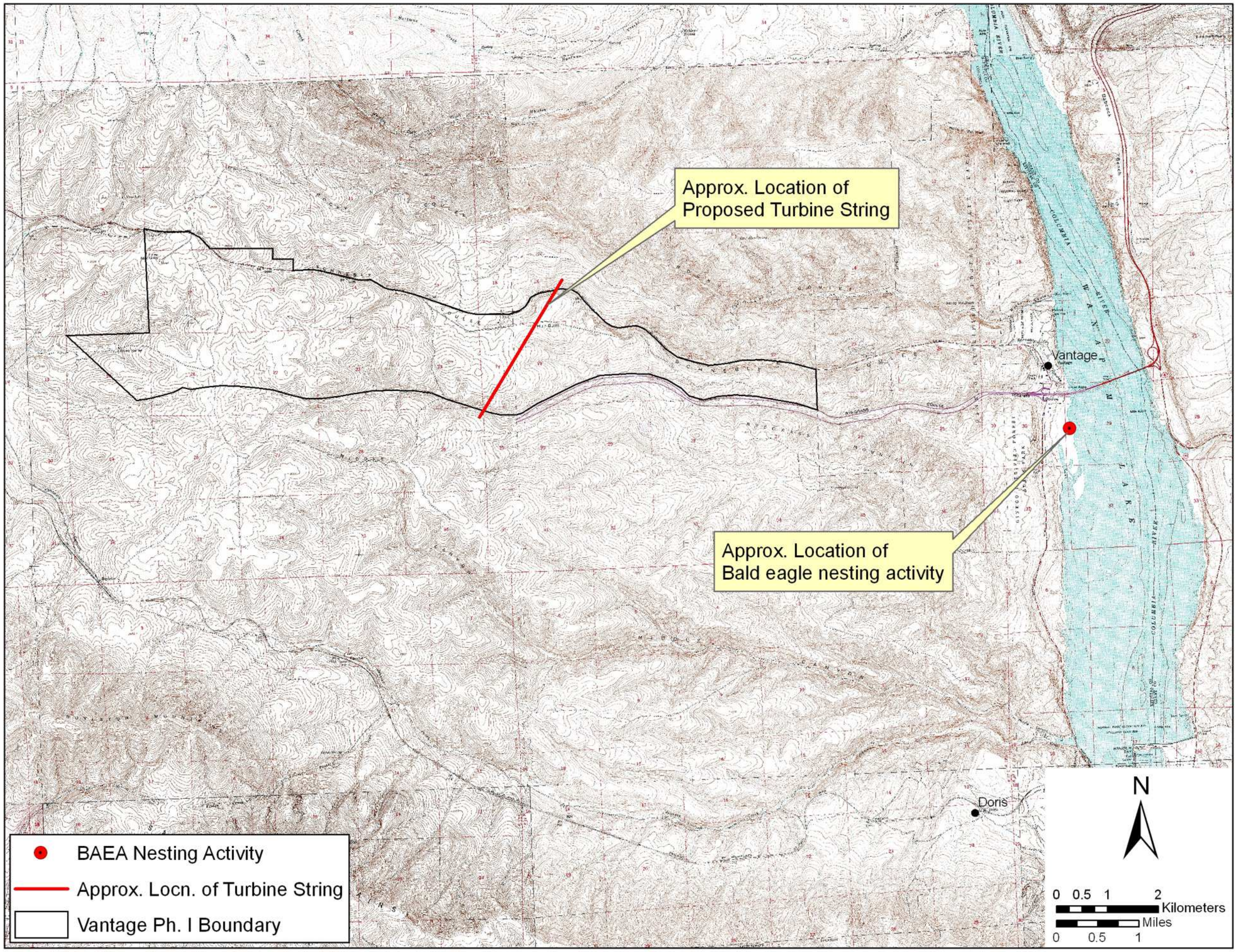


Figure 5. Aerial flight paths for 2006 raptor nest and sage grouse surveys.

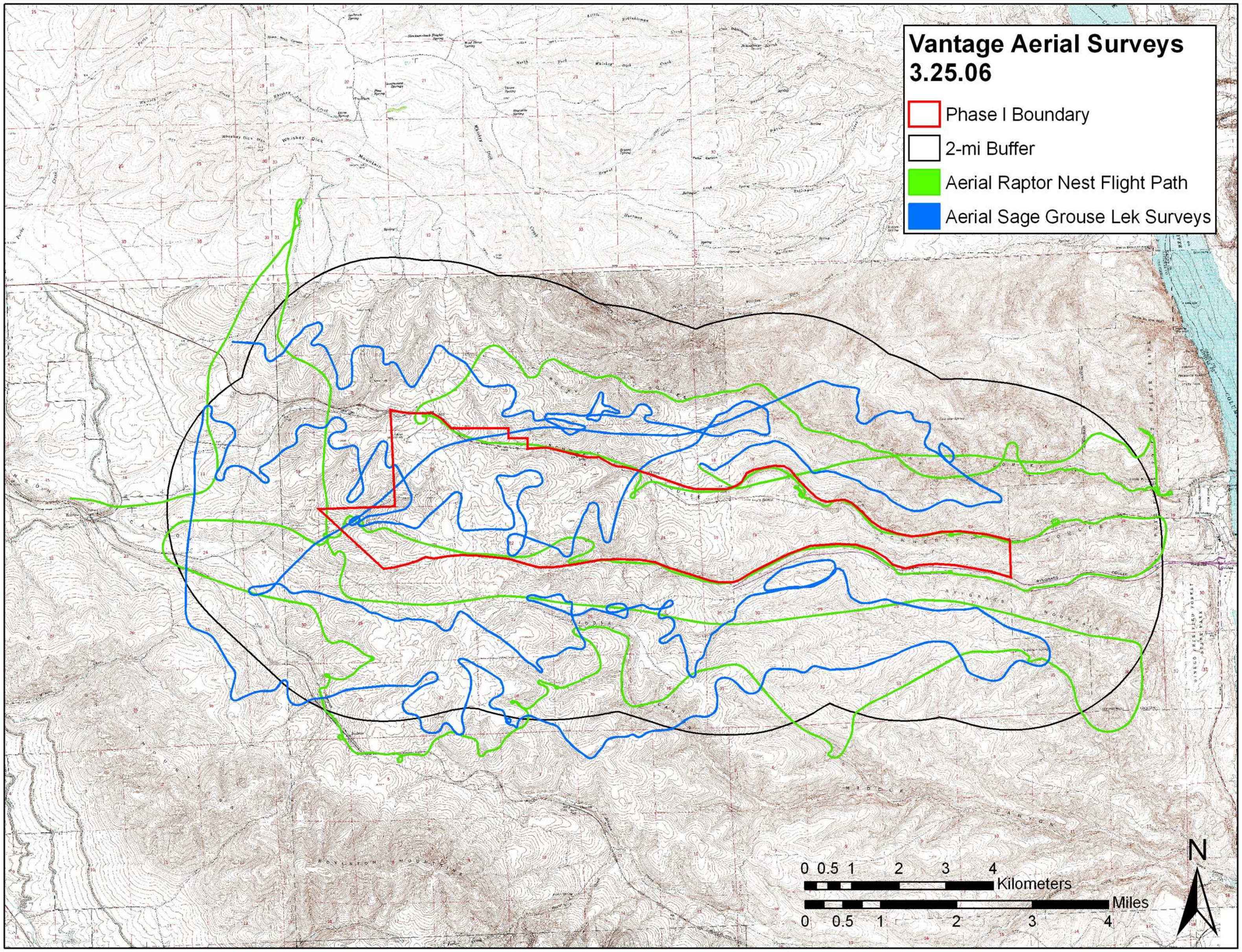


Figure 6. Habitat and hedgehog cactus (*Pediocactus simpsonii*) populations for the proposed Vantage Wind Project development area.

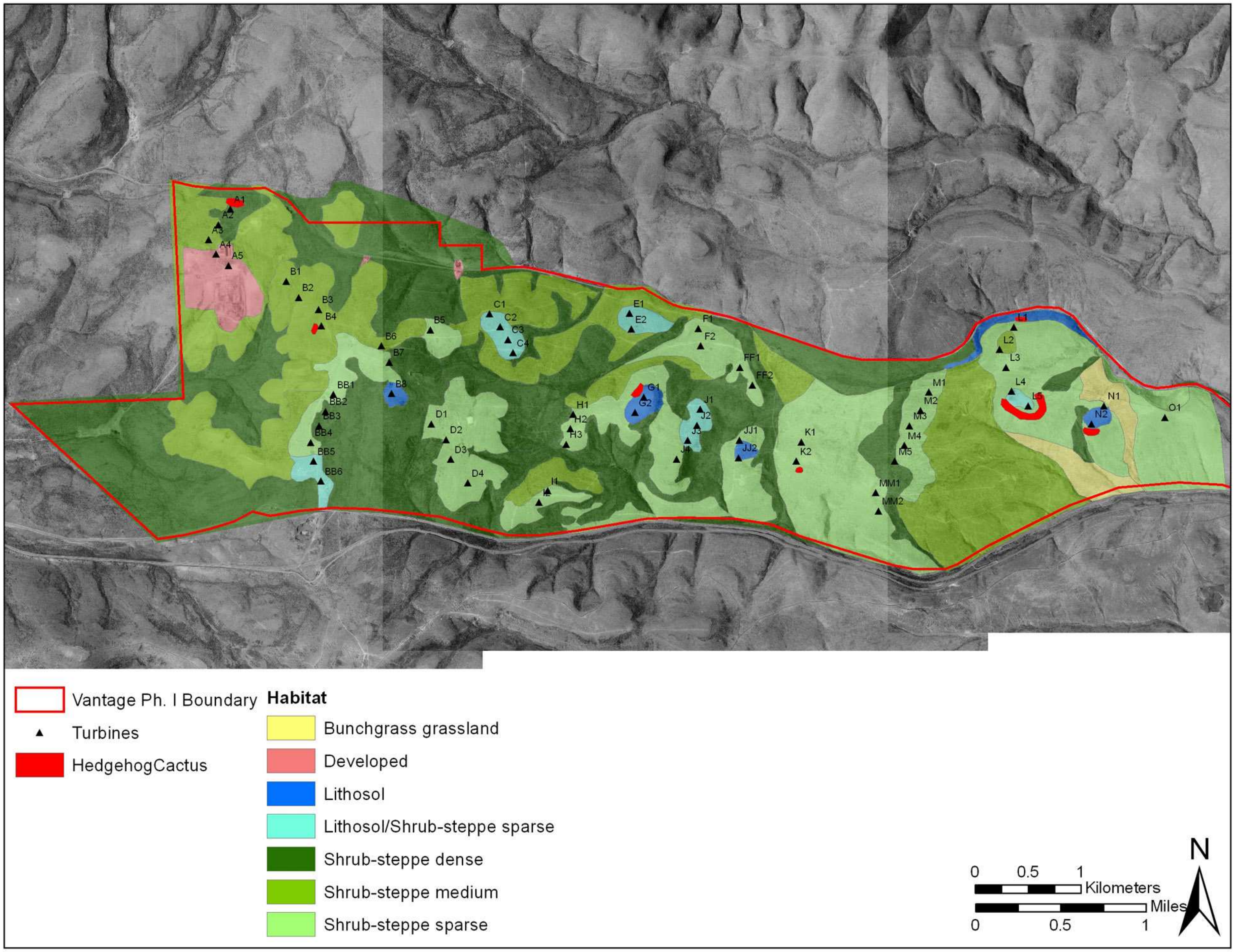
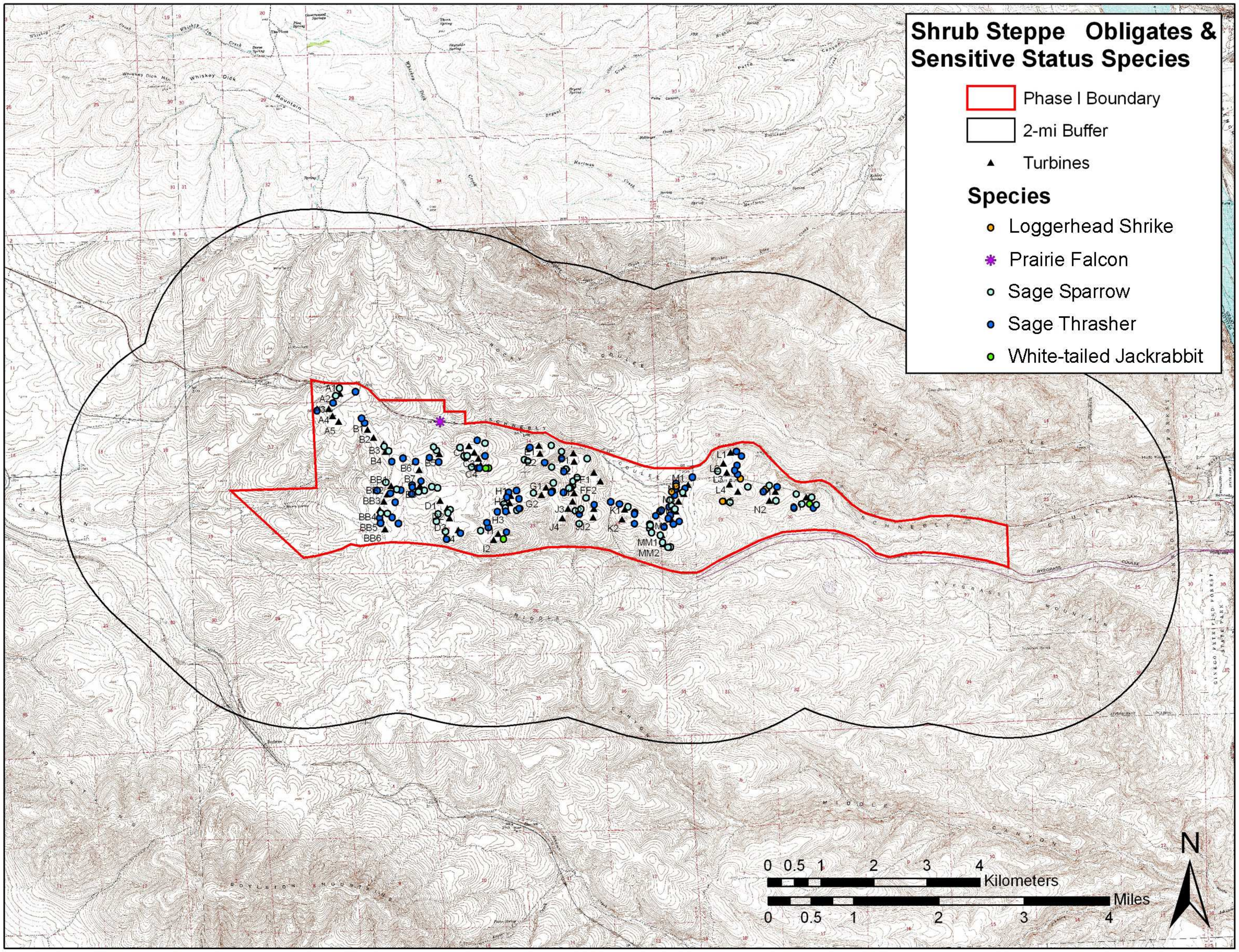


Figure 7. Shrub-steppe obligate and sensitive status species documented on the proposed Vantage Wind Power Project, spring 2006.



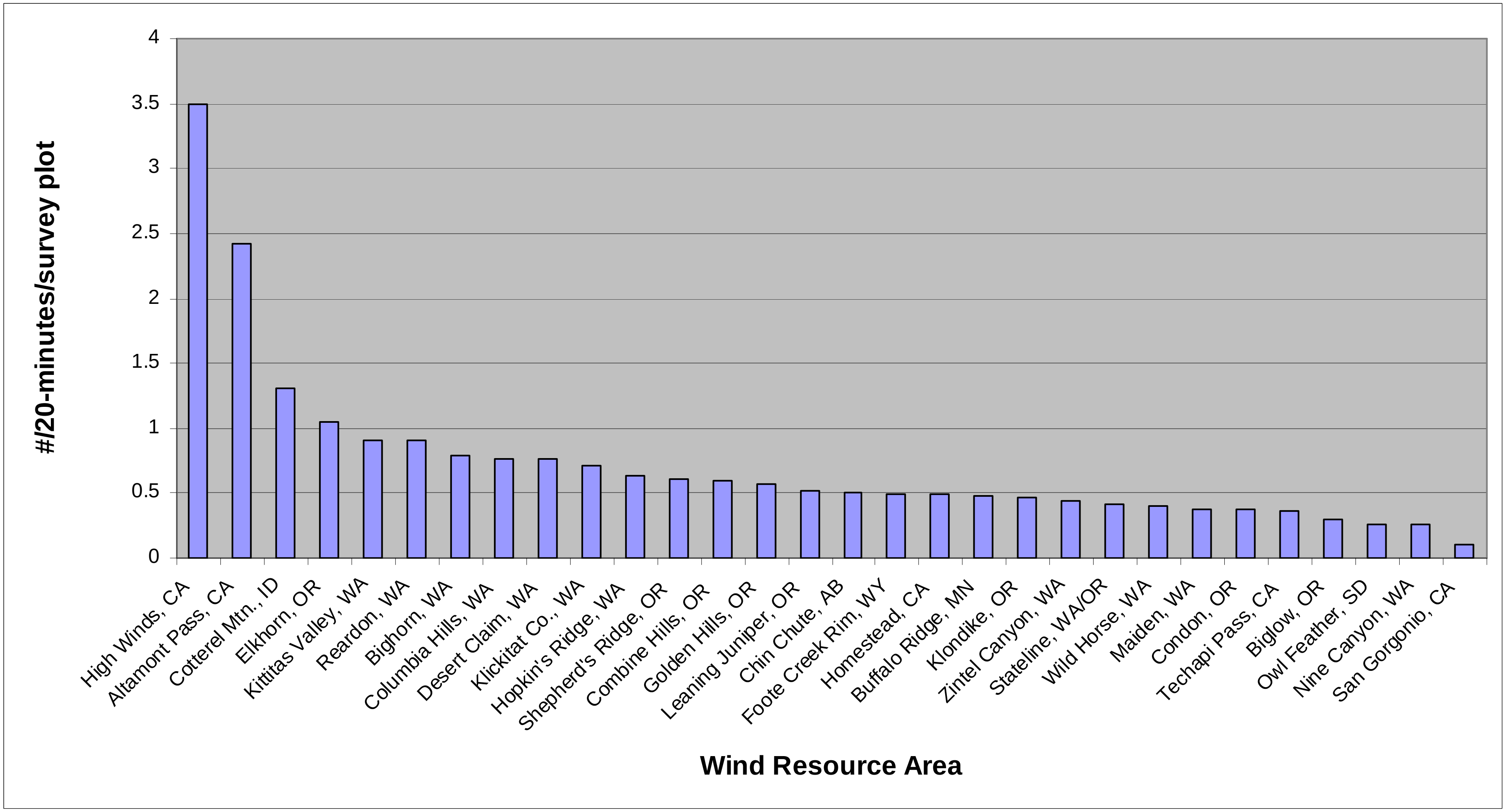
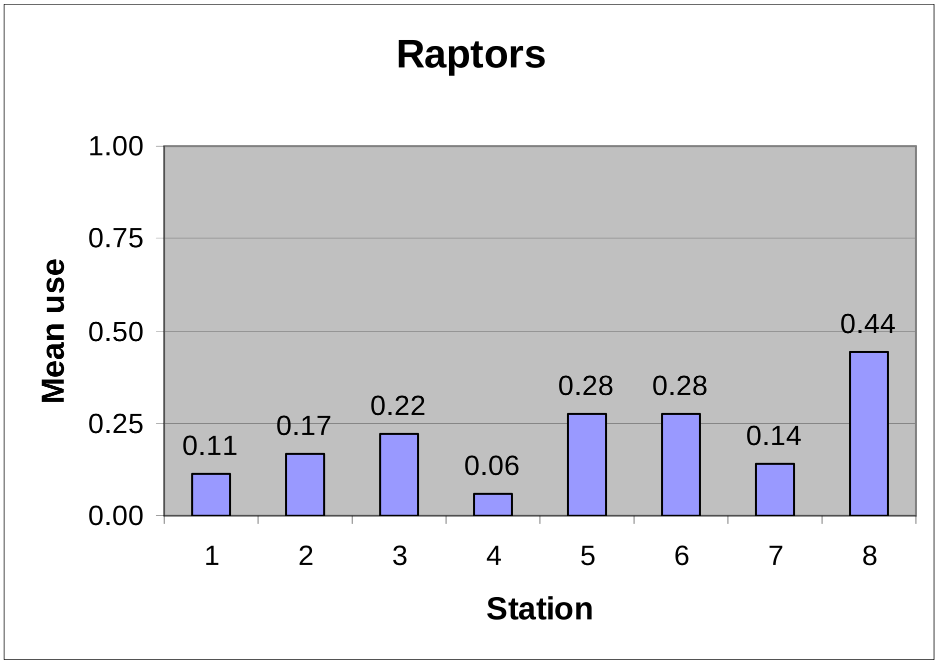


Figure 8. Raptor Use Estimates from Open Habitat Facilities in the West and Midwest That Have Used Similar Methods of Data Collection.

Figure 9. Avian use (#/20-min survey) by fixed-point station and mapped flight paths or perch locations from March 2006 through March 2007.



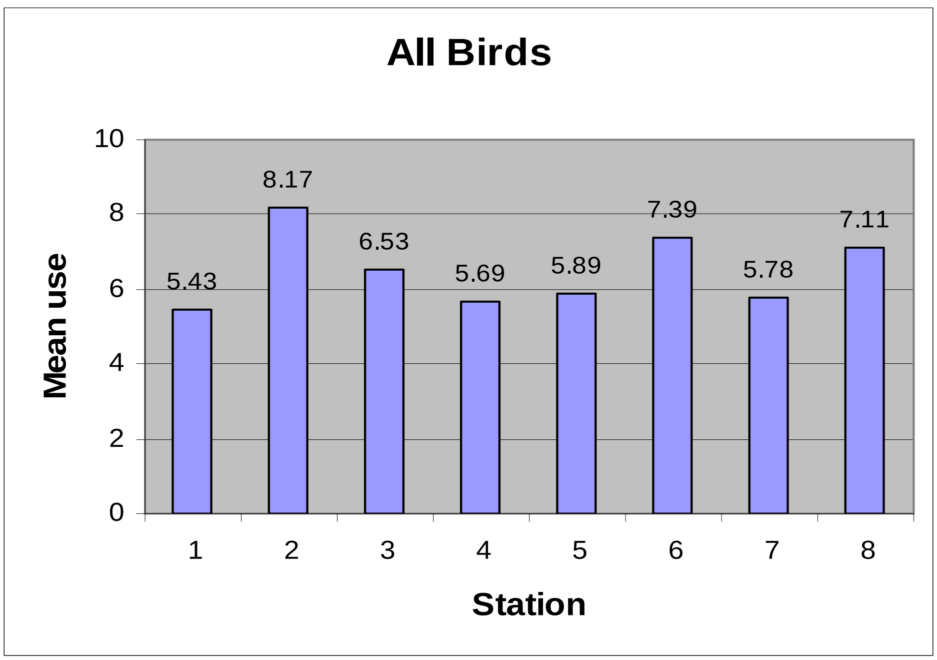
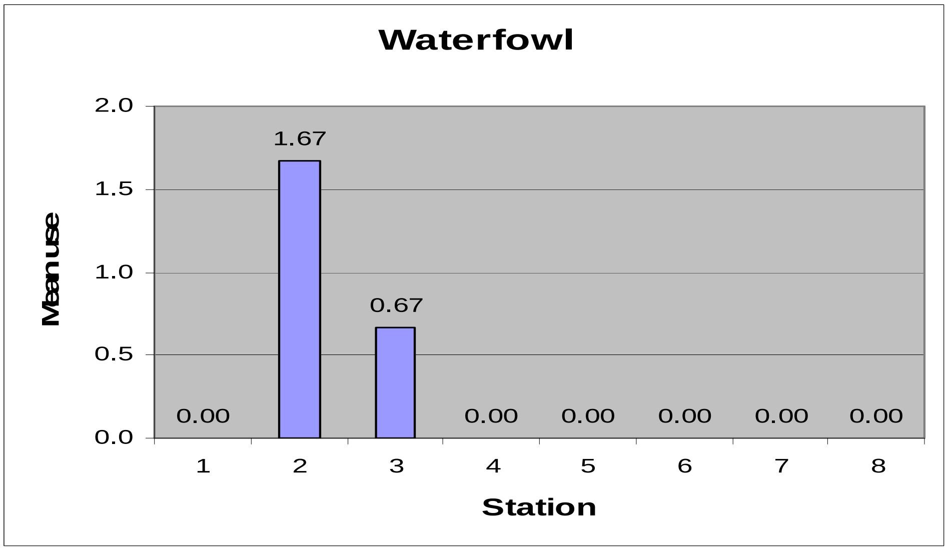


Figure 9a. Station use (#/20-min survey) for Raptors and All Birds for the Invenergy Vantage site.



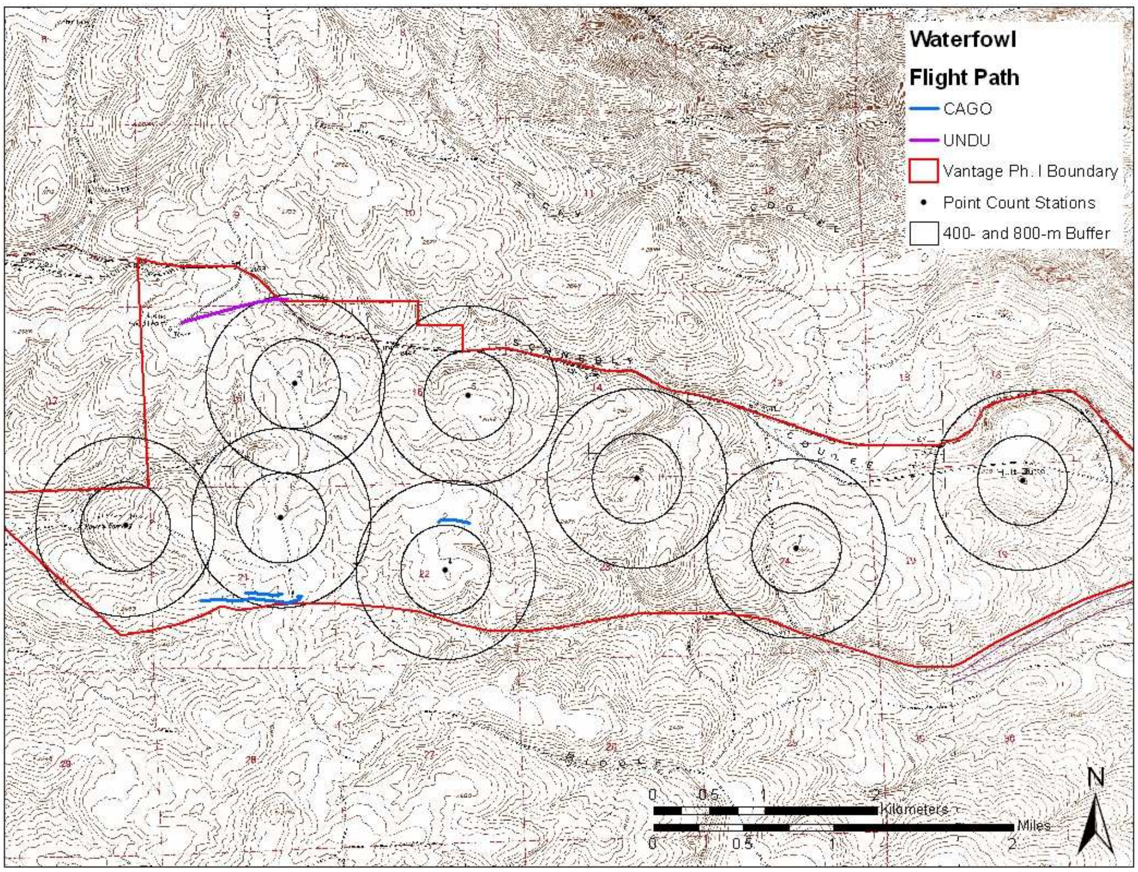
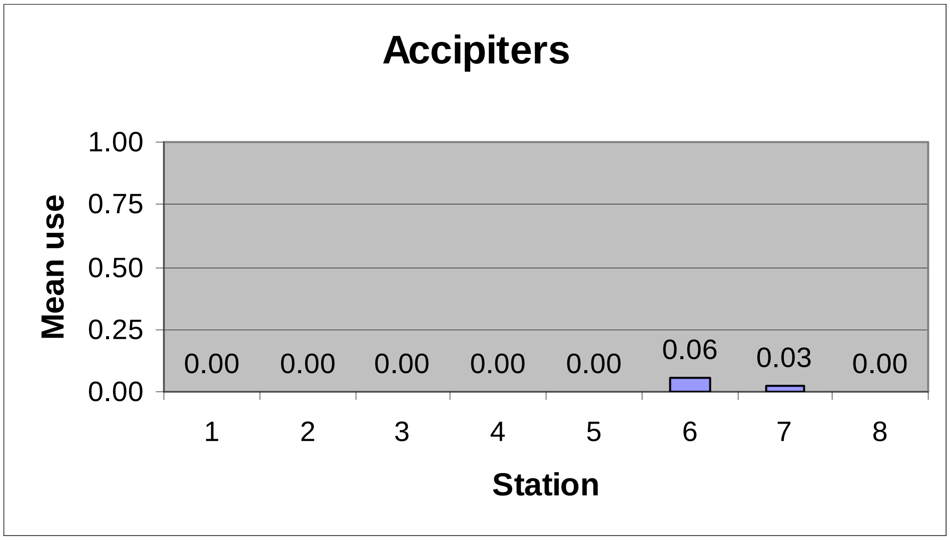


Figure 9b. Station use (#/20-min survey), flight paths, and perched points for waterfowl for the Invenergy Vantage site.



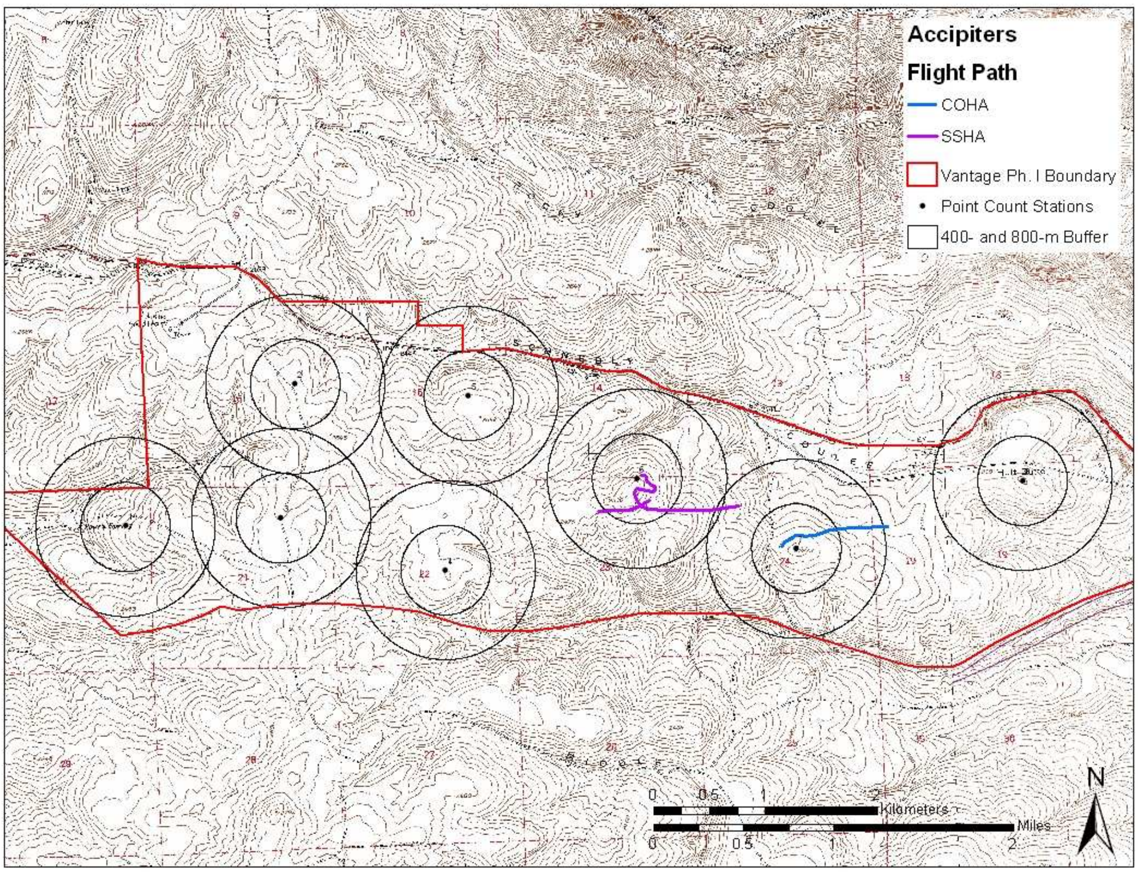
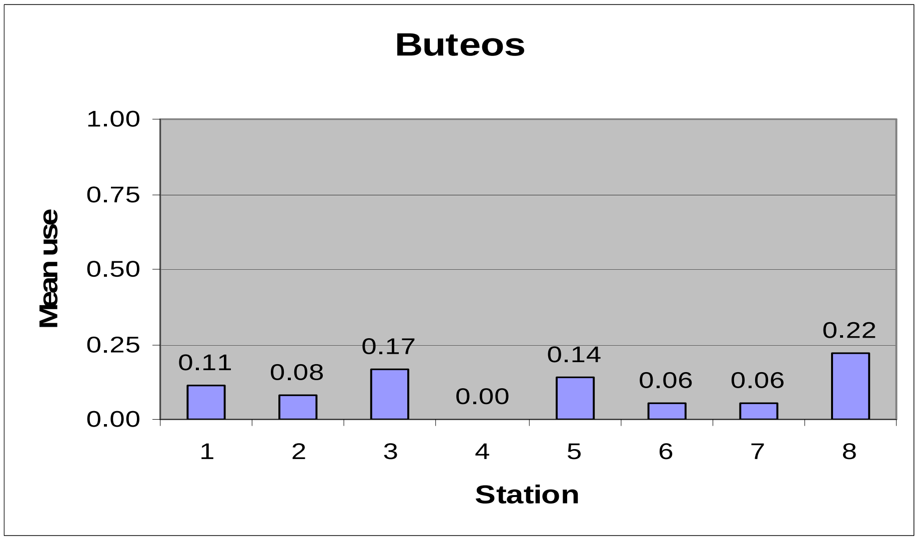


Figure 9c . Station use (#/20-min survey), flight paths, and perched points for accipiters for the Invenergy Vantage site.



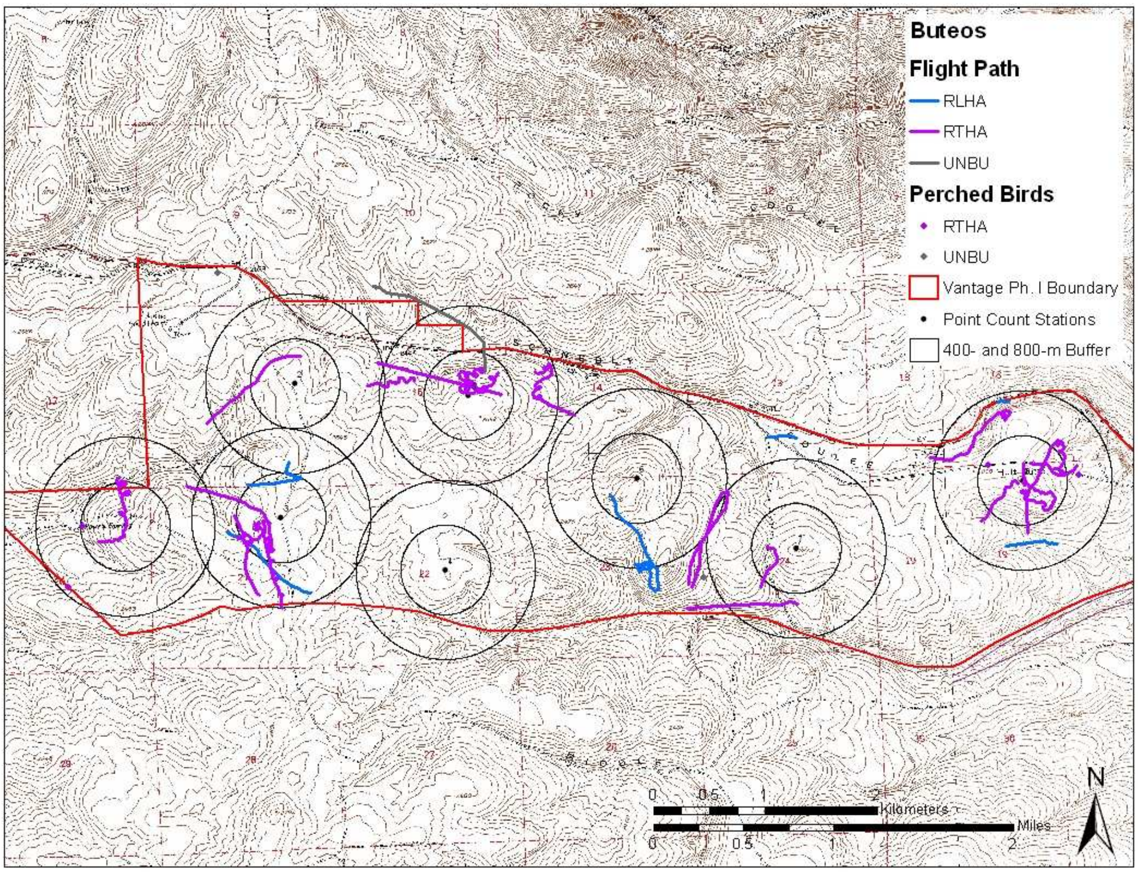
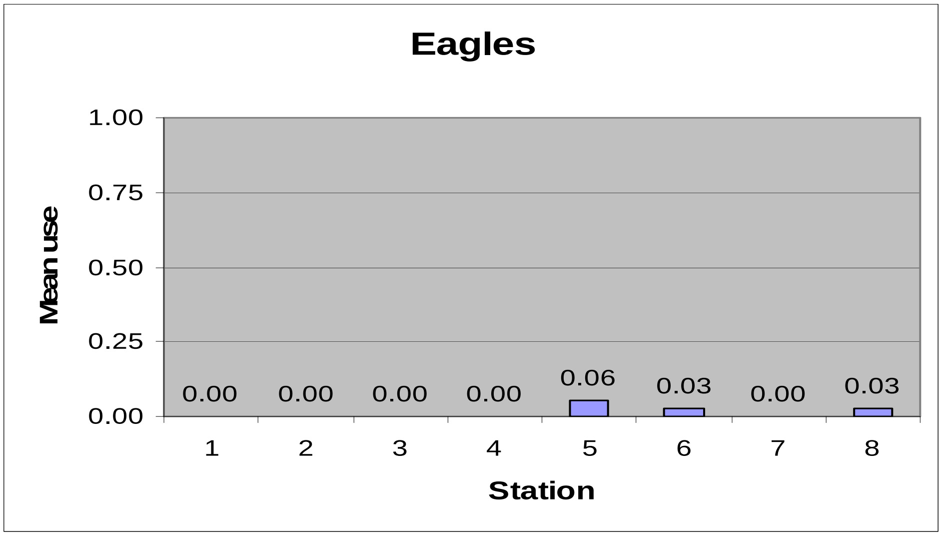


Figure 9d. Station use (#/20-min survey), flight paths, and perched points for buteos for the Invenergy Vantage site.



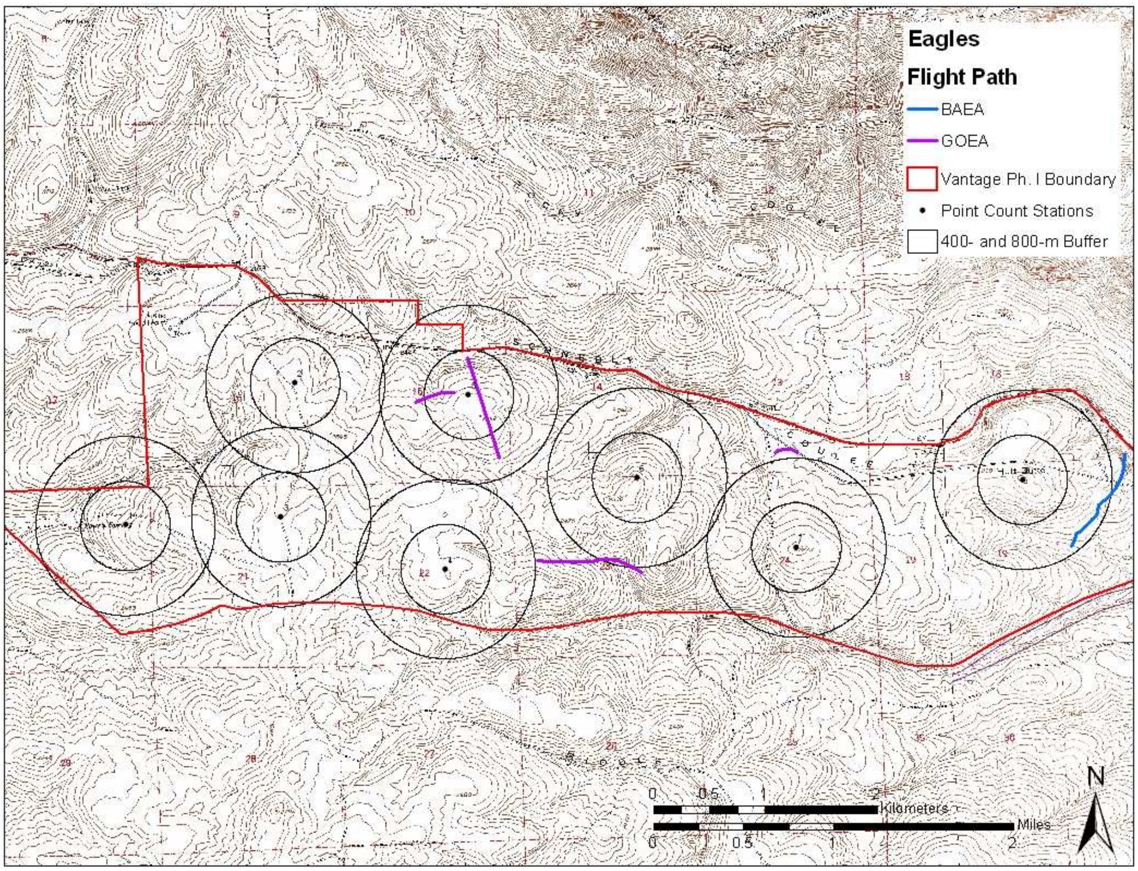


Figure 9e. Station use (#/20-min survey) and flight paths for eagles for the Invenergy Vantage site

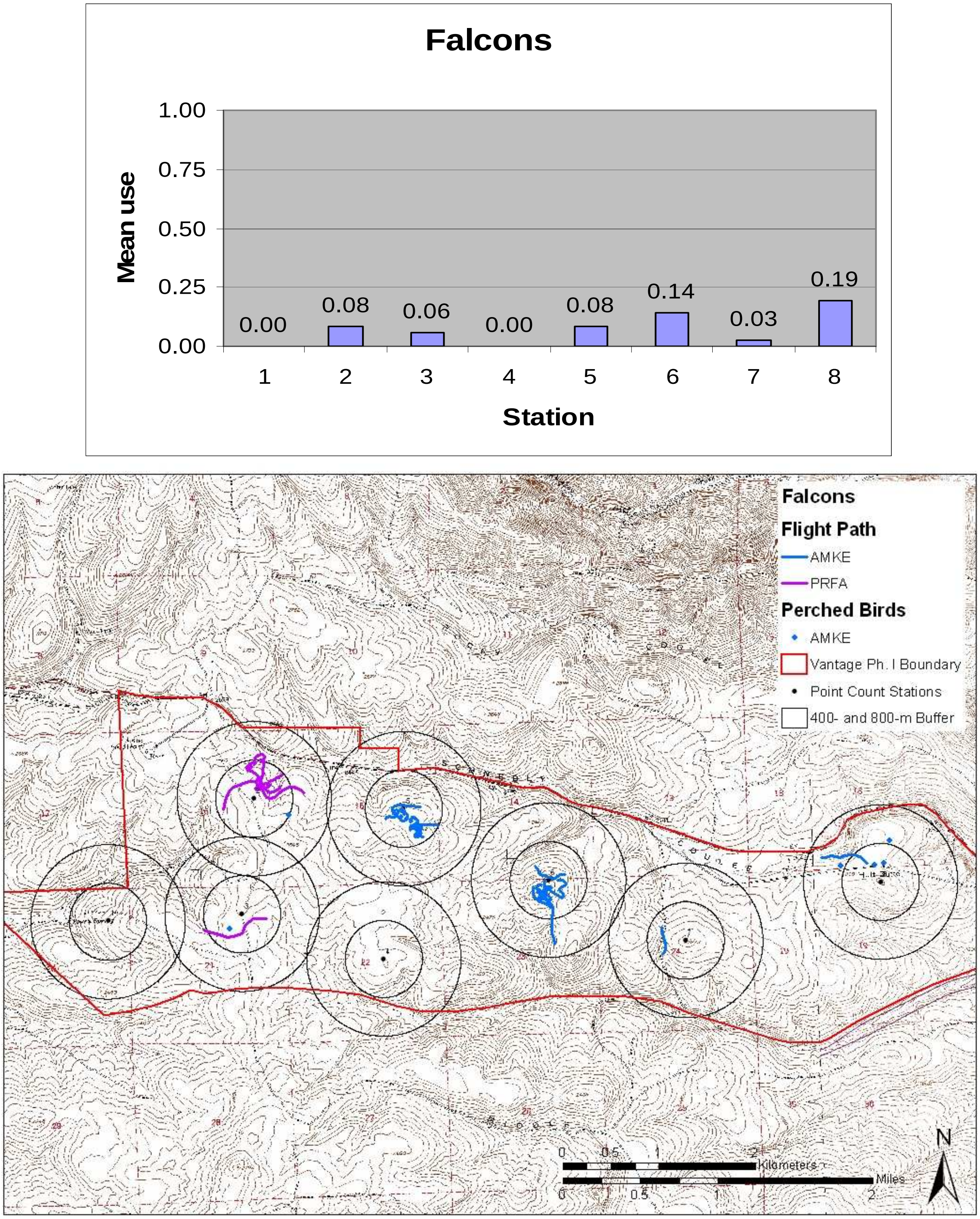
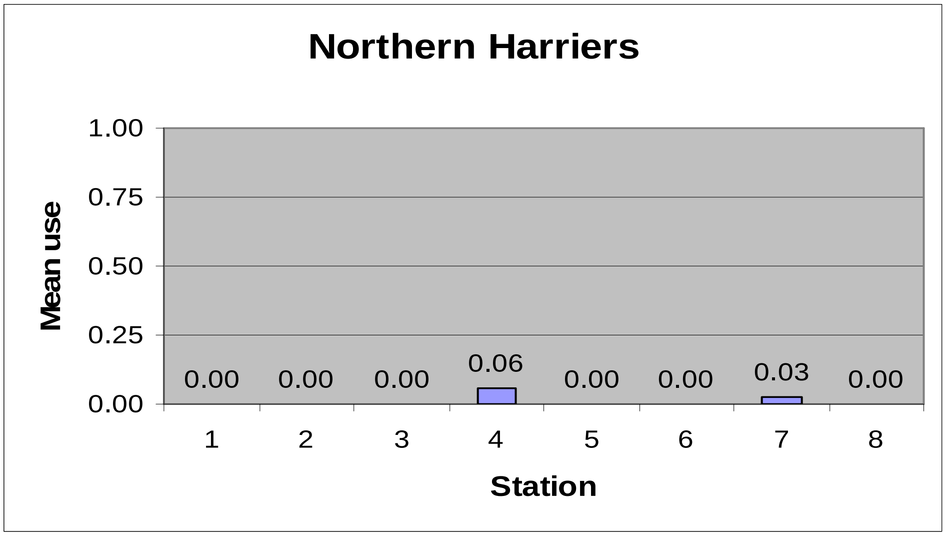


Figure 9f . Station use (#/20-min survey), flight paths, and perched points for Falcons for the Invenergy Vantage site.



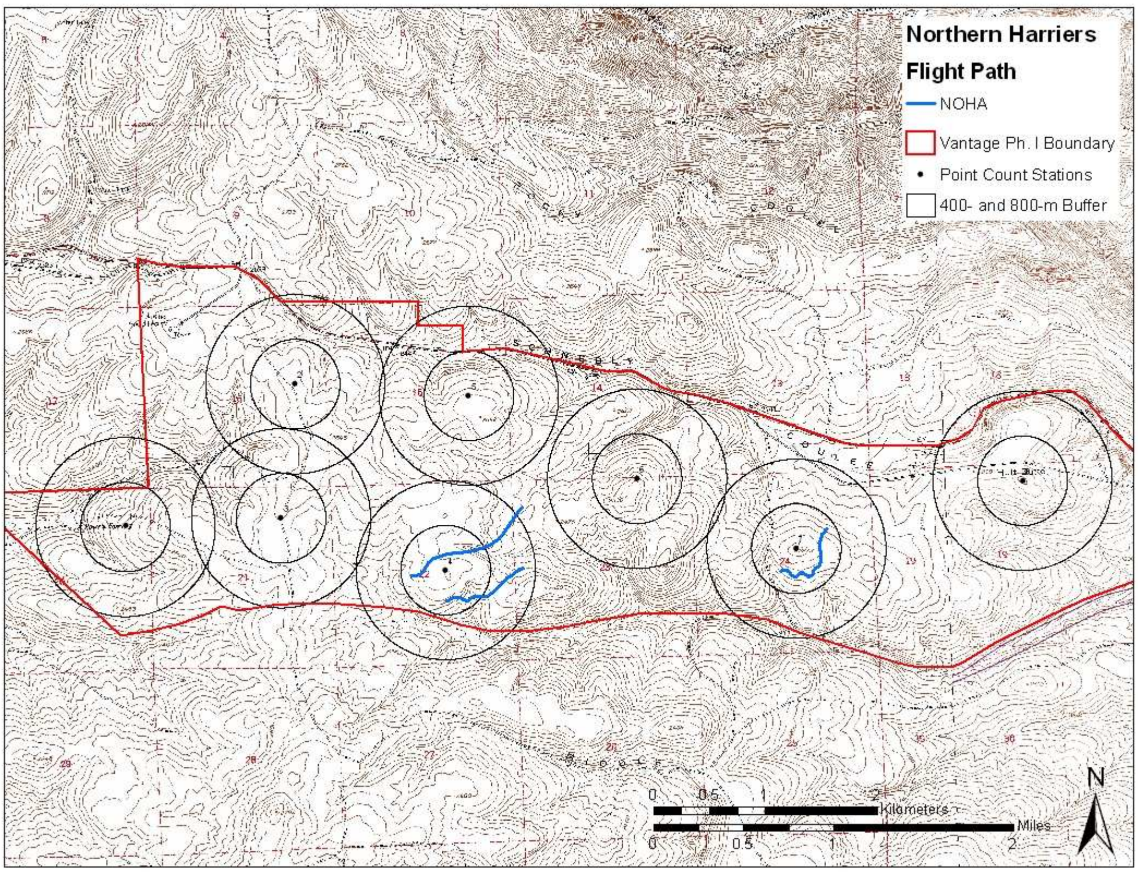


Figure 9g. Station use (#/20-min survey) and flight paths for northern harriers for the Invenergy Vantage site.

Appendix A. List of vascular plant species documented during spring 2006 rare plant surveys at the proposed Vantage Wind Energy Facility, Washington.

Family	Scientific Name	Common Name
APIACEAE	*Lomatiun canbyi*	Canby's lomatium
	Lomatium dissectum	fern-leaved lomatium
	Lomatium macrocarpum	large-fruited lomatium
	Lomatium grayi	Gray's desert parsley
	Lomatium gormanii	salt and pepper
	Lomatium spp.	lomatium
	Osmorhiza sp.	sweet-root
ASTERACEAE	*Achillea millefolium*	common yarrow
	Agoseris sp.	agoseris
	Antennaria dimorpha	low pussytoes
	Antennaria spp.	pussytoes
	Artemisia rigida	stiff sagebrush
	Artemisia tridentata	big sagebrush
	Balsamorhiza sagittata	arrow-leaf balsamroot
	Balsamorhiza hookeri	Hooker's balsamroot
	Centaurea sp.	knapweed
	Chaenactis sp.	chaenactis
	Cirsium sp.	thistle
	Ericameria nauseosa ssp. *nauseosa*	gray rabbitbrush
	Erigeron sp.	fleabane
	Madia sp.	tarweed
	Senecio integerrimus	western groundsel
	Stenotus stenophyllus	woolly goldenweed
	Taraxacum officinale	common dandelion
	Tragopogon dubius	yellow salsify
BORAGINACEAE	*Amsinckia* sp.	fiddleneck
	Cryptantha spp.	cryptantha
	Lithospermum ruderale	Columbia puccoon
	Mertensia longiflora	long-flowered bluebells
BRASSICACEAE	*Arabis* sp.	rockcress
	Chorispora tenella	blue mustard
	Descurainia sp.	tanseymustard
	Erysimum asperum	rough wallflower
	Sisymbrium altissimum	tumble mustard
CACTACEAE	*Pediocactus simpsonii*	hedgehog cactus
	Symphoricarpos oreophilus var. *utahensis*	mountain snowberry
CARYOPHYLLACEAE	*Silene* sp.	silene
CHENOPODIACEAE	*Salsola kali*	Russian thistle
CRASSULACEAE	*Sedum sp.*	stonecrop
CRUCIFERAE	*Phoenicaulis cheiranthoides*	dagger-pod
FABACEAE	*Astragalus* spp.	milkvetch
	Astragalus purshii	wooly-pod milkvetch
	Lupinus argenteus	silver lupine

Appendix A (continued). List of vascular plant species documented during spring 2006 rare plant surveys at the proposed Vantage Wind Energy Facility, Washington.

Family	Scientific Name	Common Name
	Trifolium macrecephalum	big-headed clover
	Vicia americana	American vetch
HYDROPHYLLACEAE	*Phacelia linearis*	threadleaf phacelia
	Phacelia sp.	phacelia
IRIDACEAE	*Iris missouriensis*	western blue flag
LAMIACEAE	*Salvia dorrii*	purple sage
LILIACEAE	*Allium* spp.	onion
	Calochortus spp.	mariposa
	Fritillaria pudica	yellow bell
	Maianthemum sp.	Solomon-plume
	Triteleia douglasii	Douglas' triteleia
	Zigadenus venenosus	death camas
ONOGRACEAE	*Epilobium* sp.	willow herb
POACEAE	*Bromus tectorum*	cheatgrass
	Festuca idahoensis	Idaho fescue
	Hesperostipa comata	needle-and-thread grass
	Poa bulbosa	bulbous bluegrass
	Poa pratensis	Kentucky bluegrass
	Poa secunda	Sandberg's bluegrass
	Pseudoroegneria spicata	blue-bunch wheatgrass
POLEMONIACEAE	*Collomia grandiflora*	large flowered collomia
	Gilia aggregata	scarlet gilia
	Phlox hoodii	Hood's phlox
	Phlox longifolia	long-leaf phlox
POLYGONACEAE	*Eriogonum douglasii*	Douglas' buckwheat
	Eriogonum ovalifolium	cushion buckwheat
	Eriogonum sphaerocephalum	round-headed desert buckwheat
	Eriogonum sp.	Buckwheat
	Rumex acetosella	field sorrel
PORTULACACEAE	*Lewisia rediviva*	bitterroot
	Talinum spinescens	spiny fameflower
	Claytonia lanceolata	spring beauty
PRIMULACEAE	*Dodecatheon sp.*	shooting star
RANUNCULACEAE	*Delphinium nuttallianum*	larkspur
	Ranunculus testiculatus	hornseed buttercup
ROSACEAE	*Geum triflorum*	old man's whiskers
	Purshia tridentata	bitterbrush
SANTALACEAE	*Comandra umbellata*	bastard toad flax
SAXIFRAGACEAE	*Lithophragma* sp.	lithophragma
SCROPHULARIACEAE	*Castilleja thompsonii*	Thompson's paintbrush
	Castilleja sp.	Paintbrush
	Penstemon gairdneri	Gairdner's penstemon
	Penstemon spp.	penstemon
VIOLACEAE	*Viola trinervata*	sagebrush violet

Appendix B. Example of avian use datasheet with 800-m radius circular fixed point station overlaid on 1:24,000 USGS togographic quadrangle map with appropriate cropping.

AVIAN OBSERVATION DATA SHEET: FIXED POINT INVENERGY-VANTAGE **WIND SITE** **STATION 8**

DATE: ________ OBSERVER _____ START TIME ______ END TIME ______ PAGE_____ OF_____

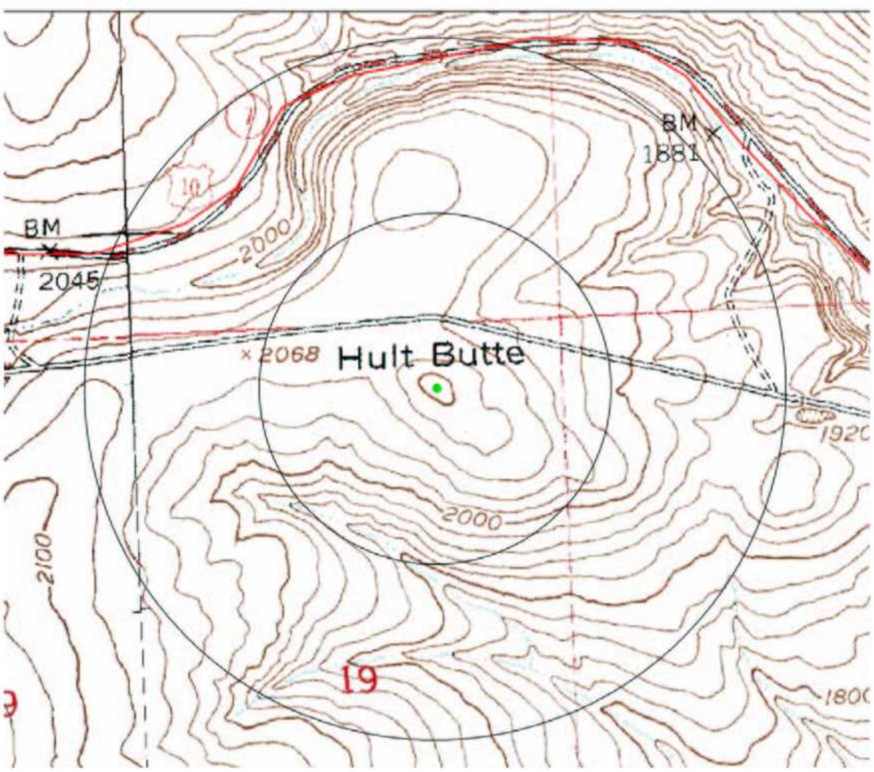
WEATHER: VISIBILITY(CIRCLE ONE) good fair poor CLOUD COVER(%) _____ TEMP(^{O}C) _____

WIND DIRECTION (CIRCLE ONE) N NE E SE S SW W NW n/a SPEED(KPH) Low: _____ High: _____

PRECIPITATION(CIRCLE ONE) none light rain rain light snow snow sleet hail other

Obs. No.	Species	Sex	Age	# Inds	Distance (m) from observer	Activity	Flight Characteristics				Habitat	Instantaneous Count (Height/Distance)			A[a]	Notes.
							Flight Height (m)			Dir.						
					1st/closest		1st	low	high			0	10	20		
1						PE SO FL FH CS HO ST OT					GS CF DT MF SS DS OT					
2						PE SO FL FH CS HO ST OT					GS CF DT MF SS DS OT					
3						PE SO FL FH CS HO ST OT					GS CF DT MF SS DS OT					
4						PE SO FL FH CS HO ST OT					GS CF DT MF SS DS OT					
5						PE SO FL FH CS HO ST OT					GS CF DT MF SS DS OT					
6						PE SO FL FH CS HO ST OT					GS CF DT MF SS DS OT					
7						PE SO FL FH CS HO ST OT					GS CF DT MF SS DS OT					
8						PE SO FL FH CS HO ST OT					GS CF DT MF SS DS OT					
9						PE SO FL FH CS HO ST OT					GS CF DT MF SS DS OT					
10						PE SO FL FH CS HO ST OT					GS CF DT MF SS DS OT					

[a] check if Auditory only



Comments ____________________

Big Game Observations

Obs. no.	Species	No. of Ind.	Distance from (m) observer