PRAIRIE ROSE WIND, LLC.
A SUBSIDIARY OF ENEL GREEN POWER NORTH AMERICA, INC.

PRAIRIE ROSE WIND FARM
Rock & Pipestone Counties, MN

Enel
Green Power

Enel Green Power North America, Inc.

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February 3, 2015

Dr. Burl Haar,
Executive Secretary
Minnesota Public Utilities Commission
121 7th Place E., Sute 350
Saint Paul, MN 55101-2147

Re: Quarterly Avian Mortality Report; Prairie Rose Wind, LLC
MPUC Docket Number IP-6830/WS-10-425

Dear Secretary Haar,

Prairie Rose Wind, LLC (Prairie Rose) submits this letter to the Minnesota Public Utilities Commission (the "Commission") in accordance with Section 6.7 of the Prairie Rose site permit issued Sept. 16th, 2011 and as described in Section 6.3 of the Prairie Rose Wind Project and Transmission Line, Environmental Management Plan (EMP), Rev. April 26, 2012. During the fourth quarter of 2014 (October 15, 2014 to December 31, 2014), there were no reported observations of avian or bat injuries or mortality by operations staff.

Attached, please find the 2014 Post-Construction Coordinated Monitoring report submitted in accordance with the revised Post-Construction Avian and Bat Mortality Study submitted April 14, 2014 by Western Ecosystems Technology (WEST), Inc. Please do not hesitate to contact me at (978) 681-1900, extension 451 or at hans.vanlingen@enel.com if you have any questions concerning this matter.

Sincerely,
Prairie Rose Wind Project, LLC.

Digitally signed by Hans P. van Lingen
DN: cn=Hans P. van Lingen, o=Enel Green Power North America, ou=ECRS, email=hans.vanlingen@enel.com, c=US
Date: 2015.02.03 15:27:45 -05'00'

Hans P. van Lingen
Environmental Compliance & Regulatory Services

Post Construction Fatality Surveys for the Prairie Rose Wind Energy Facility Rock County, Minnesota

Final Report
April 15 to June 13, 2014 and August 15 to October 29, 2014

Prepared for:

Enel Green Power, North America
3636 Nobel Drive, Suite 475
San Diego, California 92122

Prepared by:

Kristen Chodachek, Kristen Adachi, and Guy DiDonato

Western EcoSystems Technology Inc.
4007 State Street, Suite 109
Bismarck, North Dakota 58503

January 23, 2015

WEST Inc.

EXECUTIVE SUMMARY

Enel Green Power, North America operates the Prairie Rose Wind Energy Facility (Prairie Rose), located in Rock County, Minnesota. This facility began commercial operation in December 2012 and consists of 119 1.68-megawatt (MW) GE wind turbines, with an overall capacity of 200 MW of electricity. The turbine towers are 262 feet (ft; 80 meters [m]) high with a 256-ft (78-m) blade diameter, resulting in rotor swept heights of 138 to 387 ft (42 to 118 m) above ground level.

Monitoring studies designed to estimate bird and bat fatality rates attributable to wind turbine operation was conducted from April 15 through October 29, 2014. Monitoring included carcass removal and searcher efficiency trials to estimate potential sources of bias. Fatality estimates were generated for bats using methods consistent with the approach outlined by Shoenfeld (2004) and Erickson et al. (2005).

The adjusted bird and bat fatality rates for the survey period of April 15 to October 29, 2014, (excluding the summer season) were 0.44 bird fatalities per megawatt (MW) per study period and 0.41 bat fatalities per MW per study period, respectively. These estimates are within the range reported for bird and bat fatality rates at other facilities in the Midwest. Fatality estimates for both birds and bats may be underestimated due to a power shut down from August 18 to August 28, 2014, for maintenance. Overall risk to birds and bats from collision is low for Prairie Rose. No state or federally endangered, threatened, or sensitive species were identified during fatality monitoring in 2014.

STUDY PARTICIPANTS

Western EcoSystems Technology

Kristen Chodachek	Project Manager
Kristen Adachi	Statistician
Guy DiDonato	Statistician
Terri Thorn	GIS Technician
Troy Rintz	GIS Technician
Andrea Palochak	Technical Editor
Jennifer VanderMeer	Field Technician
Karen Seginak	Field Technician
Scott Kleindl	Field Technician

REPORT REFERENCE

Chodachek, K., K. Adachi, and. G. DiDonato. 2015. Post-Construction Fatality Surveys for the Prairie Rose Wind Energy Facility, Rock County, Minnesota. Final Report: April 15 to June 13, 2014 and August 15 to October 29, 2014. Prepared for Enel Green Power, North America, Andover, Massachusetts. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota.

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INTRODUCTION

Enel Green Power, North America (EGPNA) owns and operates the Prairie Rose Wind Energy Facility (Prairie Rose), with a capacity of 200 megawatts (MW) in Rock County, Minnesota. Prairie Rose is located one mile (1.6 kilometers [km]) west of Hardwick, Minnesota, in an area dominated by cultivated agriculture such as corn (*Zea mays*), soybean (*Glycine max*), and spring wheat (*Triticum* spp.) fields. Prairie Rose consists of 119 1.68 MW GE wind turbines (Figure 1). Each turbine has an 80-meter (m; 262-foot [ft]) hub height and 82.5-m (271-ft) rotor diameter. Prairie Rose became operational in December 2012.

Year one of fatality monitoring was conducted in 2013, documenting total number of bird and bat fatalities. The second year of fatality monitoring studies at Prairie Rose was designed to fulfill requirements specified in Section 6.7 of Prairie Rose Wind, LLC's Site Permit, issued September 16, 2011, and the Prairie Rose Environmental Management Plan (EMP; aka Avian and Bat Protection Plan) Coordinated Monitoring Effort. The primary objective of fatality monitoring was to estimate the level (high, moderate, or low relative to other projects) of bat and bird mortality attributable to collisions with turbines for Prairie Rose during spring and fall migrations. Although the Prairie Rose EMP allows for mortality monitoring to be performed by an onsite Environmental Inspector, EGPNA opted to use trained biologists that have existing training and knowledge on the performance of avian and bat fatality surveys for this effort. The Minnesota Department of Commerce will use information collected during this study to confirm the validity of the avian and bat low risk classification that was predicted prior to construction.

STUDY AREA

Prairie Rose falls within the Northern Glaciated Plains Ecoregion which covers the eastern third of North Dakota, South Dakota, and the southwestern corner of Minnesota (Bryce et al. 1996, US Environmental Protection Agency [USEPA] 2007). Historically covered by a transitional grassland containing both tallgrass and shortgrass prairies, the Northern Glaciated Plains Ecoregion has largely been converted to tilled agriculture, predominantly corn, soybeans, and spring wheat, with smaller amounts of pastureland. Topography in the region is gently rolling, with elevations ranging from 1,683-1,877 ft (513 to 572 m).

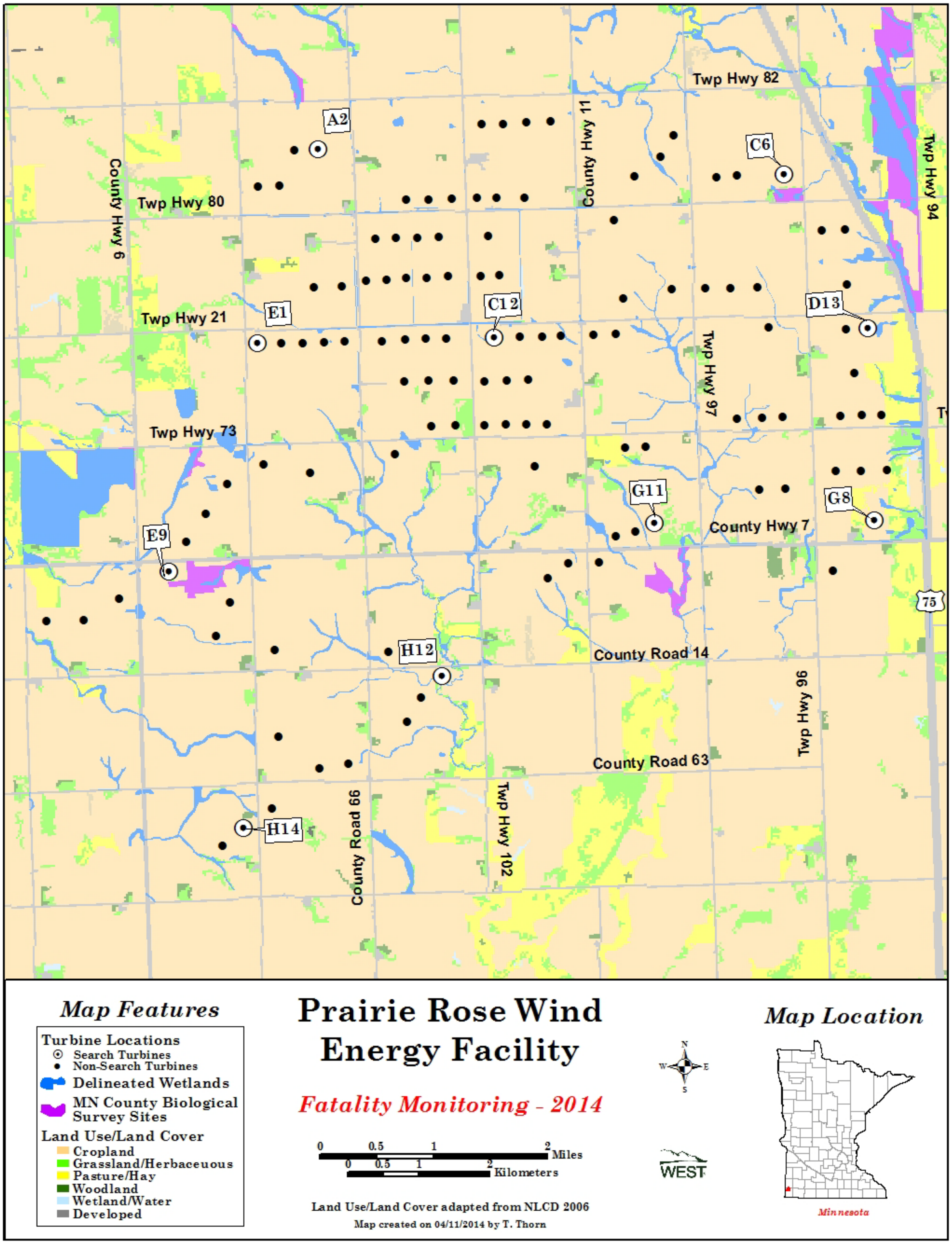

Figure 1. Location of the Prairie Rose Wind Energy Facility and turbines, Rock County, Minnesota.

METHODS

The fatality monitoring study at Prairie Rose consisted of the following components:

1) standardized carcass surveys at selected turbines;
2) searcher efficiency trials to estimate the percentage of carcasses found by searchers; and
3) carcass removal trials to estimate the length of time that a carcass remained in the field for possible detection

All bat and bird casualties located within areas surveyed, regardless of species, were recorded and a cause of death was determined if possible, based on field inspection of the carcass. The total number of bat and bird casualties (including dead and injured bats and birds) were estimated by adjusting for search frequency, removal bias (length of stay in the field), searcher efficiency bias (percent found), and area searched. For carcasses where the cause of death was not apparent, the assumption that the fatality was caused by a wind turbine collision was made for the analysis. This approach likely led to an overestimate of the true number of facility-related bird fatalities, however is unknown for bats.

Sample Size, Search Area, and Search Frequency

Ten turbines, which were selected in consultation with EGPNA, were surveyed once a week, in accordance with the Prairie Rose EMP dated March 27, 2012 (Figure 1). Square plots (100-m x 100-m [328-ft by 328-ft] plots centered on the turbine) were surveyed at the 10 selected turbines. To the extent possible, turbines searched were rotated throughout the day such that all daylight periods were surveyed (i.e. morning, mid-day, and afternoon). No crop clearing was conducted at any of the search turbines. During spring surveys, full plots were searched, however during fall surveys, only roads and pads were searched due to reduced visibility of agricultural crops.

Standardized Carcass Searches

Monitoring was conducted during the spring (April 15 to June 15) and fall (August 15 to October 31), a period corresponding to the migration periods for bats and birds. All 10 turbines were systematically searched for bat and bird casualties that were attributable to collision with the turbines. A searcher walked at a casual walking rate of approximately 45-60 m per minute (148-197 ft per minute) through the search area. For full plots, transects were walked 10 m (33 ft) apart within each plot to sample the area under and around the turbine (Figure 2). For road and pad searches, the searcher looked around the turbine pad, turbine driveway, and access roads within 50 m (164 ft) of the turbine (Figure 3). As such, the searcher would survey a distance of 50 m (164 ft) along the access road in either direction from the turbine for a combined distance of 100 m (328 ft).

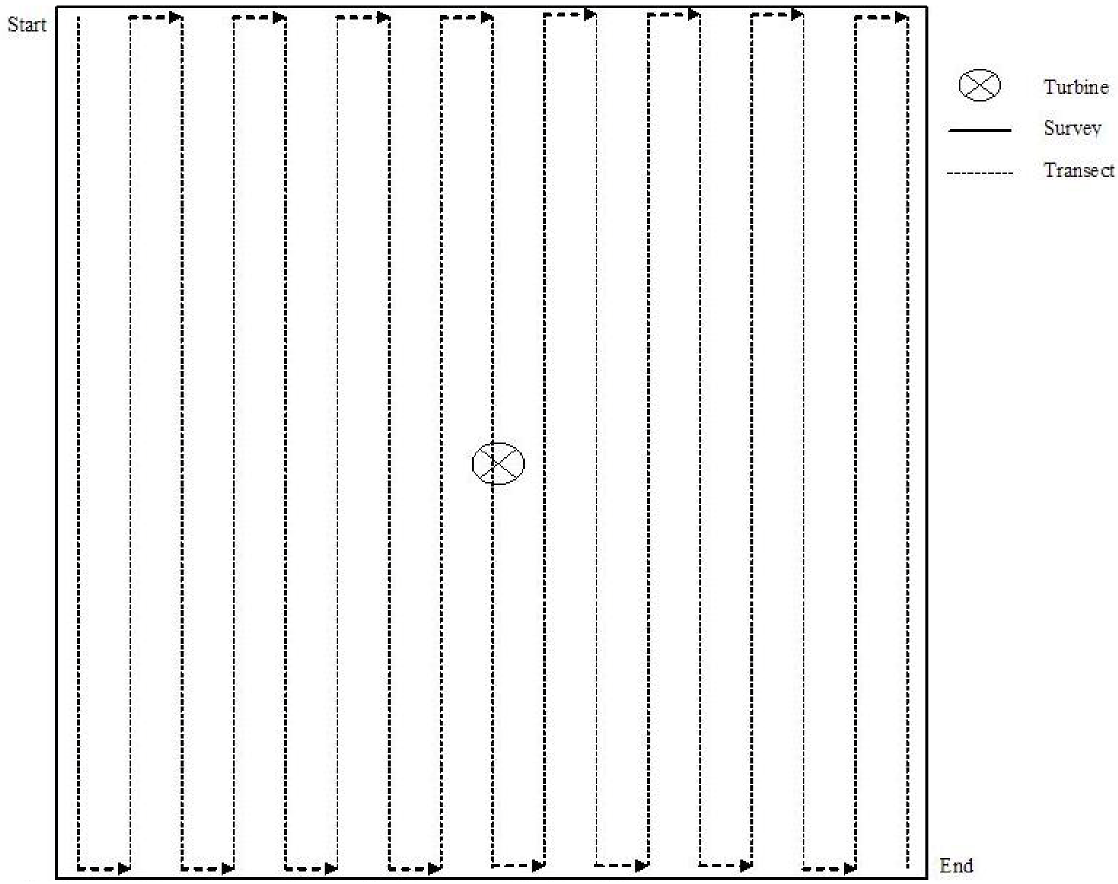

Figure 2. Example schematic of survey pattern (not to scale) for carcass search plots at the Prairie Rose Wind Energy Facility. Transects were placed 10 meters apart. Turbine pad and access road (not shown) were included in the area searched.

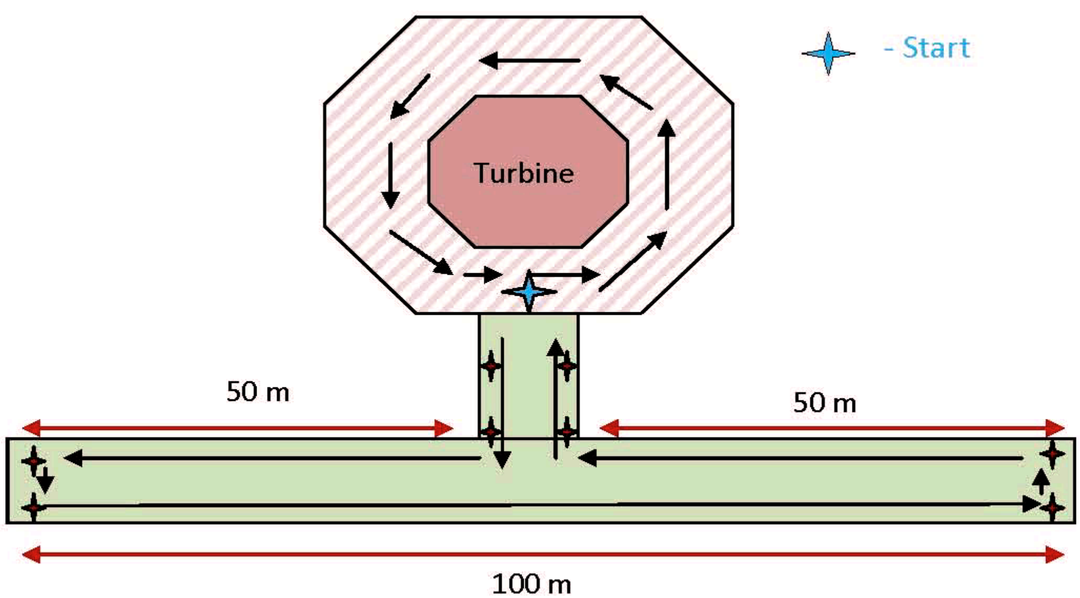

Figure 3. Example schematic of search area along road and turbine pad (not to scale; area searched varied, however all road and pad areas located within the 100 meter x 100 meter plot were surveyed).

Bird and bat casualties were processed using the protocol outlined within the Prairie Rose EMP. Additionally, any incidental observations of sensitive species or raptors were recorded according to the Prairie Rose EMP.

Casualties found outside the formal search time but inside of search plots were treated following the above protocol as closely as possible and treated as a fatality. Bat and bird casualties found outside of carcass search plots were coded as incidental discoveries and documented in a similar fashion as those found during standard searches.

Searcher Efficiency Trials

The objective of the searcher efficiency trials was to estimate the percentage of casualties found by searchers. All carcasses were placed at random locations within areas being searched prior to the carcass search on the same day. Estimates of searcher efficiency were used to correct for detection bias by adjusting the total number of carcasses found for those missed by the searchers.

Searcher efficiency trials were conducted by placing “detection” carcasses within the search plots or along roads/pads of the selected turbines. Efficiency trials commenced with the start of carcass searches and were conducted periodically throughout the survey periods. Searchers conducting carcass searches did not know when the trials were being conducted or the locations where the “detection” carcasses were placed in a search plot. A total of 51 carcasses were used, including 21 large bird carcasses and 30 small bird carcasses. Carcasses used in trials were composed of non-native/non-protected or commercially available species, such as house sparrows (*Passer domesticus*), European starlings (*Sturnus vulgaris*), and rock pigeons (*Columba livia*). The house sparrow and European starling were used as bat surrogates due to the lack of bat carcasses available for trials. All “detection” carcasses were placed at random locations within areas being searched prior to the carcass search on the same day. Carcasses were dropped from waist height or higher and allowed to land in a random posture. Each “detection” carcass was discreetly marked (e.g., tape or thread on the leg of the carcass) so that it could be identified as a “detection” carcass after it was found. The number and location of the “detection” carcasses found during the carcass search were recorded. The number of carcasses available for detection during each trial was determined immediately after the trial by the person responsible for distributing the carcasses.

Carcass Removal Trials

The objective of carcass removal trials was to estimate the length of time bat and bird carcasses remained in the search area before being removed by scavengers or by other means, such as being plowed into a field. Carcass removal studies were conducted concurrently with standardized carcass searching. Estimates of carcass removal were used to adjust the total number of carcasses found for those removed from the search area, correcting for removal bias.

Removal trial carcasses were placed within a search area of similar size to the actual search areas at random non-search turbine locations within Prairie Rose. A total of 35 carcasses were used, including 14 large bird carcasses and 21 small bird carcasses. Bat surrogate carcasses used were similar to those used in the searcher efficiency trials. By spreading trials throughout the spring and fall survey periods, the effects of varying weather, climatic conditions, and scavenger densities were taken into account. All trial carcasses were discreetly marked using black electrical tape around the ankle to avoid confusion with turbine fatalities. Major habitats represented around the turbines were included in these trials. Carcasses were dropped from waist height or higher and allowed to land in a random posture.

Personnel conducting carcass searches monitored the trial carcasses over a 30-day period according to the following schedule as closely as possible. Carcasses were checked every day for the first four days, and then on days seven, 10, 14, 20, and 30. At the end of the 30-day period, any remaining evidence of the carcass was removed.

Statistical Methods for Fatality Estimates

Estimates of facility-related fatalities were based on:

1) Observed number of carcasses found during standardized searches during the monitoring period for which the cause of death was likely facility-related;
2) Non-removal rates, which are expressed as the estimated average probability a carcass is expected to remain in the study area and be available for detection by the searchers during removal trials;
3) Searcher efficiency, which is expressed as the proportion of placed carcasses found by searchers during searcher efficiency trials; and
4) Proportion of the area searched around each turbine.

Definition of Variables

The following variables were used in the equations below:

c_i the number of carcasses detected at plot *i* for the study period of interest, for which the cause of death is either unknown or was attributed to the facility

n the number of search plots

k the number of turbines searched (including the turbines centered within each search plot)

$\bar{c}$ the average number of carcasses observed per turbine per monitoring study period

s the number of carcasses used in removal trials

s_c the number of carcasses in removal trials that remained in the study area after 30 days

se standard error (square of the sample variance of the mean)

t_i the time (in days) a carcass remained in the study area before it was removed, as determined by the removal trials

- $\bar{t}$ the average time (in days) a carcass remained in the study area before it was removed, as determined by the removal trials
- *d* the total number of carcasses placed in searcher efficiency trials
- *p* the estimated proportion of detectable carcasses found by searchers, as determined by the searcher efficiency trials
- *I* the average interval between standardized carcass searches, in days
- A proportion of the search area of a turbine actually searched
- $\hat{\pi}$ the estimated probability that a carcass was both available to be found during a search and was found, as determined by the removal trials and the searcher efficiency trials
- *m* the estimated annual average number of fatalities per turbine per study period, adjusted for removal and searcher efficiency bias

Observed Number of Carcasses

The estimated average number of carcasses ($\bar{c}$) observed per turbine per study period was:

$$\bar{c} = \frac{\sum_{i=1}^{n} c_i}{k \cdot A} \qquad (1)$$

Estimation of Carcass Non-Removal Rates

Estimates of carcass non-removal rates were used to adjust carcass counts for removal bias. Mean carcass removal time ($\bar{t}$) was the average length of time a carcass remained in the study area before it was removed:

$$\bar{t} = \frac{\sum_{i=1}^{s} t_i}{s - s_c} \qquad (2)$$

Estimation of Searcher Efficiency Rates

Searcher efficiency rates are expressed as *p,* the proportion of trial carcasses that were detected by searchers in the searcher efficiency trials. These rates were estimated by carcass size and season.

Search Area Adjustment for Roads and Pads

The calculation of the road and pad correction factor was based on a carcass density-weighted proportion of area searched (Huso and Dalthorpe 2014). In lieu of cleared plot data onsite, bat fatality distance data was collected from publicly available studies at several nearby sites, with similar turbine height. Data from 122 fatalities at seven publicly-available wind projects in the United States were used. The observed distances on cleared plots were used to fit the distribution of bird and bat distances from the turbine, which in turn was used to calculate the proportion of fatalities expected to fall within each 1-m distance band from a turbine.

The specification of the bat fatality distances followed a truncated normal prior distribution with truncation bounds of 0 m (at the turbine) and 100m (the size of a search plot), and a mean and standard deviation of 15.51 ± 26.00 m (Casella and Berger 1990). The truncated normal prior was chosen from a list of candidate distributions based on AIC scores for fits to the carcass distance data (Burnham and Anderson 2002). Candidate distributions included the folded normal, exponential, gamma, Rayleigh, Rician, Gompertz and Weibull distributions, as well as mixture distributions of folded normals and truncated normals. Site-specific carcass data and a Gibbs sampler were used to determine the posterior density distribution of bat carcasses.

Road and pad configurations at the wind facility were digitized in ArcGIS, and the proportion of each of 50 1-m distance bands (with respect to turbines) that were captured by road or pad area were calculated. Multiplying this proportion by the proportion of fatalities expected to fall within each of the distance bands and summing over the distance bands yielded a carcass density-weighted area correction factor for the road and pad plots.

Estimation of Facility-Related Fatality Rates

The estimated per turbine study period fatality rate (*m*) was calculated by:

$$m = \frac{\bar{c}}{\hat{\pi}} \tag{3}$$

where $\hat{\pi}$ included adjustments for both carcass removal (from scavenging and other means) and searcher efficiency bias. If not statistically different across seasons or plot types, data for carcass removal and searcher efficiency bias will be pooled across the study to estimate $\hat{\pi}$.

$\hat{\pi}$ was calculated as follows:

$$\hat{\pi} = \frac{\bar{t} \cdot p}{I} \cdot \left[\frac{\exp\left({}^{I}\!/\!_{\bar{t}} \right) - 1}{\exp\left({}^{I}\!/\!_{\bar{t}} \right) - 1 + p} \right].$$

This formula has been independently verified by Shoenfeld (2004). The Shoenfeld bias correction factor combines single-search searcher efficiency with an exponential model related to the average number of searches before carcass removal to account for the ability of a carcass to be missed during a search but located on subsequent searches and an exponential model of carcass removal.

The reported estimates of *m* and associated standard errors and 90% confidence intervals were calculated using bootstrapping (Manly 1997). Bootstrapping is a computer simulation technique that is useful for calculating point estimates, variances, and confidence intervals for complicated test statistics. Each bootstrap sample comprised a random resample from the fatality search data (with individual turbines as the unit of replication), the carcass removal data (with individual carcasses as the units of replication), and the searcher efficiency data (with individual carcasses as the units of replication). Bootstrap samples preserved sample sizes for turbines, large and small bird, or bat carcass removal carcasses, and large or small, or bat searcher efficiency carcasses.

For each bootstrap sample, $\overline{c}$, $\bar{t}$, p, $\hat{\pi}$, and m were calculated. A total of 1,000 bootstrap samples were used. The reported estimates were the mathematical means of the 5,000 bootstrap estimates. The standard deviation of the bootstrap estimates was the estimated standard error. The lower fifth and upper ninety-fifth percentiles of the 5,000 bootstrap estimates were estimates of the lower limit and upper limit of 90% confidence intervals.

DISPOSITION OF DATA AND REPORTING STANDARDS

This monitoring study provides information on fatalities and total bird and bat mortality associated with operations of Prairie Rose and the data used to evaluate the overall impacts of the facility on birds and bats. At the end of the study, all data were provided to EGPNA, the facility owner, including the data forms and electronic data files. During the study, the raw data forms were housed by WEST.

RESULTS

Surveys were conducted from April 15 to June 13, 2014, and August 15 to October 29, 2014. All casualties (including dead and injured bats and birds) located within areas surveyed, regardless of species, were recorded and a cause of death or injury (no injured birds or bats were located) determined, if possible. Results of the standardized carcass searches for bats and birds, searcher efficiency, carcass removal trials, and adjusted fatality estimates for bats and birds are discussed in the sections below.

Standardized Carcass Surveys

A total of 204 turbine searches were conducted during 21 search periods. Four bird fatalities and one bat fatality were found during standardized carcass surveys (Table 1). No incidental bird or bat fatalities recorded. The low number of bird and bat fatalities found in 2014 is similar to 2013 where only one bat fatality was documented on September 27, 2013 (Chodachek 2013).

Table 1. Total number of bird and bat casualties and the composition of casualties discovered at the Prairie Rose Wind Energy Facility from April 15, to June 13, 2014 and August 15, to October 29, 2014.

Species	Fatalities during Scheduled Searches Total	Fatalities during Scheduled Searches % Composition	Incidental Fatalities at Search Plots* Total	Incidental Fatalities at Search Plots* % Composition	Total	Total % Composition
Birds						
unidentified sparrow	2	50.0	0	0	2	50.0
Canada goose	1	25.0	0	0	1	25.0
red-tailed hawk	1	25.0	0	0	1	25.0
Overall Birds	4	100	0	0	4	100
Bats						
silver-haired bat	1	100	0	0	1	100
Overall Bats	1	100	0	0	1	100

*Fatalities found incidentally on turbine search plots were included in analyses.

All of the bird fatalities were located during the spring, while the one bat fatality was found during the fall survey period at Prairie Rose (Figure 4). Turbine C12 had two bird fatalities and one bat fatality recorded, while turbines C6 and H14 each had one bird fatality recorded. All bird fatalities were found within 30 m (98.4 ft) of the turbine, with all fatalities found between 21-30 m (68.9-98.4 ft). The lone bat fatality was found 3 m (9.8 ft) from the turbine.

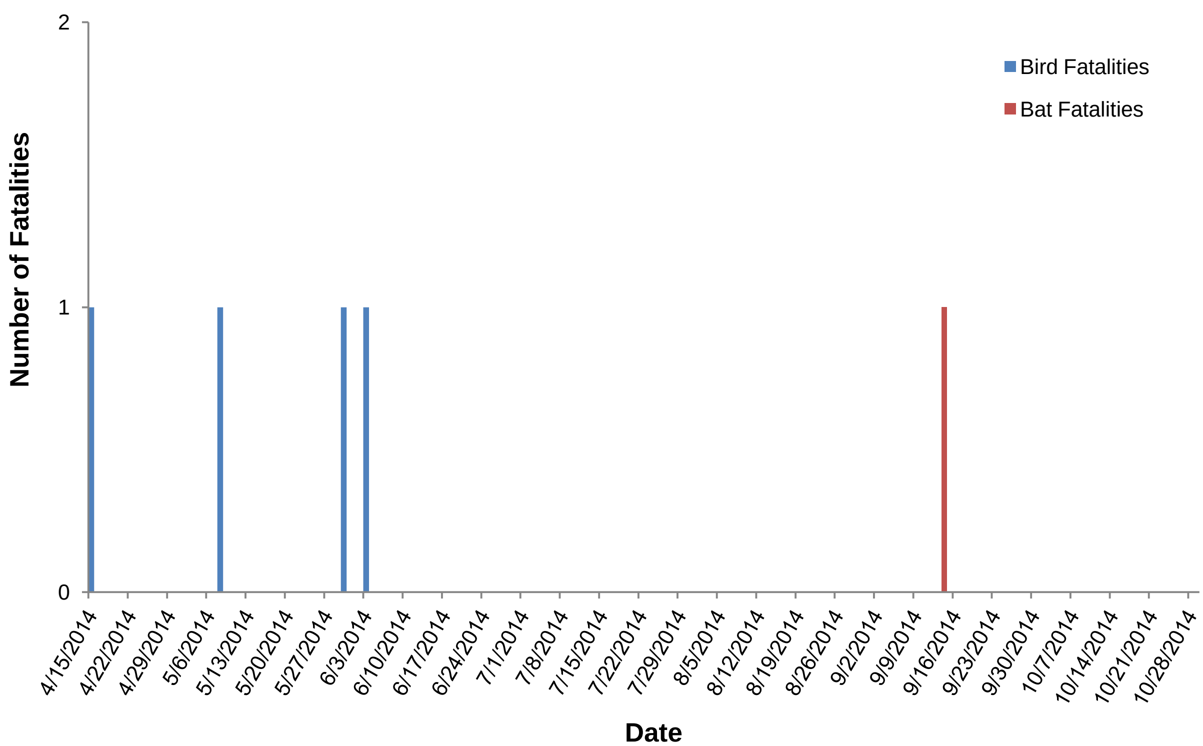

Figure 4. Temporal distribution of bird and bat fatalities found at the Prairie Rose Wind Energy Facility from April 15 to June 13, 2014 and August 15, to October 29, 2014,.

The bat casualty was estimated to be less than 3 days old, while bird casualties ranged from last night up to 14 days (Table 2).

Table 2. Estimated time of death for bird and bat fatalities found at the Prairie Rose Wind Energy Facility from April 15, to June 13, 2014 and August 15, to October 29, 2014.

	Bird		Bat	
Estimated Time of Death	**# of fatalities**	**% composition**	**# of fatalities**	**% composition**
last night	1	25.0	0	0
2-3 days	1	25.0	1	100
4-7 days	1	25.0	0	0
7-14 days	1	25.0	0	0
>2 weeks	0	0	0	0
>month	0	0	0	0
unknown	0	0	0	0

Searcher Efficiency Trials

A total of 51 searcher efficiency carcasses, 21 large bird carcasses and 30 small bird carcasses, were placed at Prairie Rose during 2014 (Table 3). Overall searcher efficiency for all trials was estimated to be 70.4% for small bird carcasses and 95.2% for large bird carcasses (Table 3). Using Pearson's Chi Square test, no relationship was found between seasons for small birds (X^2 = 0.28, p = 0.60) or large birds (X^2 = 0.03, p = 0.86) was observed. As such, data was pooled across seasons for large birds and small birds.

Table 3. Searcher efficiency results at the Prairie Rose Wind Energy Facility as a function of carcass size.

Size	Date	# Placed	# Available	# Found	% Found
Small Birds	5/1/2014	3	3	3	100
	6/2/2014	6	4	2	50.0
	6/12/2014	6	6	3	50.0
	8/27/2014	6	6	4	66.7
	9/8/2014	5	4	4	100
	9/30/2014	4	4	3	75.0
Overall		30	27	19	70.4
Large Birds	5/1/2014	4	4	3	75.0
	6/2/2014	5	5	5	100
	6/12/2014	4	4	4	100
	8/27/2014	2	2	2	100
	9/8/2014	3	3	3	100
	9/30/2014	3	3	3	100
Overall		21	21	20	95.2

Carcass Removal Trials

A total of 35 carcasses were used, including 14 large bird carcasses and 21 small bird carcasses. Approximately 35% of small birds remained by Day 4 and 15% remained by Day 10. For large birds, approximately 75% of the large birds remained by Day 4, and 50% remained by Day 10 (Figure 5).

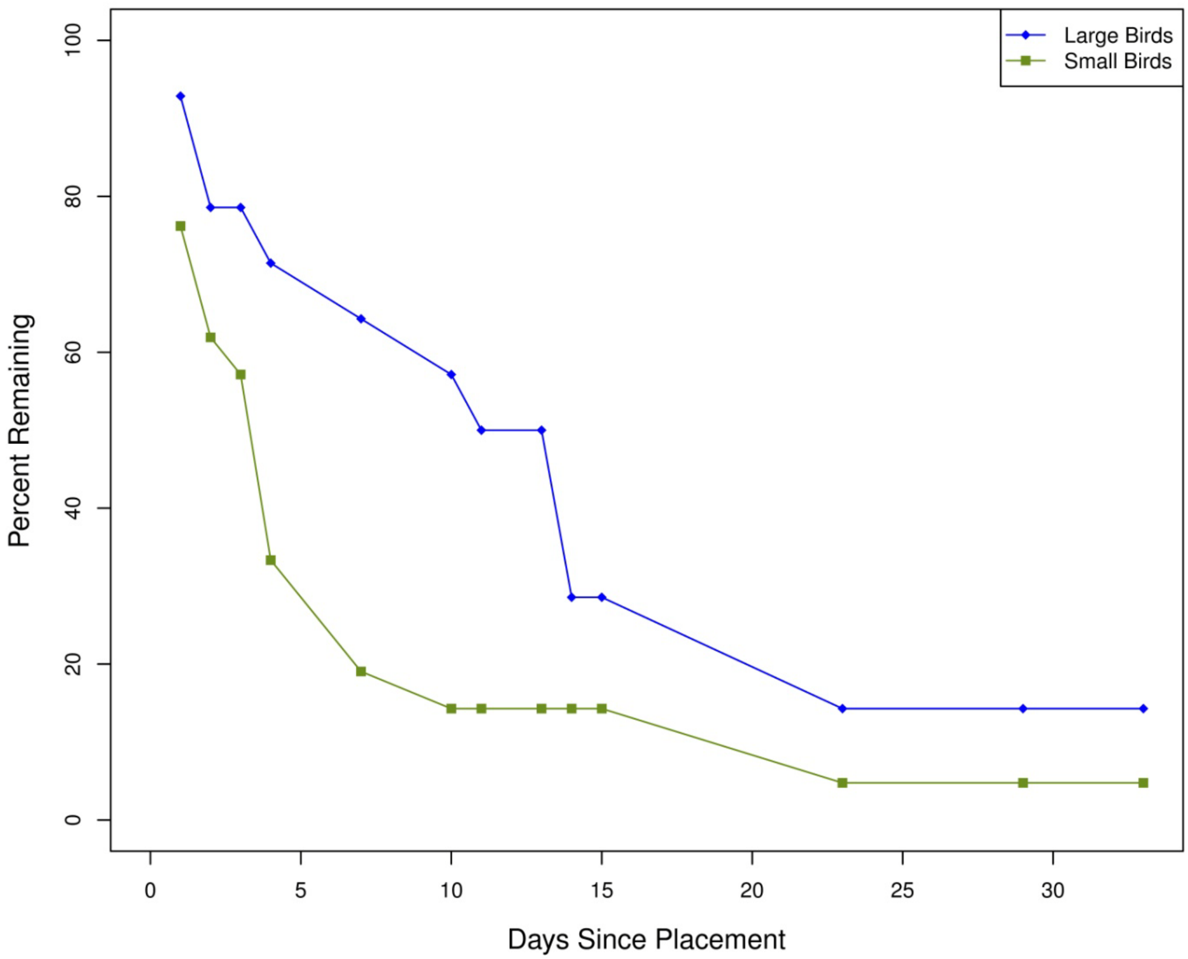

Figure 5. Carcass removal rates for large and small birds within the Prairie Rose Wind Energy Facility from April 15 to June 13, 2014 and August 15 to October 28, 2014.

Adjusted Fatality Estimates

Additionally, fatality estimates, standard errors, and confidence intervals (CI) were calculated for birds and bats for the period of April 15 to June 13 and August 15 to October 29 for each year of the survey based on a plot size of 100 m x 100 m for cleared plots (Table 4). All fatality estimates were adjusted based on the corrections for carcass removal, observer detection bias (searcher efficiency), and the proportion of the plot searched.

Regardless of bird or bat, all fatality estimates were less than one fatality per turbine per study period (Table 4). Overall, birds were estimated to be 0.74 birds per turbine per study period (0.44 bird fatalities per megawatt [MW] per study period) and bats were 0.69 bat fatalities per turbine per study period (0.41 bat fatalities per MW per study period).

Table 4. Adjusted bird and bat fatality estimates for the Prairie Rose Wind Energy Facility from April 15, to June 13, 2014 and August 15, to October 29, 2014. For more details concerning correction factors and confidence intervals, refer to Appendices A and B.

	Corrected Fatality Estimate	
Type	**# fatalities/turbine/study period**	**# fatalities/MW/study period**
Small Birds	0.48	0.29
Large Birds	0.26	0.16
Raptors	0.13	0.08
All Birds	0.74	0.44
Bats	0.69	0.41

Sensitive Species

No state or federally endangered or threatened bat or avian species were identified during fatality monitoring.

DISCUSSION

Concern has been raised regarding biases associated with fatality monitoring at wind facilities and the following paragraphs briefly identify these biases and how they were addressed. The approach used for calculating adjusted fatality estimates was consistent with the approach outlined by Shoenfeld (2004) and Erickson et al. (2005), and accounted for search interval, total area searched, proportion of area searched at specific distances from the turbine, searcher efficiency rates, and carcass removal rates. Separate fatality rate estimates were calculated for bats for cleared plots and road and pad plots.

There are numerous factors that could contribute to both positive and negative biases in estimating fatality rates (Erickson 2006). The overall design of this study incorporates several assumptions or factors that affect the results of the fatality estimates. First, all bird and bat casualties found within the standardized search plots during the study were included in the analysis. Second, it was assumed that all bird and bat carcasses found during the study were due to collision with wind turbines. True cause of death was unknown for most of the fatalities. It is possible that some of the fatalities were caused by predators, and some of the casualties included in the data pool were potentially due to natural causes (background mortality).

Additionally, there are other potential negative biases. For example, no adjustments were made for fatalities possibly occurring outside of the search boundaries. Search boundaries were established a minimum distance of 50 m from the turbines to focus on birds and bats. Based on the distribution of fatalities as a function of distance from turbines it is possible that bird fatalities fell outside the search plots and may have been missed. This factor would lead to an underestimate of bird fatality rates.

Concern has also been raised regarding how the number of carcasses placed in the field for carcass removal trials on a given day could lead to biased estimates of scavenging rates. Hypothetically, this would lead to underestimating true scavenging rates if the scavenger densities are low enough such that scavenging rates for these placed carcasses are lower than for actual fatalities. The logic is that if the trials are based on too many carcasses on a given day, scavengers are unable to access all trial carcasses, whereas they could potentially access and remove all wind turbine collision fatalities (Smallwood 2010). If this is the case, and the trial carcass density was much greater than actual turbine fatality density, the trials would underestimate scavenging rates compared to rates on actual fatalities. Conversely, placing carcasses in an area could bring in additional scavengers, therefore artificially overestimating scavenging rates compared to rates on actual fatalities.

Bird Fatalities

During this study, a total of four bird fatalities were found from April 15 to June 13, 2014 and August 15 to October 29, 2014. Bird fatality rates at other sites with publically-available data across North America exhibit a wide range of mortality, from 0.08 bird fatalities per MW per study period at the Red Hills facility in Oklahoma (Derby et al. 2013c) to 11.02 bird fatalities per MW per study period at the Buffalo Mountain facility in Tennessee (Nicholson et al. 2005; Appendix C). Within the Midwest, bird estimates ranged from 0.27 bird fatalities per MW per year at the Pioneer Prairie II facility in Iowa (Chodachek et al. 2012) to 8.25 bird fatalities per MW per year at the Wessington Springs facility in South Dakota (Derby et al. 2010f; Appendix C). The estimated bird fatality rate of 0.44 bird fatalities per MW per study period at Prairie Rose ranked thirty-first out of 33 other wind energy facilities in the Midwest (Figure 6). Although, most of these studies typically included at least three seasons (springs, summer, or winter) or an all year survey, it is unlikely that the bird fatality estimate at Prairie Rose would change much with a summer survey as songbirds are the most common fatality reported at wind energy facilities, particularly during spring and fall migration (Strickland et al. 2011). Based on the results of this study, risk of collision for birds is considered to be low.

The raptor fatality estimate of 0.08 raptors per MW per study period at Prairie Rose is within the range of other Midwest projects, ranking ninth (Figure 7). Raptor fatality estimates at other facilities in the Midwest ranged from zero raptor fatalities per MW per study period and several facilities to 0.47 raptors per MW per study period at the Buffalo Ridge facility in (Phase 1; Johnson et al. 2000a; Appendix C).

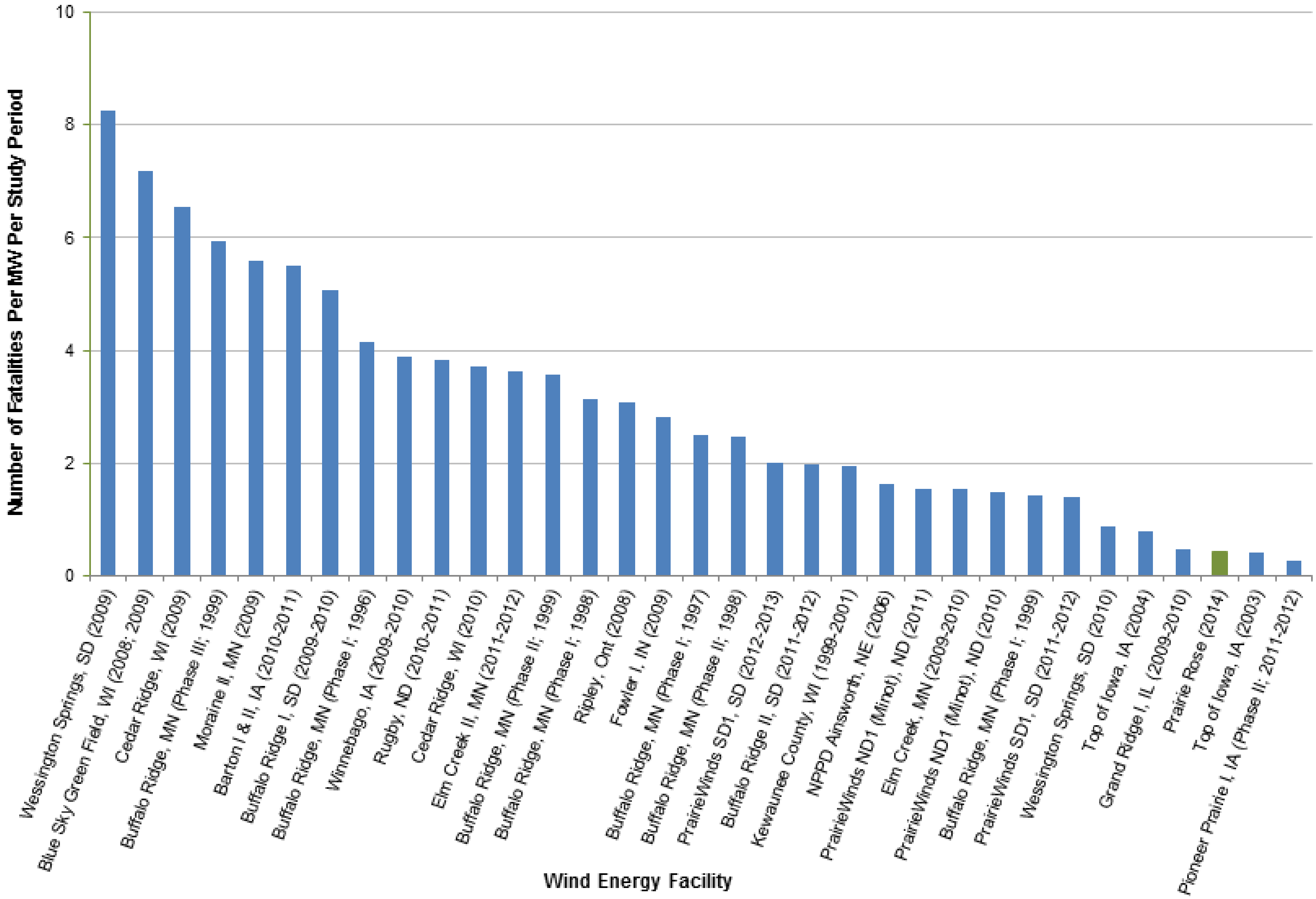

Figure 6. Bird fatality rates from comparable publicly-available studies at Midwest wind energy facilities, with the Prairie Rose Wind Energy Facility highlighted in green.

Figure 6 (*continued*). Bird fatality rates from comparable publicly-available studies at Midwest wind energy facilities, with the Prairie Rose Wind Energy Facility highlighted in green.

Data from the following sources:

Facility, Location	Fatality Reference	Facility, Location	Fatality Reference	Facility, Location	Fatality Reference
Prairie Rose, MN (14)	**This study**				
Wessington Springs, SD (09)	Derby et al. 2010f	Elm Creek II, MN (11-12)	Derby et al. 2012b	PrairieWinds ND1 (Minot), ND (11)	Derby et al. 2012c
Blue Sky Green Field, WI (08; 09)	Gruver et al. 2009	Buffalo Ridge, MN (Phase II; 99)	Johnson et al. 2000a	Elm Creek, MN (09-10)	Derby et al. 2010c
Cedar Ridge, WI (09)	BHE Environmental 2010	Buffalo Ridge, MN (Phase I; 98)	Johnson et al. 2000a	PrairieWinds ND1 (Minot), ND (10)	Derby et al. 2011c
Buffalo Ridge, MN (Phase III; 99)	Johnson et al. 2000a	Ripley, Ont (08)	Jacques Whitford 2009	Buffalo Ridge, MN (Phase I; 99)	Johnson et al. 2000a
Moraine II, MN (09)	Derby et al. 2010d	Fowler I, IN (09)	Johnson et al. 2010a	PrairieWinds SD1, SD (11-12)	Derby et al. 2012d
Barton I & II, IA (10-11)	Derby et al. 2011a	Buffalo Ridge, MN (Phase I; 97)	Johnson et al. 2000a	Wessington Springs, SD (10)	Derby et al. 2011d
Buffalo Ridge I, SD (09-10)	Derby et al. 2010b	Buffalo Ridge, MN (Phase II; 98)	Johnson et al. 2000a	Top of Iowa, IA (04)	Jain 2005
Buffalo Ridge, MN (Phase I; 96)	Johnson et al. 2000a	PrairieWinds SD1, SD (12-13)	Derby et al. 2013a	Grand Ridge, IL (09-10)	Derby et al. 2010g
Winnebago, IA (09-10)	Derby et al. 2010e	Buffalo Ridge II, SD (11-12)	Derby et al. 2012a	Top of Iowa, IA (03)	Jain 2005
Rugby, ND (10-11)	Derby et al. 2011b	Kewaunee County, WI (99-01)	Howe et al. 2002	Pioneer Prairie I, IA (Phase II; 11-12)	Chodachek et al. 2012
Cedar Ridge, WI (10)	BHE Environmental 2011	NPPD Ainsworth, NE (06)	Derby et al. 2007		

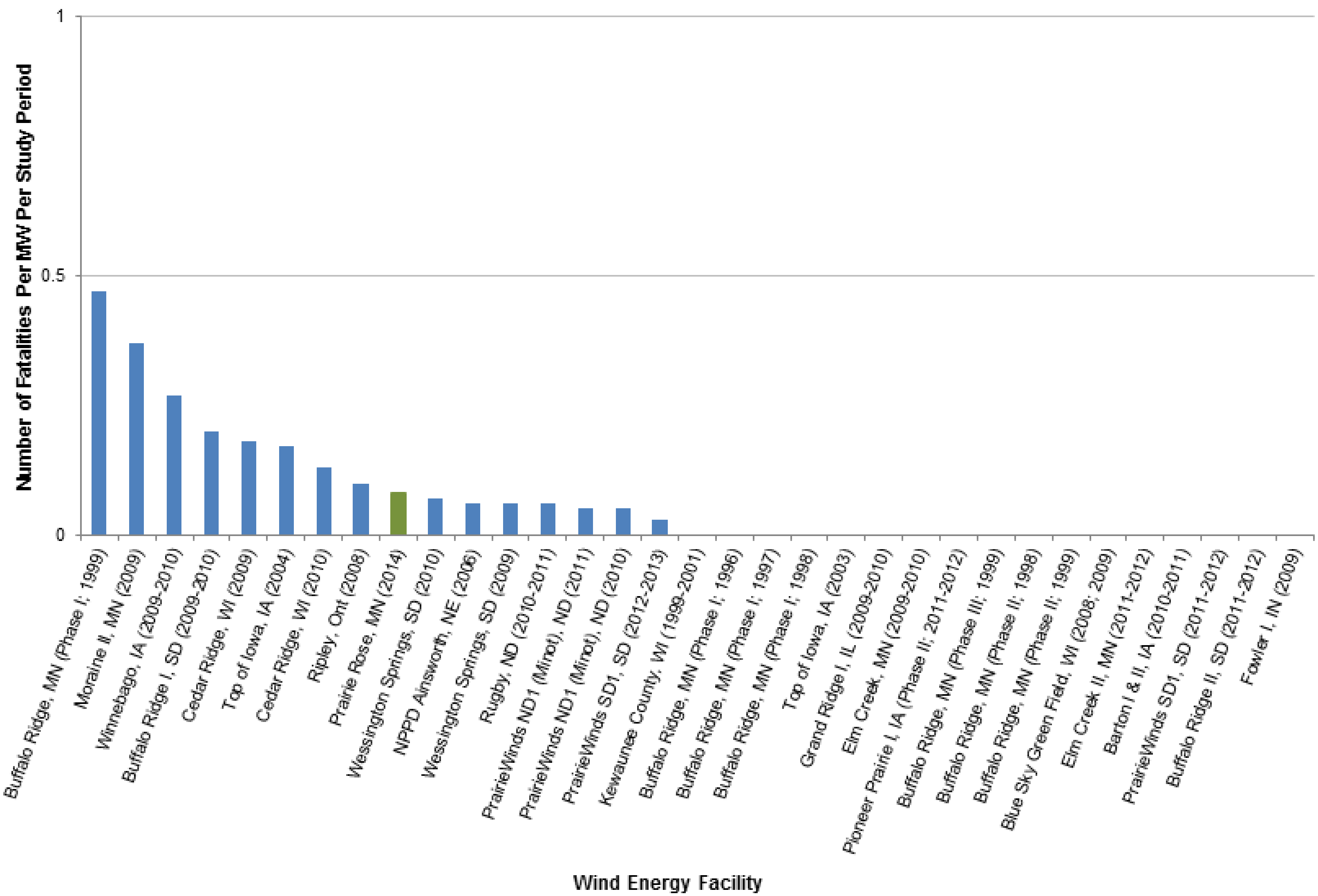

Figure 7. Raptor fatality rates from comparable publicly-available studies at Midwest wind energy facilities, with the Prairie Rose Wind Energy Facility highlighted in green.

Figure 7 (*continued*). Raptor fatality rates from comparable publicly-available studies at Midwest wind energy facilities, with the Prairie Rose Wind Energy Facility highlighted in green.

Data from the following sources:

Facility, Location	Fatality Reference	Facility, Location	Fatality Reference	Facility, Location	Fatality Reference
Prairie Rose, MN (14)	**This study**				
Buffalo Ridge, MN (Phase I; 99)	Johnson et al. 2000a	Rugby, ND (10-11)	Derby et al. 2011b	Pioneer Prairie I, IA (Phase II; 11-12)	Chodachek et al. 2012
Moraine II, MN (09)	Derby et al. 2010d	PrairieWinds ND1 (Minot), ND (11)	Derby et al. 2012c	Buffalo Ridge, MN (Phase III; 99)	Johnson et al. 2000a
Winnebago, IA (09-10)	Derby et al. 2010e	PrairieWinds ND1 (Minot), ND (10)	Derby et al. 2011c	Buffalo Ridge, MN (Phase II; 98)	Johnson et al. 2000a
Buffalo Ridge I, SD (09-10)	Derby et al. 2010b	PrairieWinds SD1, SD (12-13)	Derby et al. 2013a	Buffalo Ridge, MN (Phase II; 99)	Johnson et al. 2000a
Cedar Ridge, WI (09)	BHE Environmental 2010	Kewaunee County, WI (99-01)	Howe et al. 2002	Blue Sky Green Field, WI (08; 09)	Gruver et al. 2009
Top of Iowa, IA (04)	Jain 2005	Buffalo Ridge, MN (Phase I; 96)	Johnson et al. 2000a	Elm Creek II, MN (11-12)	Derby et al. 2012b
Cedar Ridge, WI (10)	BHE Environmental 2011	Buffalo Ridge, MN (Phase I; 97)	Johnson et al. 2000a	Barton I & II, IA (10-11)	Derby et al. 2011a
Ripley, Ont (08)	Jacques Whitford 2009	Buffalo Ridge, MN (Phase I; 98)	Johnson et al. 2000a	PrairieWinds SD1, SD (11-12)	Derby et al. 2012d
Wessington Springs, SD (10)	Derby et al. 2011d	Top of Iowa, IA (03)	Jain 2005	Buffalo Ridge II, SD (11-12)	Derby et al. 2012a
NPPD Ainsworth, NE (06)	Derby et al. 2007	Grand Ridge I, IL (09-10)	Derby et al. 2010g	Fowler I, IN (09)	Johnson et al. 2010a
Wessington Springs, SD (09)	Derby et al. 2010f	Elm Creek, MN (09-10)	Derby et al. 2010c		

Bat Fatalities

During this study, one bat fatality was found from April 15 to June 13, 2014, and August 15 to October 29, 2014. Bat fatality estimates from other wind energy facilities across North America ranged from 0.08 bat fatalities per MW per study period at the Alta Wind II-VI facility in California (Chatfield et al. 2012) to 39.70 at the Buffalo Mountain facility in Tennessee (Fiedler et al. 2007; Appendix C). Within the Midwest, bat fatality estimates ranged from 0.16 (Derby et al. 2010b) to 30.61 (BHE Environmental 2010) bat fatalities per MW per study period (Appendix C). The estimated bat fatality rate of 0.41 bat fatalities per MW per study period at Prairie Rose is within the range of other facilities in Midwest, ranking fortieth overall (Figure 8). The adjusted fatality estimate for bats may be slightly underestimated at Prairie Rose due to a facility shut down from August 18 to August 28, 2014, which is a period of higher mortality in bats (Johnson 2005, Arnett et al. 2008). Based on the results of this study, risk of collision for bats is low.

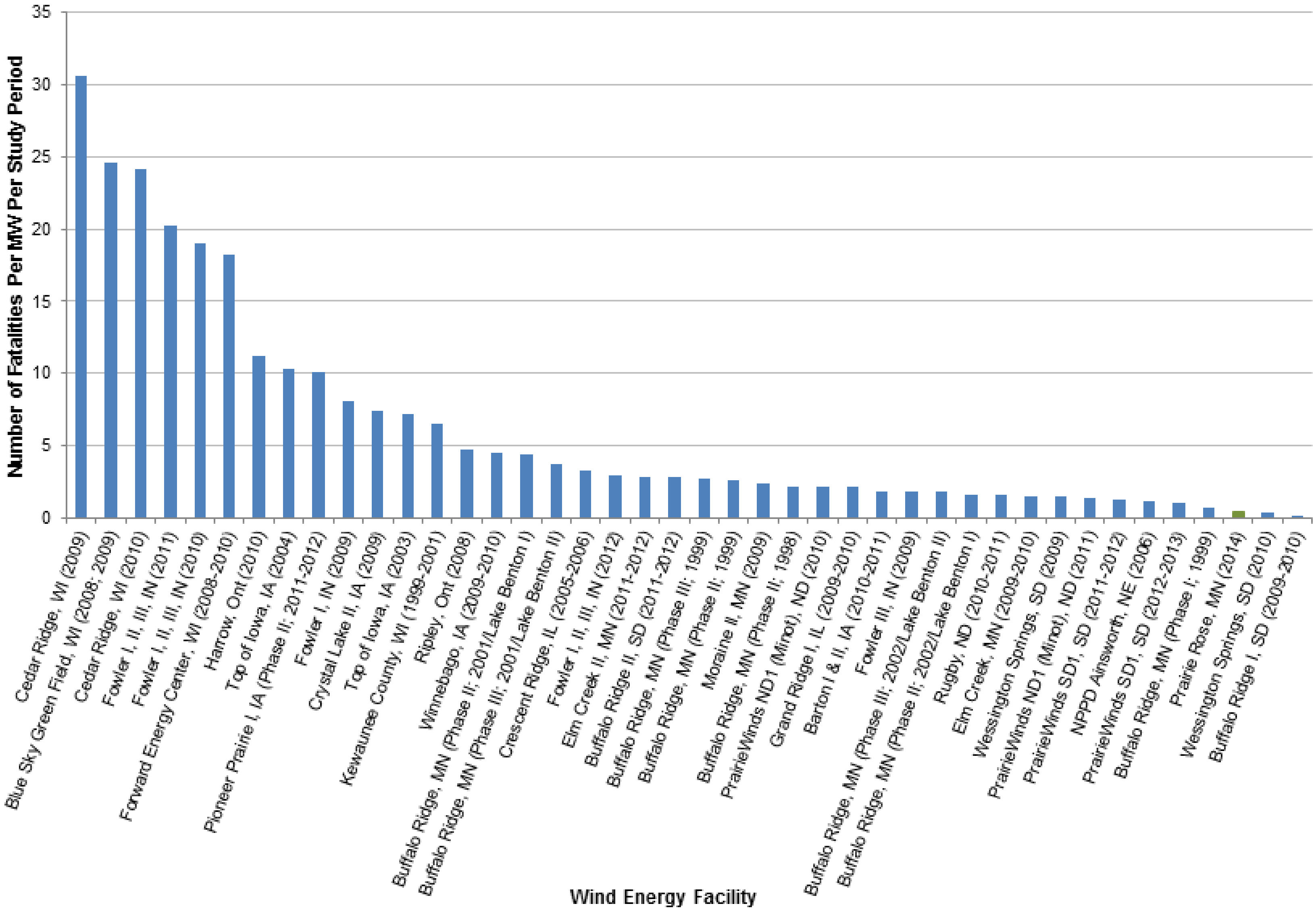

Figure 8. Bat fatality rates from comparable publicly-available studies at Midwest wind energy facilities, with the Prairie Rose Wind Energy Facility highlighted in green.

Figure 8 (*continued*). Bat fatality rates from comparable publicly-available studies at Midwest wind energy facilities, with the Prairie Rose Wind Energy Facility highlighted in green.

Data from the following sources:

Facility, Location	Fatality Reference	Facility, Location	Fatality Reference	Facility, Location	Fatality Reference
Prairie Rose, MN (14)	**This study**				
Cedar Ridge, WI (09)	BHE Environmental 2010	Winnebago, IA (09-10)	Derby et al. 2010e	Fowler III, IN (09)	Johnson et al. 2010b
Blue Sky Green Field, WI (08; 09)	Gruver et al. 2009	Buffalo Ridge, MN (Ph. II; 01/Lake Benton I)	Johnson et al. 2004	Buffalo Ridge, MN (Ph. III; 02/Lake Benton II)	Johnson et al. 2004
Cedar Ridge, WI (10)	BHE Environmental 2011	Buffalo Ridge, MN (Ph. III; 01/Lake Benton II)	Johnson et al. 2004	Buffalo Ridge, MN (Ph. II; 02/Lake Benton I)	Johnson et al. 2004
Fowler I, II, III, IN (11)	Good et al. 2012	Crescent Ridge, IL (05-06)	Kerlinger et al. 2007	Rugby, ND (10-11)	Derby et al. 2011b
Fowler I, II, III, IN (10)	Good et al. 2011	Fowler I, II, III, IN (12)	Good et al. 2013	Elm Creek, MN (09-10)	Derby et al. 2010c
Forward Energy Center, WI (08-10)	Grodsky and Drake 2011	Elm Creek II, MN (11-12)	Derby et al. 2012b	Wessington Springs, SD (09)	Derby et al. 2010f
Harrow, Ont (10)	NRSI 2011	Buffalo Ridge II, SD (11-12)	Derby et al. 2012a	PrairieWinds ND1 (Minot), ND (11)	Derby et al. 2012c
Top of Iowa, IA (04)	Jain 2005	Buffalo Ridge, MN (Ph. III; 99)	Johnson et al. 2000a	PrairieWinds SD1 (Crow Lake), SD (11-12)	Derby et al. 2012d
Pioneer Prairie I, IA (Ph. II; 11-12)	Chodachek et al. 2012	.falo Ridge, MN (Ph. II; 99)	Johnson et al. 2000a	NPPD Ainsworth, NE (06)	Derby et al. 2007
Fowler I, IN (09)	Johnson et al. 2010a	Moraine II, MN (09)	Derby et al. 2010d	PrairieWinds SD1 (Crow Lake), SD (12-13)	Derby et al. 2013a
Crystal Lake II, IA (09)	Derby et al. 2010a	Buffalo Ridge, MN (Ph. II; 98)	Johnson et al. 2000a	Buffalo Ridge, MN (Phase I; 99)	Johnson et al. 2000a
Top of Iowa, IA (03)	Jain 2005	PrairieWinds ND1 (Minot), ND (10)	Derby et al. 2011c	Wessington Springs, SD (10)	Derby et al. 2011d
Kewaunee County, WI (99-01)	Howe et al. 2002	Grand Ridge I, IL (09-10)	Derby et al. 2010g	Buffalo Ridge I, SD (09-10)	Derby et al. 2010b
Ripley, Ont (08)	Jacques Whitford 2009	Barton I & II, IA (10-11)	Derby et al. 2011a		

SUMMARY

The bird and bat fatality rates of (0.44 bird fatalities per MW per study period and 0.41 bat fatalities per MW per study period, respectively) are lower than most of the other facilities in the Midwest. Fatality estimates for both birds and bats may be underestimated due to a power shut down from August 18 to August 28, 2014 for maintenance. Based on the results of this study, overall risk for birds and bats at Prairie Rose is low.

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Appendix A. Complete Bird Fatality Rate Estimations at the Prairie Rose Wind Energy Facility for studies conducted from April 15 to June 13, 2014, and August 15 to October 29, 2014

Appendix B. Complete bird fatality table for the Prairie Rose Wind Energy Facility for studies conducted from April 15 to June 13, 2014, and August 15 to October 29, 2014.

	Spring			Fall		
Parameter	**Mean**	**ll**	**ul**	**Mean**	**ll**	**ul**
Search Area Adjustment						
A (small birds)	1	--	--	1	--	--
A (large birds)	1	--	--	1	--	--
Observer Detection						
A (small birds)	0.70	0.56	0.85	0.70	0.56	0.85
A (large birds)	0.95	0.86	1.0	0.95	0.86	1.0
Mean Carcass Removal Time (days)						
$\bar{t}$ (small birds)	5.4	3.4	7.8	5.4	3.4	7.8
$\bar{t}$ (large birds)	14.3	8.5	23.2	14.3	8.5	23.2
Observed Fatality Rates (Fatalities/turbine/study period)						
Small birds	0.2	0	0.4	0	--	--
Large birds	0.2	0	0.4	0	--	--
Raptors	0.1	0	0.3	0	--	--
Average Probability of Carcass Availability and Detected						
Small birds	0.42	0.27	0.54	0.42	0.27	0.54
Large birds	0.77	0.65	0.85	0.77	0.65	0.85
Adjusted Fatality Estimates (Fatalities/turbine/study period)						
Small birds	0.48	0	1.2	0	--	--
Large birds	0.26	0	0.56	0	--	--
Raptors	0.13	0	0.38	0	--	--
All birds	0.74	0.23	1.49	0	--	--

Appendix B. Complete Bat Fatality Rate Estimations at the Prairie Rose Wind Energy Facility for studies conducted from April 15 to June 13, 2014, and August 15 to October 29, 2014

Appendix B. Complete bat fatality table for the Prairie Rose Wind Energy Facility for studies conducted from April 15 to June 13, 2014, and August 15 to October 29, 2014.

	Spring			Fall		
Parameter	**Mean**	**ll**	**ul**	**Mean**	**ll**	**ul**
Search Area Adjustment						
A (bats)	1	--	--	2.88	2.27	3.45
Observer Detection						
A (bats)	0.70	0.56	0.85	0.70	0.56	0.85
Mean Carcass Removal Time (days)						
$\bar{t}$ (bats)	5.4	3.4	7.8	5.4	3.4	7.8
Observed Fatality Rates (Fatalities/turbine/study period)						
Bats	0	--	--	0.1	0	0.3
Average Probability of Carcass Availability and Detected						
Bats	0.42	0.27	0.54	0.42	0.27	0.54
Adjusted Fatality Estimates (Fatalities/turbine/study period)						
Bats	0	--	--	0.69	0	2.13

Appendix C. North American Fatality Summary Tables

Appendix C1. Wind energy facilities in North America with fatality data for all bird species, by geographic region.

Wind Energy Facility	Fatality Estimate[A]	No. of Turbines	Total MW
Prairie Rose, MN	0.44	119	200
Midwest			
Wessington Springs, SD (2009)	8.25	34	51
Blue Sky Green Field, WI (2008; 2009)	7.17	88	145
Cedar Ridge, WI (2009)	6.55	41	67.6
Buffalo Ridge, MN (Phase III; 1999)	5.93	138	103.5
Moraine II, MN (2009)	5.59	33	49.5
Barton I & II, IA (2010-2011)	5.5	80	160
Buffalo Ridge I, SD (2009-2010)	5.06	24	50.4
Buffalo Ridge, MN (Phase I; 1996)	4.14	73	25
Winnebago, IA (2009-2010)	3.88	10	20
Rugby, ND (2010-2011)	3.82	71	149
Cedar Ridge, WI (2010)	3.72	41	68
Elm Creek II, MN (2011-2012)	3.64	62	148.8
Buffalo Ridge, MN (Phase II; 1999)	3.57	143	107.25
Buffalo Ridge, MN (Phase I; 1998)	3.14	73	25
Ripley, Ont (2008)	3.09	38	76
Fowler I, IN (2009)	2.83	162	301
Buffalo Ridge, MN (Phase I; 1997)	2.51	73	25
Buffalo Ridge, MN (Phase II; 1998)	2.47	143	107.25
PrairieWinds SD1, SD (2012-2013)	2.01	108	162
Buffalo Ridge II, SD (2011-2012)	1.99	105	210
Kewaunee County, WI (1999-2001)	1.95	31	20.46
NPPD Ainsworth, NE (2006)	1.63	36	20.5
PrairieWinds ND1 (Minot), ND (2011)	1.56	80	115.5
Elm Creek, MN (2009-2010)	1.55	67	100
PrairieWinds ND1 (Minot), ND (2010)	1.48	80	115.5
Buffalo Ridge, MN (Phase I; 1999)	1.43	73	25
PrairieWinds SD1, SD (2011-2012)	1.41	108	162
Wessington Springs, SD (2010)	0.89	34	51
Top of Iowa, IA (2004)	0.81	89	80
Grand Ridge I, IL (2009-2010)	0.48	66	99
Top of Iowa, IA (2003)	0.42	89	80
Pioneer Prairie I, IA (Phase II; 2011-2012)	0.27	62	102.3
Northeast			
Criterion, MD (2011)	6.4	28	70
Mount Storm, WV (2011)	4.24	132	264
Mount Storm, WV (2009)	3.85	132	264
Lempster, NH (2009)	3.38	12	24
Casselman, PA (2009)	2.88	23	34.5
Mountaineer, WV (2003)	2.69	44	66
Stetson Mountain I, ME (2009)	2.68	38	57
Noble Ellenburg, NY (2009)	2.66	54	80
Lempster, NH (2010)	2.64	12	24
Mount Storm, WV (2010)	2.6	132	264
Maple Ridge, NY (2007)	2.34	195	321.75
Noble Bliss, NY (2009)	2.28	67	100
Criterion, MD (2012)	2.14	28	70
Maple Ridge, NY (2007-2008)	2.07	195	321.75
Noble Altona, NY (2010)	1.84	65	97.5

Appendix C1. Wind energy facilities in North America with fatality data for all bird species, by geographic region.

Wind Energy Facility	Fatality Estimate[A]	No. of Turbines	Total MW
Mars Hill, ME (2008)	1.76	28	42
High Sheldon, NY (2010)	1.76	75	112.5
Noble Wethersfield, NY (2010)	1.7	84	126
Mars Hill, ME (2007)	1.67	28	42
Noble Chateaugay, NY (2010)	1.66	71	106.5
Noble Clinton, NY (2008)	1.59	67	100
High Sheldon, NY (2011)	1.57	75	112.5
Casselman, PA (2008)	1.51	23	34.5
Munnsville, NY (2008)	1.48	23	34.5
Stetson Mountain II, ME (2010)	1.42	17	25.5
Cohocton/Dutch Hill, NY (2009)	1.39	50	125
Cohocton/Dutch Hills, NY (2010)	1.32	50	125
Noble Bliss, NY (2008)	1.3	67	100
Beech Ridge, WV (2012)	1.19	67	100.5
Stetson Mountain I, ME (2011)	1.18	38	57
Noble Clinton, NY (2009)	1.11	67	100
Locust Ridge, PA (Phase II; 2009)	0.84	51	102
Noble Ellenburg, NY (2008)	0.83	54	80
Locust Ridge, PA (Phase II; 2010)	0.76	51	102
Southeast			
Buffalo Mountain, TN (2000-2003)	11.02	3	1.98
Buffalo Mountain, TN (2005)	1.1	18	28.98
Southern Plains			
Buffalo Gap I, TX (2006)	1.32	67	134
Barton Chapel, TX (2009-2010)	1.15	60	120
Buffalo Gap II, TX (2007-2008)	0.15	155	233
Big Smile, OK (2012-2013)	0.09	66	132
Red Hills, OK (2012-2013)	0.08	82	123
Rocky Mountains			
Foote Creek Rim, WY (Phase I; 1999)	3.4	69	41.4
Foote Creek Rim, WY (Phase I; 2000)	2.42	69	41.4
Foote Creek Rim, WY (Phase I; 2001-2002)	1.93	69	41.4
Summerview, Alb (2005-2006)	1.06	39	70.2
Southwest			
Dry Lake I, AZ (2009-2010)	2.02	30	63
Dry Lake II, AZ (2011-2012)	1.57	31	65
California			
Pine Tree, CA (2009-2010)	8.3	90	135
Alta Wind I, CA (2011-2012)	7.07	100	150
Shiloh I, CA (2006-2009)	6.96	100	150
Dillon, CA (2008-2009)	4.71	45	45
Diablo Winds, CA (2005-2007)	4.29	31	20.46
Alta Wind II-V, CA (2011-2012)	1.66	190	570
High Winds, CA (2003-2004)	1.62	90	162
Shiloh II, CA (2009-2010)	1.51	75	150
High Winds, CA (2004-2005)	1.1	90	162
Alite, CA (2009-2010)	0.55	8	24

Appendix C1. Wind energy facilities in North America with fatality data for all bird species, by geographic region.

Wind Energy Facility	Fatality Estimate[A]	No. of Turbines	Total MW
Pacific Northwest			
Windy Flats, WA (2010-2011)	8.45	114	262.2
Leaning Juniper, OR (2006-2008)	6.66	67	100.5
Linden Ranch, WA (2010-2011)	6.65	25	50
Biglow Canyon, OR (Phase II; 2009-2010)	5.53	65	150
White Creek, WA (2007-2011)	4.05	89	204.7
Tuolumne (Windy Point I), WA (2009-2010)	3.2	62	136.6
Stateline, OR/WA (2001-2002)	3.17	454	299
Klondike II, OR (2005-2006)	3.14	50	75
Klondike III (Phase I), OR (2007-2009)	3.02	125	223.6
Hopkins Ridge, WA (2008)	2.99	87	156.6
Harvest Wind, WA (2010-2012)	2.94	43	98.9
Nine Canyon, WA (2002-2003)	2.76	37	48.1
Biglow Canyon, OR (Phase II; 2010-2011)	2.68	65	150
Stateline, OR/WA (2003)	2.68	454	299
Klondike IIIa (Phase II), OR (2008-2010)	2.61	51	76.5
Combine Hills, OR (Phase I; 2004-2005)	2.56	41	41
Big Horn, WA (2006-2007)	2.54	133	199.5
Biglow Canyon, OR (Phase I; 2009)	2.47	76	125.4
Combine Hills, OR (2011)	2.33	104	104
Biglow Canyon, OR (Phase III; 2010-2011)	2.28	76	174.8
Hay Canyon, OR (2009-2010)	2.21	48	100.8
Elkhorn, OR (2010)	1.95	61	101
Pebble Springs, OR (2009-2010)	1.93	47	98.7
Biglow Canyon, OR (Phase I; 2008)	1.76	76	125.4
Wild Horse, WA (2007)	1.55	127	229
Goodnoe, WA (2009-2010)	1.4	47	94
Vantage, WA (2010-2011)	1.27	60	90
Hopkins Ridge, WA (2006)	1.23	83	150
Stateline, OR/WA (2006)	1.23	454	299
Kittitas Valley, WA (2011-2012)	1.06	48	100.8
Klondike, OR (2002-2003)	0.95	16	24
Vansycle, OR (1999)	0.95	38	24.9
Elkhorn, OR (2008)	0.64	61	101
Marengo I, WA (2009-2010)	0.27	78	140.4
Marengo II, WA (2009-2010)	0.16	39	70.2

A=number of bird fatalities/MW/year

Appendix C1 (*continued*). Wind energy facilities in North America with fatality data for all bird species.

Data from the following sources:

Wind Energy Facility	Fatality Estimate Reference	Wind Energy Facility	Fatality Estimate Reference
Alite, CA (09-10)	Chatfield et al. 2010	Klondike II, OR (05-06)	NWC and WEST 2007
Alta Wind I, CA (11-12)	Chatfield et al. 2012	Klondike III, OR (Phase I; 07-09)	Gritski et al. 2010
Alta Wind II-V, CA (11-12)	Chatfield et al. 2012	Klondike IIIa, OR (Phase II; 08-10)	Gritski et al. 2011
Barton I & II, IA (10-11)	Derby et al. 2011a	Leaning Juniper, OR (06-08)	Gritski et al. 2008
Barton Chapel, TX (09-10)	WEST 2011	Lempster, NH (09)	Tidhar et al. 2010
Beech Ridge, WV (12)	Tidhar et al. 2013	Lempster, NH (10)	Tidhar et al. 2011
Big Horn, WA (06-07)	Kronner et al. 2008	Linden Ranch, WA (10-11)	Enz and Bay 2011
Big Smile, OK (12-13)	Derby et al. 2013b	Locust Ridge, PA (Phase II; 09)	Arnett et al. 2011
Biglow Canyon, OR (Phase I; 08)	Jeffrey et al. 2009a	Locust Ridge, PA (Phase II; 10)	Arnett et al. 2011
Biglow Canyon, OR (Phase I; 09)	Enk et al. 2010	Maple Ridge, NY (07)	Jain et al. 2009a
Biglow Canyon, OR (Phase II; 09-10)	Enk et al. 2011a	Maple Ridge, NY (07-08)	Jain et al. 2009d
Biglow Canyon, OR (Phase II; 10-11)	Enk et al. 2012b	Marengo I, WA (09-10)	URS Corporation 2010b
Biglow Canyon, OR (Phase III; 10-11)	Enk et al. 2012a	Marengo II, WA (09-10)	URS Corporation 2010c
Blue Sky Green Field, WI (08; 09)	Gruver et al. 2009	Mars Hill, ME (07)	Stantec 2008
Buffalo Gap I, TX (06)	Tierney 2007	Mars Hill, ME (08)	Stantec 2009a
Buffalo Gap II, TX (07-08)	Tierney 2009	Moraine II, MN (09)	Derby et al. 2010d
Buffalo Mountain, TN (00-03)		Mount Storm, WV (09)	Young et al. 2009a, 2010b
Buffalo Mountain, TN (05)	Fiedler et al. 2007	Mount Storm, WV (10)	Young et al. 2010a, 2011b
Buffalo Ridge, MN (Phase I; 96)	Johnson et al. 2000a	Mount Storm, WV (11)	Young et al. 2011a, 2012b
Buffalo Ridge, MN (Phase I; 97)	Johnson et al. 2000a	Mountaineer, WV (03)	Kerns and Kerlinger 2004
Buffalo Ridge, MN (Phase I; 98)	Johnson et al. 2000a	Munnsville, NY (08)	Stantec 2009b
Buffalo Ridge, MN (Phase I; 99)	Johnson et al. 2000a	Nine Canyon, WA (02-03)	Erickson et al. 2003b
Buffalo Ridge, MN (Phase II; 98)	Johnson et al. 2000a	Noble Altona, NY (10)	Jain et al. 2011b
Buffalo Ridge, MN (Phase II; 99)	Johnson et al. 2000a	Noble Bliss, NY (08)	Jain et al. 2009e
Buffalo Ridge, MN (Phase III; 99)	Johnson et al. 2000a	Noble Bliss, NY (09)	Jain et al. 2010a
Buffalo Ridge I, SD (09-10)	Derby et al. 2010b	Noble Chateaugay, NY (10)	Jain et al. 2011c
Buffalo Ridge II, SD (11-12)	Derby et al. 2012a	Noble Clinton, NY (08)	Jain et al. 2009c
Casselman, PA (08)	Arnett et al. 2009a	Noble Clinton, NY (09)	Jain et al. 2010b
Casselman, PA (09)	Arnett et al. 2010	Noble Ellenburg, NY (08)	Jain et al. 2009b
Cedar Ridge, WI (09)	BHE Environmental 2010	Noble Ellenburg, NY (09)	Jain et al. 2010c
Cedar Ridge, WI (10)	BHE Environmental 2011	Noble Wethersfield, NY (10)	Jain et al. 2011a
Cohocton/Dutch Hill, NY (09)	Stantec 2010	NPPD Ainsworth, NE (06)	Derby et al. 2007
Cohocton/Dutch Hill, NY (10)	Stantec 2011	Pebble Springs, OR (09-10)	Gritski and Kronner 2010b
Combine Hills, OR (Ph. I; 04-05)	Young et al. 2006	Pine Tree, CA (09-10)	BioResource Consultants 2010
Combine Hills, OR (11)	Enz et al. 2012	Pioneer Prairie I, IA (Phase II; 11-12)	Chodachek et al. 2012
Criterion, MD (11)	Young et al. 2012a	PrairieWinds ND1 (Minot), ND (10)	Derby et al. 2011c
Criterion, MD (12)	Young et al. 2013	PrairieWinds ND1 (Minot), ND (11)	Derby et al. 2012c
Diablo Winds, CA (05-07)	WEST 2006, 2008	PrairieWinds SD1 (Crow Lake), SD (11-12)	Derby et al. 2012d
Dillon, CA (08-09)	Chatfield et al. 2009	PrairieWinds SD1 (Crow Lake), SD (12-13)	Derby et al. 2013a
Dry Lake I, AZ (09-10)	Thompson et al. 2011	Red Hills, OK (12-13)	Derby et al. 2013c
Dry Lake II, AZ (11-12)	Thompson and Bay 2012	Ripley, Ont (08)	Jacques Whitford 2009
Elkhorn, OR (08)	Jeffrey et al. 2009b	Rugby, ND (10-11)	Derby et al. 2011b
Elkhorn, OR (10)	Enk et al. 2011b	Shiloh I, CA (06-09)	Kerlinger et al. 2009
Elm Creek, MN (09-10)	Derby et al. 2010c	Shiloh II, CA (09-10)	Kerlinger et al. 2010b
Elm Creek II, MN (11-12)	Derby et al. 2012b	Stateline, OR/WA (01-02)	Erickson et al. 2004
Foote Creek Rim, WY (Phase I; 99)	Young et al. 2003b	Stateline, OR/WA (03)	Erickson et al. 2004
Foote Creek Rim, WY (Phase I; 00)	Young et al. 2003b	Stateline, OR/WA (06)	Erickson et al. 2007
Foote Creek Rim, WY (Ph. I; 01-02)	Young et al. 2003b	Stetson Mountain I, ME (09)	Stantec 2009c
Fowler I, IN (09)	Johnson et al. 2010a	Stetson Mountain I, ME (11)	Normandeau Associates 2011
Goodnoe, WA (09-10)	URS Corporation 2010a	Stetson Mountain II, ME (10)	Normandeau Associates 2010
Grand Ridge, IL (09-10)	Derby et al. 2010g	Summerview, Alb (05-06)	Brown and Hamilton 2006b
Harvest Wind, WA (10-12)	Downes and Gritski 2012a	Top of Iowa, IA (03)	Jain 2005
Hay Canyon, OR (09-10)	Gritski and Kronner 2010a	Top of Iowa, IA (04)	Jain 2005
High Sheldon, NY (10)	Tidhar et al. 2012a	Tuolumne (Windy Point I), WA (09-10)	Enz and Bay 2010
High Sheldon, NY (11)	Tidhar et al. 2012b	Vansycle, OR (99)	Erickson et al. 2000b
High Winds, CA (03-04)	Kerlinger et al. 2006	Vantage, WA (10-11)	Ventus 2012
High Winds, CA (04-05)	Kerlinger et al. 2006	Wessington Springs, SD (09)	Derby et al. 2010f
Hopkins Ridge, WA (06)	Young et al. 2007	Wessington Springs, SD (10)	Derby et al. 2011d
Hopkins Ridge, WA (08)	Young et al. 2009c	White Creek, WA (07-11)	Downes and Gritski 2012b
Kewaunee County, WI (99-01)	Howe et al. 2002	Wild Horse, WA (07)	Erickson et al. 2008
Kittitas Valley, WA (11-12)	Stantec 2012	Windy Flats, WA (10-11)	Enz et al. 2011
Klondike, OR (02-03)	Johnson et al. 2003b	Winnebago, IA (09-10)	Derby et al. 2010e

Appendix C2. Wind energy facilities in North America with fatality data for raptors, by geographic region.

Wind Energy Facility	Use Estimate[A]	Raptor Fatality Estimate[B]	No. of Turbines	Total MW
Prairie Rose, MN	**NA**	**0.08**	**119**	**200**
	Midwest			
Buffalo Ridge, MN (Phase I; 1999)	NA	0.47	73	25
Moraine II, MN (2009)	NA	0.37	33	49.5
Winnebago, IA (2009-2010)	NA	0.27	10	20
Buffalo Ridge I, SD (2009-2010)	NA	0.2	24	50.4
Cedar Ridge, WI (2009)	NA	0.18	41	67.6
Top of Iowa, IA (2004)	NA	0.17	89	80
Cedar Ridge, WI (2010)	NA	0.13	41	68
Ripley, Ont (2008)	NA	0.1	38	76
Wessington Springs, SD (2010)	0.232	0.07	34	51
NPPD Ainsworth, NE (2006)	NA	0.06	36	20.5
Wessington Springs, SD (2009)	0.232	0.06	34	51
Rugby, ND (2010-2011)	NA	0.06	71	149
PrairieWinds ND1 (Minot), ND (2011)	NA	0.05	80	115.5
PrairieWinds ND1 (Minot), ND (2010)	NA	0.05	80	115.5
PrairieWinds SD1, SD (2012-2013)	NA	0.03	108	162
Kewaunee County, WI (1999-2001)	NA	0	31	20.46
Buffalo Ridge, MN (Phase I; 1996)	NA	0	73	25
Buffalo Ridge, MN (Phase I; 1997)	NA	0	73	25
Buffalo Ridge, MN (Phase I; 1998)	NA	0	73	25
Top of Iowa, IA (2003)	NA	0	89	80
Grand Ridge I, IL (2009-2010)	0.195	0	66	99
Elm Creek, MN (2009-2010)	NA	0	67	100
Pioneer Prairie I, IA (Phase II; 2011-2012)	NA	0	62	102.3
Buffalo Ridge, MN (Phase III; 1999)	NA	0	138	103.5
Buffalo Ridge, MN (Phase II; 1998)	NA	0	143	107.25
Buffalo Ridge, MN (Phase II; 1999)	NA	0	143	107.25
Blue Sky Green Field, WI (2008; 2009)	NA	0	88	145
Elm Creek II, MN (2011-2012)	NA	0	62	148.8
Barton I & II, IA (2010-2011)	NA	0	80	160
PrairieWinds SD1, SD (2011-2012)	NA	0	108	162
Buffalo Ridge II, SD (2011-2012)	NA	0	105	210
Fowler I, IN (2009)	NA	0	162	301
	Northeast			
Munnsville, NY (2008)	NA	0.59	23	34.5
Noble Ellenburg, NY (2009)	NA	0.25	54	80
Noble Clinton, NY (2009)	NA	0.16	67	100
Noble Wethersfield, NY (2010)	NA	0.13	84	126
Noble Bliss, NY (2009)	NA	0.12	67	100
Noble Ellenburg, NY (2008)	NA	0.11	54	80
Noble Bliss, NY (2008)	NA	0.1	67	100
Noble Clinton, NY (2008)	NA	0.1	67	100
Mount Storm, WV (2010)	NA	0.1	132	264
Noble Chateaugay, NY (2010)	NA	0.08	71	106.5
Cohocton/Dutch Hills, NY (2010)	NA	0.08	50	125
Mountaineer, WV (2003)	NA	0.07	44	66
High Sheldon, NY (2010)	NA	0.06	75	112.5
Mount Storm, WV (2011)	NA	0.03	132	264

Appendix C2. Wind energy facilities in North America with fatality data for raptors, by geographic region.

Wind Energy Facility	Use Estimate[A]	Raptor Fatality Estimate[B]	No. of Turbines	Total MW
Maple Ridge, NY (2007-2008)	NA	0.03	195	321.75
Criterion, MD (2011)	NA	0.02	28	70
Beech Ridge, WV (2012)	NA	0.01	67	100.5
Lempster, NH (2009)	NA	0	12	24
Lempster, NH (2010)	NA	0	12	24
Stetson Mountain II, ME (2010)	NA	0	17	25.5
Casselman, PA (2009)	NA	0	23	34.5
Casselman, PA (2008)	NA	0	23	34.5
Mars Hill, ME (2007)	NA	0	28	42
Mars Hill, ME (2008)	NA	0	28	42
Stetson Mountain I, ME (2011)	NA	0	38	57
Stetson Mountain I, ME (2009)	NA	0	38	57
Noble Altona, NY (2010)	NA	0	65	97.5
Locust Ridge, PA (Phase II; 2009)	NA	0	51	102
Locust Ridge, PA (Phase II; 2010)	NA	0	51	102
High Sheldon, NY (2011)	NA	0	75	112.5
Cohocton/Dutch Hill, NY (2009)	NA	0	50	125
Mount Storm, WV (2009)	NA	0	132	264
Southeast				
Buffalo Mountain, TN (2000-2003)	NA	0	3	1.98
Buffalo Mountain, TN (2005)	NA	0	18	28.98
Southern Plains				
Barton Chapel, TX (2009-2010)	NA	0.25	60	120
Buffalo Gap I, TX (2006)	NA	0.1	67	134
Red Hills, OK (2012-2013)	NA	0.04	82	123
Big Smile, OK (2012-2013)	NA	0	66	132
Buffalo Gap II, TX (2007-2008)	NA	0	155	233
Rocky Mountains				
Summerview, Alb (2005-2006)	NA	0.11	39	70.2
Foote Creek Rim, WY (Phase I; 1999)	0.554	0.08	69	41.4
Foote Creek Rim, WY (Phase I; 2000)	0.554	0.05	69	41.4
Foote Creek Rim, WY (Phase I; 2001-2002)	0.554	0	69	41.4
Southwest				
Dry Lake I, AZ (2009-2010)	0.13	0	30	63
Dry Lake II, AZ (2011-2012)	NA	0	31	65
California				
High Winds, CA (2003-2004)	2.337	0.5	90	162
Shiloh I, CA (2006-2009)	NA	0.42	100	150
Diablo Winds, CA (2005-2007)	2.161	0.4	31	20.46
High Winds, CA (2004-2005)	2.337	0.28	90	162
Alta Wind I, CA (2011-2012)	0.19	0.27	100	150
Pine Tree, CA (2009-2010)	NA	0.133	90	135
Alite, CA (2009-2010)	NA	0.12	8	24
Shiloh II, CA (2009-2010)	NA	0.12	75	150
Alta Wind II-V, CA (2011-2012)	0.04	0.05	190	570
Dillon, CA (2008-2009)	NA	0	45	45

Appendix C2. Wind energy facilities in North America with fatality data for raptors, by geographic region.

Wind Energy Facility	Use Estimate[A]	Raptor Fatality Estimate[B]	No. of Turbines	Total MW
		Pacific Northwest		
White Creek, WA (2007-2011)	NA	0.47	89	204.7
Vantage, WA (2010-2011)	NA	0.29	60	90
Tuolumne (Windy Point I), WA (2009-2010)	0.77	0.29	62	136.6
Linden Ranch, WA (2010-2011)	NA	0.27	25	50
Harvest Wind, WA (2010-2012)	NA	0.23	43	98.9
Goodnoe, WA (2009-2010)	NA	0.17	47	94
Leaning Juniper, OR (2006-2008)	0.522	0.16	67	100.5
Klondike III (Phase I), OR (2007-2009)	NA	0.15	125	223.6
Hopkins Ridge, WA (2006)	0.698	0.14	83	150
Biglow Canyon, OR (Phase II; 2009-2010)	0.318	0.14	65	150
Big Horn, WA (2006-2007)	0.511	0.11	133	199.5
Stateline, OR/WA (2006)	0.478	0.11	454	299
Kittitas Valley, WA (2011-2012)	NA	0.09	48	100.8
Wild Horse, WA (2007)	0.291	0.09	127	229
Stateline, OR/WA (2001-2002)	0.478	0.09	454	299
Stateline, OR/WA (2003)	0.478	0.09	454	299
Elkhorn, OR (2010)	1.07	0.08	61	101
Hopkins Ridge, WA (2008)	0.698	0.07	87	156.6
Klondike II, OR (2005-2006)	0.504	0.06	50	75
Klondike IIIa (Phase II), OR (2008-2010)	NA	0.06	51	76.5
Elkhorn, OR (2008)	1.07	0.06	61	101
Marengo II, WA (2009-2010)	NA	0.05	39	70.2
Combine Hills, OR (2011)	0.746	0.05	104	104
Biglow Canyon, OR (Phase III; 2010-2011)	0.318	0.05	76	174.8
Pebble Springs, OR (2009-2010)	NA	0.04	47	98.7
Windy Flats, WA (2010-2011)	NA	0.04	114	262.2
Nine Canyon, WA (2002-2003)	0.35	0.03	37	48.1
Biglow Canyon, OR (Phase I; 2008)	0.318	0.03	76	125.4
Biglow Canyon, OR (Phase II; 2010-2011)	0.318	0.03	65	150
Klondike, OR (2002-2003)	0.504	0	16	24
Vansycle, OR (1999)	0.66	0	38	24.9
Combine Hills, OR (Phase I; 2004-2005)	0.746	0	41	41
Hay Canyon, OR (2009-2010)	NA	0	48	100.8
Biglow Canyon, OR (Phase I; 2009)	0.318	0	76	125.4
Marengo I, WA (2009-2010)	NA	0	78	140.4

A=number of raptors/plot/20min survey
B=number of fatalities/MW/year

Appendix C2 (*continued*). Wind energy facilities in North America with use and fatality data for raptors.

Data from the following sources:

Facility	Use Reference	Fatality Reference	Facility	Use Reference	Fatality Reference
Alite, CA (09-10)	NA	Chatfield et al. 2010	Klondike II, OR (05-06)	Johnson et al. 2002	NWC and WEST 2007
Alta Wind I, CA (11-12)	Erickson and Chatfield 2009	Chatfield et al. 2012	Klondike III (Phase I), OR (07-09)	NA	Gritski et al. 2010
Alta Wind II-V, CA (11-12)	Erickson and Chatfield 2009	Chatfield et al. 2012	Klondike IIIa (Phase II), OR (08-10)	NA	Gritski et al. 2011
Barton I & II, IA (10-11)	NA	Derby et al. 2011a	Leaning Juniper, OR (06-08)	Kronner et al. 2005	Gritski et al. 2008
Barton Chapel, TX (09-10)	NA	WEST 2011	Lempster, NH (09)	NA	Tidhar et al. 2010
Beech Ridge, WV (12)	NA	Tidhar et al. 2013	Lempster, NH (10)	NA	Tidhar et al. 2011
Big Horn, WA (06-07)	Johnson and Erickson 2004	Kronner et al. 2008	Linden Ranch, WA (10-11)	NA	Enz and Bay 2011
Big Smile, OK (12-13)	NA	Derby et al. 2013b	Locust Ridge, PA (Phase II; 09)	NA	Arnett et al. 2011
Biglow Canyon, OR (Phase I; 08)	WEST 2005b	Jeffrey et al. 2009a	Locust Ridge, PA (Phase II; 10)	NA	Arnett et al. 2011
Biglow Canyon, OR (Phase I; 09)	WEST 2005b	Enk et al. 2010	Maple Ridge, NY (07-08)	NA	Jain et al. 2009d
Biglow Canyon, OR (Phase II; 09-10)	WEST 2005b	Enk et al. 2011a	Marengo I, WA (09-10)	NA	URS Corporation 2010b
Biglow Canyon, OR (Phase II; 10-11)	WEST 2005b	Enk et al. 2012b	Marengo II, WA (09-10)	NA	URS Corporation 2010c
Biglow Canyon, OR (Phase III; 10-11)	WEST 2005b	Enk et al. 2012a	Mars Hill, ME (07)	NA	Stantec 2008
Blue Sky Green Field, WI (08; 09)	NA	Gruver et al. 2009	Mars Hill, ME (08)	NA	Stantec 2009a
Buffalo Gap I, TX (06)	NA	Tierney 2007	Moraine II, MN (09)	NA	Derby et al. 2010d
Buffalo Gap II, TX (07-08)	NA	Tierney 2009	Mount Storm, WV (09)	NA	Young et al. 2009a, 2010b
Buffalo Mountain, TN (00-03)	NA	Nicholson et al. 2005	Mount Storm, WV (10)	NA	Young et al. 2010a, 2011b
Buffalo Mountain, TN (05)	NA	Fiedler et al. 2007	Mount Storm, WV (11)	NA	Young et al. 2011a, 2012b
Buffalo Ridge, MN (Phase I; 96)	NA	Johnson et al. 2000a	Mountaineer, WV (03)	NA	Kerns and Kerlinger 2004
Buffalo Ridge, MN (Phase I; 97)	NA	Johnson et al. 2000a	Munnsville, NY (08)	NA	Stantec 2009b
Buffalo Ridge, MN (Phase I; 98)	NA	Johnson et al. 2000a	Nine Canyon, WA (02-03)	Erickson et al. 2001	Erickson et al. 2003b
Buffalo Ridge, MN (Phase I; 99)	NA	Johnson et al. 2000a	Noble Altona, NY (10)	NA	Jain et al. 2011b
Buffalo Ridge, MN (Phase II; 98)	NA	Johnson et al. 2000a	Noble Bliss, NY (08)	NA	Jain et al. 2009e
Buffalo Ridge, MN (Phase II; 99)	NA	Johnson et al. 2000a	Noble Bliss, NY (09)	NA	Jain et al. 2010a
Buffalo Ridge, MN (Phase III; 99)	NA	Johnson et al. 2000a	Noble Chateaugay, NY (10)	NA	Jain et al. 2011c
Buffalo Ridge I, SD (09-10)	NA	Derby et al. 2010b	Noble Clinton, NY (08)	NA	Jain et al. 2009c
Buffalo Ridge II, SD (11-12)	NA	Derby et al. 2012a	Noble Clinton, NY (09)	NA	Jain et al. 2010b
Casselman, PA (08)	NA	Arnett et al. 2009a	Noble Ellenburg, NY (08)	NA	Jain et al. 2009b
Casselman, PA (09)	NA	Arnett et al. 2010	Noble Ellenburg, NY (09)	NA	Jain et al. 2010c
Cedar Ridge, WI (09)	NA	BHE Environmental 2010	Noble Wethersfield, NY (10)	NA	Jain et al. 2011a
Cedar Ridge, WI (10)	NA	BHE Environmental 2011	NPPD Ainsworth, NE (06)	NA	Derby et al. 2007
Cohocton/Dutch Hill, NY (09)	NA	Stantec 2010	Pebble Springs, OR (09-10)	NA	Gritski and Kronner 2010b
Cohocton/Dutch Hills, NY (10)	NA	Stantec 2011	Pine Tree, CA (09-10)	NA	BioResource Consultants 2010
Combine Hills, OR (Phase I; 04-05)	Young et al. 2003c	Young et al. 2006	Pioneer Prairie I, IA (Phase II; 11-12)	NA	Chodachek et al. 2012
Combine Hills, OR (11)	Young et al. 2003c	Enz et al. 2012	PrairieWinds ND1 (Minot), ND (10)	NA	Derby et al. 2011c
Criterion, MD (11)	NA	Young et al. 2012a	PrairieWinds ND1 (Minot), ND (11)	NA	Derby et al. 2012c
Diablo Winds, CA (05-07)	WEST 2006, 2008	WEST 2006, 2008	PrairieWinds SD1 (Crow Lake), SD (11-12)	NA	Derby et al. 2012d
Dillon, CA (08-09)	NA	Chatfield et al. 2009	PrairieWinds SD1 (Crow Lake), SD (12-13)	NA	Derby et al. 2013a
Dry Lake I, AZ (09-10)	Thompson et al. 2011	Thompson et al. 2011	Red Hills, OK (12-13)	NA	Derby et al. 2013c
Dry Lake II, AZ (11-12)	NA	Thompson and Bay 2012	Ripley, Ont (08)	NA	Jacques Whitford 2009

Appendix C2 (*continued*). Wind energy facilities in North America with use and fatality data for raptors.

Data from the following sources:

Facility	Use Reference	Fatality Reference	Facility	Use Reference	Fatality Reference
Elkhorn, OR (08)	WEST 2005a	Jeffrey et al. 2009b	Rugby, ND (10-11)	NA	Derby et al. 2011b
Elkhorn, OR (10)	WEST 2005a	Enk et al. 2011b	Shiloh I, CA (06-09)	NA	Kerlinger et al. 2009
Elm Creek, MN (09-10)	NA	Derby et al. 2010c	Shiloh II, CA (09-10)	NA	Kerlinger et al. 2010b
Elm Creek II, MN (11-12)	NA	Derby et al. 2012b	Stateline, OR/WA (01-02)	Erickson et al. 2003a	Erickson et al. 2004
Foote Creek Rim, WY (Phase I; 99)	Johnson et al. 2000b	Young et al. 2003b	Stateline, OR/WA (03)	Erickson et al. 2003a	Erickson et al. 2004
Foote Creek Rim, WY (Phase I; 00)	Johnson et al. 2000b	Young et al. 2003b	Stateline, OR/WA (06)	Erickson et al. 2003a	Erickson et al. 2007
Foote Creek Rim, WY (Phase I; 01-02)	Johnson et al. 2000b	Young et al. 2003b	Stetson Mountain I, ME (09)	NA	Stantec 2009c
Fowler I, IN (09)	NA	Johnson et al. 2010a	Stetson Mountain I, ME (11)	NA	Normandeau Associates 2011
Goodnoe, WA (09-10)	NA	URS Corporation 2010a	Stetson Mountain II, ME (10)	NA	Normandeau Associates 2010
Grand Ridge I, IL (09-10)	Derby et al. 2009	Derby et al. 2010g	Summerview, Alb (05-06)	NA	Brown and Hamilton 2006b
Harvest Wind, WA (10-12)	NA	Downes and Gritski 2012a	Top of Iowa, IA (03)	NA	Jain 2005
Hay Canyon, OR (09-10)	NA	Gritski and Kronner 2010a	Top of Iowa, IA (04)	NA	Jain 2005
High Sheldon, NY (10)	NA	Tidhar et al. 2012a	Tuolumne (Windy Point I), WA (09-10)	Johnson et al. 2006	Enz and Bay 2010
High Sheldon, NY (11)	NA	Tidhar et al. 2012b	Vansycle, OR (99)	WCIA and WEST 1997	Erickson et al. 2000b
High Winds, CA (03-04)	Kerlinger et al. 2005	Kerlinger et al. 2006	Vantage, WA (10-11)	NA	Ventus 2012
High Winds, CA (04-05)	Kerlinger et al. 2005	Kerlinger et al. 2006	Wessington Springs, SD (09)	Derby et al. 2008	Derby et al. 2010f
Hopkins Ridge, WA (06)	Young et al. 2003a	Young et al. 2007	Wessington Springs, SD (10)	Derby et al. 2008	Derby et al. 2011d
Hopkins Ridge, WA (08)	Young et al. 2003a	Young et al. 2009c	White Creek, WA (07-11)	NA	Downes and Gritski 2012b
Kewaunee County, WI (99-01)	NA	Howe et al. 2002	Wild Horse, WA (07)	Erickson et al. 2003c	Erickson et al. 2008
Kittitas Valley, WA (11-12)	NA	Stantec 2012	Windy Flats, WA (10-11)	NA	Enz et al. 2011
Klondike, OR (02-03)	Johnson et al. 2002	Johnson et al. 2003b	Winnebago, IA (09-10)	NA	Derby et al. 2010e

Appendix C3. Wind energy facilities in North America with comparable activity and fatality data for bats, separated by geographic region.

Wind Energy Facility	Bat Activity Estimate[A]	Bat Activity Dates	Fatality Estimate[B]	No. of Turbines	Total MW
Prairie Rose, MN	**NA**	**NA**	**0.41**	**119**	**200**
	Midwest				
Cedar Ridge, WI (2009)	9.97[C,D,E,F]	7/16/07-9/30/07	30.61	41	67.6
Blue Sky Green Field, WI (2008; 2009)	7.7[E]	7/24/07-10/29/07	24.57	88	145
Cedar Ridge, WI (2010)	9.97 [C,D,E,F]	7/16/07-9/30/07	24.12	41	68
Fowler I, II, III, IN (2011)	NA	NA	20.19	355	600
Fowler I, II, III, IN (2010)	NA	NA	18.96	355	600
Forward Energy Center, WI (2008-2010)	6.97	8/5/08-11/08/08	18.17	86	129
Harrow, Ont (2010)	NA	NA	11.13	24 (four 6-turb facilities)	39.6
Top of Iowa, IA (2004)	35.7	5/26/04-9/24/04	10.27	89	80
Pioneer Prairie I, IA (Phase II; 2011-2012)	NA	NA	10.06	62	102.3
Fowler I, IN (2009)	NA	NA	8.09	162	301
Crystal Lake II, IA (2009)	NA	NA	7.42	80	200
Top of Iowa, IA (2003)	NA	NA	7.16	89	80
Kewaunee County, WI (1999-2001)	NA	NA	6.45	31	20.46
Ripley, Ont (2008)	NA	NA	4.67	38	76
Winnebago, IA (2009-2010)	NA	NA	4.54	10	20
Buffalo Ridge, MN (Phase II; 2001/Lake Benton I)	2.2[C]	6/15/01-9/15/01	4.35	143	107.25
Buffalo Ridge, MN (Phase III; 2001/Lake Benton II)	2.2[C]	6/15/01-9/15/01	3.71	138	103.5
Crescent Ridge, IL (2005-2006)	NA	NA	3.27	33	49.5
Fowler I, II, III, IN (2012)	NA	NA	2.96	355	600
Elm Creek II, MN (2011-2012)	NA	NA	2.81	62	148.8
Buffalo Ridge II, SD (2011-2012)	NA	NA	2.81	105	210
Buffalo Ridge, MN (Phase III; 1999)	NA	NA	2.72	138	103.5
Buffalo Ridge, MN (Phase II; 1999)	NA	NA	2.59	143	107.25
Moraine II, MN (2009)	NA	NA	2.42	33	49.5
Buffalo Ridge, MN (Phase II; 1998)	NA	NA	2.16	143	107.25
PrairieWinds ND1 (Minot), ND (2010)	NA	NA	2.13	80	115.5
Grand Ridge I, IL (2009-2010)	NA	NA	2.1	66	99
Barton I & II, IA (2010-2011)	NA	NA	1.85	80	160
Fowler III, IN (2009)	NA	NA	1.84	60	99
Buffalo Ridge, MN (Phase III; 2002/Lake Benton II)	1.9[C]	6/15/02-9/15/02	1.81	138	103.5
Buffalo Ridge, MN (Phase II; 2002/Lake Benton I)	1.9[C]	6/15/02-9/15/02	1.64	143	107.25
Rugby, ND (2010-2011)	NA	NA	1.6	71	149
Elm Creek, MN (2009-2010)	NA	NA	1.49	67	100
Wessington Springs, SD (2009)	NA	NA	1.48	34	51
PrairieWinds ND1 (Minot), ND (2011)	NA	NA	1.39	80	115.5
PrairieWinds SD1, SD (2011-2012)	NA	NA	1.23	108	162
NPPD Ainsworth, NE (2006)	NA	NA	1.16	36	20.5
PrairieWinds SD1, SD (2012-2013)	NA	NA	1.05	108	162
Buffalo Ridge, MN (Phase I; 1999)	NA	NA	0.74	73	25
Wessington Springs, SD (2010)	NA	NA	0.41	34	51
Buffalo Ridge I, SD (2009-2010)	NA	NA	0.16	24	50.4

Appendix C3. Wind energy facilities in North America with comparable activity and fatality data for bats, separated by geographic region.

Wind Energy Facility	Bat Activity Estimate[A]	Bat Activity Dates	Fatality Estimate[B]	No. of Turbines	Total MW
		Northeast			
Mountaineer, WV (2003)	NA	NA	31.69	44	66
Mount Storm, WV (2009)	30.09	7/15/09-10/7/09	17.53	132	264
Noble Wethersfield, NY (2010)	NA	NA	16.3	84	126
Criterion, MD (2011)	NA	NA	15.61	28	70
Mount Storm, WV (2010)	36.67[G]	4/18/10-10/15/10	15.18	132	264
Locust Ridge, PA (Phase II; 2010)	NA	NA	14.38	51	102
Locust Ridge, PA (Phase II; 2009)	NA	NA	14.11	51	102
Casselman, PA (2008)	NA	NA	12.61	23	34.5
Maple Ridge, NY (2006)	NA	NA	11.21	120	198
Cohocton/Dutch Hills, NY (2010)	NA	NA	10.32	50	125
Wolfe Island, Ont (July-December 2010)	NA	NA	9.5	86	197.8
Cohocton/Dutch Hill, NY (2009)	NA	NA	8.62	50	125
Casselman, PA (2009)	NA	NA	8.6	23	34.5
Noble Bliss, NY (2008)	NA	NA	7.8	67	100
Criterion, MD (2012)	NA	NA	7.62	28	70
Mount Storm, WV (2011)	NA	NA	7.43	132	264
Mount Storm, WV (Fall 2008)	35.2	7/20/08-10/12/08	6.62	82	164
Maple Ridge, NY (2007)	NA	NA	6.49	195	321.75
Wolfe Island, Ont (July-December 2009)	NA	NA	6.42	86	197.8
Maple Ridge, NY (2007-2008)	NA	NA	4.96	195	321.75
Noble Clinton, NY (2009)	1.9[F]	8/1/09-09/31/09	4.5	67	100
Casselman Curtailment, PA (2008)	NA	NA	4.4	23	35.4
Noble Altona, NY (2010)	NA	NA	4.34	65	97.5
Noble Ellenburg, NY (2009)	16.1[F]	8/16/09-09/15/09	3.91	54	80
Noble Bliss, NY (2009)	NA	NA	3.85	67	100
Lempster, NH (2010)	NA	NA	3.57	12	24
Noble Ellenburg, NY (2008)	NA	NA	3.46	54	80
Noble Clinton, NY (2008)	2.1[F]	8/8/08-09/31/08	3.14	67	100
Lempster, NH (2009)	NA	NA	3.11	12	24
Mars Hill, ME (2007)	NA	NA	2.91	28	42
Wolfe Island, Ont (July-December 2011)	NA	NA	2.49	86	197.8
Noble Chateaugay, NY (2010)	NA	NA	2.44	71	106.5
High Sheldon, NY (2010)	NA	NA	2.33	75	112.5
Beech Ridge, WV (2012)	NA	NA	2.03	67	100.5
Munnsville, NY (2008)	NA	NA	1.93	23	34.5
High Sheldon, NY (2011)	NA	NA	1.78	75	112.5
Stetson Mountain II, ME (2010)	NA	NA	1.65	17	25.5
Stetson Mountain I, ME (2009)	28.5; 0.3[H]	7/10/09-10/15/09	1.4	38	57
Mars Hill, ME (2008)	NA	NA	0.45	28	42
Stetson Mountain I, ME (2011)	NA	NA	0.28	38	57
Kibby, ME (2011)	NA	NA	0.12	44	132
		Southeast			
Buffalo Mountain, TN (2005)	NA	NA	39.7	18	28.98
Buffalo Mountain, TN (2000-2003)	23.7	NA	31.54	3	1.98
		Southern Plains			
Barton Chapel, TX (2009-2010)	NA	NA	3.06	60	120
Big Smile, OK (2012-2013)	NA	NA	2.9	66	132
Buffalo Gap II, TX (2007-2008)	NA	NA	0.14	155	233
Red Hills, OK (2012-2013)	NA	NA	0.11	82	123
Buffalo Gap I, TX (2006)	NA	NA	0.1	67	134

Appendix C3. Wind energy facilities in North America with comparable activity and fatality data for bats, separated by geographic region.

Wind Energy Facility	Bat Activity Estimate[A]	Bat Activity Dates	Fatality Estimate[B]	No. of Turbines	Total MW
Rocky Mountains					
Summerview, Alb (2006; 2007)	7.65[C]	07/15/06-07-09/30/06-07	11.42	39	70.2
Summerview, Alb (2005-2006)	NA	NA	10.27	39	70.2
Judith Gap, MT (2006-2007)	NA	NA	8.93	90	135
Foote Creek Rim, WY (Phase I; 1999)	NA	NA	3.97	69	41.4
Judith Gap, MT (2009)	NA	NA	3.2	90	135
Foote Creek Rim, WY (Phase I; 2001-2002)	2.2[C,D]	6/15/01-9/1/01	1.57	69	41.4
Foote Creek Rim, WY (Phase I; 2000)	2.2[C,D]	6/15/00-9/1/00	1.05	69	41.4
Southwest					
Dry Lake I, AZ (2009-2010)	8.8	4/29/10-11/10/10	3.43	30	63
Dry Lake II, AZ (2011-2012)	11.5	5/11/11-10/26/11	1.66	31	65
California					
Shiloh I, CA (2006-2009)	NA	NA	3.92	100	150
Shiloh II, CA (2009-2010)	NA	NA	2.72	75	150
High Winds, CA (2003-2004)	NA	NA	2.51	90	162
Dillon, CA (2008-2009)	NA	NA	2.17	45	45
High Winds, CA (2004-2005)	NA	NA	1.52	90	162
Alta Wind I, CA (2011-2012)	4.42[I]	6/26/2009 - 10/31/2009	1.28	100	150
Diablo Winds, CA (2005-2007)	NA	NA	0.82	31	20.46
Alite, CA (2009-2010)	NA	NA	0.24	8	24
Alta Wind II-V, CA (2011-2012)	0.78	6/26/2009 - 10/31/2009	0.08	190	570
Pacific Northwest					
Biglow Canyon, OR (Phase II; 2009-2010)	NA	NA	2.71	65	150
Nine Canyon, WA (2002-2003)	NA	NA	2.47	37	48.1
Stateline, OR/WA (2003)	NA	NA	2.29	454	299
Elkhorn, OR (2010)	NA	NA	2.14	61	101
White Creek, WA (2007-2011)	NA	NA	2.04	89	204.7
Biglow Canyon, OR (Phase I; 2008)	NA	NA	1.99	76	125.4
Leaning Juniper, OR (2006-2008)	NA	NA	1.98	67	100.5
Big Horn, WA (2006-2007)	NA	NA	1.9	133	199.5
Combine Hills, OR (Phase I; 2004-2005)	NA	NA	1.88	41	41
Linden Ranch, WA (2010-2011)	NA	NA	1.68	25	50
Pebble Springs, OR (2009-2010)	NA	NA	1.55	47	98.7
Hopkins Ridge, WA (2008)	NA	NA	1.39	87	156.6
Harvest Wind, WA (2010-2012)	NA	NA	1.27	43	98.9
Elkhorn, OR (2008)	NA	NA	1.26	61	101
Vansycle, OR (1999)	NA	NA	1.12	38	24.9
Klondike III (Phase I), OR (2007-2009)	NA	NA	1.11	125	223.6
Stateline, OR/WA (2001-2002)	NA	NA	1.09	454	299
Stateline, OR/WA (2006)	NA	NA	0.95	454	299
Tuolumne (Windy Point I), WA (2009-2010)	NA	NA	0.94	62	136.6
Klondike, OR (2002-2003)	NA	NA	0.77	16	24
Combine Hills, OR (2011)	NA	NA	0.73	104	104
Hopkins Ridge, WA (2006)	NA	NA	0.63	83	150
Biglow Canyon, OR (Phase I; 2009)	NA	NA	0.58	76	125.4
Biglow Canyon, OR (Phase II; 2010-2011)	NA	NA	0.57	65	150
Hay Canyon, OR (2009-2010)	NA	NA	0.53	48	100.8

Appendix C3. Wind energy facilities in North America with comparable activity and fatality data for bats, separated by geographic region.

Wind Energy Facility	Bat Activity Estimate[A]	Bat Activity Dates	Fatality Estimate[B]	No. of Turbines	Total MW
Klondike II, OR (2005-2006)	NA	NA	0.41	50	75
Windy Flats, WA (2010-2011)	NA	NA	0.41	114	262.2
Vantage, WA (2010-2011)	NA	NA	0.4	60	90
Wild Horse, WA (2007)	NA	NA	0.39	127	229
Goodnoe, WA (2009-2010)	NA	NA	0.34	47	94
Marengo II, WA (2009-2010)	NA	NA	0.27	39	70.2
Biglow Canyon, OR (Phase III; 2010-2011)	NA	NA	0.22	76	174.8
Marengo I, WA (2009-2010)	NA	NA	0.17	78	140.4
Klondike IIIa (Phase II), OR (2008-2010)	NA	NA	0.14	51	76.5
Kittitas Valley, WA (2011-2012)	NA	NA	0.12	48	100.8

A = Bat passes per detector-night
B = Number of fatalities per megawatt per year
C = Activity rate was averaged across phases and/or years
D = Activity rate calculated by WEST from data presented in referenced report
E = Activity rate based on pre-construction monitoring; data for all other activity and fatality rates were collected concurrently
F = Activity rate based on data collected at various heights all other activity rates are from ground-based units only
G = Activity rate based on data collected from ground-based units excluding reference stations during the spring, summer and fall seasons
H = The overall activity rate of 28.5 is from reference stations located along forest edges which may be attractive to bats; the activity rate of 0.3 is from one unit placed on a nacelle
I = Average of ground-based detectors at CPC Proper (Phase I) for late summer/fall period only

Appendix C3 (*continued*). Wind energy facilities in North America with comparable activity and fatality data for bats, separated by geographic region.

Data from the following sources:

Facility	Activity Estimate	Fatality Estimate	Facility	Activity Estimate	Fatality Estimate
Alite, CA (09-10)	NA	Chatfield et al. 2010	Kewaunee County, WI (99-01)	NA	Howe et al. 2002
Alta Wind I, CA (11-12)	Solick et al. 2010b	Chatfield et al. 2012	Kibby, ME (11)	NA	Stantec 2012
Alta Wind II-V, CA (11-12)	Solick et al. 2010b	Chatfield et al. 2012	Kittitas Valley, WA (11-12)	NA	Stantec Consulting Services 2012
Barton I & II, IA (10-11)	NA	Derby et al. 2011a	Klondike, OR (02-03)	NA	Johnson et al. 2003a
Barton Chapel, TX (09-10)	NA	WEST 2011	Klondike II, OR (05-06)	NA	NWC and WEST 2007
Beech Ridge, WV (12)	NA	Tidhar et al. 2013	Klondike III (Phase I), OR (07-09)	NA	Gritski et al. 2010
Big Horn, WA (06-07)	NA	Kronner et al. 2008	Klondike IIIa (Phase II), OR (08-10)	NA	Gritski et al. 2011
Big Smile, OK (12-13)	NA	Derby et al. 2013b	Leaning Juniper, OR (06-08)	NA	Gritski et al. 2008
Biglow Canyon, OR (Phase I; 08)	NA	Jeffrey et al. 2009a	Lempster, NH (09)	NA	Tidhar et al. 2010
Biglow Canyon, OR (Phase I; 09)	NA	Enk et al. 2010	Lempster, NH (10)	NA	Tidhar et al. 2011
Biglow Canyon, OR (Phase II; 09-10)	NA	Enk et al. 2011a	Linden Ranch, WA (10-11)	NA	Enz and Bay 2011
Biglow Canyon, OR (Phase II; 10-11)	NA	Enk et al. 2012b	Locust Ridge, PA (Phase II; 09)	NA	Arnett et al. 2011
Biglow Canyon, OR (Phase III; 10-11)	NA	Enk et al. 2012a	Locust Ridge, PA (Phase II; 10)	NA	Arnett et al. 2011
Blue Sky Green Field, WI (08; 09)	Gruver 2008	Gruver et al. 2009	Maple Ridge, NY (06)	NA	Jain et al. 2007
Buffalo Gap I, TX (06)	NA	Tierney 2007	Maple Ridge, NY (07)	NA	Jain et al. 2009a
Buffalo Gap II, TX (07-08)	NA	Tierney 2009	Maple Ridge, NY (07-08)	NA	Jain et al. 2009d
Buffalo Mountain, TN (00-03)	Fiedler 2004	Nicholson et al. 2005	Marengo I, WA (09-10)	NA	URS Corporation 2010b
Buffalo Mountain, TN (05)	NA	Fiedler et al. 2007	Marengo II, WA (09-10)	NA	URS Corporation 2010c
Buffalo Ridge, MN (Phase I; 99)	NA	Johnson et al. 2000a	Mars Hill, ME (07)	NA	Stantec 2008
Buffalo Ridge, MN (Phase II; 98)	NA	Johnson et al. 2000a	Mars Hill, ME (08)	NA	Stantec 2009a
Buffalo Ridge, MN (Phase II; 99)	NA	Johnson et al. 2000a	Moraine II, MN (09)	NA	Derby et al. 2010d
Buffalo Ridge, MN (Phase II; 01/Lake Benton I)	Johnson et al. 2004	Johnson et al. 2004	Mount Storm, WV (Fall 08)	Young et al. 2009b	Young et al. 2009b
Buffalo Ridge, MN (Phase II; 02/Lake Benton I)	Johnson et al. 2004	Johnson et al. 2004	Mount Storm, WV (09)	Young et al. 2009a, 2010b	Young et al. 2009a, 2010b
Buffalo Ridge, MN (Phase III; 99)	NA	Johnson et al. 2000a	Mount Storm, WV (10)	Young et al. 2010a, 2011b	Young et al. 2010a, 2011b
Buffalo Ridge, MN (Phase III; 01/Lake Benton II)	Johnson et al. 2004	Johnson et al. 2004	Mount Storm, WV (11)	NA	Young et al. 2011a, 2012b
Buffalo Ridge, MN (Phase III; 02/Lake Benton II)	Johnson et al. 2004	Johnson et al. 2004	Mountaineer, WV (03)	NA	Kerns and Kerlinger 2004
Buffalo Ridge I, SD (09-10)	NA	Derby et al. 2010b	Munnsville, NY (08)	NA	Stantec 2009b
Buffalo Ridge II, SD (11-12)	NA	Derby et al. 2012a	Nine Canyon, WA (02-03)	NA	Erickson et al. 2003b
Casselman, PA (08)	NA	Arnett et al. 2009a	Noble Altona, NY (10)	NA	Jain et al. 2011b
Casselman, PA (09)	NA	Arnett et al. 2010	Noble Bliss, NY (08)	NA	Jain et al.2009e
Casselman Curtailment, PA (08)	NA	Arnett et al. 2009b	Noble Bliss, NY (09)	NA	Jain et al. 2010a
Cedar Ridge, WI (09)	BHE Environmental 2008	BHE Environmental 2010	Noble Chateaugay, NY (10)	NA	Jain et al. 2011c
Cedar Ridge, WI (10)	BHE Environmental 2008	BHE Environmental 2011	Noble Clinton, NY (08)	Reynolds 2010a	Jain et al. 2009c
Cohocton/Dutch Hill, NY (09)	NA	Stantec 2010	Noble Clinton, NY (09)	Reynolds 2010a	Jain et al. 2010b
Cohocton/Dutch Hills, NY (10)	NA	Stantec 2011	Noble Ellenburg, NY (08)	NA	Jain et al. 2009b
Combine Hills, OR (Phase I; 04-05)	NA	Young et al. 2006	Noble Ellenburg, NY (09)	Reynolds 2010b	Jain et al. 2010c
Combine Hills, OR (11)	NA	Enz et al. 2012	Noble Wethersfield, NY (10)	NA	Jain et al. 2011a
Crescent Ridge, IL (05-06)	NA	Kerlinger et al. 2007	NPPD Ainsworth, NE (06)	NA	Derby et al. 2007
Criterion, MD (11)	NA	Young et al. 2012a	Pebble Springs, OR (09-10)	NA	Gritski and Kronner 2010b
Criterion, MD (12)	NA	Young et al. 2013	Pioneer Prairie I, IA (Phase II; 11-12)	NA	Chodachek et al. 2012
Crystal Lake II, IA (09)	NA	Derby et al. 2010a	PrairieWinds ND1 (Minot), ND (10)	NA	Derby et al. 2011c
Diablo Winds, CA (05-07)	NA	WEST 2006, 2008	PrairieWinds ND1 (Minot), ND (11)	NA	Derby et al. 2012c
Dillon, CA (08-09)	NA	Chatfield et al. 2009	PrairieWinds SD1 (Crow Lake), SD (11-12)	NA	Derby et al. 2012d
Dry Lake I, AZ (09-10)	Thompson et al. 2011	Thompson et al. 2011	PrairieWinds SD1 (Crow Lake), SD (12-13)	NA	Derby et al. 2013a
Dry Lake II, AZ (11-12)	Thompson and Bay 2012	Thompson and Bay 2012	Red Hills, OK (12-13)	NA	Derby et al. 2013c
Elkhorn, OR (08)	NA	Jeffrey et a. 2009b	Ripley, Ont (08)	NA	Jacques Whitford 2009
Elkhorn, OR (10)	NA	Enk et al. 2011b	Rugby, ND (10-11)	NA	Derby et al. 2011b
Elm Creek, MN (09-10)	NA	Derby et al. 2010c	Shiloh I, CA (06-09)	NA	Kerlinger et al. 2009
Elm Creek II, MN (11-12)	NA	Derby et al. 2012b	Shiloh II, CA (09-10)	NA	Kerlinger et al. 2010b

Appendix C3 (*continued*). Wind energy facilities in North America with comparable activity and fatality data for bats, separated by geographic region.

Data from the following sources:

Facility	Activity Estimate	Fatality Estimate	Facility	Activity Estimate	Fatality Estimate
Foote Creek Rim, WY (Phase I; 99)	NA	Young et al. 2003b	Stateline, OR/WA (01-02)	NA	Erickson et al. 2004
Foote Creek Rim, WY (Phase I; 00)	Gruver 2002	Young et al. 2003b, 2003d	Stateline, OR/WA (03)	NA	Erickson et al. 2004
Foote Creek Rim, WY (Phase I; 01-02)	Gruver 2002	Young et al. 2003b, 2003d	Stateline, OR/WA (06)	NA	Erickson et al. 2007
Forward Energy Center, WI (08-10)	Watt and Drake 2011	Grodsky and Drake 2011	Stetson Mountain I, ME (09)	Stantec 2009c	Stantec 2009c
Fowler I, IN (09)	NA	Johnson et al. 2010a	Stetson Mountain I, ME (11)	NA	Normandeau Associates 2011
Fowler III, IN (09)	NA	Johnson et al. 2010b	Stetson Mountain II, ME (10)	NA	Normandeau Associates 2010
Fowler I, II, III, IN (10)	NA	Good et al. 2011	Summerview, Alb (05-06)	NA	Brown and Hamilton 2006b
Fowler I, II, III, IN (11)	NA	Good et al. 2012	Summerview, Alb (06; 07)	Baerwald 2008	Baerwald 2008
Fowler I, II, III, IN (12)	NA	Good et al. 2013	Top of Iowa, IA (03)		Jain 2005
Goodnoe, WA (09-10)	NA	URS Corporation 2010a	Top of Iowa, IA (04)	Jain 2005	Jain 2005
Grand Ridge I, IL (09-10)	NA	Derby et al. 2010g	Tuolumne (Windy Point I), WA (09-10)	NA	Enz and Bay 2010
Harrow, Ont (10)	NA	NRSI 2011	Vansycle, OR (99)	NA	Erickson et al. 2000a
Harvest Wind, WA (10-12)	NA	Downes and Gritski 2012a	Vantage, WA (10-11)	NA	Ventus 2012
Hay Canyon, OR (09-10)	NA	Gritski and Kronner 2010a	Wessington Springs, SD (09)	NA	Derby et al. 2010f
High Sheldon, NY (10)	NA	Tidhar et al. 2012a	Wessington Springs, SD (10)	NA	Derby et al. 2011d
High Sheldon, NY (11)	NA	Tidhar et al. 2012b	White Creek, WA (07-11)	NA	Downes and Gritski 2012b
High Winds, CA (03-04)	NA	Kerlinger et al. 2006	Wild Horse, WA (07)	NA	Erickson et al. 2008
High Winds, CA (04-05)	NA	Kerlinger et al. 2006	Windy Flats, WA (10-11)	NA	Enz et al. 2011
Hopkins Ridge, WA (06)	NA	Young et al. 2007	Winnebago, IA (09-10)	NA	Derby et al. 2010e
Hopkins Ridge, WA (08)	NA	Young et al. 2009c	Wolfe Island, Ont (July-December 09)	NA	Stantec Ltd. 2010b
Judith Gap, MT (06-07)	NA	TRC 2008	Wolfe Island, Ont (July-December 10)	NA	Stantec Ltd. 2011b
Judith Gap, MT (09)	NA	Poulton and Erickson 2010	Wolfe Island, Ont (July-December 11)	NA	Stantec Ltd. 2012

Appendix C4. Fatality estimates for North American wind-energy facilities.

Project	Bird Fatalities (birds/MW/ year)	Raptor Fatalities (raptors/MW/ year)	Bat Fatalities (bats/MW/ year)	Predominant Habitat Type	Citation
Alite, CA (2009-2010)	0.55	0.12	0.24	Shrub/scrub & grassland	Chatfield et al. 2010
Alta Wind I, CA (2011-2012)	7.07	0.27	1.28	Woodland, grassland, shrubland	Chatfield et al. 2012
Alta Wind II-V, CA (2011-2012)	1.66	0.05	0.08	Desert scrub	Chatfield et al. 2012
Barton I & II, IA (2010-2011)	5.5	0	1.85	Agriculture	Derby et al. 2011a
Barton Chapel, TX (2009-2010)	1.15	0.25	3.06	Agriculture/forest	WEST 2011
Beech Ridge, WV (2012)	1.19	0.01	2.03	Forest	Tidhar et al. 2013
Big Horn, WA (2006-2007)	2.54	0.11	1.9	Agriculture/grassland	Kronner et al. 2008
Big Smile, OK (2012-2013)	0.09	0	2.9	Grassland, agriculture	Derby et al. 2013b
Biglow Canyon, OR (Phase I; 2008)	1.76	0.03	1.99	Agriculture/grassland	Jeffrey et al. 2009a
Biglow Canyon, OR (Phase I; 2009)	2.47	0	0.58	Agriculture/grassland	Enk et al. 2010
Biglow Canyon, OR (Phase II; 2009-2010)	5.53	0.14	2.71	Agriculture	Enk et al. 2011a
Biglow Canyon, OR (Phase II; 2010-2011)	2.68	0.03	0.57	Grassland/shrub-steppe, agriculture	Enk et al. 2012b
Biglow Canyon, OR (Phase III; 2010-2011)	2.28	0.05	0.22	Grassland/shrub-steppe, agriculture	Enk et al. 2012a
Blue Sky Green Field, WI (2008; 2009)	7.17	0	24.57	Agriculture	Gruver et al. 2009
Buffalo Gap I, TX (2006)	1.32	0.1	0.1	Grassland	Tierney 2007
Buffalo Gap II, TX (2007-2008)	0.15	0	0.14	Forest	Tierney 2009
Buffalo Mountain, TN (2000-2003)	11.02	0	31.54	Forest	Nicholson et al. 2005
Buffalo Mountain, TN (2005)	1.1	0	39.7	Forest	Fiedler et al. 2007
Buffalo Ridge, MN (Phase I; 1996)	4.14	0	NA	Agriculture	Johnson et al. 2000a
Buffalo Ridge, MN (Phase I; 1997)	2.51	0	NA	Agriculture	Johnson et al. 2000a
Buffalo Ridge, MN (Phase I; 1998)	3.14	0	NA	Agriculture	Johnson et al. 2000a
Buffalo Ridge, MN (Phase I; 1999)	1.43	0.47	0.74	Agriculture	Johnson et al. 2000a
Buffalo Ridge, MN (Phase II; 1998)	2.47	0	2.16	Agriculture	Johnson et al. 2000a
Buffalo Ridge, MN (Phase II; 1999)	3.57	0	2.59	Agriculture	Johnson et al. 2000a
Buffalo Ridge, MN (Phase II; 2001/Lake Benton I)	NA	NA	4.35	Agriculture	Johnson et al. 2004
Buffalo Ridge, MN (Phase II; 2002/Lake Benton I)	NA	NA	1.64	Agriculture	Johnson et al. 2004
Buffalo Ridge, MN (Phase III; 1999)	5.93	0	2.72	Agriculture	Johnson et al. 2000a
Buffalo Ridge, MN (Phase III; 2001/Lake Benton II)	NA	NA	3.71	Agriculture	Johnson et al. 2004

Appendix C4. Fatality estimates for North American wind-energy facilities.

Project	Bird Fatalities (birds/MW/ year)	Raptor Fatalities (raptors/MW/ year)	Bat Fatalities (bats/MW/ year)	Predominant Habitat Type	Citation
Buffalo Ridge, MN (Phase III; 2002/Lake Benton II)	NA	NA	1.81	Agriculture	Johnson et al. 2004
Buffalo Ridge I, SD (2009-2010)	5.06	0.2	0.16	Agriculture/grassland	Derby et al. 2010b
Buffalo Ridge II, SD (2011-2012)	1.99	0	2.81	Agriculture, grassland	Derby et al. 2012a
Casselman, PA (2008)	1.51	0	12.61	Forest	Arnett et al. 2009a
Casselman, PA (2009)	2.88	0	8.6	Forest, pasture, grassland	Arnett et al. 2010
Casselman Curtailment, PA (2008)	NA	NA	4.4	Forest	Arnett et al. 2009b
Cedar Ridge, WI (2009)	6.55	0.18	30.61	Agriculture	BHE Environmental 2010
Cedar Ridge, WI (2010)	3.72	0.13	24.12	Agriculture	BHE Environmental 2011
Cohocton/Dutch Hill, NY (2009)	1.39	0	8.62	Agriculture/forest	Stantec 2010
Cohocton/Dutch Hills, NY (2010)	1.32	0.08	10.32	Agriculture, forest	Stantec 2011
Combine Hills, OR (Phase I; 2004-2005)	2.56	0	1.88	Agriculture/grassland	Young et al. 2006
Combine Hills, OR (2011)	2.33	0.05	0.73	Grassland/shrub-steppe, agriculture	Enz et al. 2012
Crescent Ridge, IL (2005-2006)	NA	NA	3.27	Agriculture	Kerlinger et al. 2007
Criterion, MD (2011)	6.4	0.02	15.61	Forest, agriculture	Young et al. 2012a
Criterion, MD (2012)	2.14	NA	7.62	Forest, agriculture	Young et al. 2013
Crystal Lake II, IA (2009)	NA	NA	7.42	Agriculture	Derby et al. 2010a
Diablo Winds, CA (2005-2007)	4.29	0.4	0.82	NA	WEST 2006, 2008
Dillon, CA (2008-2009)	4.71	0	2.17	Desert	Chatfield et al. 2009
Dry Lake I, AZ (2009-2010)	2.02	0	3.43	Desert grassland/forested	Thompson et al. 2011
Dry Lake II, AZ (2011-2012)	1.57	0	1.66	Desert grassland/forested	Thompson and Bay 2012
Elkhorn, OR (2008)	0.64	0.06	1.26	Shrub/scrub & agriculture	Jeffrey et al. 2009b
Elkhorn, OR (2010)	1.95	0.08	2.14	Shrub/scrub & agriculture	Enk et al. 2011b
Elm Creek, MN (2009-2010)	1.55	0	1.49	Agriculture	Derby et al. 2010c
Elm Creek II, MN (2011-2012)	3.64	0	2.81	Agriculture, grassland	Derby et al. 2012b
Foote Creek Rim, WY (Phase I; 1999)	3.4	0.08	3.97	Grassland	Young et al. 2003b
Foote Creek Rim, WY (Phase I; 2000)	2.42	0.05	1.05	Grassland	Young et al. 2003b

Appendix C4. Fatality estimates for North American wind-energy facilities.

Project	Bird Fatalities (birds/MW/ year)	Raptor Fatalities (raptors/MW/ year)	Bat Fatalities (bats/MW/ year)	Predominant Habitat Type	Citation
Foote Creek Rim, WY (Phase I; 2001-2002)	1.93	0	1.57	Grassland	Young et al. 2003b
Forward Energy Center, WI (2008-2010)	NA	NA	18.17	Agriculture	Grodsky and Drake 2011
Fowler I, IN (2009)	2.83	0	8.09	Agriculture	Johnson et al. 2010a
Fowler I, II, III, IN (2010)	NA	NA	18.96	Agriculture	Good et al. 2011
Fowler I, II, III, IN (2011)	NA	NA	20.19	Agriculture	Good et al. 2012
Fowler I, II, III, IN (2012)	NA	NA	2.96	Agriculture	Good et al. 2013
Fowler III, IN (2009)	NA	NA	1.84	Agriculture	Johnson et al. 2010b
Goodnoe, WA (2009-2010)	1.4	0.17	0.34	Grassland and shrub-steppe	URS Corporation 2010a
Grand Ridge I, IL (2009-2010)	0.48	0	2.1	Agriculture	Derby et al. 2010g
Harrow, Ont (2010)	NA	NA	11.13	Agriculture	Natural Resource Solutions Inc. (NRSI) 2011
Harvest Wind, WA (2010-2012)	2.94	0.23	1.27	Grassland/shrub-steppe	Downes and Gritski 2012a
Hay Canyon, OR (2009-2010)	2.21	0	0.53	Agriculture	Gritski and Kronner 2010a
High Sheldon, NY (2010)	1.76	0.06	2.33	Agriculture	Tidhar et al. 2012a
High Sheldon, NY (2011)	1.57	0	1.78	Agriculture	Tidhar et al. 2012b
High Winds, CA (2003-2004)	1.62	0.5	2.51	Agriculture/grassland	Kerlinger et al. 2006
High Winds, CA (2004-2005)	1.1	0.28	1.52	Agriculture/grassland	Kerlinger et al. 2006
Hopkins Ridge, WA (2006)	1.23	0.14	0.63	Agriculture/grassland	Young et al. 2007
Hopkins Ridge, WA (2008)	2.99	0.07	1.39	Agriculture/grassland	Young et al. 2009c
Judith Gap, MT (2006-2007)	NA	NA	8.93	Agriculture/grassland	TRC 2008
Judith Gap, MT (2009)	NA	NA	3.2	Agriculture/grassland	Poulton and Erickson 2010
Kewaunee County, WI (1999-2001)	1.95	0	6.45	Agriculture	Howe et al. 2002
Kibby, ME (2011)	NA	NA	0.12	Forest; commercial forest	Stantec 2012
Kittitas Valley, WA (2011-2012)	1.06	0.09	0.12	Sagebrush-steppe, grassland	Stantec Consulting Services 2012
Klondike, OR (2002-2003)	0.95	0	0.77	Agriculture/grassland	Johnson et al. 2003a

Appendix C4. Fatality estimates for North American wind-energy facilities.

Project	Bird Fatalities (birds/MW/ year)	Raptor Fatalities (raptors/MW/ year)	Bat Fatalities (bats/MW/ year)	Predominant Habitat Type	Citation
Klondike II, OR (2005-2006)	3.14	0.06	0.41	Agriculture/grassland	NWC and WEST 2007
Klondike III (Phase I), OR (2007-2009)	3.02	0.15	1.11	Agriculture/grassland	Gritski et al. 2010
Klondike IIIa (Phase II), OR (2008-2010)	2.61	0.06	0.14	Grassland/shrub-steppe and agriculture	Gritski et al. 2011
Leaning Juniper, OR (2006-2008)	6.66	0.16	1.98	Agriculture	Gritski et al. 2008
Lempster, NH (2009)	3.38	0	3.11	Grasslands/forest/rocky embankments	Tidhar et al. 2010
Lempster, NH (2010)	2.64	0	3.57	Grasslands/forest/rocky embankments	Tidhar et al. 2011
Linden Ranch, WA (2010-2011)	6.65	0.27	1.68	Grassland/shrub-steppe, agriculture	Enz and Bay 2011
Locust Ridge, PA (Phase II; 2009)	0.84	0	14.11	Grassland	Arnett et al. 2011
Locust Ridge, PA (Phase II; 2010)	0.76	0	14.38	Grassland	Arnett et al. 2011
Maple Ridge, NY (2006)	NA	NA	11.21	Agriculture/forested	Jain et al. 2007
Maple Ridge, NY (2007-2008)	2.07	0.03	4.96	Agriculture/forested	Jain et al. 2009d
Maple Ridge, NY (2007)	2.34	NA	6.49	Agriculture/forested	Jain et al. 2009a
Marengo I, WA (2009-2010)	0.27	0	0.17	Agriculture	URS Corporation 2010b
Marengo II, WA (2009-2010)	0.16	0.05	0.27	Agriculture	URS Corporation 2010c
Mars Hill, ME (2007)	1.67	0	2.91	Forest	Stantec 2008
Mars Hill, ME (2008)	1.76	0	0.45	Forest	Stantec 2009a
Moraine II, MN (2009)	5.59	0.37	2.42	Agriculture/grassland	Derby et al. 2010d
Mount Storm, WV (Fall 2008)	NA	NA	6.62	Forest	Young et al. 2009b
Mount Storm, WV (2009)	3.85	0	17.53	Forest	Young et al. 2009a, 2010b
Mount Storm, WV (2010)	2.6	0.1	15.18	Forest	Young et al. 2010a, 2011b
Mount Storm, WV (2011)	4.24	0.03	7.43	Forest	Young et al. 2011a, 2012b
Mountaineer, WV (2003)	2.69	0.07	31.69	Forest	Kerns and Kerlinger 2004
Munnsville, NY (2008)	1.48	0.59	1.93	Agriculture/forest	Stantec 2009b

Appendix C4. Fatality estimates for North American wind-energy facilities.

Project	Bird Fatalities (birds/MW/ year)	Raptor Fatalities (raptors/MW/ year)	Bat Fatalities (bats/MW/ year)	Predominant Habitat Type	Citation
Nine Canyon, WA (2002-2003)	2.76	0.03	2.47	Agriculture/grassland	Erickson et al. 2003b
Noble Altona, NY (2010)	1.84	0	4.34	Forest	Jain et al. 2011b
Noble Bliss, NY (2008)	1.3	0.1	7.8	Agriculture/forest	Jain et al. 2009e
Noble Bliss, NY (2009)	2.28	0.12	3.85	Agriculture/forest	Jain et al. 2010a
Noble Chateaugay, NY (2010)	1.66	0.08	2.44	Agriculture	Jain et al. 2011c
Noble Clinton, NY (2008)	1.59	0.1	3.14	Agriculture/forest	Jain et al. 2009c
Noble Clinton, NY (2009)	1.11	0.16	4.5	Agriculture/forest	Jain et al. 2010b
Noble Ellenburg, NY (2008)	0.83	0.11	3.46	Agriculture/forest	Jain et al. 2009b
Noble Ellenburg, NY (2009)	2.66	0.25	3.91	Agriculture/forest	Jain et al. 2010c
Noble Wethersfield, NY (2010)	1.7	0.13	16.3	Agriculture	Jain et al. 2011a
NPPD Ainsworth, NE (2006)	1.63	0.06	1.16	Agriculture/grassland	Derby et al. 2007
Pebble Springs, OR (2009-2010)	1.93	0.04	1.55	Grassland	Gritski and Kronner 2010b
Pine Tree, CA (2009-2010)	8.3	0.133	NA	Grassland	BioResource Consultants 2010
Pioneer Prairie I, IA (Phase II; 2011-2012)	0.27	0	10.06	Agriculture, grassland	Chodachek et al. 2012
Prairie Rose, MN (2014)	0.44	0.08	0.411	Agriculture,	This study[1]
PrairieWinds ND1 (Minot), ND (2010)	1.48	0.05	2.13	Agriculture	Derby et al. 2011c
PrairieWinds ND1 (Minot), ND (2011)	1.56	0.05	1.39	Agriculture, grassland	Derby et al. 2012c
PrairieWinds SD1, SD (2011-2012)	1.41	0	1.23	Grassland	Derby et al. 2012d
PrairieWinds SD1, SD (2012-2013)	2.01	0.03	1.05	Grassland	Derby et al. 2013a
Red Hills, OK (2012-2013)	0.08	0.04	0.11	Grassland	Derby et al. 2013c
Ripley, Ont (2008)	3.09	0.1	4.67	Agriculture	Jacques Whitford 2009
Rugby, ND (2010-2011)	3.82	0.06	1.6	Agriculture	Derby et al. 2011b
Shiloh I, CA (2006-2009)	6.96	0.42	3.92	Agriculture/grassland	Kerlinger et al. 2010a
Shiloh II, CA (2009-2010)	1.51	0.12	2.72	Agriculture	Kerlinger et al. 2010b
Stateline, OR/WA (2001-2002)	3.17	0.09	1.09	Agriculture/grassland	Erickson et al. 2004
Stateline, OR/WA (2003)	2.68	0.09	2.29	Agriculture/grassland	Erickson et al. 2004
Stateline, OR/WA (2006)	1.23	0.11	0.95	Agriculture/grassland	Erickson et al. 2007
Stetson Mountain I, ME (2009)	2.68	0	1.4	Forest	Stantec 2009c
Stetson Mountain I, ME (2011)	1.18	0	0.28	Forested	Normandeau Associates 2011

Appendix C4. Fatality estimates for North American wind-energy facilities.

Project	Bird Fatalities (birds/MW/ year)	Raptor Fatalities (raptors/MW/ year)	Bat Fatalities (bats/MW/ year)	Predominant Habitat Type	Citation
Stetson Mountain II, ME (2010)	1.42	0	1.65	Forested	Normandeau Associates 2010
Summerview, Alb (2005-2006)	1.06	0.11	10.27	Agriculture	Brown and Hamilton 2006b
Summerview, Alb (2006; 2007)	NA	NA	11.42	Agriculture/grassland	Baerwald 2008
Top of Iowa, IA (2003)	0.42	0	7.16	Agriculture	Jain 2005
Top of Iowa, IA (2004)	0.81	0.17	10.27	Agriculture	Jain 2005
Tuolumne (Windy Point I), WA (2009-2010)	3.2	0.29	0.94	Grassland/shrub-steppe, agriculture and forest	Enz and Bay 2010
Vansycle, OR (1999)	0.95	0	1.12	Agriculture/grassland	Erickson et al. 2000a
Vantage, WA (2010-2011)	1.27	0.29	0.4	Shrub-steppe, grassland	Ventus Environmental Solutions 2012
Wessington Springs, SD (2009)	8.25	0.06	1.48	Grassland	Derby et al. 2010f
Wessington Springs, SD (2010)	0.89	0.07	0.41	Grassland	Derby et al. 2011d
White Creek, WA (2007-2011)	4.05	0.47	2.04	Grassland/shrub-steppe, agriculture	Downes and Gritski 2012b
Wild Horse, WA (2007)	1.55	0.09	0.39	Grassland	Erickson et al. 2008
Windy Flats, WA (2010-2011)	8.45	0.04	0.41	Grassland/shrub-steppe, agriculture	Enz et al. 2011
Winnebago, IA (2009-2010)	3.88	0.27	4.54	Agriculture/grassland	Derby et al. 2010e
Wolfe Island, Ont (July-December 2009)	NA	NA	6.42	Grassland	Stantec Ltd. 2010b
Wolfe Island, Ont (July-December 2010)	NA	NA	9.5	Grassland	Stantec Ltd. 2011b
Wolfe Island, Ont (July-December 2011)	NA	NA	2.49	Grassland	Stantec Ltd. 2012

[1] – 2 seasons of data only (spring and fall)

Appendix C5. All post-construction monitoring studies, project characteristics, and select study methodology.

Project Name	Total # of Turbines	Total MW	Tower Size (m)	Number Turbines Searched	Plot Size	Length of Study	Survey Frequency
Alite, CA (2009-2010)	8	24	80	8	200 m x 200 m	1 year	Weekly (spring, fall), bi-monthly (summer, winter)
Alta Wind I, CA (2011-2012)	100	150	80	25	120-m radius circle	12.5 months	Every two weeks
Alta Wind II-V, CA (2011-2012)	190	570	NA	41	120-m radius circle	14.5 months	Every two weeks
Barton Chapel, TX (2009-2010)	60	120	78	30	200 m x 200 m	1 year	10 turbines weekly, 20 monthly
Barton I & II, IA (2010-2011)	80	160	100	35 (9 turbines were dropped in June 2010 due to landowner issues) 26 turbines were searched for the remainder of the study	200 m x 200 m	1 year	Weekly (spring, fall; migratory turbines), monthly (summer, winter; non-migratory turbines)
Beech Ridge, WV (2012)	67	100.5	80	67	40 m radius	7 months	Every two days
Big Horn, WA (2006-2007)	133	199.5	80	133	180 m x 180 m	1 year	Bi-monthly (spring, fall), monthly (winter, summer)
Big Smile, OK (2012-2013)	66	132	NA	17 (plus one met tower)	100 x 100	1 year	Weekly (spring, summer, fall), monthly (winter)
Biglow Canyon, OR (Phase I; 2008)	76	125.4	80	50	110 m x 110 m	1 year	Bi-monthly (spring, fall), monthly (winter, summer)
Biglow Canyon, OR (Phase I; 2009)	76	125.4	80	50	110 m x 110 m	1 year	Bi-monthly (spring, fall), monthly (winter, summer)
Biglow Canyon, OR (Phase II; 2009-2010)	65	150	80	50	250 m x 250 m	1 year	Bi-monthly (spring, fall), monthly (winter, summer)
Biglow Canyon, OR (Phase II; 2010-2011)	65	150	NA	50	252 m x 252 m	1 year	Bi-weekly(spring, fall), monthly (summer, winter)
Biglow Canyon, OR (Phase III; 2010-2011)	76	174.8	NA	50	252 m x 252 m	1 year	Bi-weekly(spring, fall), monthly (summer, winter)
Blue Sky Green Field, WI (2008; 2009)	88	145	80	30	160 m x 160 m	Fall, spring	Daily(10 turbines), weekly (20 turbines)

Appendix C5. All post-construction monitoring studies, project characteristics, and select study methodology.

Project Name	Total # of Turbines	Total MW	Tower Size (m)	Number Turbines Searched	Plot Size	Length of Study	Survey Frequency
Buena Vista, CA (2008-2009)	38	38	45-55	38	75-m radius	1 year	Monthly to bi-monthly starting in September 2008
Buffalo Gap I, TX (2006)	67	134	NA	21	215 m x 215 m	10 months	Every 3 weeks
Buffalo Gap II, TX (2007-2008)	155	233	80	36	215 m x 215 m	14 months	Every 21 days
Buffalo Mountain, TN (2000-2003)	3	1.98	65	3	50-m radius	3 years	Bi-weekly, weekly, bi-monthly
Buffalo Mountain, TN (2005)	18	28.98	V47 = 65; V80 = 78	18	50-m radius	1 year	Bi-weekly, weekly, bi-monthly, and 2 to 5 day intervals
Buffalo Ridge, MN (1994-1995)	73	25	37	1994:10 plots (3 turbines/plot), 20 addition plots in Sept & Oct 1994, 1995: 30 turbines search every other week (Jan-Mar), 60 searched weekly (Apr, July, Aug) 73 searched weekly (May-June and Sept-Oct), 30 searched weekly (Nov-Dec)	100 x 100m	20 months	Varies. See number turbines searched or page 44 of report
Buffalo Ridge, MN (Phase I; 1996)	73	25	36	21	126 m x 126 m	1 year	Bi-monthly (spring, summer, and fall)
Buffalo Ridge, MN (Phase I; 1997)	73	25	36	21	126 m x 126 m	1 year	Bi-monthly (spring, summer, and fall)

Appendix C5. All post-construction monitoring studies, project characteristics, and select study methodology.

Project Name	Total # of Turbines	Total MW	Tower Size (m)	Number Turbines Searched	Plot Size	Length of Study	Survey Frequency
Buffalo Ridge, MN (Phase I; 1998)	73	25	36	21	126 m x 126 m	1 year	Bi-monthly (spring, summer, and fall)
Buffalo Ridge, MN (Phase I; 1999)	73	25	36	21	126 m x 126 m	1 year	Bi-monthly (spring, summer, and fall)
Buffalo Ridge, MN (Phase II; 1998)	143	107.25	50	40	126 m x 126 m	1 year	Bi-monthly (spring, summer, and fall)
Buffalo Ridge, MN (Phase II; 1999)	143	107.25	50	40	126 m x 126 m	1 year	Bi-monthly (spring, summer, and fall)
Buffalo Ridge, MN (Phase II; 2001/Lake Benton I)	143	107.25	50	83	60 m x 60 m	Summer, fall	Bi-monthly
Buffalo Ridge, MN (Phase II; 2002/Lake Benton I)	143	107.25	50	103	60 m x 60 m	Summer, fall	Bi-monthly
Buffalo Ridge, MN (Phase III; 1999)	138	103.5	50	30	126 m x 126 m	1 year	Bi-monthly (spring, summer, and fall)
Buffalo Ridge, MN (Phase III; 2001/Lake Benton II)	138	103.5	50	83	60 m x 60 m	Summer, fall	Bi-monthly
Buffalo Ridge, MN (Phase III; 2002/Lake Benton II)	138	103.5	50	103	60 m x 60 m	Summer, fall	Bi-monthly
Buffalo Ridge I, SD (2009-2010)	24	50.4	79	24	200 m x 200 m	1 year	Weekly (migratory), monthly (non-migratory)
Buffalo Ridge II, SD (2011-2012)	105	210	78	65 (60 road and pad, 5 turbine plots)	100 x 100m	1 year	Weekly (spring, summer, fall), monthly (winter)
Casselman, PA (2008)	23	34.5	80	10	126 m x 120 m	7 months	Daily
Casselman, PA (2009)	23	34.5	80	10	126 m x 120 m	7.5 months	Daily searches
Casselman Curtailment, PA (2008)	23	35.4	80	12 experimental; 10 control	126 m x 120 m	2.5 months	Daily
Castle River, Alb (2001-2002)	60	39.6	50	60	50-m radius	2 years	Weekly, bi-weekly
Castle River, Alb (2001-2002)	60	39.6	50	60	50-m radius	2 years	Weekly, bi-weekly

Appendix C5. All post-construction monitoring studies, project characteristics, and select study methodology.

Project Name	Total # of Turbines	Total MW	Tower Size (m)	Number Turbines Searched	Plot Size	Length of Study	Survey Frequency
Cedar Ridge, WI (2009)	41	67.6	80	20	160 m x 160 m	Spring, summer, fall	Daily, every 4 days; late fall searched every 3 days
Cedar Ridge, WI (2010)	41	68	80	20	160 m x 160 m	1 year	Five turbines were surveyed daily, 15 turbines surveyed every 4 days in rotating groups each day. All 20 surveyed every three days during late fall
Cohocton/Dutch Hill, NY (2009)	50	125	80	17	130 m x 130 m	Spring, summer, fall	Daily (5 turbines), weekly (12 turbines)
Cohocton/Dutch Hills, NY (2010)	50	125	80	17	120 m x 120 m	Spring, summer, fall	Daily, weekly
Combine Hills, OR (Phase I; 2004-2005)	41	41	53	41	90-m radius	1 year	Monthly
Combine Hills, OR (2011)	104	104	53	52 (plus 1 MET tower)	180 m x 180 m	1 year	Bi-weekly(spring, fall), monthly (summer, winter)
Condon, OR	84	NA	NA	NA	NA	NA	NA
Crescent Ridge, IL (2005-2006)	33	49.5	80	33	70-m radius	1 year	Weekly (fall, spring)
Criterion, MD (2011)	28	70	80	28	40-50m radius	7.3 months	Daily
Criterion, MD (2012)	28	70	80	14	40-50m radius	7.5 months	Weekly
Crystal Lake II, IA (2009)	80	200	80	16 turbines through week 6, and then 15 for duration of study	100 m x 100 m	Spring, summer, fall	3 times per week for 26 weeks
Diablo Winds, CA (2005-2007)	31	20.46	50 and 55	31	75 m x 75 m	2 years	Monthly
Dillon, CA (2008-2009)	45	45	69	15	200 m x 200 m	1 year	Weekly, bi-monthly in winter
Dry Lake I, AZ (2009-2010)	30	63	78	15	160 m x 160 m	1 year	Bi-monthly (spring, fall), monthly (winter, summer)

Appendix C5. All post-construction monitoring studies, project characteristics, and select study methodology.

Project Name	Total # of Turbines	Total MW	Tower Size (m)	Number Turbines Searched	Plot Size	Length of Study	Survey Frequency
Dry Lake II, AZ (2011-2012)	31	65	78	31: 5 (full plot), 26 (road & pad)	160 m x 160 m	1 year	Twice weekly (spring, summer, fall), weekly (winter)
Elkhorn, OR (2008)	61	101	80	61	220 m x 220 m	1 year	Monthly
Elkhorn, OR (2010)	61	101	80	31	220 m x 220 m	1 year	Bi-monthly (spring, fall), monthly (winter, summer)
Elm Creek, MN (2009-2010)	67	100	80	29	200 m x 200 m	1 year	Weekly, monthly
Elm Creek II, MN (2011-2012)	62	148.8	80	30	200 x 200m (2 random migration search areas 100 x 100m)	1 year	20 searched every 28 days, 10 turbines every 7 days during migration)
Erie Shores, Ont (2006)	66	99	80	66	40-m radius	2 years	Weekly, bi-monthly, 2-3 times weekly (migration)
Foote Creek Rim, WY (Phase I; 1999)	69	41.4	40	69	126 m x 126 m	1 year	Monthly
Foote Creek Rim, WY (Phase I; 2000)	69	41.4	40	69	126 m x 126 m	1 year	Monthly
Foote Creek Rim, WY (Phase I; 2001-2002)	69	41.4	40	69	126 m x 126 m	1 year	Monthly
Forward Energy Center, WI (2008-2010)	86	129	80	29	160 m x 160 m	2 years	11 turbines daily, 9 every 3 days, 9 every 5 days
Fowler I, IN (2009)	162	301	78 (Vestas), 80 (Clipper)	25	160 m x 160 m	Spring, summer, fall	Weekly, bi-weekly
Fowler I, II, III, IN (2010)	355	600	Vestas = 80, Clipper = 80, GE = 80	36 turbines, 100 road and pads	80 m x 80 m for turbines 40-m radius for roads and pads	Spring, fall	Daily, weekly

Appendix C5. All post-construction monitoring studies, project characteristics, and select study methodology.

Project Name	Total # of Turbines	Total MW	Tower Size (m)	Number Turbines Searched	Plot Size	Length of Study	Survey Frequency
Fowler I, II, III, IN (2011)	355	600	Vestas = 80, Clipper = 80, GE = 80	177 road and pads (spring), 9 turbines & 168 roads and pads (fall)	turbines (80 m circular plot), roads and pads (out to 80 m)	Spring, fall	Daily, weekly
Fowler I, II, III, IN (2012)	355	600	Vestas = 80, Clipper = 80, GE = 80	118 roads and pads	roads and pads (out to 80 m)	2.5 months	Weekly
Fowler III, IN (2009)	60	99	78	12	160 m x 160 m	10 weeks	Weekly, bi-weekly
Goodnoe, WA (2009-2010)	47	94	80	24	180 m x 180 m	1 year	14 days during migration periods, 28 days during non-migration periods
Grand Ridge I, IL (2009-2010)	66	99	80	30	160 m x 160 m	1 year	Weekly, monthly
Harrow, Ont (2010)	24 (four 6-turb facilities)	39.6	NA	12 in July, 24 Aug-Oct	50-m radius from turbine base	4 months	Twice-weekly
Harvest Wind, WA (2010-2012)	43	98.9	80	32	180 m x 180 m & 240 m x 240 m	2 years	Twice a week, weekly and monthly
Hay Canyon, OR (2009-2010)	48	100.8	79	20	180 m x 180 m	1 year	Bi-monthly (spring, fall), monthly (winter, summer)
High Winds, CA (2003-2004)	90	162	60	90	75-m radius	1 year	Bi-monthly
High Winds, CA (2004-2005)	90	162	60	90	75-m radius	1 year	Bi-monthly
Hopkins Ridge, WA (2006)	83	150	67	41	180 m x 180 m	1 year	Monthly, weekly (subset of 22 turbines spring and fall migration)
Hopkins Ridge, WA (2008)	87	156.6	67	41-43	180 m x 180 m	1 year	Bi-monthly (spring, fall), monthly (winter, summer)

Appendix C5. All post-construction monitoring studies, project characteristics, and select study methodology.

Project Name	Total # of Turbines	Total MW	Tower Size (m)	Number Turbines Searched	Plot Size	Length of Study	Survey Frequency
Jersey Atlantic, NJ (2008)	5	7.5	80	5	130 m x 120 m	9 months	Weekly
Judith Gap, MT (2006-2007)	90	135	80	20	190 m x 190 m	7 months	Monthly
Judith Gap, MT (2009)	90	135	80	30	100 m x 100 m	5 months	Bi-monthly
Kewaunee County, WI (1999-2001)	31	20.46	65	31	60 m x 60 m	2 years	Bi-weekly (spring, summer), daily (spring, fall migration), weekly (fall, winter)
Kibby, ME (2011)	44	132	124	22 turbines	75-m diameter circular plots	22 weeks	Avg 5-day
Kittitas Valley, WA (2011-2012)	48	100.8	80	48	100 m x 102 m	1 year	Bi weekly from Aug 15 Oct 31 and March 16 May 15; every 4 weeks from Nov 1 March 15 and May 16 Aug 14
Klondike, OR (2002-2003)	16	24	80	16	140 m x 140 m	1 year	Monthly
Klondike II, OR (2005-2006)	50	75	80	25	180 m x 180 m	1 year	Bi-monthly (spring, fall), monthly (summer, winter)
Klondike III (Phase I), OR (2007-2009)	125	223.6	GE = 80; Siemens= 80, Mitsubishi = 80	46	240 m x 240 m (1.5MW) 252 m x 252 m (2.3MW)	2 year	Bi-monthly (spring, fall migration), monthly (summer, winter)
Klondike IIIa (Phase II), OR (2008-2010)	51	76.5	GE = 80	34	240 m x 240 m	2 years	Bi-monthly (spring, fall), monthly (summer, winter)
Leaning Juniper, OR (2006-2008)	67	100.5	80	17	240 m x 240 m	2 years	Bi-monthly (spring, fall), monthly (winter, summer)
Lempster, NH (2009)	12	24	78	4	120 m x 130 m	6 months	Daily
Lempster, NH (2010)	12	24	78	12	120 m x 130 m	6 months	Weekly
Linden Ranch, WA (2010-2011)	25	50	80	25	110 m x 110 m	1 year	Bi-weekly(spring, fall), monthly (summer, winter)

Appendix C5. All post-construction monitoring studies, project characteristics, and select study methodology.

Project Name	Total # of Turbines	Total MW	Tower Size (m)	Number Turbines Searched	Plot Size	Length of Study	Survey Frequency
Locust Ridge, PA (Phase II; 2009)	51	102	80	15	120m x 126m	6.5 months	Daily
Locust Ridge, PA (Phase II; 2010)	51	102	80	15	120m x 126m	6.5 months	Daily
Madison, NY (2001-2002)	7	11.55	67	7	60-m radius	1 year	Weekly (spring, fall), monthly (summer)
Maple Ridge, NY (2006)	120	198	80	50	130 m x 120 m	5 months	Daily (10 turbines), every 3 days (10 turbines), weekly (30 turbines)
Maple Ridge, NY (2007)	195	321.75	80	64	130 m x 120 m	7 months	Weekly
Maple Ridge, NY (2007-2008)	195	321.75	80	64	130 m x 120 m	7 months	Weekly
Marengo I, WA (2009-2010)	78	140.4	67	39	180 m x 180 m	1 year	Bi-monthly (spring, fall), monthly (winter, summer)
Marengo II, WA (2009-2010)	39	70.2	67	20	180 m x 180 m	1 year	Bi-monthly (spring, fall), monthly (winter, summer)
Mars Hill, ME (2007)	28	42	80.5	28	76-m diameter, extended plot 238-m diameter	Spring, summer, fall	Daily (2 random turbines), weekly (all turbines): extended plot searched once per season
Mars Hill, ME (2008)	28	42	80.5	28	76-m diameter, extended plot 238-m diameter	Spring, summer, fall	Weekly: extended plot searched once per season
McBride, Alb (2004)	114	75	50	114	4 parallel transects 120-m wide	1 year	Weekly, bi-weekly
Melancthon, Ont (Phase I; 2007)	45	NA	NA	45	35m radius	5 months	Weekly, twice weekly
Meyersdale, PA (2004)	20	30	80	20	130 m x 120 m	6 weeks	Daily (half turbines), weekly (half turbines)

Appendix C5. All post-construction monitoring studies, project characteristics, and select study methodology.

Project Name	Total # of Turbines	Total MW	Tower Size (m)	Number Turbines Searched	Plot Size	Length of Study	Survey Frequency
Moraine II, MN (2009)	33	49.5	82.5	30	200 m x 200 m	1 year	Weekly (migratory), monthly (non-migratory)
Mount Storm, WV (2009)	132	264	78	44	varied	4.5 months	Weekly (28 turbines), daily (16 turbines)
Mount Storm, WV (2010)	132	264	78	24	20 to 60 m from turbine	6 months	Daily
Mount Storm, WV (2011)	132	264	78	24	varied	6 months	Daily
Mount Storm, WV (Fall 2008)	82	164	78	27	varied	3 months	Weekly (18 turbines), daily (9 turbines)
Mountaineer, WV (2003)	44	66	80	44	60-m radius	7 months	Weekly, monthly
Mountaineer, WV (2004)	44	66	80	44	130 m x 120 m	6 weeks	Daily, weekly
Munnsville, NY (2008)	23	34.5	69.5	12	120 m x 120 m	Spring, summer, fall	Weekly
Nine Canyon, WA (2002-2003)	37	48.1	60	37	90-m radius	1 year	Bi-monthly (spring, summer, fall), monthly (winter)
Noble Altona, NY (2010)	65	97.5	80	22	120 m x 120 m	Spring, summer, fall	Daily, weekly
Noble Bliss, NY (2008)	67	100	80	23	120 m x 120 m	Spring, summer, fall	Daily (8 turbines), 3-day (8 turbines), weekly (7 turbines)
Noble Bliss, NY (2009)	67	100	80	23	120 m x 120 m	Spring, summer, fall	Weekly, 8 turbines searched daily from July 1 to August 15
Noble Bliss/Wethersfield, NY (2011)	151	226	80	48 (24 from each site:12 ag, 12 forest)	road & pad 70 m out from turbine	2 months	Daily
Noble Chateaugay, NY (2010)	71	106.5	80	24	120 m x 120 m	Spring, summer, fall	Weekly
Noble Clinton, NY (2008)	67	100	80	23	120 m x 120 m	Spring, summer, fall	Daily (8 turbines), 3-day (8 turbines), weekly (7 turbines)
Noble Clinton, NY (2009)	67	100	80	23	120 m x 120 m	Spring, summer, fall	Daily (8 turbines), weekly (15 turbines), all turbines weekly from July 1 to August 15
Noble Ellenburg, NY (2008)	54	80	80	18	120 m x 120 m	Spring, summer, fall	Daily (6 turbines), 3-day (6 turbines), weekly (6 turbines)

Appendix C5. All post-construction monitoring studies, project characteristics, and select study methodology.

Project Name	Total # of Turbines	Total MW	Tower Size (m)	Number Turbines Searched	Plot Size	Length of Study	Survey Frequency
Noble Ellenburg, NY (2009)	54	80	80	18	120 m x 120 m	Spring, summer, fall	Daily (6 turbines), weekly (12 turbines), all turbines weekly from July 1 to August 15
Noble Wethersfield, NY (2010)	84	126	80	28	120 m x 120 m	Spring, summer, fall	Weekly
NPPD Ainsworth, NE (2006)	36	20.5	70	36	220 m x 220 m	Spring, summer, fall	Bi-monthly
Oklahoma Wind Energy Center, OK (2004; 2005)	68	102	70	68	20m radius	3 months (2 years)	Bi-monthly
Pebble Springs, OR (2009-2010)	47	98.7	79	20	180 m x 180 m	1 year	Bi-monthly (spring, fall), monthly (winter, summer)
Pine Tree, CA (2009-2010)	90	135	65	40	NA	1 year	Bi-weekly
Pioneer Prairie I, IA (Phase II; 2011-2012)	62	102.3	80	62 (57 road/pad) 5 full search plots	80 x 80m	1 year	Weekly (spring and fall), every two weeks (summer), monthly (winter)
PrairieWinds SD1, SD (2012-2013)	108	162	80	50	200m x 200m	1 year	Bi-weekly
PrairieWinds ND1 (Minot), ND (2010)	80	115.5	89	35	minimum of 100 m x 100 m	3 seasons	Bi-monthly
PrairieWinds ND1 (Minot), ND (2011)	80	115.5	80	35	minimum 100 x 100m	3 season	Twice monthly
PrairieWinds SD1, SD (2011-2012)	108	162	80	50	200 x 200m	1 year	Twice monthly (spring, summer, fall), monthly (winter)
Prince Wind Farm, Ont (2006)	126	189	80	38	63-m radius	4 months	Daily, weekly
Prince Wind Farm, Ont (2007)	126	189	80	38 turbines from January 1st July 8th, 126 turbines from July 9th-October 31st	63- to 45-m radius	10 months	Daily, weekly
Prince Wind Farm, Ont (2008)	126	189	80	126	45m radius	6.5 months	Daily, 3x/week, 2x/week

Appendix C5. All post-construction monitoring studies, project characteristics, and select study methodology.

Project Name	Total # of Turbines	Total MW	Tower Size (m)	Number Turbines Searched	Plot Size	Length of Study	Survey Frequency
Red Canyon, TX (2006-2007)	56	84	70	28	200 m x 200 m in fall and winter; 160 m x 160 m in spring and summer	1 year	Every 14 days in fall and winter; 7 days in spring, 3 days in summer
Red Hills, OK (2012-2013)	82	123	NA	20 (plus one met tower)	100 x 100	1 year	Weekly (spring, summer, fall), monthly (winter)
Ripley, Ont (2008)	38	76	64	38	80 m x 80 m	Spring, fall	Twice weekly for odd turbines; weekly for even turbines.
Ripley, Ont (2008-2009)	38	76	64	38	80 m x 80 m	6 weeks	Twice weekly for odd turbines; weekly for even turbines.
Rugby, ND (2010-2011)	71	149	78	32	200 m x 200 m	1 year	Weekly (spring, fall; migratory turbines), monthly (non-migratory turbines)
San Gorgonio, CA (1997-1998; 1999-2000)	3000	NA	24.4-42.7	NA	50-m radius	2 years	Quarterly
Searsburg, VT (1997)	11	7	65	11	20- to 55-m radius	Spring, fall	Weekly (fall migration)
High Sheldon, NY (2010)	75	112.5	80	25	115 m x 115 m	7 months	Daily (8 turbines), weekly (17 turbines)
High Sheldon, NY (2011)	75	112.5	80	25	115 m x 115 m	7 months	Daily (8 turbines), weekly (17 turbines)
Shiloh I, CA (2006-2009)	100	150	65	100	105-m radius	3 years	Weekly
Shiloh II, CA (2009-2010)	75	150	33 turbs = 115; 42 turbs = 125	25	100m radius	1 yr	Once/week
SMUD Solano, CA (2004-2005)	22	15	65	22	60-m radius	1 year	Bi-monthly
Stateline, OR/WA (2001-2002)	454	299	50	124	minimum 126 m x 126 m	17 months	Bi-weekly, monthly

Appendix C5. All post-construction monitoring studies, project characteristics, and select study methodology.

Project Name	Total # of Turbines	Total MW	Tower Size (m)	Number Turbines Searched	Plot Size	Length of Study	Survey Frequency
Stateline, OR/WA (2003)	454	299	50	153	minimum 126 m x 126 m	1 year	Bi-weekly, monthly
Stateline, OR/WA (2006)	454	299	50	39	variable turbine strings	1 year	Bi-weekly
Steel Winds I, NY (2007)	8	20	80	8	176m x 176m	6.5 months	Every 10 days (spring, fall) every 21 days (summer)
Stetson Mountain I, ME (2009)	38	57	80	19	76-m diameter	27 weeks (spring, summer, fall)	Weekly
Stetson Mountain I, ME (2011)	38	57	80	19	varied	6 months	Weekly
Stetson Mountain II, ME (2010)	17	25.5	80	17	varied	6 months	Weekly (3 turbines twice a week)
Summerview, Alb (2005-2006)	39	70.2	67	39	140 m x 140 m	1 year	Weekly, bi-weekly (May to July, September)
Summerview, Alb (2006; 2007)	39	70.2	65	39	52-m radius; 2 spiral transects 7 m apart	Summer, fall (2 years)	Daily (10 turbines), weekly (29 turbines)
Tehachapi, CA (1996-1998)	3300	NA	14.7 to 57.6	201	50-m radius	20 months	Quarterly
Top of Iowa, IA (2003)	89	80	71.6	26	76 m x 76 m	Spring, summer, fall	Once every 2 to 3 days
Top of Iowa, IA (2004)	89	80	71.6	26	76 m x 76 m	Spring, summer, fall	Once every 2 to 3 days
Tuolumne (Windy Point I), WA (2009-2010)	62	136.6	80	21	180 m x 180 m	1 year	Monthly throughout the year, a sub-set of 10 turbines were also searched weekly during the spring, summer, and fall
Vansycle, OR (1999)	38	24.9	50	38	126 m x 126 m	1 year	Monthly

Appendix C5. All post-construction monitoring studies, project characteristics, and select study methodology.

Project Name	Total # of Turbines	Total MW	Tower Size (m)	Number Turbines Searched	Plot Size	Length of Study	Survey Frequency
Vantage, WA (2010-2011)	60	90	80	30	240 m x 240 m	1 year	Monthly, a subset of 10 searched weekly during migration
Wessington Springs, SD (2009)	34	51	80	20	200 m x 200 m	Spring, summer, fall	Bi-monthly
Wessington Springs, SD (2010)	34	51	80	20	200 m x 200 m	8 months	Bi-weekly (spring, summer, fall)
White Creek, WA (2007-2011)	89	204.7	80	89	180 m x 180 m & 240 m x 240 m	4 years	Twice a week, weekly and monthly
Wild Horse, WA (2007)	127	229	67	64	110 m from two turbines in plot	1 year	Monthly, weekly (fall, spring migration at 16 turbines)
Windy Flats, WA (2010-2011)	114	262.2	NA	36 (plus 1 MET tower)	180 m x 180 m (120m at MET tower)	1 year	Monthly (spring, summer, fall, and winter), weekly (spring and fall migration)
Winnebago, IA (2009-2010)	10	20	78	10	200 m x 200 m	1 year	Weekly (migratory), monthly (non-migratory)
Wolfe Island, Ont (May-June 2009)	86	197.8	80	86	60-m radius	Spring	43 twice weekly, 43 weekly
Wolfe Island, Ont (July-December 2009)	86	197.8	80	86	60-m radius	Summer, fall	43 twice weekly, 43 weekly
Wolfe Island, Ont (January-June 2010)	86	197.8	80	86	60-m radius	6 months	43 twice weekly, 43 weekly
Wolfe Island, Ont (July-December 2010)	86	197.8	80	86	50-m radius	6 months	43 twice weekly, 43 weekly
Wolfe Island, Ont (January-June 2011)	86	197.8	80	86	50m radius	6 months	43 twice weekly, 43 weekly
Wolfe Island, Ont (July-December 2011)	86	197.8	80	86	50m radius	6 months	43 twice weekly, 43 weekly

Appendix C5 (*continued*). All post-construction monitoring studies, project characteristics, and select study methodology.

Data from the following sources:

Project, Location	Reference	Project, Location	Reference
Alite, CA (09-10)	Chatfield et al. 2010	Klondike IIIa (Phase II), OR (08-10)	Gritski et al. 2011
Alta Wind I, CA (11-12)	Chatfield et al. 2012	Leaning Juniper, OR (06-08)	Gritski et al. 2008
Alta Wind II-V, CA (11-12)	Chatfield et al. 2012	Lempster, NH (09)	Tidhar et al. 2010
Barton I & II, IA (10-11)	Derby et al. 2011a	Lempster, NH (10)	Tidhar et al. 2011
Barton Chapel, TX (09-10)	WEST 2011	Linden Ranch, WA (10-11)	Enz and Bay 2011
Beech Ridge, WV (12)	Tidhar et al. 2013	Locust Ridge, PA (Phase II; 09)	Arnett et al. 2011
Big Horn, WA (06-07)	Kronner et al. 2008	Locust Ridge, PA (Phase II; 10)	Arnett et al. 2011
Big Smile, OK (12-13)	Derby et al. 2013b	Madison, NY (01-02)	Kerlinger 2002b
Biglow Canyon, OR (Phase I; 08)	Jeffrey et al. 2009a	Maple Ridge, NY (06)	Jain et al. 2007
Biglow Canyon, OR (Phase I; 09)	Enk et al. 2010	Maple Ridge, NY (07)	Jain et al. 2009a
Biglow Canyon, OR (Phase II; 09-10)	Enk et al. 2011a	Maple Ridge, NY (07-08)	Jain et al. 2009d
Biglow Canyon, OR (Phase II; 10-11)	Enk et al. 2012b	Marengo I, WA (09-10)	URS Corporation 2010b
Biglow Canyon, OR (Phase III; 10-11)	Enk et al. 2012a	Marengo II, WA (09-10)	URS Corporation 2010c
Blue Sky Green Field, WI (08; 09)	Gruver et al. 2009	Mars Hill, ME (07)	Stantec 2008
Buena Vista, CA (08-09)	Insignia Environmental 2009	Mars Hill, ME (08)	Stantec 2009a
Buffalo Gap I, TX (06)	Tierney 2007	McBride, Alb (04)	Brown and Hamilton 2004
Buffalo Gap II, TX (07-08)	Tierney 2009	Melancthon, Ont (Phase I; 07)	Stantec Ltd. 2008
Buffalo Mountain, TN (00-03)	Nicholson et al. 2005	Meyersdale, PA (04)	Arnett et al. 2005
Buffalo Mountain, TN (05)	Fiedler et al. 2007	Moraine II, MN (09)	Derby et al. 2010d
Buffalo Ridge, MN (94-95)	Osborn et al. 1996, 2000	Mount Storm, WV (Fall 08)	Young et al. 2009b
Buffalo Ridge, MN (Phase I; 96)	Johnson et al. 2000a	Mount Storm, WV (09)	Young et al. 2009a, 2010b
Buffalo Ridge, MN (Phase I; 97)	Johnson et al. 2000a	Mount Storm, WV (10)	Young et al. 2010a, 2011b
Buffalo Ridge, MN (Phase I; 98)	Johnson et al. 2000a	Mount Storm, WV (11)	Young et al. 2011a, 2012b
Buffalo Ridge, MN (Phase I; 99)	Johnson et al. 2000a	Mountaineer, WV (03)	Kerns and Kerlinger 2004
Buffalo Ridge, MN (Phase II; 98)	Johnson et al. 2000a	Mountaineer, WV (04)	Arnett et al. 2005
Buffalo Ridge, MN (Phase II; 99)	Johnson et al. 2000a	Munnsville, NY (08)	Stantec 2009b
Buffalo Ridge, MN (Phase II; 01/Lake Benton I)	Johnson et al. 2004	Nine Canyon, WA (02-03)	Erickson et al. 2003b
Buffalo Ridge, MN (Phase II; 02/Lake Benton I)	Johnson et al. 2004	Noble Altona, NY (10)	Jain et al. 2011b
Buffalo Ridge, MN (Phase III; 99)	Johnson et al. 2000a	Noble Bliss, NY (08)	Jain et al.2009e
Buffalo Ridge, MN (Phase III; 01/Lake Benton II)	Johnson et al. 2004	Noble Bliss, NY (09)	Jain et al. 2010a
Buffalo Ridge, MN (Phase III; 02/Lake Benton II)	Johnson et al. 2004	Noble Bliss/Wethersfield, NY (11)	Kerlinger et al. 2011
Buffalo Ridge I, SD (09-10)	Derby et al. 2010b	Noble Chateaugay, NY (10)	Jain et al. 2011c
Buffalo Ridge II, SD (11-12)	Derby et al. 2012a	Noble Clinton, NY (08)	Jain et al. 2009c
Casselman, PA (08)	Arnett et al. 2009a	Noble Clinton, NY (09)	Jain et al. 2010b
Casselman, PA (09)	Arnett et al. 2010	Noble Ellenburg, NY (08)	Jain et al. 2009b
Casselman Curtailment, PA (08)	Arnett et al. 2009b	Noble Ellenburg, NY (09)	Jain et al. 2010c
Castle River, Alb. (01)	Brown and Hamilton 2006a	Noble Wethersfield, NY (10)	Jain et al. 2011a
Castle River, Alb. (02)	Brown and Hamilton 2006a	NPPD Ainsworth, NE (06)	Derby et al. 2007
Cedar Ridge, WI (09)	BHE Environmental 2010	Oklahoma Wind Energy Center, OK (04; 05)	Piorkowski and O'Connell 2010
Cedar Ridge, WI (10)	BHE Environmental 2011	Pebble Springs, OR (09-10)	Gritski and Kronner 2010b
Cohocton/Dutch Hill, NY (09)	Stantec 2010	Pine Tree, CA (09-10)	BioResource Consultants 2010
Cohocton/Dutch Hills, NY (10)	Stantec 2011	Pioneer Prairie I, IA (Phase II; 11-12)	Chodachek et al. 2012
Combine Hills, OR (Phase I; 04-05)	Young et al. 2006	PrairieWinds ND1 (Minot), ND (10)	Derby et al. 2011c
Combine Hills, OR (11)	Enz et al. 2012	PrairieWinds ND1 (Minot), ND (11)	Derby et al. 2012c
Condon, OR	Fishman Ecological Services 2003	PrairieWinds SD1 (Crow Lake), SD (11-12)	Derby et al. 2012d
Crescent Ridge, IL (05-06)	Kerlinger et al. 2007	PrairieWinds SD1 (Crow Lake), SD (12-13)	Derby et al. 2013a
Criterion, MD (11)	Young et al. 2012a	Prince Wind Farm, Ont (06)	Natural Resource Solutions 2009
Criterion, MD (12)	Young et al. 2013	Prince Wind Farm, Ont (07)	Natural Resource Solutions 2009
Crystal Lake II, IA (09)	Derby et al. 2010a	Prince Wind Farm, Ont (08)	Natural Resource Solutions 2009
Diablo Winds, CA (05-07)	WEST 2006, 2008	Red Canyon, TX (06-07)	Miller 2008
Dillon, CA (08-09)	Chatfield et al. 2009	Red Hills, OK (12-13)	Derby et al. 2013c
Dry Lake I, AZ (09-10)	Thompson et al. 2011	Ripley, Ont (08)	Jacques Whitford 2009
Dry Lake II, AZ (11-12)	Thompson and Bay 2012	Ripley, Ont (08-09)	Golder Associates 2010
Elkhorn, OR (08)	Jeffrey et a. 2009b	Rugby, ND (10-11)	Derby et al. 2011b
Elkhorn, OR (10)	Enk et al. 2011b	San Gorgonio, CA (97-98; 99-00)	Anderson et al. 2005
Elm Creek, MN (09-10)	Derby et al. 2010c	Searsburg, VT (97)	Kerlinger 2002a
Elm Creek II, MN (11-12)	Derby et al. 2012b	Shiloh I, CA (06-09)	Kerlinger et al. 2009
Erie Shores, Ont. (06)	James 2008	Shiloh II, CA (09-10)	Kerlinger et al. 2010b
Foote Creek Rim, WY (Phase I; 99)	Young et al. 2003b	SMUD Solano, CA (04-05)	Erickson and Sharp 2005
Foote Creek Rim, WY (Phase I; 00)	Young et al. 2003b	Stateline, OR/WA (01-02)	Erickson et al. 2004
Foote Creek Rim, WY (Phase I; 01-02)	Young et al. 2003b	Stateline, OR/WA (03)	Erickson et al. 2004
Forward Energy Center, WI (08-10)	Grodsky and Drake 2011	Stateline, OR/WA (06)	Erickson et al. 2007

Appendix C5 (*continued*). All post-construction monitoring studies, project characteristics, and select study methodology.

Data from the following sources:

Project, Location	Reference	Project, Location	Reference
Fowler I, IN (09)	Johnson et al. 2010a	Steel Winds I, NY (07)	Grehan 2008
Fowler III, IN (09)	Johnson et al. 2010b	Stetson Mountain I, ME (09)	Stantec 2009c
Fowler I, II, III, IN (10)	Good et al. 2011	Stetson Mountain I, ME (11)	Normandeau Associates 2011
Fowler I, II, III, IN (11)	Good et al. 2012	Stetson Mountain II, ME (10)	Normandeau Associates 2010
Fowler I, II, III, IN (12)	Good et al. 2013	Summerview, Alb (05-06)	Brown and Hamilton 2006b
Goodnoe, WA (09-10)	URS Corporation 2010a	Summerview, Alb (06; 07)	Baerwald 2008
Grand Ridge I, IL (09-10)	Derby et al. 2010g	Tehachapi, CA (96-98)	Anderson et al. 2004
Harrow, Ont (10)	Natural Resource Solutions 2011	Top of Iowa, IA (03)	Jain 2005
Harvest Wind, WA (10-12)	Downes and Gritski 2012a	Top of Iowa, IA (04)	Jain 2005
Hay Canyon, OR (09-10)	Gritski and Kronner 2010a	Tuolumne (Windy Point I), WA (09-10)	Enz and Bay 2010
High Sheldon, NY (10)	Tidhar et al. 2012a	Vansycle, OR (99)	Erickson et al. 2000a
High Sheldon, NY (11)	Tidhar et al. 2012b	Vantage, WA (10-11)	Ventus Environmental Solutions 2012
High Winds, CA (03-04)	Kerlinger et al. 2006	Wessington Springs, SD (09)	Derby et al. 2010f
High Winds, CA (04-05)	Kerlinger et al. 2006	Wessington Springs, SD (10)	Derby et al. 2011d
Hopkins Ridge, WA (06)	Young et al. 2007	White Creek, WA (07-11)	Downes and Gritski 2012b
Hopkins Ridge, WA (08)	Young et al. 2009c	Wild Horse, WA (07)	Erickson et al. 2008
Jersey Atlantic, NJ (08)	NJAS 2008a, 2008b, 2009	Windy Flats, WA (10-11)	Enz et al. 2011
Judith Gap, MT (06-07)	TRC 2008	Winnebago, IA (09-10)	Derby et al. 2010e
Judith Gap, MT (09)	Poulton and Erickson 2010	Wolfe Island, Ont (May-June 09)	Stantec Ltd. 2010a
Kewaunee County, WI (99-01)	Howe et al. 2002	Wolfe Island, Ont (July-December 09)	Stantec Ltd. 2010b
Kibby, ME (11)	Stantec 2012	Wolfe Island, Ont (January-June 10)	Stantec Ltd. 2011a
Kittitas Valley, WA (11-12)	Stantec Consulting 2012	Wolfe Island, Ont (July-December 10)	Stantec Ltd. 2011b
Klondike, OR (02-03)	Johnson et al. 2003a	Wolfe Island, Ont (January-June 11)	Stantec Ltd. 2011c
Klondike II, OR (05-06)	NWC and WEST 2007	Wolfe Island, Ont (July-December 11)	Stantec Ltd. 2012
Klondike III (Phase I), OR (07-09)	Gritski et al. 2010		