Klondike III (Phase 1) Wind Power Project
Wildlife Monitoring Study
October 2007–October 2009

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TABLE OF CONTENTS

Tables

Appendices

Figures

1.0 INTRODUCTION

1.1 Wind Project Description

Klondike III Wind Project (Project), located in Sherman County, Oregon is a wind-powered electric generating plant with peak generating capacity of not more than 375 MW. It was developed and is operated by Klondike Wind Power III LLC (Iberdrola Renewables, originally PPM Energy) of Portland, Oregon. There are two phases, referred to simply as Klondike III (Phase 1) and Klondike IIIa (Phase 2), both permitted by the State of Oregon through the Energy Facility Siting Council (EFSC) process. Klondike Wind Power III LLC received a Site Certificate from the EFSC through the Oregon Department of Energy on June 30, 2006 and a Site Certificate for Klondike IIIa on November 16, 2007. Klondike III Phase 1 was commissioned and operational in October, 2007 and consists of 125 turbines. Phase 2 consists of 51, 1.5 MW turbines. The MW listed is a nameplate capacity and does not reflect actual production. Of the 125 Phase 1 turbines, 80 are GE 1.5 MW turbines, 44 are Siemens 2.3 MW and there is one Mitsubishi 2.4 MW turbine. During construction however, one Siemens turbine collapsed and was not returned to service until February 2009. Additionally, the single Mitsubishi turbine was constructed and went operational in March 2008. 124 turbines were used in the fatality estimate calculations for consistency with and according to the Klondike III Wind Project Wildlife Monitoring and Mitigation Plan dated November 16, 2007: "For the 124 turbines built as of October 2007, the certificate holder shall conduct fatality monitoring for two years". Wildlife monitoring is required for each phase. Phase 1 is the subject of this final wildlife monitoring report. The results of year one of the two-year study were previously submitted (Gritski et al. 2009a).

1.2 Post-construction Wildlife Monitoring Study

This final report summarizes methods and results of the two-year avian and bat monitoring study for the Klondike III Wind Project (Phase 1) since the Project was constructed in October 2007 including:

- Wildlife fatality monitoring including reporting of all casualties found, results of Carcass Removal and Searcher Efficiency Trials, and estimated fatalities per MW in eight categories (7 avian, 1 bat) as well as 4 primary groups, as described in the Klondike III Wind Project Wildlife Monitoring and Mitigation Plan (WMMP, pages A-5 and A-10) filed under the EFSC Site Certificate (OEFSC, 2007).
- Raptor nest monitoring surveys in 2008
- Post-construction avian use surveys, 2007–2009

Wildlife fatality monitoring results include all casualties found at the Project from October 15, 2007 through October 28, 2009, including all incidental finds, casualties found during the initial "clean-up search" conducted from October 15–30, 2007, and casualties found during the first four seasons of formal monitoring conducted from winter season 2007–2008 through fall season 2009. Monitoring year 1 (or year 1) is defined as the period from October 15, 2007 through October 29, 2008; monitoring year 2 (or year 2) is defined as the period from October 20, 2008 through October 28, 2009. Previously unidentified or unconfirmed specimens were examined after the end of the first and second years of monitoring to determine species where possible. If it was not possible to identify to species, the fatality was classified to genus or taxonomic group based on available evidence. Wildlife fatality estimates included in this report were summarized from data collected during the two-year monitoring study. Preliminary results of the first year of wildlife fatality monitoring, post-construction avian use surveys, and raptor nest surveys were previously

reported in Gritski et al., 2009a; however, results presented in this final wildlife fatality report supersede all previously reported information.

2.0 METHODS

Wildlife monitoring study protocol methods are available in detail in the Klondike III Wind Project Wildlife Monitoring and Mitigation Plan (Attachment A of the Final Order on Amendment #3 of the Site Certificate for the Klondike III Wind Project, dated November 16, 2007; OEFSC, 2007). Those methods are summarized in this section.

2.1 Study Design

The study design consists of a sampling of the 124 Phase 1 turbines (of two sizes) searched during two years of monitoring (Figure 1). Of the 80 1.5 MW GE turbines, 23 were searched during monitoring year 1 (29%) and 23 were searched during monitoring year 2, resulting in 58% of all 1.5 MW turbines searched during the two years. Of the 44 Siemens 2.3 MW turbines, 23 were searched during year 1 (52%) and 23 were searched during year 2, resulting in most of the 2.3 MW turbines searched during the two years of monitoring and some turbines searched during both years. The 1.5 MW turbines had a square search plot of approximately 240 meters (m; 787 feet) on each side centered on the turbine (120 m or 394 feet from the turbine base in all directions). The 2.3 MW turbines had a square search plot of approximately 252 m (827 feet) on each side centered on the turbine (126 m or 414 feet from the turbine base in all directions). Refer to Figure 2 for a graphical depiction of search plots.

The 240-meter and 256-meter search plot areas (787-foot and 827-foot) overlapped into adjoining non-searched turbines. To account for the overlapping area, the sample size used the "effective area searched" rather than number of search plots. The effective area searched was calculated using Arc View 9.2 and the sample size of searched turbines was adjusted to reflect the effective search area. For year 1 turbines, the effective area searched for the 1.5 MW turbines was 27.30 turbines and for the 2.3 MW turbines the effective area searched were 24.83 turbines. For year 2 turbines, the effective area searched for the 1.5 MW turbines was 27.02 turbines and for the 2.3 MW turbines the effective area searched was 24.65 turbines. This correction factor was used for fatality estimates as well as for discussion of observed fatalities per turbine.

Personnel trained in proper search techniques ("the searchers") conducted the carcass searches by walking parallel transects within the search plots. Transects were set at 6-meter (19.7-foot) intervals. The searchers walked at a rate of approximately 45 to 60 meters (148 to 197 feet) per minute along each transect, searching both sides out to 3 meters (9.8 feet) for casualties. Search pace varied by searcher and in different habitat types.

2.1.1 Search Schedule

Search periods were divided into two primary intervals—searches were conducted twice a month during spring and fall migration periods, and once a month during summer and winter seasons. Dates for these search periods and actual dates that searches began are shown in Table 1. Due to inclement weather during some seasons, actual search intervals were longer than planned search intervals. An example of this was winter period during January 2008 where the searches were delayed due to snow cover and/or freezing fog resulting in unsafe field conditions. A December 2008 survey was missed due to inclement weather.

Table 1. Standardized carcass search periods at Klondike III Wind Project 2007–2009.

Season	Search Period	Search Conducted	# of Searches
Clean-up	October 15–30, 2007 October 20–21, 2008	October 15–30, 2007 October 15–17, 20–21, 2008	2
Winter	November 1, 2007–March 15, 2008 November 1, 2008–March 15, 2009	November 15, December 13, 2007; January 21, February 18, 2008; November 17, 2008; January 14–15, January 29, February 18, 2009	7
Spring	March 16–May 13, 2008 March 16–May 15, 2009	March 17, 31, April 14, 28, 2008; March 23, April 6, 20, May 5, 2009, May 15, 2009	9
Summer	May 14–August 15, 2008 May 15–August 15, 2009	May 14, June 19, July 16, 2008; June 22, July 23, 2009	5
Fall	August 16–October 31, 2008 August 16–October 31, 2009	August 18, September 9, 22, October 8, October 22, 2008; August 19, September 4, 21, October 13, October 26, 2009	10

2.1.2 Search Protocol, Data Collection, and Incidentals

Definitions

The following definitions for casualty age, condition, taxonomic group, and status are applied in this report. Incidentals and State of Oregon Special Status Species are also defined.

Age

Bird and bat fatalities were aged and sexed. The terms adult and immature are used in this report. The following definitions are applied to any mention of adult, juvenile, or immature for avian or bat fatalities:

- Birds: Birds were classified as immature if they were found as fatalities during the year of birth, but older than in nestling plumage. The exception to this rule is for taxa groups such as raptors that take multiple years to obtain adult status. Raptors classified as sub-adult birds (more than one year old but not an adult) were also classified as immature birds. All birds that were in juvenile plumage (nestling plumage) were classified as such if they had not molted into an immature plumage. Some birds in the fall and winter are not able to be aged and were left as unknown. Birds were aged by a combination of techniques including molt limits, feather wear and other characteristics (Pyle, 1997).
- Bats: Bats were aged using ossification of wing joints. Bats were classified as immature if they were found during the year of birth. The term juvenile and immature is inter-changeable and both refer to individuals born during the year of strike. Aging of bats during the fall can be difficult because during that time period bats born in that

year are in a transition period between juvenile and adult status and therefore determining age cannot always be done with certainty.

Condition

For all searches, the field staff recorded the condition of each carcass found, using the following condition categories:

- Intact – A carcass that is entire, is not badly decomposed, and shows no sign of being fed upon by a predator or scavenger.
- Scavenged – An entire carcass that shows signs of being fed upon by a predator or scavenger, or a portion(s) of a carcass in one location (e.g., wings, skeletal remains, legs, pieces of skin, etc.).
- Feather Spot – Ten or more feathers or three or more primaries (the outermost 9–12 wing feathers) at one location indicating predation or scavenging.
- Dismembered – A carcass in two or more pieces, not readily attributed to scavengers. May not include all parts of the carcass.

Taxonomic group

Casualties were assigned to a taxonomic group. The basic definitions of the taxonomic groups that were found are as follows:

- Dove – Any member of the order of Columbiformes. This group is represented by mourning dove and rock pigeon in this report.
- Galliformes – Any gallinaceous bird. These included gray partridge and ring-necked pheasant on the study.
- Heron – Any member of the order Ciconiiformes, which includes heron and egret species. This group is represented by great-blue heron in this report.
- Passerine – Any member of the order of Passeriformes, or perching birds.
- Rail – Any member of the family Rallidae. This group is represented by Virginia rail in this report.
- Raptor – Any diurnal or nocturnal bird of prey belonging to the orders of Falconiformes or Strigiformes. This includes falcons, hawks and owls (USFWS, 2002).
- Woodpecker – Any member of the order Piciformes. This group is represented by northern flicker in this report.

State of Oregon Sensitive Species status:

At Klondike III, several species that are classified as State Sensitive-Vulnerable were found as fatalities; a partial status definition is listed below. Full definitions of Oregon Sensitive statuses and lists of State Sensitive species can be found at on the Oregon Department of Fish and Wildlife (ODFW) web site:
http://www.dfw.state.or.us/wildlife/diversity/species/docs/SSL_by_category.pdf

- State Sensitive-Vulnerable: species facing one or more threats to their populations and/or habitat. Vulnerable species are not currently imperiled with extirpation from a specific geographic area or the State, but could become so with continued or increased threats to populations and/or threats.

All carcasses found were labeled with a unique number, bagged and frozen for future reference and possible necropsy. A freezer tag with pertinent information for each carcass was inserted with the bagged specimen. All casualties located were photographed as found

and plotted on a detailed map of the study area. For each carcass found, searchers recorded species, sex, and age when possible, date and time collected, location (distance and direction from turbine), condition (as detailed above), and any comments relevant to cause of death. All carcasses were collected and stored in accordance with appropriate Oregon Department of Fish and Wildlife and U.S. Fish and Wildlife Service (USFWS) collection and salvage permits obtained by NWC prior to field activities.

Incidentals

"Incidentals" are defined as bird and bat casualties found in non-search areas (e.g., near a turbine but not included in the search area) or not during scheduled searches at turbine plots.

Avian or bat casualties found in search plots by Iberdrola Renewables (IBR) maintenance personnel and others not conducting the formal searches were left undisturbed, recorded using the incident report form, and reported to the Project biologist. These casualties were left on-site, unless the animal was found alive and injured. By leaving the casualty on a search plot, researchers could determine if that casualty was found by searchers during the next scheduled search or had been removed by scavengers or not detected during searcher efforts on the plot. ODFW and USFWS permits included allowances for the collection and transport of injured animals discovered during Project activities. The specific permit compliance protocol for the handling and reporting of injured or dead birds and bats is included in the Klondike III Wildlife Monitoring and Mitigation Plan. Further details on IBR Klondike III Wind Project Wildlife Reporting and Handling System can be found in the Klondike III Wildlife Monitoring and Mitigation Plan (OEFSC, 2007).

2.2 Carcass Removal Trials

The objective of the carcass removal (or "persistence") trials is to estimate the average length of time avian and bat carcasses remain in the search area before being removed by scavengers or reach a deteriorated condition in which detection of the animal is not possible, and is inclusive of other influences on carcass persistence. Estimates of carcass removal rates are used to adjust carcass counts for removal bias. "Carcass removal" is the disappearance of a carcass from the search area. "Carcass persistence" is the mirror image of this, the persistence of a carcass in the search area in spite of potential scavenging. For consistency with terminology used for regional wind project wildlife fatality monitoring studies, collectively these are referred to as "removal" or removal/persistence trials in this report; analysis of each was not conducted separately.

The trials were conducted within each of the seasons defined above (Table 1) during the study. Trials were spread throughout the year to incorporate the effects of varying weather, farming practices, and scavenger densities. Each trial used 20 carcasses. For each trial, 10 small bird carcasses and 10 large bird carcasses were distributed spatially throughout the Project. Two trials were placed each season, resulting in 20 small and 20 large birds placed per season for a total of 160 trials for each year (80 small and 80 large). For the study duration a total of 160 small and 160 large trials were placed. The WMMP (page A-3) states that for each season one trial will be conducted resulting in at least 10 small and 10 large placed. NWC used the above sample size for large and small per season to enable more defined examination of the CRT rates by season.

Trial carcasses were marked discreetly for recognition by searchers and other personnel to ensure that these carcasses would not be confused with actual turbine mortalities. Trial carcasses were left at the location until the end of the carcass removal trial. Trials lasted for 35 days and were checked every day for the first four days and again on day 7, day 10, day

14, day 21, day 28, and day 35. At the end of the 35-day trial period, any remaining birds and feathers were removed. Birds were placed in all available habitat groups and in three different exposure classes; fully exposed, partially hidden, and fully hidden. These data were used to determine scavenging rates based on statistical methods presented below.

Two size classes, "large" (raptor size) and "small" (songbird size) were used to simulate fatalities. Native species were used whenever possible, but due to their limited availability, non-native species were also used. Small brown game bird chicks were used as surrogates for bat fatalities.

2.3 Searcher Efficiency Trials

Searcher efficiency (SEEF) trials were conducted during turbine plot searches to determine the probability of a searcher detecting a carcass known to be present. A Project biologist placed carcasses at random times and locations on search plots for searchers to detect. These were blind trials, meaning that the searcher did not know of the trial prior to searching that plot and each searcher was independent of other searchers, due to the fact that searchers did not discuss their results while the trial was on-going, but waited until searches were completed. A trial is considered a single animal and the result is either a find or a miss by the searcher. Treatment of these data is discussed below in statistical methods. The Project biologist removed the SEEF carcasses immediately following each day's trials to prevent attracting scavengers to the site.

Searcher efficiency trials were conducted on the fatality monitoring search plots in both grassland/shrub-steppe and cultivated agriculture habitat types. Searcher efficiency was estimated by season and carcass size. Estimates of searcher efficiency were used to adjust observed fatalities for detection bias.

Searcher efficiency trials were conducted in each season as defined above (Table 1) during the fatality monitoring year. Trials were spread throughout the year to incorporate the effects of seasonal variations in weather, farming practices, and vegetative cover. At least two sets of trials were conducted in each season. Each set consisted of a variable number of carcasses so that the searchers did not know the total number of trial carcasses being used in any given trial. For each trial set, both small bird and large bird carcasses were used.

On the day of a fatality monitoring search but before the beginning of the search, efficiency trial carcasses were placed at random locations within areas to be searched. Carcasses were randomly placed in a variety of postures to simulate a range of conditions. For example, birds were: 1) placed in an exposed posture (thrown over the shoulder), 2) hidden to simulate a crippled bird, and 3) partially hidden.

In order to ensure that SEEF trial carcasses were not mistaken for actual turbine casualties, each trial bird used as a SEEF carcass was discreetly marked so that it could be correctly identified as an efficiency trial carcass after it was found. The number and location of the efficiency trial carcasses found during the carcass search was recorded. The number of efficiency trial carcasses available for detection during each trial (e.g., not removed by scavengers), was determined immediately after the trial by the person responsible for distributing the carcasses. If a scavenger removed the carcass, the trial was not used, as it was not possible to determine if the bird was available for detection or not.

SEEF was estimated separately for two sizes classes, large and small. Native species were used whenever possible, but due to their limited availability, non-native species were also used. Small carcasses (e.g., non-native species like quail, juvenile ringed-necked pheasants, and native passerine species) were used to represent small birds such as

passerines. Large carcasses (e.g. adult ring-necked pheasants, rock doves, chukars, and mallards were used to simulate large birds such as raptors, game birds, and waterfowl. Due to lack of available bat carcasses, small brown game bird chicks were used as surrogates for bats.

2.4 Statistical Methods for Estimating Fatalities

2.4.1 Removal Trials

Estimates of the probability that a carcass will not be removed in the interval between searches are used to adjust carcass counts for removal bias. Removal includes removal by predation, scavenging, wind, or decomposition. In most fatality monitoring efforts, it is assumed that carcass removal occurs at a constant rate that is not dependent on the time since death. This simplifying assumption allows estimation of fatalities when search intervals exceed one day.

The length of time a carcass remains in the study area before it is removed is typically modeled as an exponentially distributed random variable. The probability that a carcass is not removed during an interval of length I can be roughly approximated as $\hat{r} \cong \sum_{d=1}^{I} \exp(-(d-0.5)/t)/I$, the average probability of persisting given its death might have occurred on any day (d) in the interval. If carcass removal rates are rapid and the search interval is long enough, then I is the length of the effective interval at the turbine, i.e. the length of time when 99% of carcasses can be expected to be removed.

Data from carcass persistence trials were fit to an interval censored parametric failure time model, carcass persistence time modeled as a function of size and season and their interaction. Using alpha=0.15, there was a strong effect of the interaction of size with season (χ^2_3=11.21, p=0.01), indicating that carcass persistence varied both with size of the carcass and season. Bootstrapped samples were fit to failure time models with size, season, and their interaction as explanatory variables.

2.4.2 Searcher Efficiency Trials

Estimates of the probability that a carcass will be detected by an observer during a search (searcher efficiency) are used to adjust carcass counts for observer bias. The failure of an observer to detect a carcass that is on the search plot may be due to its size or color, or time since death, as well as conditions in its immediate vicinity, such as vegetation density, shade, weather, etc. In most mortality monitoring efforts, because time since death cannot be measured, it is assumed that a carcass' observability is constant over the period of the search interval.

Data from searcher efficiency trials were fit to a logistic regression model, with odds of observing a carcass modeled as a function of size and season and their interaction. Using alpha=0.2 (increased due to smaller sample sizes relative to year 1), there was no effect of the interaction of size with season (χ^2_3=1.69, p= 0.64), nor of size alone (χ^2_1=0.57, p=0.45). The effect of season alone was marginal (χ^2_3=4.57, p=0.20), and it was retained in the model. Bootstrapped samples were fit to logistic regression models with only season as an explanatory variable.

2.4.3 Fatality Estimates

The annual estimated fatality rate is reported as an estimate of (assumed wind project related) bird and bat fatalities in eight primary categories as defined under the monitoring plan (OEFSC, 2007; page A-5): 1) all birds, 2) small birds, 3) large birds, 4) raptors, 5) grassland birds, 6) nocturnal migrants, 7) State Sensitive species listed under OAR 635-100-0040, and 8) bats. Grassland birds are defined as all native bird species that rely on grassland habitat and are either resident species, occurring year round, or species that nest in the area, excluding horned lark, burrowing owl, and northern harrier (OEFSC, 2007; page A-10). Small birds are defined as any bird under nine inches in total length and large birds are defined as any bird greater than nine inches in total length. This measurement is consistent with previous reports (Kronner et al., 2008, Gritski et al., 2008a).

All carcasses located within areas surveyed, regardless of species, were recorded, and if a different cause of death was not apparent, the fatality was attributed to Project operation, consistent with the approach commonly used at other regional fatality studies. The total number of avian and bat carcasses found were adjusted with removal and searcher efficiency bias trial data to determine the fatality estimate.

Because there are two sizes of turbines installed at this site, investigators were interested in estimating fatality rates for each turbine size as well as fatality rates for all birds, small birds, large birds, raptors, grassland birds, State Sensitive species, nocturnal migrants and bats. As specified in the monitoring and mitigation plan (OEFSC, 2007; page A-7) estimates were calculated using the Schoenfeld method. The Schoenfeld estimator was used in analyses for the Klondike II wind project (NWC and WEST, 2007) and the Stateline wind project (Erickson et al., 2004). For comparison, an estimator used by Huso was also calculated. The estimator proposed by Huso (Huso, Manuela. 2010) has been used in the Big Horn (Kronner et al., 2008) and Leaning Juniper (Gritski et al., 2008a) wildlife monitoring post-construction studies. Huso has shown the Schoenfeld estimator to be strongly biased under some conditions, but to have relatively little bias under others. In general, the Schoenfeld estimator is comparable to the Huso estimator when search intervals are long and carcass persistence times are short, conditions that generally prevailed in this study. Where differences in the two estimators occurred, the Schoenfeld estimator was used for comparisons to thresholds set forth in OEFSC 2007. For methods on how the Schoenfeld estimator is calculated refer to OEFSC 2007. Huso methods are outlined below.

In this analysis, a bootstrap sample of carcass persistence data for each size and season combination was drawn and average carcass persistence time for each size in each season was estimated from it. A bootstrap sample of the searcher efficiency data for each size and season was drawn and searcher efficiency for each size in each season was estimated from it. These estimates were merged with the casualty data and adjusted estimates of fatality calculated for each animal using the following equation: $\frac{c_{ijk}}{\hat{p}_{jk} * \hat{r}_{jk} * \hat{e}_{jk}} = \hat{f}_{ijk}$

where c_{ijk} is the observed number of carcasses in the k^{th} size class at the i^{th} turbine during the j^{th} search, $\hat{f}_{ijk}$ is the estimated fatality in the k^{th} size class that occurred at the i^{th} turbine during the j^{th} search, $\hat{p}_{jk}$ is the estimated probability that a carcass in the k^{th} size class that is on the ground during the j^{th} search will actually be seen by the observer, $\hat{r}_{jk}$ is the probability than an individual bird or bat that died during the interval preceding the j^{th} search will not be removed by scavengers and $\hat{e}_{jk}$ is the effective interval, i.e. the ratio of

the length of time before 99% of carcasses can be expected to be removed to the search interval. $\hat{p}_{jk}$ was estimated through searcher efficiency trials with estimates given above. $\hat{r}_{jk}$ is a function of the average carcass persistence time, estimated through carcass persistence trials, and the length of the interval preceding the j^{th} search. $\hat{r}_{jk}$, $\hat{e}_{jk}$ and $\hat{p}_{jk}$ are assumed not to differ among turbines, but differ with season (i.e. search *j*) and carcass size (*k*).

For each turbine size, the estimate of the annual per turbine fatality were calculated as $\hat{f} = \frac{\sum_{i=1}^{23}\sum_{j=1}^{n_i}\sum_{k=1}^{2}\hat{f}_{ijk}}{t}$ where n_i is the number of searches carried out at turbine *i*, *i*= 1, …, 23, and *t* is the effective number of turbines searched. The per turbine estimate and confidence limits were multiplied by 80 and 44, respectively, to give total annual fatality estimates (Cochran, 1977).

No closed form solution is available for the variance of this estimator, so 90% confidence intervals of this estimate were calculated by bootstrapping (Manly, 1997) as described above.

These estimates were summed across all turbines, then divided by the effective number of turbines searched (54.32 of 80 1.5 MW GE turbines, and 49.48 of 44 2.3 MW Siemens turbines) for the two-year study to give annual per turbine fatality rate. As noted in the study design section (2.1), some of the same 2.3 MW turbines were searched in both years, hence the effective number is higher than the actual number of turbines. Per turbine estimates were multiplied by the total number of turbines in the respective size class to give total site fatality and divided by their respective megawatt label to give per MW fatality. A bootstrapped 90% confidence interval on annual per turbine fatality was achieved by repeating this process 1,000 times and reporting the central 90% limits of the resulting distribution.

The number of individual carcasses found in each of the groups of interest (large birds, raptors, etc.) were too small to be able to estimate their fatality rates separately for the two sizes of turbines. Fatality estimates were turbine size-specific for the categories of birds and bats only.

2.4.4 Observed Fatality Rates of Nocturnal Migrants at Lit and Unlit Turbines

As specified in the WMMP (page A-9), differences in observed nocturnal migrant fatality rates were reviewed for lit and unlit turbines, and comparisons were also made between lit turbines, turbines directly adjacent to lit turbines, and turbines that were neither lit nor directly adjacent to lit turbines. A difference of means test was used, with a significance value of 0.05 to determine if there was a significant difference among groups. The turbine was the sample unit, and numbers of observed nocturnal avian fatalities were counted for each turbine. Observed number of fatalities of nocturnal avian migrants at lit turbines was compared against observed number of fatalities of nocturnal migrants at unlit turbines and against turbines that were not adjacent to lit turbines. All analysis was completed using SPSS Version 16.0 (SPSS, 2007).

2.5 Raptor Nest Monitoring

Raptor nest surveys were conducted in spring/summer 2008, the first nesting season after construction. The objective of this study is to estimate the size of the local breeding

populations of tree or other above-ground-nesting raptor species in the vicinity of the facility and to determine whether operation of the facility ultimately results in a reduction of nesting activity or nesting success in the local populations of the following raptor species: Swainson's hawk, golden eagle, and ferruginous hawk. These were the primary target species for the 2008 aerial and ground-based surveys; other species observed nesting or assumed nesting (such as America kestrel) were also recorded as encountered incidentally while searching for nests of the three target species. As specified on page A-11 of the WMMP, data from the 2008 survey year will be combined with data from the 2012 survey year and analysis conducted to determine whether a reduction in either nesting success or nest use has occurred in the vicinity of Klondike III facility (this is inclusive of Phase I and Phase II (Klondike III and IIIa).

The 2007 nest survey year data and supplemental notes for the 2006 or earlier nesting years were reviewed and used for planning the 2008 monitoring. Only one nest site surveyed in 2007 was not part of the 2008 aerial survey buffer; this was due to a slight change in the two-mile survey buffer of planned vs. actual turbine locations.

On May 9, 2008, an aerial survey was conducted within the Klondike III site boundary and a 2-mile (3.2 km) buffer around turbines to determine nest occupancy (Figure 3), as per the WMMP, page A-11. The survey was conducted by an experienced helicopter pilot and wildlife biologist. All appropriate nesting areas including trees, rock formations, and power lines were investigated by air to provide complete coverage of the Project areas to the extent possible. Areas immediately surrounding houses were not surveyed to avoid human or livestock disturbances and areas near operating wind turbines were not flown due to safety reasons. In addition to the aerial survey, while biologists were on site conducting other wildlife monitoring, several nests were checked for raptors in flight or incubating.

All potential and confirmed raptor or other large bird nests were recorded, regardless of activity status. Determination of nest status (active, inactive, unknown) was made using a combination of visual clues such as adult behavior, presence of eggs or young, presence or absence of whitewash (excrement), or supplemental observational data from the ground-based surveys. Inactive nests (without sign of current year's use) were assessed as to the type of bird that may have used the nest previously. Large stick nests, potentially used by golden eagles or ferruginous hawk were recorded and noted as such because these species are target species for monitoring in future years. Stick nests that appeared to have been constructed, and may have been used by common ravens, were conservatively included in "Inactive" status as these structures may be used by buteo raptors in future years. All nest locations were recorded using a hand-held Global Positioning System (GPS) receiver, typically with an accuracy of 8 meters (26 feet) while stationary.

Follow-up surveys to determine nesting success were conducted from the ground within the leased land boundary during the period from May 31 through June 18, 2008. All active or unknown status nests recorded during the aerial survey were checked, where feasible. Nests were monitored a minimum of one time as specified in the WMMP, but most were checked two or more times. For areas not leased by Iberdrola and where access permission was not likely (due to other wind lease arrangements or feasibility), nests were checked with spotting scopes and binoculars from public roads. In addition, a second aerial survey was conducted on July 23, 2008 to assess the final status of nests that could not be checked through ground surveys.

Data were managed in an Excel spreadsheet and in ArcMap version 9.3 GIS. Analysis for potential impacts from operating Klondike III turbines will be conducted after the second year of monitoring in 2012.

2.6 Avian Use Surveys

In addition to standardized fatality searches, avian use surveys were conducted during each fatality monitoring search throughout the two years of study. The purpose of recording avian use while conducting the fatality monitoring, as specified in the WMMP (page A-12), is to identify additional avian species that may not have been listed in the original baseline survey report. In addition, these point count surveys may provide a basis on which to evaluate, in general terms, whether the species with the highest fatality numbers are also the most common species at the site during the monitoring study year.

Observers recorded birds detected in a ten-minute period at approximately one-third of the turbines per year (15 plots per year), using standard variable circular-plot point count survey methods (Reynolds et al., 1980). An experienced avian ecologist was positioned at the center of the plot and collected data on all wildlife seen or heard during a 10-minute observation period. A full set of surveys (15 plots) was completed on the same survey day, and plots were surveyed equally during different times of day (morning, mid-day, and afternoon), to the extent feasible, to reduce temporal bias. The 15 year 1 plots corresponded to locations of year 1 turbines and the 15 year 2 plots corresponded to locations of year 2 turbines. All individuals regardless of distance were counted, thus there may have been some double counting for species such as ravens and groups such as waterfowl and raptors that cover large areas of ground.

General data recorded included date, time, weather, and wildlife observed. For birds detected, data collected included species, number of individuals, habitat association, and behavior, including flight height and direction. Whenever special status species and species of interest were observed while in-transit near the study plots, within the general Project area, these observations were also recorded. Data were entered into a Microsoft Access database.

In all, there were 240 avian surveys conducted for each monitoring year at a total of 30 different plots (480 plot surveys total). Plot dates for each season and number of surveys are summarized as follows:

- Winter season:
  Year 1 – November 14, 2007–March 11, 2008; 5 visits to 15 plots=75 surveys
  Year 2 – November 12, 2008–March 12, 2009; 5 visits to 15 plots=75 surveys
- Spring season:
  Year 1 – March 25, 2008–May 12, 2008; 4 visits to 15 plots=60 surveys
  Year 2 – March 31, 2009–May 18, 2009; 4 visits to 15 plots=60 surveys
- Summer season:
  Year 1 – June 11, 2008–August 14, 2008; 3 visits to 15 plots=45 surveys
  Year 2 – June 16, 2009–August 6, 2009; 3 visits to 15 plots=45 surveys
- Fall season:
  Year 1 – September 5, 2008–October 13, 2008; 4 visits to 15 plots=60 surveys
  Year 2 – September 10, 2009–October 26, 2009; 4 visits to 15 plots=60 surveys

2.6.1 Avian Use Data Analysis

The same avian-use metrics found in other studies in the region were used for this analysis (Johnson et al., 2002; Kronner et al., 2005a and b; Mabee et al., 2005 and 2007). Standardized metrics were computed for avian species or species-groups on mean use, percent composition, and frequency of occurrence.

- *Mean use* for a species equals the mean number of individuals/10-min point count for each species and provides an index of avian relative abundance per survey point. This index does not describe density, however, because individuals may have been observed at multiple points (particularly raptors) and data were not corrected for differences in detectability.
- *Percent composition* equals the mean use for a species/total use for all species, multiplied by 100, and provides an estimate of the relative use of a particular species compared with the use of all other species.

- *Frequency of occurrence* equals the percentage of 10-min point counts in which a species is observed and it provides an index of how often a species occurs in the Project area. Mean use and frequency of occurrence reflect different aspects of abundance, in that mean use is based on the number of individuals (i.e., large flocks can produce high estimates), whereas frequency of occurrence is based on the number of flocks (i.e., it is not influenced by flock size). Together, these two estimates help one to discern the importance of high mean use values.

3.0 RESULTS

This section summarizes the results of Klondike III Wind Project wildlife monitoring for the period October 15, 2007 through October 28, 2009. Preliminary results of the first year of monitoring were previously reported in Gritski et al., 2009a; however, results presented in this final wildlife fatality report supersede all previously reported information.

3.1 Summary of Findings Prior to Formal Monitoring

3.1.1 Incidentals

One incidental casualty was found before monitoring began; a silver-haired bat was found on October 15, 2007 (Appendix A).

3.1.2 Clean-up Searches

As stated above, the clean-up search was performed to clear the search plot area of casualties before formal monitoring was initiated.

2007–2008 Monitoring Year 1

During the year 1 clean-up search, 8 fatalities were found: 5 birds and 3 bats. Bird species found as fatalities included ring-necked pheasant (4) and dark-eyed junco (1). Bat species found as fatalities included silver-haired bat (1), hoary bat (1), and 1 bat not able to be identified to species. Further details are available in Appendix A.

2008–2009 Monitoring Year 2

During year two of monitoring, six fatalities were found during the clean-up search: 4 birds and 2 bats. Bird species found during this clean-up search included horned lark (3) and unidentified passerine (1). Bat species found during this clean-up search included hoary bat (1) and silver-haired bat (1). Further details are available in Appendix A.

3.2 Standardized Scheduled Searches and Incidentals

3.2.1 Scheduled Searches

For the two years of monitoring a total of 93 birds and 37 bats were found during scheduled searches (Table 2). Horned larks comprised the majority of avian fatalities found during

scheduled searches (33.3%). A total of 30 species of birds were found during scheduled searches, with an additional five avian fatalities that could not be identified to species as of this report: 1 each of unidentified kinglet species, unidentified warbler species, unidentified buteo species, unidentified passerine, and an unidentified bird that could not be identified to a taxon based upon only parts of a skeleton remaining.

Passerines comprised the largest number of observed avian fatalities during the monitoring period (75), followed by galliformes (6), raptors (5), doves (3), herons (1), rails (1), woodpeckers (1), and unidentified bird (1) (Table 3). All bird species found are listed in Table 2. All avian casualties were fatalities (no live, injured birds).

All bats identified to species were of three species, hoary bat, silver-haired bat, and big brown bat (Table 2). Hoary and silver-haired bats comprised 94.6% of all observed bat casualties found during monitoring. All but one bat casualty were fatalities. One live, injured silver-haired bat was found as a casualty on September 24, 2008 (it was transported to Blue Mountain rehabilitation center and was later released). Details of all casualties are found in Appendix A.

3.2.2 Incidentals

Incidentals found after the start of the formal monitoring period included 8 birds and 1 bat. During the first year of monitoring, 3 birds and 1 bat were found as incidentals (Table 3). During the second year of monitoring, 5 birds were found as incidentals. Avian species found as incidentals during the two years included Swainson's hawk (2), American kestrel (2), European starling (1), ring-necked pheasant (1), horned lark (1) and a bird that could not be identified even to the group level (Table 2). A single hoary bat was also found as an incidental.

Table 2. Summary of avian and bat species and percent composition of all fatalities found at the Klondike III Wind Project, fall season 2007–fall season 2009.

Species Found as Fatalities	Total Found During Scheduled Searches				Total Including Incidentals *	
Listed by highest to lowest % search composition (fourth column)	Year 1 2007–2008	Year 2 2008–2009	Grand Total 2007–2009	% Composition	Total 2007–2009	% Composition Including Incidentals
Avian Species						
horned lark	19	12	31	33.3	35	31.8
dark-eyed junco	2	3	5	5.4	6	5.5
Townsend's warbler	3	2	5	5.4	5	5.4
ring-necked pheasant (n)	1	3	4	4.3	9	8.2
savannah sparrow	3	1	4	4.3	4	3.6
white-crowned sparrow	4	0	4	4.3	4	3.6
golden-crowned kinglet	2	1	3	3.2	3	2.7
ruby-crowned kinglet	1	2	3	3.2	3	2.7
western meadowlark	1	2	3	3.2	3	2.7
yellow-rumped warbler	2	1	3	3.2	3	2.7
gray partridge (n)	2	0	2	2.2	2	1.8
mourning dove	2	0	2	2.2	2	1.8
winter wren	2	0	2	2.2	2	1.8
American goldfinch	1	0	1	1.1	1	0.9
American kestrel	0	1	1	1.1	3	2.7
Brewer's blackbird	1	0	1	1.1	1	0.9
common yellowthroat	1	0	1	1.1	1	0.9
European starling (n)	1	0	1	1.1	2	1.8
great-blue heron	1	0	1	1.1	1	0.9
hermit thrush	1	0	1	1.1	1	0.9
Lincoln's sparrow	1	0	1	1.1	1	0.9
MacGillivray's warbler	0	1	1	1.1	1	0.9
northern flicker	0	1	1	1.1	1	0.9
purple finch	0	1	1	1.1	1	0.9
red-tailed hawk	0	1	1	1.1	1	0.9
rock pigeon	0	1	1	1.1	1	0.9
short-eared owl	1	0	1	1.1	1	0.9
Swainson's hawk	0	1	1	1.1	3	2.7
unidentified bird	0	1	1	1.1	2	1.8
unidentified buteo	0	1	1	1.1	1	0.9
unidentified kinglet	1	0	1	1.1	1	0.9
unidentified passerine	1	0	1	1.1	2	1.8
unidentified warbler	1	0	1	1.1	1	0.9
Virginia rail	1	0	1	1.1	1	0.9
Wilson's warbler	0	1	1	1.1	1	0.9
Avian Subtotal	**56**	**37**	**93**	**100.0**	**110**	**100.0**

Species Found as Fatalities	Total Found During Scheduled Searches				Total Including Incidentals *	
Listed by highest to lowest % search composition (fourth column)	Year 1 2007–2008	Year 2 2008–2009	Grand Total 2007–2009	% Composition	Total 2007–2009	% Composition Including Incidentals
Bat Species						
silver-haired bat	10	10	20	54.1	23	52.3
hoary bat	12	3	15	40.5	18	40.9
big brown bat	1	0	1	2.7	1	2.3
unidentified bat	1	0	1	2.7	2	4.5
Bat Subtotal	**24**	**13**	**37**	**100.0**	**44**	**100.0**

* Includes both scheduled search findings and incidental observations (including clean-up searches conducted fall 2007 and 2008)

n = a non-native species

Table 3. Wildlife casualties found during two years of formal monitoring (2007–2009) at the Klondike III Wind Project, listed by taxonomic group.

Taxa Group	# of Fatalities Monitoring Year 1 2007–2008*	# of Fatalities Monitoring Year 2 2008–2009*	Total # of Fatalities 2007–2009*
Raptor	1 + 2 incidentals	4 + 2 incidental	5 + 4 incidentals
Galliform	3	3 + 1 incidental	6 + 1 incidental
Passerine	48 + 1 incidental	27 + 1 incidental	75 + 2 incidentals
Dove	2	1	3
Heron	1	0	1
Rail	1	0	1
Woodpecker	0	1	1
Unidentified bird	0	1 + 1	1 + 1 incidental
Total Birds	56 + 3 incidentals	37 + 5 incidentals	93 + 8 incidentals
Bats**	24 + 1 incidental	13	37 + 1 incidental
Total Birds and Bats	**80 + 4 incidentals**	50 + 5 incidentals	130 + 9 incidentals

* This table does not include fatalities found incidentally or during clean-up searches prior to the start of formal monitoring on November 1, 2007.

** This includes 1 bat casualty of a live bat which was transported to a rehabilitation center.

3.2.3 Timing and Composition of Observed Fatalities

Including incidental findings, passerines comprised a total of 80% of all observed avian fatalities found during the two years of monitoring (Figure 4). Passerines were followed by galliforms (7%), raptors (7%), and doves (3%). Single finds of woodpecker, heron, and rail comprised a small portion of the total of observed avian fatalities (1%). Past studies (Kronner et al., 2008; Gritski et al., 2008a) have found that percentages of passerines are lower for observed fatalities versus estimated fatalities, while larger birds such as raptors and galliforms usually show higher percentages of observed fatalities versus estimated fatalities due to searcher detection rate and carcass persistence rate differences for these small and large birds.

Timing of observed avian fatalities showed some peaks of fatalities during different times of the year depending on taxanomic group (Figure 5). Passerines had three distinct peaks where numbers of observed fatalities were higher than other times of the year; February, April–May, and September–October. These coincide with migration times for passerines and the first two peak times correspond with breeding display times for horned larks (displays which are known to increase the likelihood that males may fly into the rotor-swept area). Raptor fatalities peaked in August and doves in October representing post-breeding movements for both groups.

The majority of bats were found in the fall months of August–October (Figure 6), particularly September; however, several silver-haired bats were found during late spring and early summer periods of May–July.

3.2.4 Distance from Turbine for Observed Fatalities

Small birds, large birds, and bats were grouped into distance categories as expressed in meters from the base of the turbine (Figure 7). Distances were grouped to reflect 30 meter intervals. While search plots only extended out to 120 or 126 meters (394 or 414 feet), because search plots were square, distances in the corner of the plot could be greater than 126 meters (414 feet). Figure 7 includes findings on both scheduled searches and incidentals. There was a trend for the majority of bats to be found in the first category, which was 0–30 meters (0–98 feet) from the turbine base. There was not a strong trend for either avian category (small or large birds), although slightly more small birds were found in the 31–120-meter (102–394-feet) range. All three groups analyzed had some fatalities found at distances greater than 120 meters (394 feet).

3.2.5 Nocturnal Migrants

Species that were found during the spring and fall migration season scheduled searches that do not breed or winter on the Project were classified as nocturnal migrants. A total of 29 avian fatalities were classified as nocturnal migrants, comprising 9 species and 1 unidentified warbler. Species included in the nocturnal migrant category were 5 Townsend's warbler, 4 white-crowned sparrow, 3 dark-eyed junco, 3 yellow-rumped warbler, 3 golden-crowned kinglet, 2 winter wren, 2 ruby-crowned kinglet, 1 Lincoln's sparrow, 1 hermit thrush, 1 common yellowthroat, 1 Wilson's warbler, 1 MacGillivray's warbler, 1 purple finch, and the aforementioned unidentified warbler. This list does not include fatalities found as incidentals or during clean-up searches, as those fatalities are not included in the estimated annual fatality calculations.

3.2.6 Avian Groups of Concern

In the monitoring plan established for Klondike III (OEFSC 2007, page 10), thresholds were set for several groups of avian species. These groups included raptors, raptor species of special concern, and State Sensitive species listed under OAR 635-100-0040 (not including raptors which are covered under the raptor species of special concern). In addition to these categories, thresholds were also set for grassland avian species. This category includes all native species breeding in the area or residing year-round that rely on grasslands, but excludes horned lark, burrowing owl, and northern harrier. Numbers of fatalities found in each of the groups of concern are summarized below. Refer to Appendix A for further details such as turbine number where the fatality occurred and date when the fatality was found.

Grassland Birds

Birds included in this category found during the monitoring included 3 savannah sparrows, 3 western meadowlarks, and 1 short-eared owl. The short-eared owl is discussed under raptors below. No grassland birds were found as incidentals.

Raptors
Five raptors were found during scheduled searches, one each of short-eared owl, American kestrel, red-tailed hawk, Swainson's hawk, and unidentified buteo (either red-tailed hawk or Swainson's hawk). Four other raptors were found as incidentals during the monitoring. These were Swainson's hawk (2) and American kestrel (2).

Raptor species of special concern
Of the five raptors found during scheduled searches, only the Swainson's hawk is listed as a special status raptor species. As stated above, one Swainson's hawk was found during scheduled searches.

State Sensitive Species
One State listed avian species was found as a fatality during monitoring, State Sensitive-Vulnerable Swainson's hawk (1). This species also qualifies under the heading of raptor species of special concern. Two species of State Sensitive mammals were found as fatalities. Silver-haired bat and hoary bat are listed as a Sensitive-Vulnerable species. Details of the number of bats that were found are covered in Table 2 and 3.

3.2.7 Review of Findings at Lit and Unlit Turbines

Observed nocturnal avian fatality rates were compared between lit (n=24) and unlit turbines (n=68). Observed nocturnal avian fatality rates were also compared for lit turbines and adjacent to lit turbines (n=64) against turbines that were neither lit nor adjacent to lit turbines (n=28). At lit turbines there were a total of 11 nocturnal migrants observed as fatalities on 24 turbines, and at unlit turbines there were a total of 18 fatalities on 64 turbines. Both analyses were significant at the P=0.05 level: lit versus unlit, P=0.03 and lit plus adjacent to lit versus unlit and not adjacent to lit, P< 0.001. Thus, there were significantly more nocturnal migrants found at lit turbines and turbines directly adjacent to lit turbines than at unlit turbines.

3.3 Carcass Removal Trials

As stated in the methods section (2.2), there was a large effect of season on carcass removal rates and the two years of monitoring did not have similar rates by season (Table 4). Large birds had an average removal time ranging from slightly less than eight days in fall season of year 2 to almost 23 days in spring season of year 1. Small birds did not mirror the large bird category in terms of seasonal differences. The longest period that small birds remained was over 21 days in summer season of year 1 while the shortest period was just under four days in spring season of year 2. Bootstrapped average carcass removal times and 90% confidence limits are presented in Table 4. These estimates were factored into estimated fatalities presented in Section 3.5 along with searcher efficiency estimates presented in Section 3.4.

Table 4. Bootstrapped average Carcass Persistence (CP) times and 90% confidence limits during the two years of wildlife fatality monitoring (combined) at Klondike III Wind Project, 2007–2009.

Season	2007–2008 Monitoring Year 1				2008–2009 Monitoring Year 2			
	Number	Carcass Persistence	Lower CI[1]	Upper CI	Number	Carcass Persistence	Lower CI[1]	Upper CI
Large Size								
Spring	20	22.88	15.20	39.55	20	13.76	10.38	18.52
Summer	20	20.00	12.15	34.65	20	11.52	6.25	20.40
Fall	20	16.80	10.04	28.76	20	7.62	5.11	11.11
Winter	20	9.85	8.01	12.26	20	13.70	8.76	21.78
Small Size								
Spring	20	12.59	8.95	18.15	20	3.78	2.70	5.16
Summer	20	21.21	13.17	36.68	20	12.35	7.49	19.91
Fall	20	6.86	4.10	11.48	20	7.17	5.26	9.49
Winter	20	4.03	2.44	6.10	20	11.24	7.01	17.45

[1] lower and upper limits of the 90% confidence interval (CI)

3.4 Searcher Efficiency Trials

Using alpha=0.15, there was a marginally significant effect of the interaction of size with season (χ_3^2 = 5.39, p=0.146) and significant main effects of size (χ_1^2 = 4.07, p=0.044) and season (χ_3^2 = 8.10, p=0.044) during year 1 of monitoring. Using alpha=0.2 (increased due to smaller sample sizes relative to year 1), there was no effect of the interaction of size with season (χ_3^2 =1.69, p= 0.64), nor of size alone (χ_1^2 =0.57, p=0.45) in year 2 of monitoring. The effect of season alone was marginal (χ_3^2 =4.57, p=0.20), and it was retained in the fatality estimate model.

For the 422 searcher efficiency trial carcasses from both monitoring years, using alpha=0.15, the effect of season was found to be different in each year (χ_3^2 = 5.55, p=0.136) whereas the effect of size did not depend on year or season (χ_1^2 =0.30, p=0.581, χ_3^2 =3.58, p=0.3103, respectively. Effect of season alone: χ_1^2 = 4.40, p=0.036). Year, size, season and the interaction of year with season were retained in the final model and Searcher Efficiency (SE) trial data from both years were pooled.

Searcher efficiency rates for large birds were the highest in the winter of year 1 with an average probability of detection of 72% and the lowest in the spring of year two at 43%. For small birds the season with the highest average detection rate was winter of year one at 63% and the season with the lowest average detection rate was spring of year two at an average searcher efficiency of 33%. Bootstrapped average probability of a searcher finding a carcass and 90% confidence limits for the two size classes in each season are given in Table 5.

Table 5. Bootstrapped Searcher Efficiency (SE) and 90% confidence limits during the two years of wildlife fatality monitoring (combined) at Klondike III Wind Project, 2007–2009.

Season	2007–2008 Monitoring Year 1				2008–2009 Monitoring Year 2			
	Number	Searcher Efficiency	Lower CI[1]	Upper CI	Number	Searcher Efficiency	Lower CI[1]	Upper CI
Large Size								
Spring	35	0.61	0.52	0.72	17	0.43	0.28	0.58
Summer	50	0.50	0.42	0.59	9	0.69	0.51	0.86
Fall	22	0.57	0.44	0.69	29	0.48	0.36	0.60
Winter	22	0.72	0.62	0.82	24	0.61	0.49	0.74
Small Size								
Spring	42	0.51	0.41	0.62	14	0.33	0.20	0.47
Summer	48	0.40	0.31	0.49	8	0.60	0.39	0.79
Fall	29	0.47	0.34	0.59	27	0.38	0.26	0.48
Winter	24	0.63	0.51	0.75	22	0.51	0.39	0.65

[1] lower and upper limits of the 90% confidence interval (CI)

3.5 Estimated Annual Fatality Rates

During the study period, 130 carcasses whose deaths were attributable to the turbines were found in the search plots, 93 birds and 37 bats. The total site fatality estimates, per turbine estimates, and per megawatt estimates and 90% confidence limits derived using the Schoenfeld estimator are presented in Table 6a, and those derived using the Huso estimator for comparison are shown in Table 6b. Because the search interval was long and carcass persistence times generally short (2 weeks or less) in this study, estimates from the two estimators are very similar. The particular combination of search interval and average carcass persistence times at this site satisfied the conditions under which the two estimators show little difference from one another. Fatality rates used in comparison to other projects in the discussion section of this report, and discussion of whether or not groups exceeded thresholds of concern set in the WMMP (OEFSC, 2007) use the fatality rates calculated with the Schoenfeld estimator as defined in the WMMP (OEFSC, 2007, Page A-7 through A-9). Numbers calculated with the Huso estimator are included for visual comparisons in the tables; however, results of this report discussed below focus on the Schoenfeld estimates. While fatality estimates for each year calculated separately are presented here (Table 7a, 7b) to show annual variation, the focus of this report is on the estimated fatality rates for the two-year study period combined (Table 6a, 6b). While means are presented below, the estimate should include the 90% confidence interval (CI) and those are presented along with means (estimates) in Tables 6a, 6b, 7a, and 7b.

The all birds category had an estimate of 3.02 birds/MW/year, with an overall site fatality estimate of 668.0 birds/year (Table 6a). Year 1 results showed slightly higher mean estimates for all birds (Table 7a), although the CI overlapped between the years. Small birds are mostly represented by passerines (the only non-passerine in this group is the Virginia rail) and they comprised the majority of estimated annual fatalities at 2.60 birds/MW/year (Table 6a). Groups of interest as defined in the WMMP had annual fatality estimates as follows: raptors (0.15), grassland birds (0.23), and nocturnal migrants (0.83/MW/year) (Table 6a). It should be noted that due to small sample size of raptors and grassland birds found, the CI is wide for these groups and thus the mean estimates should

not be considered accurate. Large bird and raptor estimates were substantially higher for year 2, due to the increased amount of observed raptor fatalities between the two years (1 vs. 4; Table 7a).

Table 6a. Bootstrapped fatality estimates and 90% confidence intervals, derived using the *Schoenfeld Estimator*, for two years of wildlife fatality monitoring at Klondike III Wind Project, 2007–2009 (combined).

Categories[1]	Avg. # Found Per Year	Total Site Fatality Estimates		Estimates per Turbine		Estimates per MW	
		Estimate	90% Confidence Interval Range	Estimate	90% Confidence Interval Range	Estimate	90% Confidence Interval Range
All Birds	46.5	668.0	528.7–940.1	5.33	4.23–7.51	3.02	2.39–4.25
Small Birds	38	575.1	435.8–833.9	4.59	3.48–6.66	2.60	1.97–3.77
Large Birds	8.5	92.9	57.5–150.4	0.74	0.45–1.21	0.42	0.26–0.68
Raptors	2.5	33.2	8.8–68.6	0.26	0.07–0.55	0.15	0.04–0.31
Grassland Birds	4	50.9	19.9–90.7	0.40	0.16–0.73	0.23	0.09–0.41
Nocturnal Migrants	14.5	183.6	117.2-296.4	1.47	0.94–2.37	0.83	0.53–1.34
Bats	18.5	245.5	157.0–391.5	1.96	1.26–3.12	1.11	0.71–1.77

[1] As defined in OEFSC, 2007.

Table 6b. Bootstrapped fatality estimates and 90% confidence intervals, derived using the *Huso Estimator*, for two years of wildlife fatality monitoring at Klondike III Wind Project, 2007–2009 (combined).

Categories[1]	Avg. # Found Per Year	Total Site Fatality Estimates		Estimates per Turbine		Estimates per MW	
		Estimate	90% Confidence Interval Range	Estimate	90% Confidence Interval Range	Estimate	90% Confidence Interval Range
All Birds	46.5	705.6	561.8–986.6	5.65	4.49–7.88	3.19	2.54–4.46
Small Birds	38	608.3	464.5–867.1	4.86	3.71–6.94	2.75	2.10–3.92
Large Birds[2]	8.5	97.3	59.7–159.3	0.78	0.48–1.27	0.44	0.27–0.72
Raptors[2]	2.5	33.2	8.8–70.8	0.27	0.08–0.57	0.15	0.04–0.32
Grassland Birds[2]	4	53.1	22.1–97.3	0.43	0.18–0.77	0.24	0.10–0.44
Nocturnal Migrants	14.5	100.1	128.3–316.3	1.58	1.02–2.53	0.90	0.58–1.43
Bats	18.5	258.8	172.5–402.6	2.07	1.38–3.22	1.17	0.78–1.82

[1]As defined in OEFSC, 2007.

Table 7a. Bootstrapped fatality estimates and 90% confidence intervals, derived using the *Schoenfeld Estimator*, for each year of wildlife fatality monitoring at Klondike III Wind Project, 2007–2009 (calculated separately).

Categories[1]	# Found	Total Site Fatality Estimates		Estimates per Turbine		Estimates per MW	
		Estimate	90% Confidence Interval Range	Estimate	90% Confidence Interval Range	Estimate	90% Confidence Interval Range
2007–2008 Monitoring Year 1							
All Birds	56	730.0	564.1–955.6	5.87	4.53–7.68	3.30	2.55–4.32
Small Birds	49	668.0	508.8–893.7	5.37	4.08–7.17	3.02	2.30–4.04
Large Birds	7	61.9	50.9–77.4	0.50	0.40–0.62	0.28	0.23–0.35
Raptors	1	13.3	11.1–17.7	0.11	0.08–0.15	0.06	0.05–0.08
Grassland Birds	5	53.1	42.0–66.4	0.42	0.34–0.53	0.24	0.19–0.30
Nocturnal Migrants	18	172.5	126.1-236.7	1.38	1.01–1.89	0.78	0.57–1.07
Bats	24	278.7	190.2–404.8	2.24	1.53–3.25	1.26	0.86–1.83
2008–2009 Monitoring Year 2							
All Birds	37	568.5	404.8–851.6	4.52	3.22–6.79	2.57	1.83–3.85
Small Birds	27	424.7	274.3–679.1	3.42	2.20–5.46	1.92	1.24–3.07
Large Birds	10	137.1	70.8–245.5	1.10	0.56–1.97	0.62	0.32–1.11
Raptors	4	57.5	15.5–132.7	0.46	0.12–1.06	0.26	0.07–0.60
Grassland Birds	3	46.5	11.1–117.2	0.37	0.09–0.94	0.21	0.05–0.53
Nocturnal Migrants	11	143.8	67.7–254.4	1.16	0.55–2.05	0.65	0.31–1.15
Bats	13	170.3	84.1–307.5	1.36	0.67–2.47	0.77	0.38–1.39

[1]As defined in OEFSC, 2007.

Table 7b. Bootstrapped fatality estimates and 90% confidence intervals, derived using the *Huso Estimator*, for each year of wildlife fatality monitoring at Klondike III Wind Project, 2007–2009 (calculated separately).

Categories[1]	# Found	Total Site Fatality Estimates		Estimates per Turbine		Estimates per MW	
		Estimate	90% Confidence Interval Range	Estimate	90% Confidence Interval Range	Estimate	90% Confidence Interval Range
2007–2008 Monitoring Year 1							
All Birds	56	785.3	615–1018.5	6.30	4.93–8.17	3.55	2.78–4.60
Small Birds	49	716.7	550.8–946.7	5.75	4.42–7.60	3.24	2.49–4.28
Large Birds[2]	7	68.6	55.3–84.1	0.54	0.44–0.67	0.31	0.25–0.38
Raptors[2]	1	13.3	11.1–17.7	0.11	0.08–0.15	0.06	0.05–0.08
Grassland Birds[2]	5	57.5	46.5–70.8	0.46	0.37–0.58	0.26	0.21–0.32
Nocturnal Migrants	18	192.4	143.8–256.6	1.55	1.16–2.07	0.87	0.65–1.16
Bats	24	294.2	207.9–420.3	2.37	1.66–3.37	1.33	0.94–1.90
2008–2009 Monitoring Year 2							
All Birds	37	586.2	431.3–884.8	4.72	3.43–7.05	2.65	1.95–4.00
Small Birds	27	442.4	285.4–703.4	3.55	2.30–5.66	2.00	1.29–3.18
Large Birds[2]	10	143.8	75.2–254.4	1.16	0.61–2.04	0.65	0.34–1.15
Raptors[2]	4	59.7	15.5–134.9	0.49	0.13–1.09	0.27	0.07–0.61
Grassland Birds[2]	3	48.7	11.1–121.7	0.39	0.09–0.99	0.22	0.05–0.55
Nocturnal Migrants	11	152.6	73.0–272.1	1.24	0.58–2.19	0.69	0.33–1.23
Bats	13	177.0	88.5–320.7	1.43	0.71–2.57	0.80	0.40–1.45

3.5.1 Estimated Fatality Rates by Turbine Size

When comparing the fatality rate for the category all birds for the two different turbine sizes (Table 8a), estimates on a per MW basis show that the larger 2.3 MW turbines had a ratio of 0.80:1.0 of fewer fatalities per MW than the 1.5 MW turbines (Table 8a). Bats however, had a ratio of 1.57:1.0 for the 2.3 MW turbines compared to the 1.5 MW turbines. Reasons for the differences are not known. There were substantial year to year differences in the ratios of turbine size on birds and bats (Table 8b). Further discussion of results is elaborated in Section 4.4.

Table 8a. Comparison of all bird and bat fatality estimates for 2.3 MW turbines and 1.5 MW turbines during two years of wildlife fatality monitoring at Klondike III Wind Project, 2007–2009 (combined).

Ratio of Fatalities Per Turbine (Ratio 2.3 MW turbine:1.5 MW turbine**)**

Group	Schoenfeld Estimator		Huso Estimator	
	Estimate	90% Confidence Interval Range	Estimate	90% Confidence Interval Range
Birds	1.22:1.0	0.76–1.84	1.23:1.0	0.77–1.85
Bats	2.37:1.0	1.23–4.73	2.34:1.0	1.22–4.66

Ratio of Fatalities Per Megawatt (Ratio 2.3 MW turbine:1.5 MW turbine**)**

Group	Schoenfeld Estimator		Huso Estimator	
	Estimate	90% Confidence Interval Range	Estimate	90% Confidence Interval Range
Birds	0.80:1.0	0.49–1.20	0.81:1.0	0.50–1.21
Bats	1.57:1.0	0.80–3.09	1.55:1.0	0.79–3.04

Table 8b. Comparison of all bird and bat fatality estimates for 2.3 MW Turbines and 1.5 MW turbines during two years of wildlife fatality monitoring at Klondike III Wind Project, 2007–2009 (calculated separately).

Ratio of Fatalities Per Turbine (Ratio 2.3 MW turbine:1.5 MW turbine**)**

Group - Monitoring Year	Schoenfeld Estimator		Huso Estimator	
	Estimate	90% Confidence Interval Range	Estimate	90% Confidence Interval Range
Birds – Year 1	1.01:1.0	0.91–1.12	1.04:1.0	0.93–1.16
Birds – Year 2	1.53:1.0	0.94–2.77	1.55:1.0	0.96–2.80
Bats – Year 1	1.63:1.0	1.30–1.92	1.63:1.0	1.32–1.91
Bats – Year 2	3.48:1.0	0.94–13.93	3.47:1.0	0.94–13.63

Ratio of Fatalities Per Megawatt (Ratio 2.3 MW turbine:1.5 MW turbine**)**

Group	Schoenfeld Estimator		Huso Estimator	
	Estimate	90% Confidence Interval Range	Estimate	90% Confidence Interval Range
Birds – Year 1	0.66:1.0	0.59–0.73	0.68:1.0	0.60–0.76
Birds – Year 2	1.0:1.0	0.61–1.81	1.01:1.0	0.63–1.83
Bats – Year 1	1.06:1.0	0.85–1.25	1.06:1.0	0.86–1.24
Bats – Year 2	2.27:1.0	0.61–9.09	2.26:1.0	0.62–8.89

3.6 Raptor Nest Monitoring

On May 9, 2008, an aerial survey was conducted within the Klondike III and IIIa site boundary and a 2-mile buffer (3.2 km) around turbines (total survey area of 98.04 square miles or 253.02 square kilometers) to determine nest occupancy. Within the nest survey area, there were a total of 14 active nests, 19 inactive nests, and 1 nest not present in 2008 (Figure 3 and Appendix B). In addition, one active long-eared owl nest and four active American kestrel nests (exact location unknown) were observed incidentally, but not monitored. Nine inactive common raven or buteo species nests in the 2007 database that

are not within the Klondike III or IIIa project boundaries were not relocated in 2008 for various reasons (nest was likely too obstructed for viewing, was blown out of tree or was missed by surveyor). The number of active nests of each species within the survey area is listed as follows:

Target Species	Other Species or Inactive Nests
6 Swainson's hawk	4 American kestrel (exact location unknown)
1 golden eagle	5 red-tailed hawk
1 ferruginous hawk	1 unknown buteo
	1 long-eared owl
	17 inactive stick nests
	2 inactive large stick nests – i.e. golden eagle

As previously described in the Methods section (2.5), nests of target species were checked during a second aerial survey where additional information to determine success was needed. The following summarizes the success for the target species. Distances to turbines reflect only Klondike III and IIIa turbines, not Klondike I and II turbines. Refer to Appendix B for number of young likely fledged and additional details. There is not a sufficient sample size of nests where nesting success was determined to analyze for any trends or patterns.

Swainson's hawk (Record #s)

Six active nests –

Three were onsite within the Klondike III or IIIa facility boundaries (42, 49 and 52), 42 and 52 were successful, and the success of nest 49 was unconfirmed. Nests 42 and 52 were within 0.5 miles of KIII turbines.

Three were offsite (48, 55, 66), two successful, and one with unconfirmed success status.

Golden eagle

1 active nest (89), but not onsite and not within 0.50 mile of turbines.

Ferruginous hawk

1 active nest (50) onsite, but not within 0.50 mile of turbines.

3.7 Avian Use Surveys

There was some year to year variation in terms of which seasons had the most individual bird detections during avian use surveys overall; however, summer season had the fewest number of individual bird detections during both survey years (Table 9). Passerines as a group had the most individuals reported during post-construction avian use surveys overall during the two years, 2007–2009 (Table 9). Horned lark was the most commonly observed passerine species during all seasons in both years that post-construction surveys were conducted (Table 10a). Waterfowl and raptors are two other taxonomic groups of interest. The majority of waterfowl individuals, specifically Canada goose, were observed in the winter season of year 2 (Table 10a). Raptor numbers were relatively even among seasons and years, although fewer raptor detections were observed during summer season in both years than the other three seasons (Table 9). Common raptor species observed included northern harrier, red-tailed hawk, rough-legged hawk, and American kestrel (Table 10a).

Comparison of metrics such as mean use, percent composition, and frequency of occurrence can be used to determine whether pre- vs. post-construction avian use changed for various groups, and how observed fatalities for species compared to their observed use of the Project area in post-construction avian use surveys. While there was some variation between seasons and years as is expected (as species movements change), several species had higher mean use that other species throughout post-construction avian use surveys. These species were horned lark, Canada goose, common raven, western meadowlark, red-

tailed hawk, and ring-necked pheasant (Table 10a). In general, these same species that had high mean use also comprised the majority of the composition (Table 10b). One additional species ranked high in terms of percent composition, Swainson's hawk during year 1 (Table 10b). Frequency of occurrence is factored into exposure indices, which are used to predict pre-construction avian risk analysis. Frequency of occurrence followed similar trends as mean use and percent composition for post-construction avian use surveys (Table 10c).

Avian use percent composition can be directly compared with percent composition of observed fatalities. In Table 11, percent composition of species and groups observed during pre- and post-construction avian use surveys are compared to percent composition of observed avian fatalities found during post-construction fatality monitoring. The comparison allows for a visual analysis to determine whether there were changes in avian composition between pre- and post-construction avian use surveys on the Project area, and whether species observed commonly during post-construction avian use surveys were also found as common avian fatalities. Only winter and spring pre-construction surveys were conducted for Klondike III, so no comparisons between pre- and post-construction surveys could be made for summer or fall seasons. Passerines comprised the highest percent composition of all taxonomic groups during both pre- and post-construction avian use surveys and post-construction fatality monitoring. Specifically, horned lark was the most common species in all comparison groups. Substantial differences between pre- and post-construction avian use surveys among taxonomic groups were observed for waterfowl, raptors, and passerines during the winter season. More waterfowl, specifically Canada goose, and more raptors were observed during post-construction winter surveys than pre-construction, while fewer passerines were observed during winter season post-construction avian use surveys than pre-construction.

Comparisons between post-construction avian use surveys and post-construction observed fatalities showed that despite waterfowl comprising 17.5% of all avian use, no waterfowl fatalities were observed during monitoring (Table 11). Other groups such as passerines and raptors were observed in similar percent composition between post-construction avian use and post-construction observed fatalities. There were eleven species observed during post-construction avian use surveys, but not found as fatalities at KIII searched turbines during the two years of study (Table 11). Among these species were common raven, Canada goose, northern harrier, and rough-legged hawk. There were nineteen species found as fatalities that were not detected during post-construction avian use surveys (Table 11). Fourteen of these nineteen species were classified as nocturnal migrants and two others are likely local migrants through the Project area, Virginia rail and great-blue heron. Short-eared owl was another species not observed during avian use surveys, but found as a fatality at the Project, which is similar to the Big Horn Wind Project in Klickitat County, Washington, which also had fatalities of that species with no observed avian use prior to construction (Kronner et al., 2008).

Table 9. Species observed during post-construction avian use surveys in four seasons* in monitoring year 1 and monitoring year 2, November 14, 2007–October 26, 2009, Klondike III Wind Project.

Species/Groups	Winter				Spring				Summer				Fall			
	Year 1		Year 2		Year 1		Year 2		Year 1		Year 2		Year 1		Year 2	
	# Grps	# Ind	# Grps	# Ind	# Grps	# Ind	# Grps	# Ind	# Grps	# Ind	# Grps	# Ind	# Grps	# Ind	# Grps	# Ind
Waterfowl		**8**		**327**		**0**		**0**		**0**		**0**		**0**	**2**	**19**
Canada goose	1	8	4	327		0		0		0		0		0	2	19
Raptors		**10**		**13**		**11**		**17**		**5**		**9**		**12**		**16**
northern harrier	*2*	*3*	*4*	*4*		*0*	*4*	*4*		*0*	*2*	*2*	*1*	*1*	*5*	*5*
Buteos		*5*		*7*		*6*		12		*5*		6		*9*		10
Swainson's hawk		0		0		0	2	3	3	5	1	1		0		0
red-tailed hawk	1	1	3	3	3	4	7	7		0	5	5	9	9	9	10
rough-legged hawk	4	4	3	3	2	2	2	2		0		0		0		0
unidentified buteo	0	0	1	1	0	0		0	0	0		0		0		0
Falcons		*2*		*2*		*5*		0		*0*		0		*1*		1
American kestrel	1	1	1	1	3	3		0		0		0	1	1	1	1
prairie falcon	1	1	1	1	2	2		0		0		0		0		0
Accipiters		*0*		*0*		*0*		*1*		*0*		*0*	*1*	*1*		*0*
Cooper's hawk		0		0		0	1	1		0		0		0		0
unidentified accipiter		0		0		0		0		0		0	1	1		0
Unidentified raptors		*0*		*0*		*0*		*0*		*0*	*1*	*1*		*0*		*0*
Vultures		**0**		**0**		**1**		**0**		**0**		**0**		**0**		**0**
turkey vulture		0		0	1	1		0		0		0		0		0
Game Birds		**1**		**2**		**12**		**10**		**4**		**0**		**0**		**0**
ring-necked pheasant	1	1	2	2	9	12	10	10	4	4		0		0		0
Shorebirds		**0**		**0**		**0**	**1**	**3**		**0**		**0**		**0**		**0**
long-billed curlew		*0*		*0*		*0*	*1*	*3*		*0*		*0*		*0*		*0*
Passerines		**184**		**306**		**193**		**249**		**76**		**111**		**225**		**170**
Songbirds		*178*		*296*		*190*		*242*		*74*		*108*		*216*		*159*
American robin		0		0		0	1	1		0		0		0		0
Brewer's blackbird		0		0		0		0		0		0	1	60		0
brown-headed cowbird		0		0		0	1	1		0		0		0		0
European starling	3	15		0		0		0		0		0		0		0
horned lark	59	155	54	283	56	106	43	116	23	41	33	97	47	116	49	129
house finch		0		0		0	1	22		0		0		0	1	3

Species/Groups	Winter				Spring				Summer				Fall			
	Year 1		Year 2		Year 1		Year 2		Year 1		Year 2		Year 1		Year 2	
	# Grps	# Ind	# Grps	# Ind	# Grps	# Ind	# Grps	# Ind	# Grps	# Ind	# Grps	# Ind	# Grps	# Ind	# Grps	# Ind
unidentified passerine	2	2		0		0		0	1	12		0	4	34	1	20
unidentified swallow		0		0		0	1	50		0		0		0		0
western meadowlark	4	6	9	13	37	84	29	52	13	21	7	11	5	6	7	7
Corvids		*6*		*10*		*3*		*0*		*2*	*2*	*3*		*9*	*8*	*11*
common raven	6	6	6	10	3	3	6	7	2	2	2	3	5	9	8	11
Doves/Pigeons		**0**		**25**		**2**		**0**		**1**		**0**		**0**		**0**
mourning dove		0		0	1	2		0	1	1		0		0		0
rock pigeon		0	1	25		0		0		0		0		0		0
Woodpeckers		**0**		**0**		**1**		**0**		**0**		**0**		**0**		**0**
northern flicker		0		0	1	1		0		0		0		0		0
Total	**85**	**203**	**89**	**673**	**118**	**220**	**109**	**279**	**47**	**86**	**51**	**120**	**74**	**237**	**83**	**205**

* Survey dates in each season, number of surveys, and plots surveyed in each monitoring year

Winter:
Year 1 – November 14, 2007–March 11, 2008; 5 visits to 15 plots=75 surveys
Year 2 – November 12, 2008–March 12, 2009; 5 visits to 15 plots=75 surveys

Spring:
Year 1 – March 25, 2008–May 12, 2008; 4 visits to 15 plots=60 surveys
Year 2 – March 31, 2009–May 18, 2009; 4 visits to 15 plots=60 surveys

Summer:
Year 1 – June 11, 2008–August 14, 2008; 3 visits to 15 plots=45 surveys
Year 2 – June 16, 2009–August 6, 2009; 3 visits to 15 plots=45 surveys

Fall:
Year 1 – September 5, 2008–October 13, 2008; 4 visits to 15 plots=60 surveys
Year 2 – September 10, 2009–October 26, 2009; 4 visits to 15 plots=60 surveys

Study Plots:
Year 1 plots: B 09-10, B 16-17, C 06-07, D 10-11, G 03-04, H 03-04, J 05-06, L 01-02, L 05-06, M 05-06, P 05-06, R 05-06, S 07-08, V 02-03, V 10-11
Year 2 plots: B 03-04, B 12-13, C 03-04, D 02-03, F 01-02, G 06-07, H 01-02, L 03-04, M 03-04, P 02-03, R 03-04, S 05-06, V 04-05, V 08-09, W 01-02

Table 10a. Mean use for avian groups observed during post-construction avian use surveys in monitoring year 1 and monitoring year 2 November 14, 2007–October 26, 2009*, Klondike III Wind Project.

Group and Species	Winter		Spring		Summer		Fall	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
	Mean Use**							
Waterfowl	**0.107**	**4.360**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.317**
Canada goose	0.107	4.360	0.000	0.000	0.000	0.000	0.000	0.317
Raptors	**0.133**	**0.173**	**0.983**	**0.283**	**0.111**	**0.200**	**0.200**	**0.267**
northern harrier	*0.040*	*0.053*	*0.000*	*0.067*	*0.000*	*0.044*	*0.017*	*0.083*
Buteos	*0.067*	*0.093*	*0.100*	*0.200*	*0.111*	*0.134*	*0.150*	*0.167*
Swainson's hawk	0.000	0.000	0.000	0.050	0.111	0.022	0.000	*0.000*
red-tailed hawk	0.013	0.040	0.067	0.117	0.000	0.111	0.150	0.167
rough-legged hawk	0.053	0.040	0.033	0.033	0.000	0.000	0.000	0.000
unidentified buteo	0.000	0.013	0.000	0.000	0.000	0.000	0.000	0.000
Falcons	*0.027*	0.027	*0.083*	0.000	*0.000*	0.000	*0.017*	0.017
American kestrel	0.013	0.013	0.050	0.000	0.000	0.000	0.017	0.017
prairie falcon	0.013	0.013	0.033	0.000	0.000	0.000	0.000	0.000
Accipiters	*0.000*	*0.000*	*0.000*	*0.017*	*0.000*	*0.000*	*0.017*	*0.000*
Cooper's hawk	0.000	0.000	0.000	0.017	0.000	0.000	0.000	*0.000*
unidentified accipiter	0.000	0.000	0.000	0.000	0.000	0.000	0.017	*0.000*
Unidentified raptors	0.000	0.000	0.000	0.000	0.000	0.022	0.000	0.000
Vultures	**0.000**	**0.000**	**0.017**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
turkey vulture	0.000	0.000	0.017	0.000	0.000	0.000	0.000	0.000
Game Birds	**0.013**	**0.027**	**0.200**	**0.167**	**0.089**	**0.000**	**0.000**	**0.000**
ring-necked pheasant	0.013	0.027	0.200	0.167	0.089	0.000	0.000	0.000
Shorebirds	**0.000**	**0.000**	**0.000**	**0.050**	**0.000**	**0.000**	**0.000**	**0.000**
long-billed curlew	0.000	*0.000*	0.000	*0.050*	0.000	*0.000*	0.000	*0.000*
Passerines	**2.453**	**4.080**	**3.217**	**4.150**	**1.689**	**2.467**	**3.750**	**2.833**
Songbirds	*2.373*	*3.947*	*3.167*	*4.033*	*1.644*	*2.400*	*3.600*	*2.650*
American robin	0.000	0.000	0.000	0.017	0.000	0.000	0.000	0.000
Brewer's blackbird	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000
brown-headed cowbird	0.000	0.000	0.000	0.017	0.000	0.000	0.000	0.000
European starling	0.200	0.000	0.000	0.000	0.000	0.000	0.000	0.000
horned lark	2.067	3.773	1.767	1.933	0.911	2.156	1.933	2.150
house finch	0.000	0.000	0.000	0.367	0.000	0.000	0.000	0.050
unidentified passerine	0.027	0.000	0.000	0.000	0.267	0.000	0.567	0.333
unidentified swallow	0.000	0.000	0.000	0.833	0.000	0.000	0.000	0.000
western meadowlark	0.080	0.173	1.400	0.867	0.467	0.244	0.100	0.117
Corvids	*0.080*	*0.133*	*0.050*	*0.117*	*0.044*	*0.067*	*0.150*	*0.183*
common raven	0.080	0.133	0.050	0.117	0.044	0.067	0.150	0.183
Doves/Pigeons	**0.000**	**0.333**	**0.033**	**0.000**	**0.022**	**0.000**	**0.000**	**0.000**
mourning dove	0.000	0.000	0.033	0.000	0.022	0.000	0.000	0.000
rock pigeon	0.000	0.333	0.000	0.000	0.000	0.000	0.000	0.000
Woodpeckers	**0.000**	**0.000**	**0.017**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
northern flicker	0.000	0.000	0.017	0.000	0.000	0.000	0.000	0.000
Total	**2.707**	**8.973**	**3.667**	**4.650**	**1.911**	**2.667**	**3.950**	**3.417**

* Survey dates in each season and plots surveyed described in footnotes of Table 9.

** Mean Use: mean number of individuals within 800m plot/20-minute point count for each species or group provides an index of the magnitude of avian use, but it does not describe density.

Table 10b. Percent composition for avian groups observed during post-construction avian use surveys in monitoring year 1 and monitoring year 2 November 14, 2007–October 26, 2009, Klondike III Wind Project.

Group and Species	Winter		Spring		Summer		Fall	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
	% Composition*							
Waterfowl	**3.94**	**48.59**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**9.27**
Canada goose	3.94	48.59	0.00	0.00	0.00	0.00	0.00	9.27
Raptors	**4.93**	**1.93**	**5.00**	**6.09**	**5.81**	**7.50**	**5.06**	**7.80**
Northern harrier	*1.48*	*0.59*	*0.00*	*1.43*	*0.00*	*1.67*	*0.42*	*2.44*
Buteos	*2.46*	*1.04*	*2.73*	*4.30*	*5.81*	*5.00*	*3.80*	*4.88*
Swainson's hawk	0.00	0.00	0.00	1.08	5.81	0.83	0.00	0.00
red-tailed hawk	0.49	0.45	1.82	2.51	0.00	4.17	3.80	4.88
rough-legged hawk	1.97	0.45	0.91	0.72	0.00	0.00	0.00	0.00
unidentified buteo	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00
Falcons	*0.99*	0.30	2.27	0.00	*0.00*	0.00	*0.42*	*0.49*
American kestrel	0.49	0.15	1.36	0.00	0.00	0.00	0.42	0.49
prairie falcon	0.49	0.15	0.91	0.00	0.00	0.00	0.00	0.00
Accipiters	*0.00*	*0.00*	*0.00*	*0.36*	*0.00*	*0.00*	*0.42*	*0.00*
Cooper's hawk	0.00	0.00	0.00	0.36	0.00	0.00	0.00	0.00
unidentified accipiter	0.00	0.00	0.00	0.00	0.00	0.00	0.42	0.00
Unidentified raptors	0.00	0.00	0.00	0.00	0.00	0.83	0.00	0.00
Vultures	**0.00**	**0.00**	**0.45**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
turkey vulture	0.00	0.00	0.45	0.00	0.00	0.00	0.00	0.00
Game Birds	**0.49**	**0.30**	**5.45**	**3.58**	**4.65**	**0.00**	**0.00**	**0.00**
ring-necked pheasant	0.49	0.30	5.45	3.58	4.65	0.00	0.00	0.00
Shorebirds	**0.00**	**0.00**	**0.00**	**1.08**	**0.00**	**0.00**	**0.00**	**0.00**
long-billed curlew	0.00	*0.00*	0.00	*1.08*	0.00	*0.00*	0.00	*0.00*
Passerines	**90.64**	**45.47**	**87.73**	**89.25**	**88.37**	**92.50**	**94.94**	**82.93**
Songbirds	*87.68*	*43.98*	*86.36*	*86.74*	*86.05*	*90.00*	*91.14*	*77.56*
American robin	0.00	0.00	0.00	0.36	0.00	0.00	0.00	0.00
Brewer's blackbird	0.00	0.00	0.00	0.00	0.00	0.00	25.32	0.00
brown-headed cowbird	0.00	0.00	0.00	0.36	0.00	0.00	0.00	0.00
European starling	7.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00
horned lark	76.35	42.05	48.18	41.58	47.67	80.83	48.95	62.93
house finch	0.00	0.00	0.00	7.89	0.00	0.00	0.00	1.46
unidentified passerine	0.99	0.00	0.00	0.00	13.95	0.00	14.35	9.76
unidentified swallow	0.00	0.00	0.00	17.92	0.00	0.00	0.00	0.00
Western meadowlark	2.96	1.93	38.18	18.64	24.42	9.17	2.53	3.41
Corvids	*2.96*	*1.49*	*1.36*	*2.51*	*2.33*	*2.50*	*0.00*	*5.37*
common raven	2.96	1.49	1.36	2.51	2.33	2.50	0.00	5.37
Doves/Pigeons	**0.00**	**3.71**	**0.91**	**0.00**	**1.16**	**0.00**	**0.00**	**0.00**
mourning dove	0.00	0.00	0.91	0.00	1.16	0.00	0.00	0.00
rock pigeon	0.00	3.71	0.00	0.00	0.00	0.00	0.00	0.00
Woodpeckers	**0.00**	**0.00**	**0.45**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Northern flicker	0.00	0.00	0.45	0.00	0.00	0.00	0.00	0.00
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

* Percent Composition: mean use for a species/total use across all species, multiplied by 100, providing an estimate of the relative use of any particular species, compared to the use by all other species combined.

Table 10c. Percent frequency of occurrence for avian groups observed during post-construction avian use surveys in monitoring year 1 and monitoring year 2 November 14, 2007–October 26, 2009, Klondike III Wind Project.

Group and Species	Winter		Spring		Summer		Fall	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
	% Frequency of Occurrence							
Waterfowl	**1.33**	**5.33**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**3.33**
Canada goose	1.33	5.33	0.00	0.00	0.00	0.00	0.00	3.33
Raptors	**10.67**	**16.00**	**18.33**	**20.00**	**6.67**	**20.00**	**20.00**	**23.33**
northern harrier	*2.67*	*5.33*	*0.00*	*6.67*	*0.00*	*4.44*	*1.67*	*8.33*
Buteos	*6.67*	*9.33*	*8.33*	*15.00*	*6.67*	*13.33*	*13.33*	*15.00*
Swainson's hawk	0.00	0.00	0.00	3.33	6.67	2.22	2.22	*0.00*
red-tailed hawk	1.33	4.00	5.00	11.67	0.00	11.11	11.11	15.00
rough-legged hawk	5.33	4.00	3.33	3.33	0.00	0.00	0.0	0.00
unidentified buteo	0.00	1.33	0.00	0.00	0.00	0.00	0.00	0.00
Falcons	*2.67*	2.67	*8.33*	0.00	*0.00*	0.00	*1.67*	1.67
American kestrel	1.33	1.33	5.00	0.00	0.00	0.00	1.67	1.67
prairie falcon	1.33	1.33	3.33	0.00	0.00	0.00	0.00	0.00
Accipiters	*0.00*	*0.00*	*0.00*	*1.67*	*0.00*	*0.00*	*1.67*	*0.00*
Cooper's hawk	0.00	0.00	0.00	1.67	0.00	0.00	0.00	*0.00*
unidentified accipiter	0.00	0.00	0.00	0.00	0.00	0.00	1.67	*0.00*
Unidentified raptors	0.00	0.00	0.00	0.00	0.00	2.22	0.00	0.00
Vultures	**0.00**	**0.00**	**1.67**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
turkey vulture	0.00	0.00	1.67	0.00	0.00	0.00	0.00	0.00
Game Birds	**1.33**	**2.67**	**15.00**	**16.67**	**8.89**	**0.00**	**0.00**	**0.00**
ring-necked pheasant	1.33	2.67	15.00	16.67	8.89	0.00	0.00	0.00
Shorebirds	**0.00**	**0.00**	**0.00**	**1.67**	**0.00**	**0.00**	**0.00**	**0.00**
long-billed curlew	0.00	*0.00*	0.00	*1.67*	0.00	*0.00*	0.00	*0.00*
Passerines	**70.67**	**73.33**	**93.33**	**80.00**	**66.67**	**80.00**	**81.67**	**83.33**
Songbirds	*69.33*	*73.33*	*93.33*	*80.00*	*62.22*	*80.00*	*81.67*	*81.67*
American robin	0.00	0.00	0.00	1.67	0.00	0.00	0.00	0.00
Brewer's blackbird	0.00	0.00	0.00	0.00	0.00	0.00	1.67	0.00
brown-headed cowbird	0.00	0.00	0.00	1.67	0.00	0.00	0.00	0.00
European starling	2.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00
horned lark	66.67	72.00	85.00	71.67	51.11	73.33	78.33	81.67
house finch	0.00	0.00	0.00	1.67	0.00	0.00	0.00	1.67
unidentified passerine	2.67	0.00	0.00	0.00	2.22	0.00	6.67	1.67
unidentified swallow	0.00	0.00	0.00	1.67	0.00	0.00	0.00	0.00
western meadowlark	5.33	12.00	61.67	48.33	28.89	15.56	8.33	11.67
Corvids	*8.00*	*8.00*	*5.00*	*10.00*	*4.44*	*4.44*	*8.33*	*13.33*
Common raven	8.00	8.00	5.00	10.00	4.44	4.44	8.33	13.33
Doves/Pigeons	**0.00**	**1.33**	**1.67**	**0.00**	**2.22**	**0.00**	**0.00**	**0.00**
mourning dove	0.00	0.00	1.67	0.00	2.22	0.00	0.00	0.00
rock pigeon	0.00	1.33	0.00	0.00	0.00	0.00	0.00	0.00
Woodpeckers	**0.00**	**0.00**	**1.67**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Northern flicker	0.00	0.00	1.67	0.00	0.00	0.00	0.00	0.00
Total	**73.33**	**76.00**	**93.33**	**85.00**	**75.56**	**88.89**	**86.67**	**86.67**

* Frequency of Occurrence: percentage of surveys in which a species was observed with the survey plot providing an index of how often a species occurs in the project area.

Table 11. Percent composition for avian groups observed during post-construction avian use surveys in monitoring year 1 and monitoring year 2 in winter and spring seasons (2007–2009) and all four seasons combined, pre-construction avian use surveys in winter and spring season (2004–2005), and for fatalities found on scheduled searches 2007–2009, Klondike III Wind Project.

Group and Species	Estimated % Composition of Avian Species					
	Winter Season		Spring Season		Monitoring Year 1 and 2 Combined (2007–2009, All Seasons Combined)	
	Pre-Construction Point Counts[1]	Post-Construction Point Counts[2]	Pre-Construction Point Counts[1]	Post-Construction Point Counts[2]	Post-construction Point Counts[3]	Fatalities Found on Scheduled Searches[4]
Wading birds	**0**	**0**	**0.11**	**0**	**0**	**1.08**
great-blue heron	0	0	0.11	0	0	1.08
Rails	**0**	**0**	**0**	**0**	**0**	**1.08**
Virginia rail	0	0	0	0	0	1.08
Waterfowl	**11.89**	**38.24**	**0**	**0**	**17.50**	**0**
Canada goose	11.82	38.24	0	0	17.50	0
trumpeter swan	0.06	0	0	0	0	0
Vulture	**0**	**0**	**0.21**	**0.20**	**0.05**	**0**
turkey vulture	0	0	0.21	0.20	0.05	0
Raptors	**0.45**	**2.63**	**4.94**	**5.61**	**4.60**	**5.40**
northern harrier	*0.05*	*0.80*	*1.05*	*0.80*	*0.94*	*0*
Eagles	*0.05*	*0*	*0.11*	*0*	*0*	*0*
golden eagle	0.03	0	0	0	0	0
unidentified eagle	0.03	0	0.11	0	0	0
Buteos	*0.23*	*1.37*	*2.73*	*3.61*	*2.96*	*3.24*
Swainson's hawk	0	0	1.58	0.60	0.44	1.08
red-tailed hawk	0.01	0.46	0.95	2.20	1.93	1.08
rough-legged hawk	0.16	0.80	0.21	0.80	0.54	0
unidentified buteo	0.06	0.11	0	0	0.05	1.08
Falcons	*0.05*	*0.46*	*0.74*	*1.00*	*0.55*	*1.08*
American kestrel	0.04	0.23	0.32	0.60	0.35	1.08
prairie falcon	0	0.23	0.42	0.40	0.20	0
unidentified falcon	0.01	0	0	0	0	0
Accipiters	*0*	*0*	*0*	*0.20*	*0.10*	*0*
Cooper's hawk	0	0	0	0.20	0.05	0
unidentified accipiter	0	0	0	0	0.05	0
Owls	*0*	*0*	*0*	*0*	*0*	*1.08*
short-eared owl	0	0	0	0	0	1.08

Group and Species	Estimated % Composition of Avian Species					
	Winter Season		Spring Season		Monitoring Year 1 and 2 Combined (2007–2009, All Seasons Combined)	
	Pre-Construction Point Counts[1]	Post-Construction Point Counts[2]	Pre-Construction Point Counts[1]	Post-Construction Point Counts[2]	Post-construction Point Counts[3]	Fatalities Found on Scheduled Searches[4]
Unidentified raptors	*0.06*	*0*	*0.11*	*0*	*0.05*	*0*
Game Birds	**0.16**	**0.34**	**1.68**	**4.41**	**1.43**	**6.45**
chukar	0.09	0	0.42	0	0	0
gray partridge	0	0	0	0	0	2.15
ring-necked pheasant	0.06	0.34	1.26	4.41	1.43	4.30
Shorebirds	**0.04**	**0**	**0.42**	**0.60**	**0.15**	**0**
killdeer	0.04	0	0.42	0	0	0
long-billed curlew	0	0	0	0.60	0.15	0
Passerines	**87.45**	**55.94**	**92.75**	**88.58**	**74.85**	**80.72**
Songbirds	*86.85*	*54.11*	*90.76*	*86.57*	*72.33*	*80.72*
American goldfinch	0	0	0	0	0	1.08
American robin	0.96	0	0	0.20	0.05	0
barn swallow	0	0	0.32	0	0	0
Brewer's blackbird	0.71	0	9.03	0	2.97	1.08
brown-headed cowbird	0.04	0	0	0.20	0.05	0
common redpoll	0.09	0	0	0	0	0
common yellowthroat	0	0	0	0	0	1.08
dark-eyed junco	0.01	0	0	0	0	5.38
European starling	0.96	1.71	0.11	0	0.74	1.08
golden-crowned kinglet	0	0	0	0	0	3.23
grasshopper sparrow	0	0	0.63	0	0	0
hermit thrush	0	0	0	0	0	1.08
horned lark	67.42	50.00	54.94	44.49	51.56	33.33
house finch	0	0	0.21	4.41	1.24	0
Lincoln's sparrow	0	0	0	0	0	1.08
loggerhead shrike	0.01	0	0	0	0	0
MacGillivray's warbler	0	0	0	0	0	1.08
northern rough-winged	0	0	0.21	0	0	0
purple finch	0	0	0	0	0	1.08
red-winged blackbird	0.01	0	0	0	0	0
ruby-crowned kinglet	0	0	0	0	0	3.23
savannah sparrow	0	0	0.74	0	0	4.30
Say's phoebe	0.08	0	0.32	0	0	0

Group and Species	Estimated % Composition of Avian Species					
	Winter Season		Spring Season		Monitoring Year 1 and 2 Combined (2007–2009, All Seasons Combined)	
	Pre-Construction Point Counts[1]	Post-Construction Point Counts[2]	Pre-Construction Point Counts[1]	Post-Construction Point Counts[2]	Post-construction Point Counts[3]	Fatalities Found on Scheduled Searches[4]
spotted towhee	0.01	0	0	0	0	0
Townsend's warbler	0	0	0	0	0	5.38
unidentified blackbird	13.65	0	0.11	0	0	0
unidentified finch	0.16	0	0.11	0	0	0
unidentified kinglet	0	0	0	0	0	1.08
unidentified passerine	2.42	0.23	3.78	0	3.36	1.08
unidentified shrike	0.01	0	0	0	0	0
unidentified swallow	0	0	4.20	10.02	2.47	0
unidentified warbler	0	0	0	0	0	1.08
vesper sparrow	0	0	0.11	0	0	0
violet-green swallow	0	0	0.11	0	0	0
western kingbird	0	0	0.21	0	0	0
western meadowlark	1.20	2.17	15.65	27.25	9.89	3.23
white-crowned sparrow	0	0	0	0	0	4.30
Wilson's warbler	0	0	0	0	0	1.08
winter wren	0	0	0	0	0	2.15
yellow-rumped warbler	0	0	0	0	0	3.23
Corvids	*0.61*	*1.83*	*2.00*	*2.00*	*2.52*	*0*
American crow	0.01	0	0	0	0	0
common raven	0.59	1.83	2.00	2.00	2.52	0
Doves/Pigeons	**0**	**2.85**	**0.11**	**0.40**	**1.39**	**3.23**
mourning dove	0	0	0.11	0.40	0.15	2.15
rock pigeon	0	2.85	0	0	1.24	1.08
Woodpeckers	**0.01**	**0**	**0**	**0.20**	**0.05**	**1.08**
northern flicker	0.01	0	0	0.20	0.05	1.08
Unidentified bird	*0*	*0*	*0*	*0*	*0*	*1.08*

[1] Pre-construction avian use data conducted for two seasons, previously reported in Mabee et al., 2005 (see that report for detailed methods). 20-minute point counts at 800 m plots. Winter season: November 4, 2004–March 14, 2005; Spring season: March 15, 2005–May 15, 2005

[2] Post-construction Year 1 and Year 2 data combined. 10-min. point counts (methods in Section 2.6 of this report). Winter season: November 14, 2007–March 11, 2008, November 12, 2008–March 12, 2009; Spring season: March 25, 2008–May 12, 2008, March 31, 2009–May 18, 2009

[3] Post-construction four seasons for Year 1 and Year 2 combined. 10-min. counts (methods in Section 2.6 of this report); November 14, 2007–October 26, 2009

[4] Percent composition of observed avian fatalities on scheduled searches. Four seasons of Monitoring Year 1 and Year 2 combined due to small sample size.

4.0 DISCUSSION

4.1 Birds—Comparison to Other Columbia Basin Ecoregion Wind Projects

Annual fatality estimates for all birds and raptors are presented in Table 12 for wind projects in the Columbia Plateau Ecoregion (CPE) where fatality monitoring has been reported for at least one full year. Numbers presented are only mean estimates; refer to the source documents (listed in citations) for each monitoring study for complete confidence intervals. Mean fatality rates for the two groups (all birds and raptors) for Klondike III are also included in Table 12 for comparison to other regional wind projects. Raptors are included in their own category, due to increased focus on that taxonomic group regarding wind power fatality monitoring studies. Although results of the comparison of ratios of 2.3 MW to 1.5 MW turbines for the Klondike III study did not show a consistent difference in fatality estimates attributed to the different turbine sizes (Section 3.5.1) for avian species, text in this report focuses on fatality rates on a per/MW basis, in order to maintain consistency with recent reports in the CPE. Both per MW and per turbine estimates are shown in Table 12. For turbine sizes and specifications for the different wind projects discussed, refer to Table 13.

The range of mean fatality estimates for all birds on a per MW basis to date for the CPE is 0.9 to 6.7 birds/MW/year with an average of 2.55 birds/MW/year. On a per/MW basis, Klondike III (3.02 birds/MW/year) is slightly above the mean, although examination of the 90% CI reported in this report (2.39–4.25 birds/MW/year; Table 6a) shows that there is a wide overlap with the 90% CI and the regional mean. Klondike II also reported very similar estimated fatality rates to Klondike III despite multiple years lapsing between monitoring efforts at the two neighboring projects (Table 12).

Estimated fatality rates for raptors at Klondike III on a per/MW basis (0.15) were above the regional mean (0.08; Table 12). The average estimated raptor fatality rate was similar to that at Big Horn Wind Project and Hopkins Ridge in Washington which were second highest in terms of raptor fatalities after Leaning Juniper Wind Project in Oregon (average 0.21/MW/year). The 90% CI rates at Klondike III were quite wide for this group (0.04–0.31/MW/year for raptors) and overlap with the regional mean and Leaning Juniper estimates, thus, no significant conclusions can be drawn beyond anecdotal observations.

Table 12. Annual fatality estimates on a per turbine and per MW nameplate basis for all birds and for all raptors in the Columbia Plateau Ecoregion where fatality monitoring studies have been completed.

Columbia Plateau Ecoregion Wind Project [1]	All Bird Fatality Rates		Raptor Fatality Rates [2]	
Listed in order of highest to lowest All Bird Fatality Rate per MW/Year	#/ MW	#/ Turbine	#/ MW	#/ Turbine
Leaning Juniper I, OR[5]	6.7	10.0	0.21	0.32
Klondike II, OR	3.1	4.7	0.11	0.17
Klondike III, OR (Phase I)	**3.0**	**5.3**	**0.15**	**0.26**
Hopkins Ridge I, WA, 2008	3.0	5.4	0.07	0.12
Stateline I and II, WA/OR	2.9	1.9	0.09	0.06
Nine Canyon I[3], WA	2.8	3.6	0.05	0.07
Combine Hills, OR	2.6	2.3	0.00	0.00
Big Horn, WA[5]	2.5	3.8	0.15	0.23
Biglow Canyon, OR (Phase I)[4]	1.8	2.9	0.03	0.06
Wild Horse[4], WA	1.6	2.8	0.09	0.17
Hopkins Ridge I, WA, 2006	1.2	2.2	0.14	0.25
Vansycle, OR	1.0	0.6	0.00	0.00
Klondike I, OR	0.9	1.4	0.00	0.00
Mean	**2.55**	**3.61**	**0.08**	**0.13**

[1] References for projects: Big Horn (Kronner et al., 2008), Biglow Canyon Phase I (Jeffrey, et al., 2009), Combine Hills (Young et al., 2006), Hopkins Ridge I (Young et al., 2007, 2009), Klondike I (Johnson et al., 2003c), Klondike II (NWC and West, 2007), Klondike III (this report), Leaning Juniper I (Gritski et al., 2008a), Nine Canyon (Erickson et al., 2003), Stateline I and II-partial (Erickson et al., 2004), Vansycle (Erickson et al., 2000), Wild Horse (Erickson et al., 2008).

[2] Raptor estimates include diurnal raptors and owls.

[3] Nine Canyon II monitored only part-year.

[4] Wild Horse, Biglow Canyon estimates include only data for the first year of the respective 2-year studies.

[5] Huso estimator used to determine estimated fatality rates (Gritski et al., 2008a; Kronner 2008).

Table 13. Project and turbine characteristics of regional wind energy facilities where fatality monitoring studies have been completed*.

Columbia Plateau Ecoregion Wind Project[1]	Project Size		Turbine Characteristics		
	# Turbines	MW	RD[2] (meters)	Tip Height (max. meters)	MW
Hopkins Ridge I, WA	83	150	80	107	1.80
Wild Horse, WA	127	229	80	107	1.80
Biglow Canyon, OR (Phase I)	76	125.4	90	121	1.65
Big Horn, WA	133	199.5	77	118.5	1.50
Klondike I, OR	16	24	65	100	1.50
Klondike II, OR	50	75	77	118.5	1.50
Klondike III, OR (Phase I) [3]	**80/44**	**120/101.2**	**77/93**	**118.5/126.5**	**1.50/2.30**
Leaning Juniper I, OR	67	100.5	77	118.5	1.50
Nine Canyon I, WA	37	48	62	91	1.30
Combine Hills I, OR	41	41	61	84	1.00
Stateline, OR/WA	454	300	47	74	0.66
Vansycle, OR	38	25	47	74	0.66

[1] Similar study methods. Condon Wind Project Carcass Study omitted due to differences in study methods. Projects are sorted by MW of turbine type.

[2] RD= rotor diameter

[3] Project has two different turbines sizes. 1.5 MW is first followed by 2.3 MW turbines for turbine specs.

Estimated fatality rates are the primary focus of most fatality monitoring studies completed to date in the CPE. However, anecdotal comparison of species found as fatalities (observed not estimated) at this and other CPE wind projects studied gives some indication as to how species found as a fatality on a project may be different or similar to other projects. Table 14 compares all CPE wind related fatalities found on scheduled searches (at projects with publicly available annual or final reports) to fatalities found during scheduled searches at Klondike III. Only fatalities found on scheduled searches were included because some species are more easily detected incidentally than others.

Overall observed species composition is similar between Klondike III and the other CPE wind projects. Horned larks were found in similar observed composition percentages at Klondike III (33.3%) compared to other CPE projects combined (32.8%; Table 14). Six avian species were found as fatalities at Klondike III that were not identified in other CPE fatality monitoring studies during scheduled searches (in Table 14): Brewer's blackbird, common yellowthroat, hermit thrush, Lincoln's sparrow, purple finch, and Wilson's warbler. All of these species, except for the blackbird, were deemed to be nocturnal migrants based on timing of the fatality finding at Klondike III. This trend presents itself in other areas of the fatality composition list. While the observed percent composition for many of the raptor, gamebird, and native grassland species was similar to that at other operational wind projects, the percent composition for many of the nocturnal passerine species was higher at Klondike III. Nocturnal passerine species including Townsend's warbler, yellow-rumped warbler, dark-eyed junco, white-crowned sparrow, and ruby-crowned kinglet all had a higher percent composition of observed fatalities at Klondike III than at the other CPE projects combined (Table 14). This difference may be even more pronounced when factoring in Klondike II data as Klondike II was the only project to date in the CPE where horned lark was not the number one overall fatality found (NWC and WEST, 2007). Similar to Klondike III, nearby Klondike II wind project also had several unique nocturnal passerine fatalities such as black-throated sparrow and sage thrasher that have not been found at other

Projects as a migrant fatality (sage thrasher has been found as a fatality at another project where it breeds).

Table 14. Number, species and composition of observed bird fatalities found at Columbia Plateau Ecoregion wind projects where fatality monitoring studies have been completed* or are in progress (data obtained from public files).

Species (in descending order of % Composition for CPE Wind Projects)	**CPE Wind Projects**[1] (excludes Klondike III for comparison)		**Klondike III** (Year 1 and 2 Combined)	
	% Composition (Includes Scheduled Searches Only)	**Number of Fatalities Found** (on Scheduled Searches)	**% Composition** (Includes Scheduled Searches Only)	**Number of Fatalities Found** (on Scheduled Searches)
horned lark	32.8	251	33.3	31
golden-crowned kinglet	6.0	46	3.2	3
ring-necked pheasant (n)	5.6	43	4.3	4
gray partridge (n)	5.4	41	2.2	2
western meadowlark	3.5	27	3.2	3
chukar (n)	3.1	24	0.0	0
American kestrel	3.0	23	1.1	1
European starling (n)	2.9	22	1.1	1
mourning dove	2.9	22	2.2	2
unidentified passerine	2.9	22	1.1	1
dark-eyed junco	2.2	17	5.4	5
white-crowned sparrow	2.0	15	4.3	4
rock pigeon (n)	1.4	11	1.1	1
yellow-rumped warbler	1.4	11	3.2	3
red-tailed hawk	1.3	10	1.1	1
unidentified bird	1.3	10	1.1	1
winter wren	1.3	10	2.2	2
northern flicker	1.0	8	1.1	1
ruby-crowned kinglet	1.0	8	3.2	3
red-breasted nuthatch	0.9	7	0.0	0
short-eared owl	0.9	7	1.1	1
Townsend’s warbler	0.9	7	5.4	5
black-billed magpie	0.8	6	0.0	0
house wren	0.8	6	0.0	0
unidentified kinglet	0.8	6	1.1	1
golden-crowned sparrow	0.7	5	0.0	0
American robin	0.5	4	0.0	0
great-horned owl	0.5	4	0.0	0
savannah sparrow	0.5	4	4.3	4
unidentified sparrow	0.5	4	0.0	0
Brewer's sparrow	0.4	3	0.0	0
Canada goose	0.4	3	0.0	0
common nighthawk	0.4	3	0.0	0
song sparrow	0.4	3	0.0	0
vesper sparrow	0.4	3	0.0	0
American coot	0.3	2	0.0	0
Cassin’s vireo	0.3	2	0.0	0
downy woodpecker	0.3	2	0.0	0
ferruginous hawk	0.3	2	0.0	0
great blue heron	0.3	2	1.1	1
house sparrow (n)	0.3	2	0.0	0
mallard	0.3	2	0.0	0
northern harrier	0.3	2	0.0	0
orange-crowned warbler	0.3	2	0.0	0

Species (in descending order of % Composition for CPE Wind Projects)	CPE Wind Projects[1] (excludes Klondike III for comparison)		Klondike III (Year 1 and 2 Combined)	
	% Composition (Includes Scheduled Searches Only)	Number of Fatalities Found (on Scheduled Searches)	% Composition (Includes Scheduled Searches Only)	Number of Fatalities Found (on Scheduled Searches)
rough-legged hawk	0.3	2	0.0	0
sage thrasher	0.3	2	0.0	0
spotted towhee	0.3	2	0.0	0
Swainson's hawk	0.3	2	1.1	1
unidentified buteo	0.3	2	1.1	1
Vaux's swift	0.3	2	0.0	0
American goldfinch	0.1	1	1.1	1
American pipit	0.1	1	0.0	0
barn owl	0.1	1	0.0	0
black-throated sparrow	0.1	1	0.0	0
brown-headed cowbird	0.1	1	0.0	0
California quail	0.1	1	0.0	0
chipping sparrow	0.1	1	0.0	0
common raven	0.1	1	0.0	0
Cooper's hawk	0.1	1	0.0	0
grasshopper sparrow	0.1	1	0.0	0
hairy woodpecker	0.1	1	0.0	0
horned grebe	0.1	1	0.0	0
house finch	0.1	1	0.0	0
killdeer	0.1	1	0.0	0
Lewis's woodpecker	0.1	1	0.0	0
long-eared owl	0.1	1	0.0	0
MacGillivray's warbler	0.1	1	1.1	1
merlin	0.1	1	0.0	0
mountain bluebird	0.1	1	0.0	0
pine siskin	0.1	1	0.0	0
red-winged blackbird	0.1	1	0.0	0
Swainson's thrush	0.1	1	0.0	0
Townsend's solitaire	0.1	1	0.0	0
tree swallow	0.1	1	0.0	0
unidentified accipiter	0.1	1	0.0	0
unidentified duck	0.1	1	0.0	0
unidentified flycatcher	0.1	1	0.0	0
unidentified thrush	0.1	1	0.0	0
unidentified vireo	0.1	1	0.0	0
unidentified warbler	0.1	1	1.1	1
varied thrush	0.1	1	0.0	0
Virginia rail	0.1	1	1.1	1
warbling vireo	0.1	1	0.0	0
western grebe	0.1	1	0.0	0
western kingbird	0.1	1	0.0	0
western tanager	0.1	1	0.0	0
western wood-pewee	0.1	1	0.0	0
white-throated swift	0.1	1	0.0	0
yellow warbler	0.1	1	0.0	0
unidentified owl	0.1	1	0.0	0
Brewer's blackbird	0.0	0	1.1	1
common yellowthroat	0.0	0	1.1	1
hermit thrush	0.0	0	1.1	1
Lincoln's sparrow	0.0	0	1.1	1
purple finch	0.0	0	1.1	1

Species (in descending order of % Composition for CPE Wind Projects)	CPE Wind Projects[1] (excludes Klondike III for comparison)		Klondike III (Year 1 and 2 Combined)	
	% Composition (Includes Scheduled Searches Only)	**Number of Fatalities Found** (on Scheduled Searches)	**% Composition** (Includes Scheduled Searches Only)	**Number of Fatalities Found** (on Scheduled Searches)
Wilson's warbler	0.0	0	1.1	1
Totals	**100.0**	**766**	**100.00**	**93**

Footnotes for Table 14:

* with similar study protocols. Only projects with completed annual or final reports are included.

n = non-native species

[1] Data from the following formal monitoring studies during the monitoring periods stated below. Includes one incidental found after monitoring was complete. For full reference, see reference Section 6.0. These are observed fatalities and not final estimates of fatalities, which are higher.

Erickson et al. 2000. Avian and bat mortality associated with the Vansycle Wind Plant, Umatilla County Oregon. 1999 study year.

Erickson et al. 2003. Nine Canyon Wind Power Project Avian and Bat Monitoring Report, September 2002–August 2003.

Erickson et al. 2004. Stateline Wind Project Wildlife Monitoring Final Report, July 2001–December 2003.

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Jeffrey, et al., 2009. Biglow Canyon Wind Farm Phase I post-construction avian and bat monitoring first annual report, January 2008–December 2008

Johnson, et al. 2003. Avian and bat mortality at the Klondike, Oregon Phase I Wind Plant, Sherman County, Oregon. February 2002–February 2003.

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Young et al. 2006. Eurus Combine Hills Turbine Ranch Phase 1 Post Construction Wildlife Monitoring First Annual Report February 2004–February 2005.

Young et al. 2007. Puget Sound Energy, Hopkins Ridge Wind Project Phase 1 Post-Construction Avian and Bat Monitoring First Annual Report. January–December 2006.

Young, et al., 2009. Puget Sound Energy, Hopkins Ridge Wind Project Phase 1, post-construction avian and bat monitoring, second annual report, January–December 2008.

4.1.1 OEFSC Avian Thresholds of Concern

The WMMP enumerates thresholds of concern for four avian groups (OEFSC, 2007). The groups are: raptors, raptor species of special concern, grassland species, and State sensitive avian species listed under OAR 635-100-0040. There were sufficient data collected to calculate results for two groups listed under thresholds of concern, raptors and native grassland species. As defined in the WMMP thresholds of concern were 0.09 raptors/MW/year and 0.59 grassland birds/MW/year. Fatality estimates calculated for raptors exceeded thresholds, though there was some overlap between the 90% CI (0.09-0.41/MW/year) and the OEFSC threshold (0.09/MW/year). Grassland bird mean fatality rates and the associated 90% CI were below the OEFSC thresholds of 0.59/MW/year.

4.1.2 Migrants

Nocturnal migrants comprised approximately 30% of annual small bird fatalities. As described in Section 4.1, there was a high diversity of observed nocturnal migrant fatalities at Klondike III, and the percent composition for many of the nocturnal passerine species was higher at Klondike III than at other CPE projects listed in Table 14 as well as at some individual projects (Kronner et al., 2008; Gritski et al., 2008a). Nocturnal migrant observed fatality composition, however, was roughly comparable to higher observed fatality rates of

nocturnal migrants found as fatalities during monitoring at Klondike II (NWC and WEST, 2007), though higher than other projects in the CPE monitored to date. As Klondike II and III are adjacent projects monitored in different years, this pattern suggests that the immediate area may have a higher nocturnal migrant fatality rate than other projects in the CPE.

4.2 Bats

Mean annual bat fatality rates for Klondike III were below the mean of fatality rates for the CPE. Klondike III had a mean fatality rate of 1.11 bats/MW/year (Table 15); however the 90% CI range was 0.86-1.83 bats/MW/year. The CPE mean of 1.36 bats/MW/year (Table 15) was overlapped with the reported 90% CI for Klondike III. Table 15 demonstrates that there is a large variation in the immediate area either by project and/or year for bat fatalities. Klondike I and II are adjacent projects and Biglow Canyon is directly to the north. Klondike I and II were studied in previous years, while the Biglow Canyon study overlapped Klondike III temporally. The mean per MW fatality estimates for these surrounding projects ranged from 0.41 to 1.99 bats/MW/year. Biglow Canyon estimates reported here are only estimated from the first of a two-year study and not the final fatality estimates.

Table 15. Annual bat mortality estimates at existing wind projects in the Columbia Plateau Ecoregion with completed fatality monitoring studies.

CPE Wind Project [1] Listed in order of highest to lowest at fatality rate per MW/year (last column)	**Number of Bat Fatalities Found**	**Annual Fatality Estimate** (number of bats)	**Number of Bat Fatalities per Turbine per Year** (mean)	**Number of Bat Fatalities per MW per Year** (mean)
Nine Canyon I [2], WA	27	119	3.21	2.47
Biglow Canyon, OR (Phase I)[3]	39	250	3.29	1.99
Leaning Juniper I, OR[4]	20	199	2.97	1.98
Big Horn, WA[4]	59	380	2.86	1.90
Combine Hills, OR	21	77	1.88	1.88
Stateline I and II, WA/OR	128	500	1.12	1.70
Hopkins Ridge I, WA 2008	23	208	2.50	1.39
Vansycle, OR	10	28	0.74	1.12
Klondike III, OR (Phase I)	**37**	**246**	**1.96**	**1.11**
Klondike I, OR	6	19	1.16	0.77
Hopkins Ridge I, WA, 2006	19	94	1.13	0.63
Klondike II, OR	5	31	0.63	0.41
Wild Horse, WA[3]	17	89	0.70	0.39
Mean			**1.86**	**1.36**

[1] References for projects: Big Horn (Kronner et al., 2008), Biglow Canyon Phase I (Jeffrey, et al., 2009), Combine Hills (Young et al., 2006), Hopkins Ridge I (Young et al., 2007, 2009), Klondike I (Johnson et al., 2003c), Klondike II (NWC and West, 2007), Klondike III (this report), Leaning Juniper I (Gritski et al., 2008a), Nine Canyon (Erickson et al., 2003), Stateline I and II-partial (Erickson et al., 2004), Vansycle (Erickson et al., 2000), Wild Horse (Erickson et al., 2008).

[2] Nine Canyon II monitored only part-year (July 25 through November 2, 2004).

[3] Wild Horse, Biglow Canyon estimates include only data for the first year of the respective 2-year studies.

[4] Huso estimator used to determine estimated fatality rates (Gritski et al., 2008a; Kronner 2008).

4.3 Distribution of Fatalities within the Project Area

The number of birds found at searched turbines ranged from 0–4 per turbine, except turbine S-8 which had seven observed fatalities, all passerine, three of which were nocturnal migrants. As presented in the estimated fatality section, the number of observed fatalities is a small percent of the estimated fatalities per turbine, thus it is difficult to draw definitive conclusions from these results.

The number of bats found at searched turbines ranged from 0–3 per turbine. Three turbines, R3, S8, and V1 all had three observed bat fatalities; all other turbines had fewer than three observed bat fatalities.

Although it is not known why there were more observed avian fatalities at turbine S-8, it is important to note that the turbine is near several canyon edges (Figure 1) and the turbine is lighted with FAA lighting. Analyses of fatalities at lit and unlit turbines at many CPE wind projects (including Jeffrey et al., 2009; Johnson et al., 2003; Kronner et al., 2008; Erickson et al., 2008, Erickson et al., 2004; Young et al., 2006; Young et al., 2007) have shown no statistically significant effect of lighting on bird and/or bat fatalities, and one analysis of effects of lighting across projects on a nation-wide level has suggested that there are not large differences between fatality rates at lit and unlit turbines at most wind projects (Erickson, 2009). At Klondike III during this two-year study, however, analysis of nocturnal migrant fatalities found at lit versus unlit turbines did show that there were significantly more nocturnal migrants found at lit turbines and turbines directly adjacent to lit turbines than at unlit turbines. The reasons behind the different results found at Klondike III are not known. For this analysis, it is assumed the casualty found had interacted with the closest turbine to where it was found and this may not be the case in all instances. However, analysis including turbines adjacent to lit turbines also showed a significant difference suggesting that even if fatalities were found on adjacent non-lit turbines the result would be the same as lit turbines alone.

4.4 Comparison of Estimated Fatality Rates by Turbine Size

Results of a comparison between the two turbine sizes and corresponding fatality estimates did not show a consistent effect of turbine size on estimated avian fatality rates. There was substantial year to year variation and the ratio was more pronounced for bats than birds. Combined with the two years of study, there was no significant difference in the ratio of estimated fatalities between the two turbines sizes on birds; however, there was significantly more estimated bat fatalities on a per turbine basis at the larger turbine size. These results suggest that turbine blade size (and the resulting larger MW nameplate size) was not proportional to the amount of avian fatalities found at Klondike III over the course of the two-year study. In this case, it may be just as relevant to review fatalities per turbine in comparison to other CPE projects, as well as the more conventionally used per MW metric to compare fatality rates between wind projects.

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7.0 APPENDICES

Appendix A. Summary of wildlife casualties* found at Klondike III Wind Project from October 15, 2007–October 28, 2009.

Date Found	Season	Species[1]	Taxa Group	Sex[2]	Age[3]	Habitat	Condition	Found During[4]	Turbine
Casualties Found Prior To Scheduled Searches									
Birds									
Casualties Found Prior to Monitoring Year 1									
10/15/07	N/A[5]	ring-necked pheasant	Galliform	U	U	Dryland Agriculture	Feather spot	Clean-up	C-6
10/15/07	N/A	ring-necked pheasant	Galliform	M	U	Dryland Agriculture	Feather spot	Clean-up	C-6
10/15/07	N/A	dark-eyed junco	Passerine	M	U	Dryland Agriculture	Intact	Clean-up	C-6
10/15/07	N/A	ring-necked pheasant	Galliform	M	U	Dryland Agriculture	Feather spot	Clean-up	C-6
10/15/07	N/A	ring-necked pheasant	Galliform	U	U	CRP	Feather spot	Clean-up	C-7
Casualties Found Prior to Monitoring Year 2									
10/20/08	N/A	horned lark	Passerine	U	U	Dryland Agriculture	Feather Spot	Cleanup	R-3
10/20/08	N/A	horned lark	Passerine	U	U	Dryland Agriculture	Feather Spot	Cleanup	L-8
10/20/08	N/A	horned lark	Passerine	U	U	Dryland Agriculture	Feather Spot	Cleanup	L-8
10/20/08	N/A	unidentified passerine	Passerine	U	U	Dryland Agriculture	Scavenged	Cleanup	M-3
Bats									
Casualties Found Prior to Monitoring Year 1									
10/15/07	N/A	silver-haired bat	Bat	U	U	Dryland Agriculture	Intact	Incidental	M-7
10/15/07	N/A	unidentified bat	Bat	U	U	Disturbed Area	Scavenged	Clean-up	C-6
10/15/07	N/A	hoary bat	Bat	U	U	Dryland Agriculture	Intact	Clean-up	B-8
10/30/07	N/A	silver-haired bat	Bat	U	J	Disturbed	Intact	Clean-up	V-11
Casualties Found Prior to Monitoring Year 2									
10/20/08	N/A	silver-haired bat	Bat	F	A	Dryland Agriculture	Intact	Cleanup	L-7
10/21/08	N/A	hoary bat	Bat	U	A	Dryland Agriculture	Scavenged	Cleanup	R-4
Monitoring Year 1 Casualties - Birds									
11/15/07	Winter	gray partridge	Galliform	M	U	CRP	Feather spot	Search	C-6
11/16/07	Winter	horned lark	Passerine	M	U	Dryland Agriculture	Dismembered	Search	G-5
11/16/07	Winter	American goldfinch	Passerine	M	A	Dryland Agriculture	Intact	Search	G-4
11/16/07	Winter	unidentified kinglet	Passerine	U	U	Dryland Agriculture	Scavenged	Search	G-5
02/06/08	Winter	horned lark	Passerine	U	A	Disturbed Area	Feather spot	Search	V-7
02/08/08	Winter	short-eared owl	Owl/Raptor	U	U	CRP	Feather spot	Search	V-10
02/18/08	Winter	horned lark	Passerine	U	A	Dryland Agriculture	Feather spot	Search	D-10
02/19/08	Winter	dark-eyed junco	Passerine	U	A	Dryland Agriculture	Intact	Search	J-6

Date Found	Season	Species[1]	Taxa Group	Sex[2]	Age[3]	Habitat	Condition	Found During[4]	Turbine
02/20/08	Winter	horned lark	Passerine	U	A	Dryland Agriculture	Scavenged	Search	L-6
02/21/08	Winter	mourning dove	Dove	U	A	Disturbed Area	Feather spot	Search	M-5
02/21/08	Winter	horned lark	Passerine	U	A	Dryland Agriculture	Scavenged	Search	R-1
02/22/08	Winter	European starling	Passerine	U	A	Disturbed Area	Scavenged	Search	S-8
03/18/08	Spring	horned lark	Passerine	U	A	Dryland Agriculture	Feather spot	Search	L-5
03/19/08	Spring	horned lark	Passerine	M	A	Disturbed Area	Intact	Search	R-1
03/19/08	Spring	mourning dove	Dove	U	A	Dryland Agriculture	Scavenged	Search	M-1
04/02/08	Spring	horned lark	Passerine	U	A	Dryland Agriculture	Feather Spot	Search	M-2
04/07/08	Spring	horned lark	Passerine	M	A	Road	Feather Spot	Search	S-8
04/07/08	Spring	western meadowlark	Passerine	U	A	Grassland	Feather Spot	Search	V-7
04/14/08	Spring	savannah sparrow	Passerine	U	A	Dryland Agriculture	Intact	Search	B-9
04/14/08	Spring	Lincoln's sparrow	Passerine	U	A	Dryland Agriculture	Intact	Search	D-11
04/14/08	Spring	white-crowned sparrow	Passerine	M	A	Dryland Agriculture	Intact	Search	D-11
04/16/08	Spring	white-crowned sparrow	Passerine	U	A	Dryland Agriculture	Intact	Search	L-2
04/16/08	Spring	white-crowned sparrow	Passerine	U	A	Dryland Agriculture	Intact	Search	L-5
04/16/08	Spring	horned lark	Passerine	U	J	Dryland Agriculture	Scavenged	Search	S-2
04/16/08	Spring	yellow-rumped warbler	Passerine	U	A	Dryland Agriculture	Feather Spot	Search	R-1
04/16/08	Spring	hermit thrush	Passerine	U	A	CRP	Intact	Search	S-8
04/18/08	Spring	ruby-crowned kinglet	Passerine	M	A	CRP	Scavenged	Search	V-11
04/28/08	Spring	yellow-rumped warbler	Passerine	U	A	Dryland Agriculture	Feather Spot	Search	D-11
04/29/08	Spring	Brewer's blackbird	Passerine	M	A	Dryland Agriculture	Intact	Search	H-4
04/29/08	Spring	white-crowned sparrow	Passerine	U	A	Dryland Agriculture	Scavenged	Search	E-1
05/05/08	Spring	horned lark	Passerine	U	J	Disturbed Area	Intact	Search	V-7
05/15/08	Summer	savannah sparrow	Passerine	U	A	Dryland Agriculture	Scavenged	Search	D-10
05/16/08	Summer	horned lark	Passerine	U	A	Dryland Agriculture	Feather Spot	Search	L-5
05/19/08	Summer	horned lark	Passerine	U	A	CRP	Scavenged	Search	V-4
06/18/08	Summer	Swainson's hawk	Raptor	U	A	Dryland Agriculture	Scavenged	Incidental	K-3
06/19/08	Summer	horned lark	Passerine	M	A	Dryland Agriculture	Scavenged	Search	M-6
06/19/08	Summer	American kestrel	Raptor	M	I	Road	Scavenged	Incidental	R-4
06/20/08	Summer	horned lark	Passerine	M	A	Disturbed Area	Scavenged	Incidental	S-6
06/20/08	Summer	horned lark	Passerine	M	A	CRP	Feather Spot	Search	S-8
06/20/08	Summer	gray partridge	Galliform	U	U	CRP	Scavenged	Search	V-7
07/18/08	Summer	great-blue heron	Heron	U	U	Dryland Agriculture	Feather spot	Search	H-4
07/18/08	Summer	horned lark	Passerine	U	I	Dryland Agriculture	Scavenged	Search	K-4
08/19/08	Fall	Virginia rail	Rail	U	I	Dryland Agriculture	Scavenged	Search	E-1
08/19/08	Fall	Townsend's warbler	Passerine	F	I	Dryland Agriculture	Scavenged	Search	F-1

Date Found	Season	Species[1]	Taxa Group	Sex[2]	Age[3]	Habitat	Condition	Found During[4]	Turbine
09/09/08	Fall	Townsend's warbler	Passerine	F	I	Dryland Agriculture	Intact	Search	J-6
09/09/08	Fall	unidentified warbler	Passerine	U	U	Dryland Agriculture	Scavenged	Search	P-5
09/09/08	Fall	unidentified passerine	Passerine	U	U	Dryland Agriculture	Scavenged	Search	P-5
09/23/08	Fall	common yellowthroat	Passerine	F	I	Dryland Agriculture	Scavenged	Search	G-4
09/24/08	Fall	Townsend's warbler	Passerine	F	A	Dryland Agriculture	Intact	Search	P-6
10/08/08	Fall	horned lark	Passerine	F	A	Dryland Agriculture	Scavenged	Search	P-6
10/10/08	Fall	dark-eyed junco	Passerine	U	U	CRP	Intact	Search	S-8
10/10/08	Fall	winter wren	Passerine	U	U	CRP	Scavenged	Search	S-8
10/22/08	Fall	golden-crowned kinglet	Passerine	F	A	Dryland Agriculture	Intact	Search	C-6
10/23/08	Fall	winter wren	Passerine	U	U	Dryland Agriculture	Scavenged	Search	P-6
10/23/08	Fall	golden-crowned kinglet	Passerine	U	U	Dryland Agriculture	Scavenged	Search	F-1
10/27/08	Fall	horned lark	Passerine	U	U	Dryland Agriculture	Feather Spot	Search	R-1
10/28/08	Fall	horned lark	Passerine	M	I	Road	Scavenged	Search	S-8
10/28/08	Fall	ring-necked pheasant	Galliform	U	U	Dryland Agriculture	Feather Spot	Search	R-5
10/28/08	Fall	savannah sparrow	Passerine	U	U	Dryland Agriculture	Scavenged	Search	R-6
Monitoring Year 2 Casualties - Birds									
12/08/08	Winter	unidentified bird	Unknown	U	U	Turbine pad	Other	Incidental	S-6
01/29/09	Winter	horned lark	Passerine	U	A	Dryland Agriculture	Feather Spot	Search	P-3
02/19/09	Winter	western meadowlark	Passerine	U	A	Dryland Agriculture	Scavenged	Search	G-6
02/19/09	Winter	western meadowlark	Passerine	U	A	Lithosol	Feather Spot	Search	J-2
02/23/09	Winter	horned lark	Passerine	F	A	Dryland Agriculture	Scavenged	Search	S-5
02/24/09	Winter	horned lark	Passerine	U	A	CRP	Feather Spot	Search	V-4
03/23/09	Spring	rock pigeon	Dove	U	A	Dryland Agriculture	Feather Spot	Search	E-2
03/24/09	Spring	horned lark	Passerine	M	A	Dryland Agriculture	Scavenged	Search	G-7
03/26/09	Spring	unidentified bird	Unknown	U	U	Dryland Agriculture	Scavenged	Search	V-8
04/22/09	Spring	ring-necked pheasant	Galliform	M	A	CRP	Feather Spot	Search	V-4
04/22/09	Spring	ruby-crowned kinglet	Passerine	F	A	CRP	Intact	Search	V-5
04/22/09	Spring	American kestrel	Raptor	M	A	Dryland Agriculture	Intact	Search	W-2
05/06/09	Spring	horned lark	Passerine	U	A	Dryland Agriculture	Scavenged	Search	R-3
05/06/09	Spring	horned lark	Passerine	U	A	Dryland Agriculture	Feather Spot	Search	R-4
05/06/09	Spring	horned lark	Passerine	U	A	CRP	Feather Spot	Search	V-5
05/18/09	Summer	savannah sparrow	Passerine	U	A	Dryland Agriculture	Scavenged	Search	B-12
05/19/09	Summer	Townsend's warbler	Passerine	F	A	Dryland Agriculture	Intact	Search	L-7
05/19/09	Summer	MacGillivray's warbler	Passerine	U	A	Dryland Agriculture	Dismembered	Search	L-6
06/22/09	Summer	ring-necked pheasant	Galliform	M	A	Turbine Pad	Scavenged	Incidental	T-31
07/27/09	Summer	horned lark	Passerine	U	I	Dryland Agriculture	Feather Spot	Search	L-4

Date Found	Season	Species[1]	Taxa Group	Sex[2]	Age[3]	Habitat	Condition	Found During[4]	Turbine
07/30/09	Summer	horned lark	Passerine	U	I	Dryland Agriculture	Intact	Search	S-4
08/20/09	Fall	Swainson's hawk	Raptor	U	A	Dryland Agriculture	Scavenged	Incidental	T-45
08/20/09	Fall	red-tailed hawk	Raptor	U	A	Dryland Agriculture	Scavenged/	Search	H-2
08/20/09	Fall	horned lark	Passerine	U	I	Dryland Agriculture	Scavenged	Search	J-9
08/24/09	Fall	Swainson's hawk	Raptor	U	U	Road	Feather Spot	Search	M-7
08/24/09	Fall	horned lark	Passerine	U	I	Disturbed Area	Feather Spot	Search	S-1
08/24/09	Fall	unidentified buteo	Raptor	U	U	Dryland Agriculture	Feather Spot	Search	R-7
09/04/09	Fall	Wilson's warbler	Passerine	U	U	Dryland Agriculture	Dismembered	Search	D-3
09/04/09	Fall	Townsend's warbler	Passerine	U	U	Dryland Agriculture	Dismembered	Search	D-2
09/09/09	Fall	horned lark	Passerine	U	U	Dryland Agriculture	Feather Spot	Search	M-8
09/21/09	Fall	American kestrel	Raptor	U	U	Dryland Agriculture	Feather Spot	Incidental	D-5
09/22/09	Fall	yellow-rumped warbler	Passerine	U	U	Dryland Agriculture	Feather Spot	Search	P-8
09/22/09	Fall	ruby-crowned kinglet	Passerine	U	U	Road	Intact	Search	L-6
09/24/09	Fall	purple finch	Passerine	U	U	CRP	Scavenged	Search	V-8
10/14/09	Fall	dark-eyed junco	Passerine	U	U	Dryland Agriculture	Scavenged	Search	D-13
10/15/09	Fall	northern flicker	Woodpecker	U	U	Dryland Agriculture	Feather Spot	Search	F-2
10/15/09	Fall	European starling	Passerine	U	I	Dryland Agriculture	Feather Spot	Incidental	T-18
10/16/09	Fall	ring-necked pheasant	Galliform	U	U	Dryland Agriculture	Feather Spot	Search	R-3
10/16/09	Fall	golden-crowned kinglet	Passerine	M	A	Dryland Agriculture	Scavenged	Search	S-4
10/19/09	Fall	ring-necked pheasant	Galliform	M	A	Turbine Pad	Scavenged	Search	V-5
10/26/09	Fall	dark-eyed junco	Passerine	U	U	Dryland Agriculture	Dismembered	Search	D-2
10/28/09	Fall	dark-eyed junco	Passerine	U	U	Dryland Agriculture	Dismembered	Search	M-8
Monitoring Year 1 Casualties - Bats									
05/19/08	Summer	silver-haired bat	Bat	F	A	CRP	Intact	Search	S-8
07/18/08	Summer	unidentified bat	Bat	U	U	Dryland Agriculture	Scavenged	Search	P-5
08/19/08	Fall	hoary bat	Bat	F	A	Dryland Agriculture	Intact	Search	D-11
08/20/08	Fall	big brown bat	Bat	U	J	Dryland Agriculture	Intact	Search	J-12
09/08/08	Fall	hoary bat	Bat	F	J	Dryland Agriculture	Intact	Search	D-4
09/08/08	Fall	silver-haired bat	Bat	M	J	Road	Intact	Search	D-11
09/08/08	Fall	hoary bat	Bat	F	U	Dryland Agriculture	Scavenged	Search	E-1
09/09/08	Fall	silver-haired bat	Bat	U	U	Dryland Agriculture	Scavenged	Search	H-4
09/10/08	Fall	silver-haired bat	Bat	U	U	Dryland Agriculture	Scavenged	Search	M-1
09/11/08	Fall	hoary bat	Bat	U	U	Dryland Agriculture	Scavenged	Search	S-7
09/11/08	Fall	silver-haired bat	Bat	M	J	Dryland Agriculture	Intact	Search	R-6
09/11/08	Fall	hoary bat	Bat	U	U	CRP	Scavenged	Search	S-8
09/22/08	Fall	hoary bat	Bat	U	U	Dryland Agriculture	Scavenged	Search	B-9

Date Found	Season	Species[1]	Taxa Group	Sex[2]	Age[3]	Habitat	Condition	Found During[4]	Turbine
09/24/08	Fall	silver-haired bat	Bat	U	A	Dryland Agriculture	Scavenged	Search	L-5
09/24/08	Fall	hoary bat	Bat	U	A	Dryland Agriculture	Scavenged	Search	K-4
09/24/08	Fall	hoary bat	Bat	U	A	Dryland Agriculture	Scavenged	Search	M-5
09/24/08	Fall	silver-haired bat	Bat	U	U	Road	Injured	Search	M-5
09/25/08	Fall	silver-haired bat	Bat	M	A	Disturbed	Scavenged	Search	M-6
09/26/08	Fall	hoary bat	Bat	U	U	Road	Scavenged	Search	V-3
09/29/08	Fall	hoary bat	Bat	M	A	CRP	Scavenged	Search	V-11
09/29/08	Fall	silver-haired bat	Bat	M	A	CRP	Intact	Search	V-11
10/08/08	Fall	hoary bat	Bat	U	A	Road	Scavenged	Search	I-3
10/09/08	Fall	hoary bat	Bat	U	U	Dryland Agriculture	Scavenged	Incidental	L-6
10/10/08	Fall	hoary bat	Bat	M	A	CRP	Intact	Search	S-8
10/29/08	Fall	silver-haired bat	Bat	U	U	CRP	Scavenged	Search	V-4
Monitoring Year 2 Casualties - Bats									
04/20/09	Spring	silver-haired bat	Bat	F	A	Disturbed Area	Intact	Search	D-13
04/22/09	Spring	silver-haired bat	Bat	M	A	Turbine pad	Intact	Search	M-7
06/24/09	Summer	silver-haired bat	Bat	U	A	CRP	Scavenged	Search	V-1
08/25/09	Fall	hoary bat	Bat	M	A	CRP	Intact	Search	V-1
08/25/09	Fall	silver-haired bat	Bat	U	J	CRP	Scavenged	Search	V-1
09/09/09	Fall	hoary bat	Bat	U	J	Dryland Agriculture	Scavenged	Search	P-3
09/09/09	Fall	silver-haired bat	Bat	U	J	Dryland Agriculture	Scavenged	Search	L-6
09/09/09	Fall	silver-haired bat	Bat	M	J	Dryland Agriculture	Intact	Search	L-6
09/09/09	Fall	silver-haired bat	Bat	M	A	Dryland Agriculture	Intact	Search	R-4
09/10/09	Fall	silver-haired bat	Bat	M	A	Dryland Agriculture	Scavenged	Search	S-4
09/23/09	Fall	hoary bat	Bat	M	A	Dryland Agriculture	Intact	Search	R-4
09/23/09	Fall	silver-haired bat	Bat	M	J	Turbine Pad	Scavenged	Search	M-3
10/26/09	Fall	silver-haired bat	Bat	U	U	Road	Scavenged	Search	B-12

* Includes all casualties found. All are attributable to the wind project operations in the absence of sufficient information to determine causes of death.

[1] Includes those identified to species and for those where species identification could not be confirmed, taxonomic group or other is used. Previously unidentified specimens were examined to determine species when possible. Changes have been incorporated into this table and supersede any species identification in previous reports.

[2] Sex: U = Unknown, M = Male, F = Female

[3] Age: U = Unknown, A = Adult, I = Immature, J = Juvenile

[4] Types are scheduled carcass search (search), incidental, or clean-up search

[5] N/A: Season not-applicable, found during clean-up search.

Appendix B. Results of Klondike III 2008 raptor nest monitoring* and distance to nearest Klondike III or IIIa turbine.

Nest Record[1] red = within ½ mi of Klondike III or IIIa Turbines	**Inside Klondike III or Klondike IIIa Boundary**	**2008 Status, Species, Number Fledged**[2]**, Other Notes** (red = Successful nests of the three target species)	**Distance to Nearest Turbine** (Turbine # and Feet)	**Likely Associated Nests** (Nest Record #)
41	III	Inactive	L8 1,948 ft.	-
42	III	SWHA 1 fledged	P5 1,811 ft.	43, 295
43	III	Inactive	P5 2,085 ft.	42, 295
45	III	Inactive	J7 1,837 ft.	-
46	III	RTHA 3 fledged	K2 994 ft.	-
49	IIIa	SWHA Success unconfirmed. nest gone at last visit 7/19, may have blown out	G1 1,864 ft.	-
50	IIIa	FEHA 1 fledged	M8 2,925 ft.	-
52	III	SWHA 2 fledged	D10 879 ft.	-
84	IIIa	RTHA Unknown number fledged	BB6 2,081 ft.	-
86	III	Unknown buteo Success unconfirmed	AA1 2,598 ft.	-
99	III	Inactive SWHAs observed near nest	H1 700 ft.	-
295	III	2007 nest but not present in 2008	P6 910 ft.	42, 43, 294
Nests Not In Klondike III or IIIa Boundary				
37	No	Inactive	P1 10,174 ft.	-
38	No	Inactive	V1 8,451 ft.	-
39	No	Inactive	V1 6,599 ft.	40
40	No	Inactive	V1 6,625 ft.	39
44	No	RTHA Success unconfirmed	J2 6,695 ft.	-
47	No	RTHA	K4 3,205 ft.	-
48	No	SWHA 1 fledged	K4 5,502 ft.	-
55	No	SWHA Success unconfirmed, no whitewash present	Z1 10,472 ft.	-
56	No	Inactive	Z1 8,712 ft.	-
57	No	Inactive	Z1 5,771 ft.	-
58	No	Inactive[3]	Z1 1,276 ft.	59
59	No	Inactive[4]	Z1 1,411 ft.	58
61	No	Inactive	D13 3,807 ft.	60, 62, 63
62	No	Inactive	D13 4,252 ft.	60, 61, 63

Nest Record[1] red = within ½ mi of Klondike III or IIIa Turbines	Inside Klondike III or Klondike IIIa Boundary	2008 Status, Species, Number Fledged[2], Other Notes (red = Successful nests of the three target species)	Distance to Nearest Turbine (Turbine # and Feet)	Likely Associated Nests (Nest Record #)
63	No	Inactive	D13 3,742 ft.	60, 61, 62
65	No	Inactive	B17 7,473 ft.	-
66	No	SWHA 1 fledged	B17 3,908 ft.	-
67	No	RTHA 2 fledged	B3 7,639 ft.	-
81	No	Inactive	BB5 8,157 ft.	-
85	No	Inactive	G9 1,823 ft.	-
89	No	GOEA 2 fledged	X7 4,906 ft.	133, 134
91	No	Inactive	AA1 6,472 ft.	263
2007 Nest Sites Not within K-III or K-IIIa Boundaries and Not Relocated During 2008 Surveys[5]				
		2007 and 2008 Notes		
129	No	CORA in 2007	P1 7,956 ft.	-
131	No	CORA in 2007	X7 4,207 ft.	-
134	No	GOEA in 2007 Associated with 2008 active GOEA #89 nest	X7 5,182 ft.	89
253	No	Inactive in 2007 May not be raptor or raven but magpie	B17 4,141 ft.	-
255	No	Inactive in 2007	C8 2,118 ft.	-
267	No	Inactive in 2007	AA1 4,878 ft	-
269	No	2007 notes indicate "old" nest (may have blown out by 2008)	AA1 1,867 ft.	-
277	No	RTHA in 2007	B10 8,356 ft.	-
278	No	Inactive in 2007	B5 1,709 ft.	-

* Does not include some species such as American kestrel and long-eared owl

[1] Some nests are very near others and are considered one traditional nest "site" with two or more tree nests or cliff shelf platforms used alternatively through the years. These side–by-side nests are not likely to be used by multiple birds in the same year.

[2] Number of young likely fledged successfully based on final nest check

[3] SWHA flying

[4] Unknown activity status - appeared to have had some activity, no whitewash present, likely not used, close to #58

[5] For some nests not relocated, nest was likely too obstructed for viewing, was blown out of tree or was missed by surveyor. This list does not include 2007 American kestrel assumed nesting sites.

Species Codes (where shown, nest was determined to be Active)
SWHA – Swainson's Hawk GOEA – Golden Eagle
RTHA – Red-Tailed Hawk FEHA – Ferruginous Hawk CORA – Common Raven

Active = observed perched on nest, repairing nest, incubating, etc.
Inactive = no sign of use
Not present = no nest present
Unsuccessful = bird confirmed incubating and/or young present but no young documented fledged

Appendix C. Special status wildlife observed (live) during wildlife monitoring at the Klondike III Wind Power Project 2007–2009.

Date	Species *Listed in alphabetical order*	Status [1]	Number	Location
	Mammals			
02/07/08	White-Tailed Jackrabbit	SV	1	Turbine V-2
10/06/08	White-Tailed Jackrabbit	SV	1	Turbine B-10
10/10/08	White-Tailed Jackrabbit	SV	1	Turbine V-7
10/17/08	White-Tailed Jackrabbit	SV	1	Turbine J-9
10/16/08	White-Tailed Jackrabbit	SV	1	Turbine D-13
05/05/09	White-Tailed Jackrabbit	SV	1	Turbine B-3
01/30/09	White-Tailed Jackrabbit	SV	1	Turbine R-4
03/26/09	White-Tailed Jackrabbit	SV	1	Turbine V-9
06/23/09	White-Tailed Jackrabbit	SV	1	Turbine D-13
08/19/09	White-Tailed Jackrabbit	SV	2	Turbine D-13
09/21/09	White-Tailed Jackrabbit	SV	1	Turbine B-13

[1] Status:
SV = State of Oregon Sensitive Vulnerable

Scientific names available upon request

8.0 FIGURES

Figure 1. Turbine search plots at Klondike III Wind Project, fall 2007 through fall 2009.

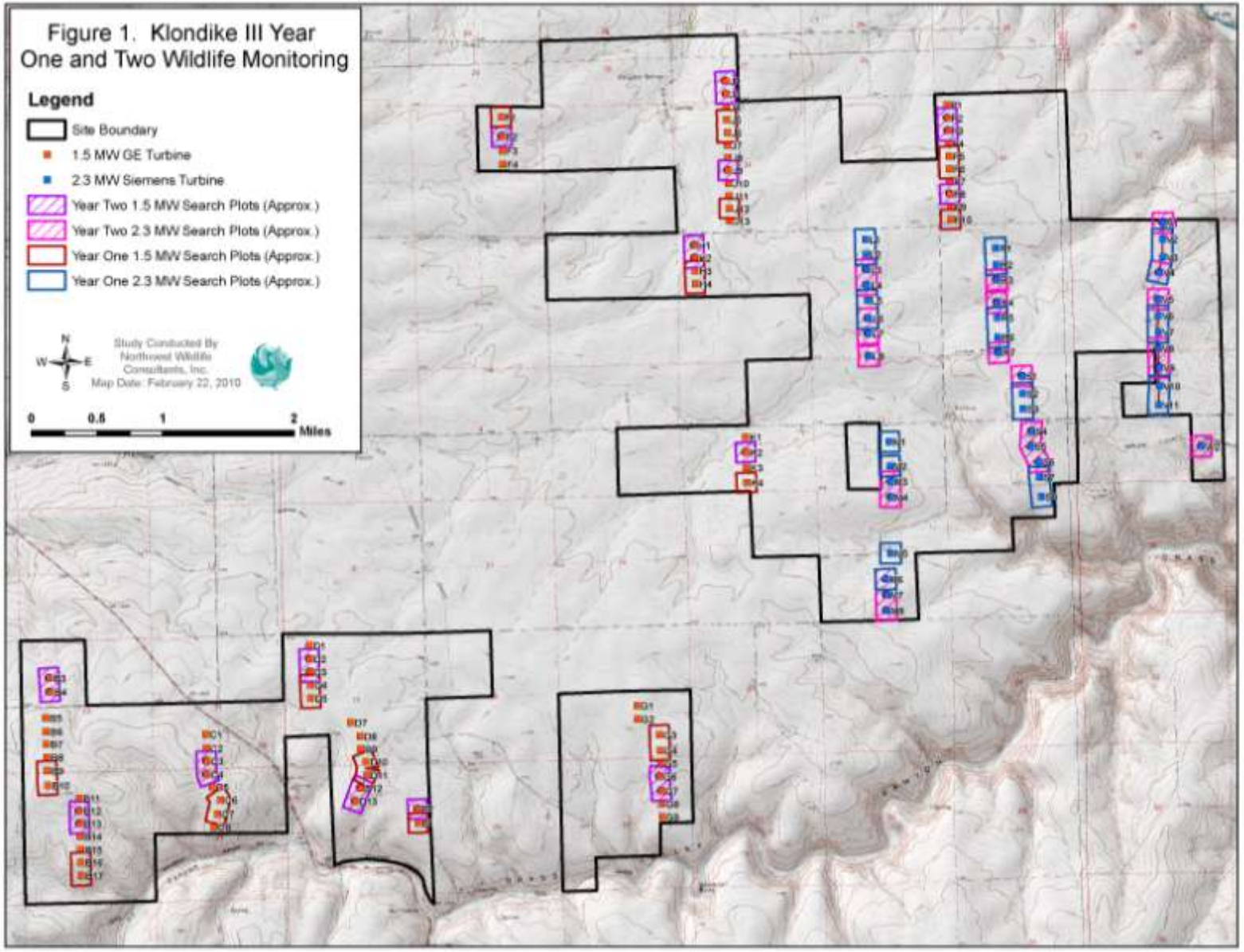


Figure 2. Graphical depiction of 120 meter (solid line) and 126 meter (dashed line) search plots conducted during monitoring at Klondike III Wind Project.

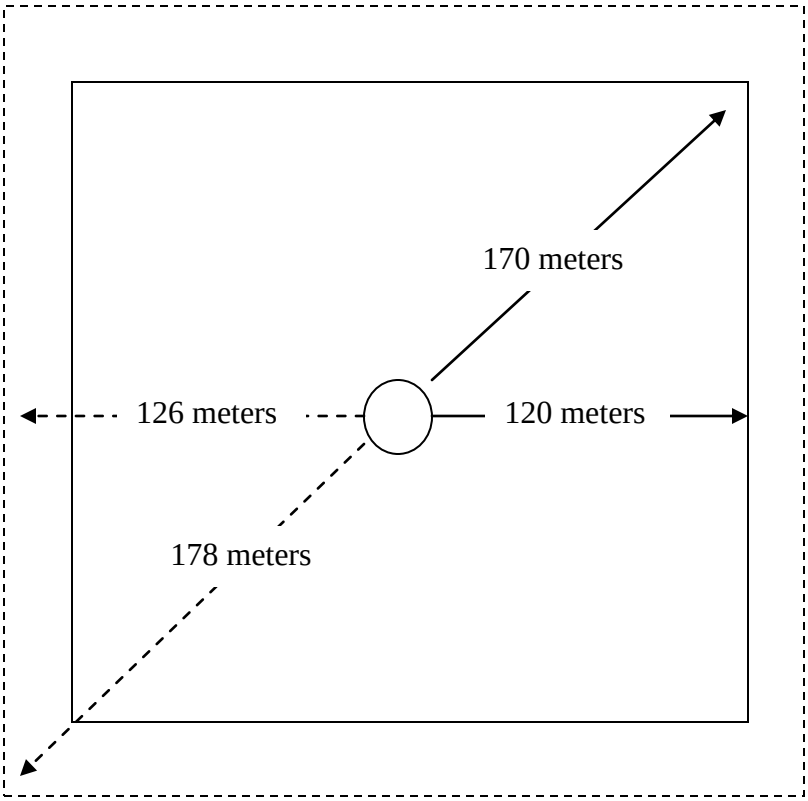
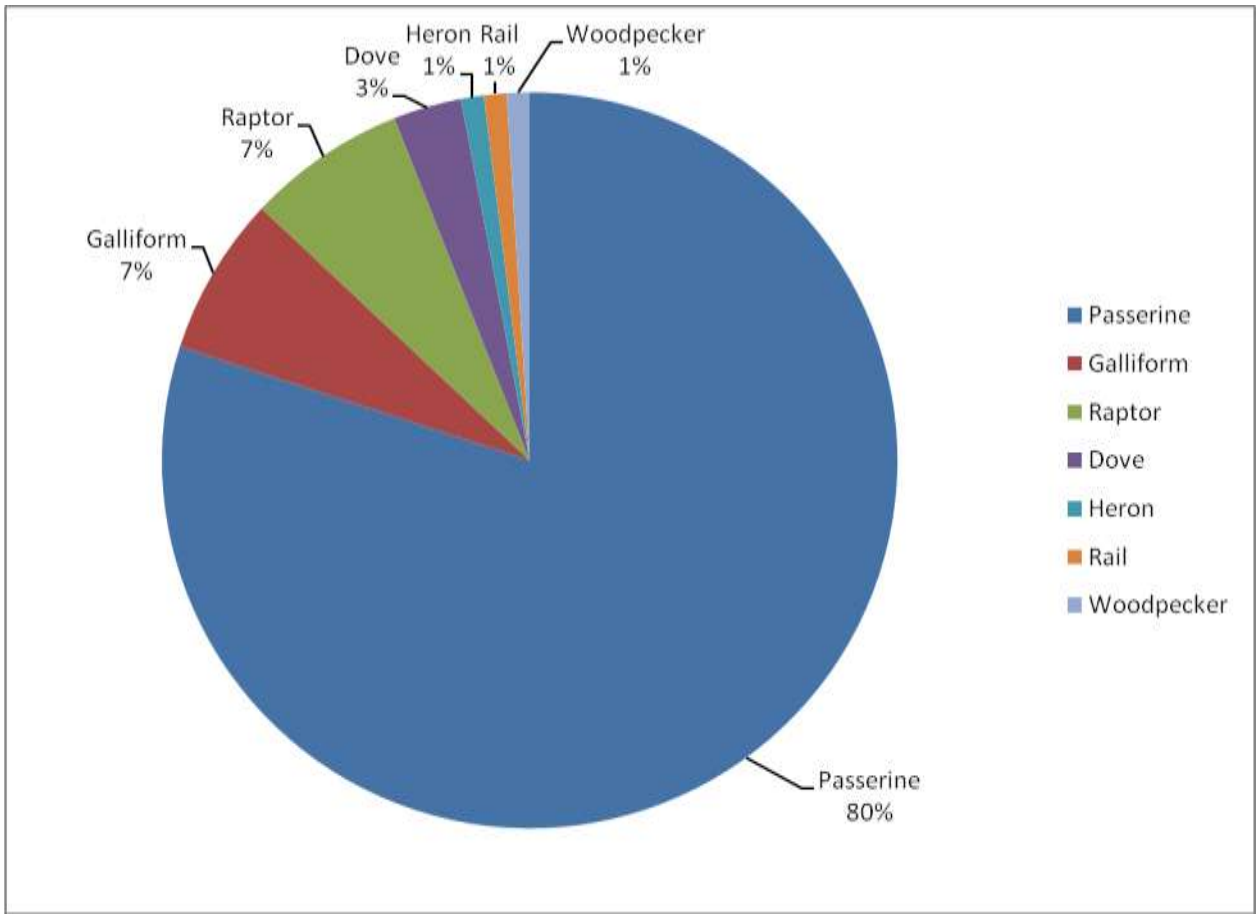


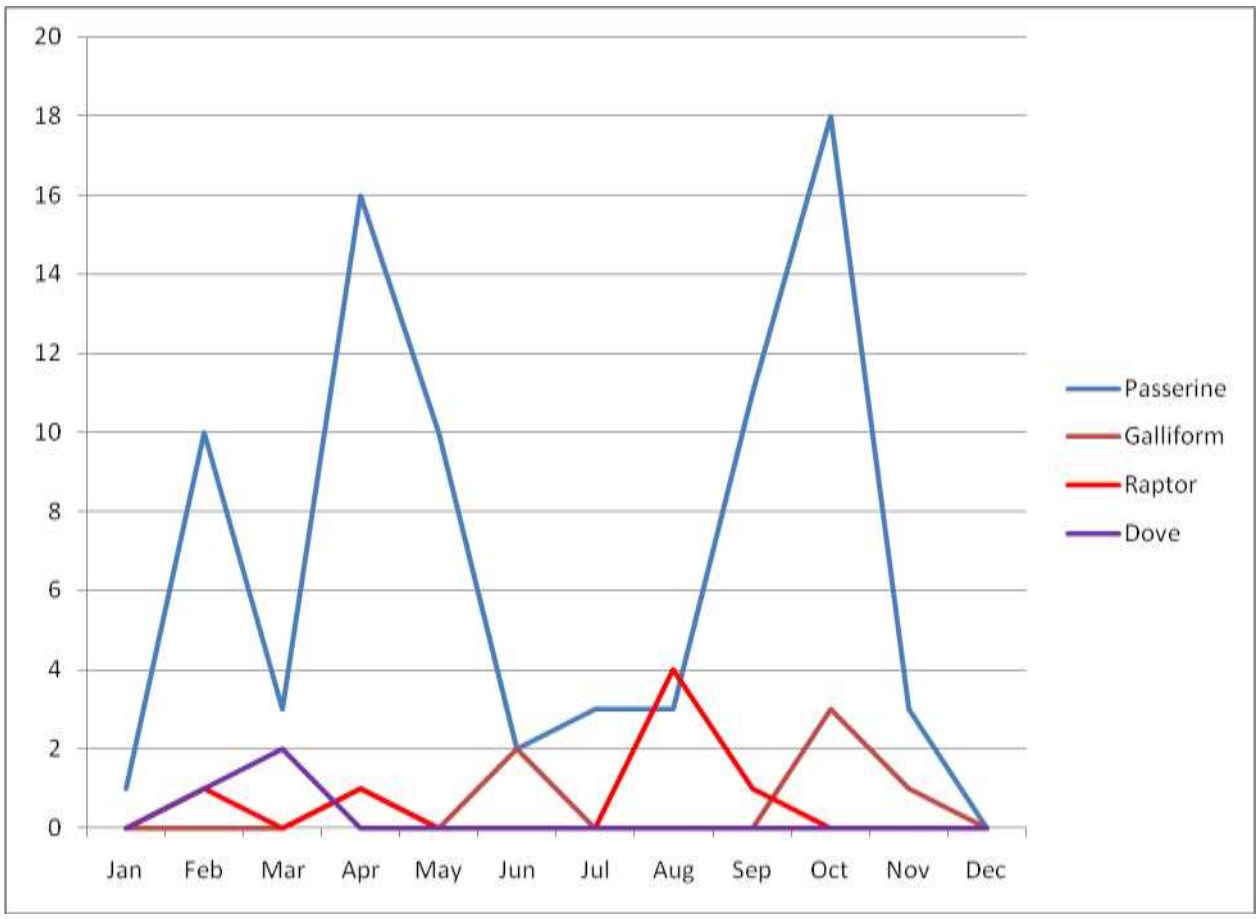
Figure 3. Klondike III and IIIa Raptor and Other Large Bird Nest Monitoring (*Confidential - submitted under separate cover*)

Figure 4. Composition of observed (documented) avian fatalities[1] by taxonomic group at Klondike III Wind Project, 2007–2009.



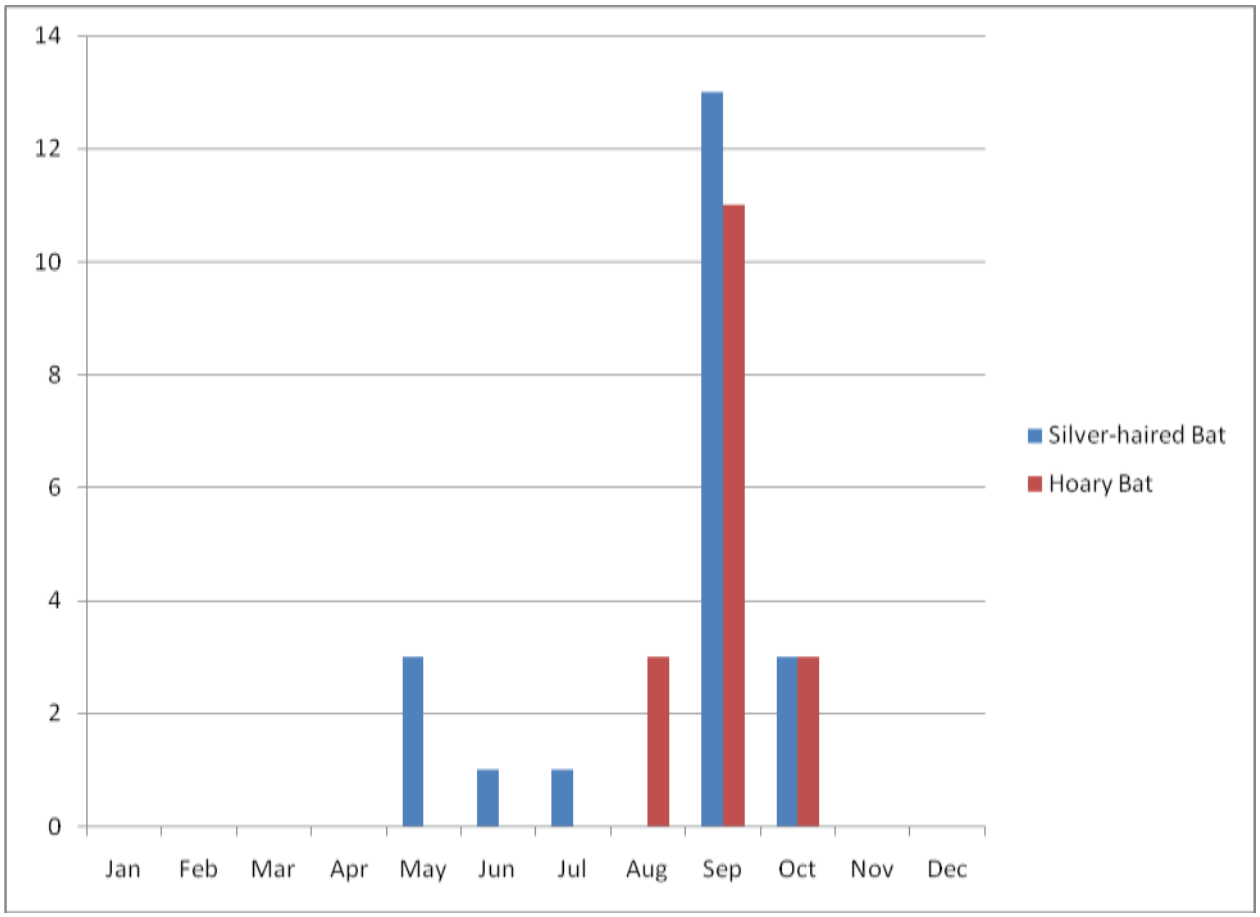
[1] Includes Incidentals

Figure 5. Observed avian fatalities[1] found by month at Klondike III Wind Project, grouped by taxa group.



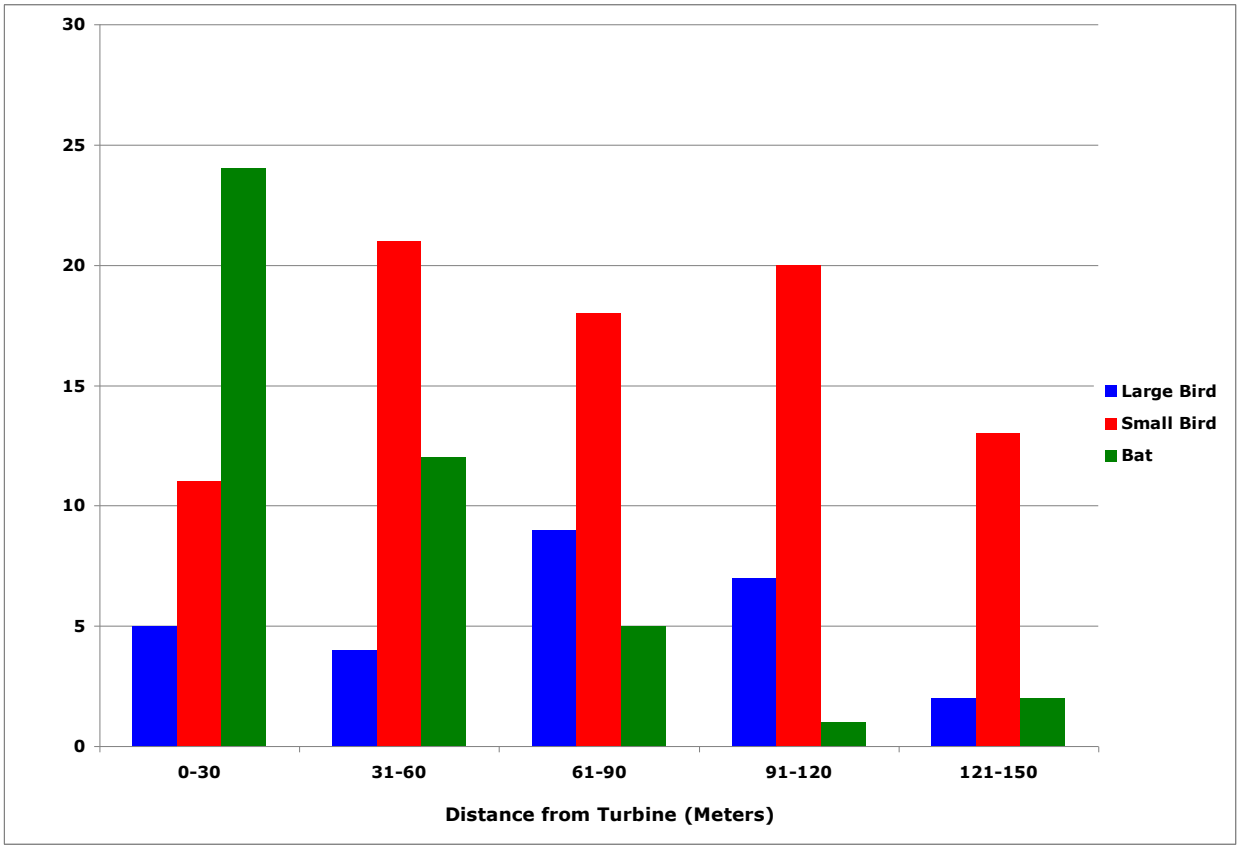
[1] Includes incidentals

Figure 6. Observed bat fatalities[1] found by month at Klondike III Wind Project.



[1] Includes incidentals

Figure 7. Observed fatalities[1] for large birds, small birds, and bats, grouped by distance from turbine at Klondike III Wind Project.



[1] Includes incidentals