Appendix D-10

Bat Acoustic Studies 2011

NATURAL RESOURCES ◆ SCIENTIFIC SOLUTIONS

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TECHNICAL MEMORANDUM

Results of Bat Acoustic Surveys at the Proposed Alta East Wind Resource Area Kern County, California

December 13, 2010 – April 11, 2011

Submitted by:
Western EcoSystems Technology, Inc.

May 16, 2011

INTRODUCTION

In December of 2010, on behalf of CH2M HILL and Alta Windpower, LLC (Alta Windpower), Western EcoSystems Technology, Inc. (WEST) initiated a second year of acoustic surveys for bats at the Alta East Wind Resource Area (AEWRA) in Kern County, California. These surveys were designed to supplement an initial year of baseline acoustic monitoring conducted in 2009/2010 (Solick et al. 2010). This second year of the studies involved monitoring bat activity in the southwest corner of the AEWRA (see Figure 1), which was not covered in the previous year of surveys. Thus far the results of the current study are consistent with those results from the first year of studies, indicating that a wind energy facility at the AEWRA would not have a significant impact to bats. This memorandum summarizes results for the survey period from December 13, 2010, through April 11, 2011.

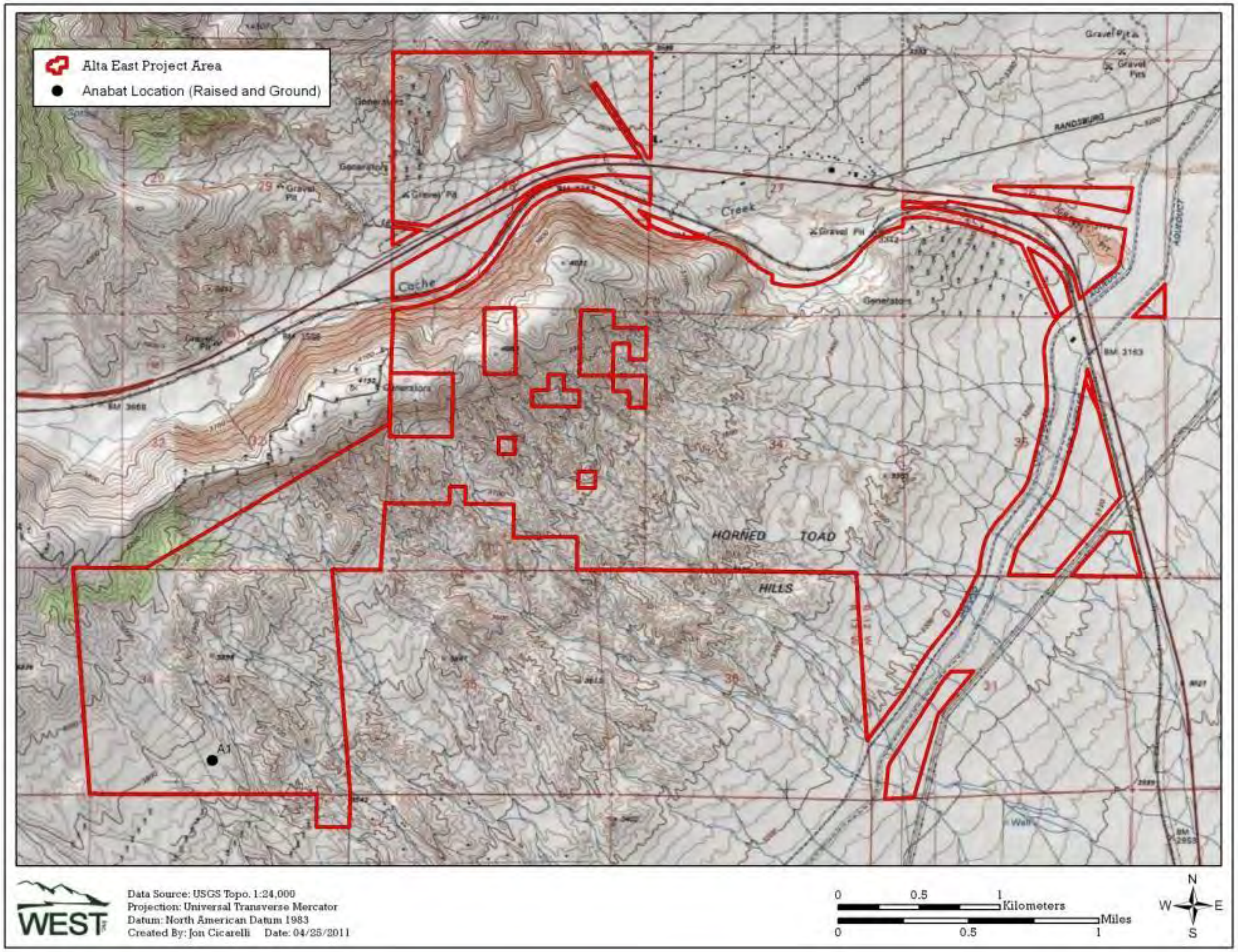

Figure 1. Map of the Alta East Wind Resource Area showing location of the Anabat station.

METHODS

The protocol used for this study follows guidelines set forth by the California Energy Commission (CEC and CDFG 2007). For Category 2 projects, the guidelines call for continuous monitoring of bat activity at meteorological (met) towers on site for 12 consecutive months. Surveys using passive ultrasonic bat detectors were initiated December 13, 2010, at one met tower located within the southwest corner of the AEWRA (Figure 1). Bat detectors are a recommended method to index and compare habitat use by bats. The use of bat detectors for calculating an index to bat impacts is a primary bat risk assessment tool for baseline wind development surveys (Arnett 2007; Kunz et al. 2007a). A total of two Anabat™ SD1 bat detectors (Titley™ Scientific, Australia) were deployed during the survey period at the AEWRA. One of the detectors was elevated 30 meters (m; 98 feet [ft]) on the met tower, while the other detector was positioned approximately 2 m (6.5 ft) above the ground at the base of the tower. The raised microphone was encased in a Bat-Hat weatherproof housing (EME Systems, Berkeley, California), and attached to a coaxial cable that transmitted ultrasonic sounds to an Anabat unit at the base of the tower. Detectors were programmed to collect data continuously from 30 minutes (min) before sunset to 30 min after sunrise, the period corresponding to greatest bat activity. A technician checked the detectors every two weeks, collected the data, and replacedpower supplies.

Anabat detectors record bat echolocation calls with a broadband microphone. The echolocation sounds are translated into frequencies audible to humans by dividing the frequencies by a predetermined ratio. A division ratio of eight was used for the study. Bat echolocation detectors also detect other ultrasonic sounds, such as those sounds made by insects, raindrops hitting vegetation, and other sources. A sensitivity level of six was used to reduce interference from these other sources of ultrasonic noise, as this level of sensitivity is optimal for removing noise while still recording the majority of bat call in range (Brooks and Ford 2005). Calls were recorded to a compact flash memory card with large storage capacity. The detection range of Anabat detectors depends on a number of factors (e.g., echolocation call characteristics, microphone sensitivity, habitat, the orientation of the bat, atmospheric conditions; Limpens and McCracken 2004), but is generally less than 30 m (98 ft) due to atmospheric absorption (attenuation) of echolocation pulses (Fenton 1991). To ensure similar detection ranges among detectors, microphone sensitivities were calibrated using a BatChirp (Tony Messina, Las Vegas, Nevada) ultrasonic emitter as described in Larson and Hayes (2000).

The units of bat activity were number of bat passes (Hayes 1997). A pass was defined as a continuous series of two or more call notes produced by an individual bat with no pauses between call notes of more than one second (White and Gehrt 2001, Gannon et al. 2003). The number of bat passes was determined by downloading the data files to a computer and tallying the number of echolocation passes recorded. Total number of passes was corrected for effort by dividing by the number of detector nights. For each station, bat passes were sorted into three groups, based on their minimum frequency, that correspond roughly to species groups of interest. For example, species such as western red bat (*Lasiurus blossevellii*) and most species in the genus *Myotis* generally echolocate at frequencies at or above 40 kilohertz (kHz), while species such as little brown bat (*Myotis lucifigus*) and western yellow bat (*Lasiurus xanthinus*) produce calls between 30 and 40 kHz, and silver-haired bat (*Lasionycteris noctivagans*) and hoary bat (*Lasiurus cinereus*) have echolocation frequencies that fall between 15 and 35 kHz. Therefore, passes were classified as either high-frequency (HF; greater than or equal to 40 kHz), mid-frequency (MF; between 30 and 40 kHz), and low-frequency (LF; below 30 kHz) passes. To establish which species may have produced passes in each category, a list of species expected to occur in the study area was compiled from range maps (Table 1; Harvey et al. 1999, BCI 2011). Data determined to be noise (produced by a source other than a bat) or call notes that did not meet the pre-specified criteria to be termed a pass were removed from the analysis.

Table 1. Bat species determined from range-maps (Harvey et al. 1999, BCI 2011) as likely to occur at the Alta East Wind Resource Area, sorted by call frequency.

Common Name	State/Federal Status	Scientific Name
High-Frequency (>40 kHz)		
California bat		*Myotis californicus*
California leaf-nosed bat	SSC	*Macrotus californicus*
canyon bat[1]		*Parastrellus hesperus*
cave bat[1]	SSC	*Myotis velifer*
long-legged bat[1]		*Myotis volans*
western red bat[1]	SSC	*Lasiurus blossevillii*
western small-footed bat		*Myotis ciliolabrum*
Yuma bat		*Myotis yumanensis*
Mid-Frequency (30-40 kHz)		
little brown bat[1]		*Myotis lucifugus*
western long-eared bat[1]		*Myotis evotis*
western yellow bat[1]	SSC	*Lasiurus xanthinus*
Low-Frequency (<30 kHz)		
big brown bat[1]		*Eptesicus fuscus*
fringed bat		*Myotis thysanodes*
hoary bat[1,2]		*Lasiurus cinereus*
Mexican free-tailed bat[1,2]		*Tadarida brasiliensis mexicanus*
pallid bat	SSC	*Antrozous pallidus*
pocketed free-tailed bat[1]	SSC	*Nyctinomops femorosaccus*
silver-haired bat[1,2]		*Lasionycteris noctivagans*
Townsend's big-eared bat	SSC	*Corynorhinus townsendii*
spotted bat	SSC	*Euderma maculatum*
western mastiff bat	SSC	*Eumops perotis califonicus*

[1]species known to have been killed at wind energy facilities
[2]long-distance migrant
Species found as fatalities reported in Anderson et al. 2004, Kunz et al. 2007b, Baerwald 2008, Miller 2008, Chatfield et al. 2009, Piorkowski and O'Connell 2010.
SSC = State Species of Special Concern (CDFG 2011)

Within these categories, an attempt was made to identify passes made by hoary bat and western red bat. Passes that produced a distinct U-shaped sonogram and that exhibited variability in the minimum frequency across the call sequence were identified as belonging to the *Lasiurus* genus (C. Corben, pers comm.). Hoary and western red bats were distinguished based on minimum frequency; hoary bats typically produce calls with minimum frequencies between 18 and 24 kHz, whereas western red bats typically emit calls with minimum frequencies between 38 and 50 kHz (J. Szewczak, pers comm.). Only sequences containing three or more calls were used for species identification.

INTERIM RESULTS AND RECOMMENDATIONS

During the period December 13, 2010, to April 11, 2011, WEST recorded a total of 95 bat passes during 233 detector-nights, or 0.41 ± 0.31 (mean ± standard error [SE]) bat passes per detector per night (Table 2). Bat activity was higher at the ground station, A1g (0.56 ± 0.50) compared to the raised station, A1h (0.26 ± 0.19; Figure 2).

Passes attributable to LF bats comprised the majority of bat activity (82.1% of all bat passes; Table 2), suggesting greater relative abundance of species such as silver-haired bat and Mexican free-tailed bat (*Tadarida brasiliensis mexicana*; Table 1). Included in these LF bat passes were five hoary bat passes recorded within the AEWRA, with three recorded at the ground station and one at the raised station (Table 2). No western red bat calls were identified. The parameters used to identify hoary and western red bat calls were conservative. Given the high intraspecific variability of bat calls and the number of call files that were too fragmented for proper identification, it is likely that more hoary bat and western red bat calls were recorded during the study than were positively identified.

The remaining calls (17.9%) were given by MF bats, such as little brown bat and western long-eared bat (*Myotis evotis*; Table 2). No HF bat passes were recorded during the study period, indicating that these species are generally absent from the study area during the late winter and spring.

Table 2. Results of acoustic bat surveys conducted at the Alta East Wind Resource Area, December 13, 2010 through April 11, 2011, separated by call frequency (MF= mid frequency; LF = low frequency).

			# of LF Bat Passes				
Anabat Station	**Location**	**# of MF Bat Passes**	**Unkn. LF species**	**Hoary Bats**	**Total Bat Passes**	**Detector-Nights**	**Bat Passes/ Night[1]**
A1g	ground	10	54	3	64	114	0.56±0.50
A1h	raised	7	24	2	31	119	0.26±0.19
Total		**17**	**78**	**5**	**95**	**233**	**0.41±0.31**

[1] ± standard error.

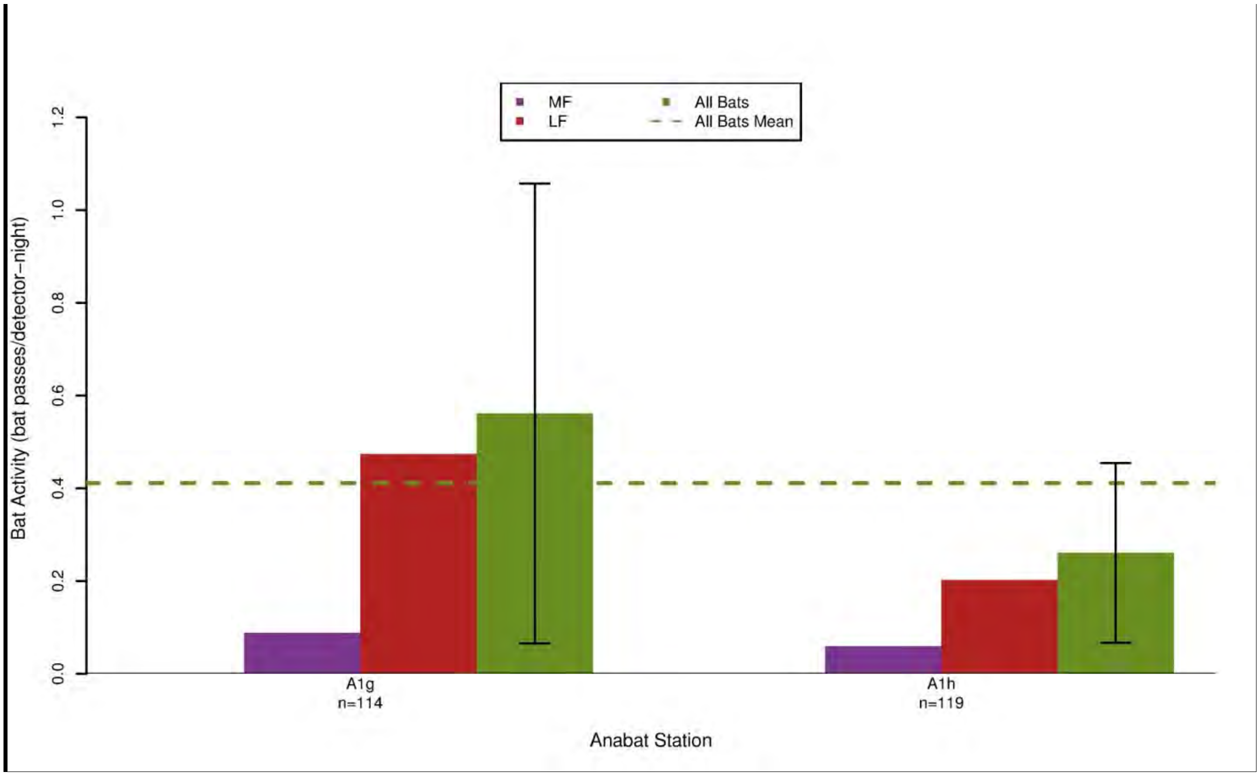

Figure 2. Number of bat passes per detector-night by Anabat station at the Alta East Resource Area for the study period December 13, 2010, through April 11, 2011. The standard errors are represented by the black error barson the 'All Bats' columns.

The highest bat activity occurred during the first week of the study period (December 13 -16, 2010), with an average of 9.88 bat passes per detector-night recorded during that period. Very low levels of activity were recorded throughout the remainder of the winter and the early spring, with average weekly activity rates ranging from zero to 0.36 bat passes per detector-night (Figure 3).

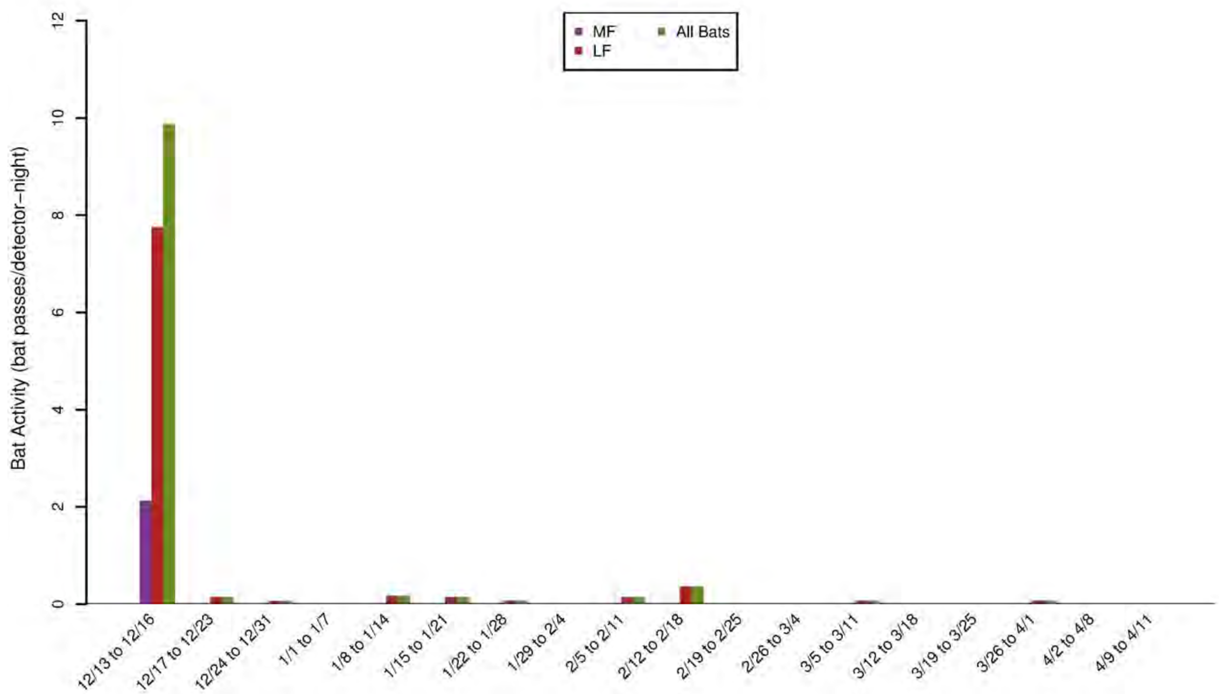

Figure 3. Weekly bat activity by mid-frequency (MF) and low-frequency (LF) bats at the Alta East Wind Resource Area for the study period December 13, 2010 through April 11, 2011.

Due to the differences in study period length, type of equipment, placement of equipment and presentation of data, it is not possible to directly compare the results from the AEWRA with studies conducted at other proposed wind energy facilities; however, some generalizations can be made. In general, reported fatality rates have been highest in the Northeast and lowest in the Northwest, although a high degree of variation in reported fatality rates is present for most regions. For studies that measured activity and fatality, the highest (38.3) and lowest (0.3) mean bat passes per detector night correspond with the highest (31.69) and lowest (1.4) bat fatalities/MW/study period (Table 3). However, the relationship in bat activity and bat fatalities is not consistent. For example, despite high activity at Top of Iowa (34.9; 2003), fatalities were relatively low (7.16), whereas low bat activity at Blue Sky Green Field (7.7) corresponded with a high fatality estimate (24.57; Table 3).

Bat activity recorded at the AEWRA during this study (0.41 ± 0.31 bat passes per detector-night) is relatively very low, and is consistent with bat activity recorded during the previous year of study at the AEWRA (0.22 ± 0.03 bat passes per detector-night; Solick et al. 2010; Table 3). Based on reported fatality rates at wind energy facilities in California and the Pacific Northwest regions of the US, the bat activity observed at the AEWRA during two years of study, and habitats within the project, it is expected that the potential risk to bats from turbine operations to be lower than or similar to the rates observed at other western facilities, and not nearly as high as the rates observed at eastern ridgeline facilities. As well, comparatively very few bat mortalities have been found during post-construction fatality surveys at existing wind energy facilities in the immediate vicinity (see Anderson et al. 2004, M.H. Wolfe and Associates 2008, Chatfield et al. 2010), further suggesting that fatality rates at the AEWRA will be relatively low.

Table 3. Wind energy facilities in North America with activity and fatality data for bats, grouped by geographic region.

Wind Energy Facility	Bat Activity Estimate[A]	Fatality Estimate[B]	No. of Turbines	Total MW
Alta East, CA (this study)	**0.41**			
Alta East, CA (2009/2010)	0.22			
California				
High Winds, CA (2004)		2.51	90	162
Dillon, CA		2.17	45	45
High Winds, CA (2005)		1.52	90	162
Alite, CA		0.24	8	24
SMUD Solano, CA		0.07		15
Alta-Oak Creek Mojave, CA	2.5			
Pacific Northwest				
Stateline, OR/WA (2003)		2.52	454	300
Nine Canyon, WA		2.47	37	48
Biglow Canyon, OR (Phase I; 2008)		1.99	76	125.4
Leaning Juniper, OR		1.98	67	100.5
Big Horn, WA		1.90	133	199.5
Combine Hills, OR		1.88	41	41
Hopkins Ridge, WA (2008)		1.39	83	150
Elkhorn, OR		1.26	61	101
Klondike III, OR		1.26	122	375
Stateline, OR/WA (2002)		1.20	454	300
Vansycle, OR		1.12	38	24.9
Klondike, OR		0.77	16	24
Hopkins Ridge, WA (2006)		0.63	83	150
Biglow Canyon, OR (Phase I; 2009)		0.58	76	125.4
Klondike II, OR		0.41	50	75
Wild Horse, WA		0.39	127	229
Marengo II, WA		0.27	39	70.2
Marengo I, WA		0.17	78	140.4
Southern Plains				
Oklahoma Wind Energy Center, OK		0.53	68	102
Buffalo Gap, TX		0.10	67	134

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Wind Energy Facility	Bat Activity Estimate[A]	Fatality Estimate[B]	No. of Turbines	Total MW
	Midwest			
Cedar Ridge, WI		30.6[F]	41	68
Blue Sky Green Field, WI	7.7[D]	24.57	88	145
Top of Iowa, IA (2004)	35.7[C]	10.27	89	80
Fowler Ridge I, IN (2009)		8.09	162	301
Crystal Lake II, IA		7.42[E]	80	200
Top of Iowa, IA (2003)	35.7[C]	7.16	89	80
Kewaunee County, WI		6.55	31	20
Ripley, Ont		4.67	38	76
Winnebago, IA		4.54	10	20
Buffalo Ridge, MN (Phases II & III; 2001)	2.2	4.03	281	210.75
Crescent Ridge, IL		3.27	33	49.5
Buffalo Ridge, MN (Phase III; 1999)		2.72	138	103.5
Buffalo Ridge, MN (Phase II; 1999)		2.59	143	107.25
Moraine II, MN		2.42	33	49.5
Buffalo Ridge, MN (Phase II; 1998)		2.16	143	107.25
Grand Ridge, IL		2.10	66	99
Fowler Ridge III, IN (2009)		1.84[G]	60	99
Buffalo Ridge, MN (Phases II & III; 2002)	1.9	1.73	281	210.75
Elm Creek, MN		1.49	67	100
Wessington Springs, SD	0.18	1.48	34	51
NPPD Ainsworth, NE		1.16	36	59.4
Buffalo Ridge, MN (Phase I; 1999)		0.76	73	25
Buffalo Ridge I, SD		0.16	24	50.4
Timber Road II, OH	2.78			
	Rocky Mountains			
Summerview, Alb. (2006)	5.3	14.62	39	70.2
Summerview, Alb. (2005/2006)		10.27	39	70.2
Judith Gap, MT		8.93	90	135
Summerview, Alb. (2007)		8.23	39	70.2
Foote Creek Rim, WY (Phase I; 1999)		3.97	69	41.4
Foote Creek Rim, WY (Phase I; 2001/2002)		1.57	69	41.4
Foote Creek Rim, WY (Phase I; 2000)	2.2	1.05	69	41.4

Table 3. Wind energy facilities in North America with activity and fatality data for bats, grouped by geographic region.

Wind Energy Facility	Bat Activity Estimate[A]	Fatality Estimate[B]	No. of Turbines	Total MW
	Northeastern			
Buffalo Mountain, TN (2006)		39.70	18	29
Mountaineer, WV	38.3	31.69	44	66
Buffalo Mountain, TN (2000-2003)	23.7	31.54	3	2
Meyersdale, PA		18.00	20	30
Cohocton/Dutch Hill, NY		16.02	50	125
Maple Ridge, NY (2006)		15.00	120	198
Noble Bliss, NY (2008)		14.66	67	100
Cassleman, PA (Spring & Fall 2008)		12.61	23	34.5
Mount Storm, WV (2008)	35.2	12.11	82	164
Casselman, PA (Fall 2008)		9.91	23	34.5
Maple Ridge, NY (2007)		9.42	195	321.75
Noble Clinton, NY (2009)		6.48	67	100
Wolfe Island, Ont.		6.42	86	197.8
Noble Bliss, NY (2009)		5.50	67	100
Noble Ellenburg, NY (2008)		5.45	54	80
Noble Ellenburg, NY (2009)		5.34	54	80
Noble Clinton, NY (2008)		3.63	67	100
Mars Hill, ME (2007)		2.91	28	42
Stetson Mountain, ME	0.30	1.40	38	57
Munnsville, NY		0.46	23	34.5
Mars Hill, ME (2008)		0.45	28	42

A=bat passes per detector night;
B=number of bat fatalities/MW/study period;
C=averaged across phases and/or study years, and may not be directly related to mortality estimates;
D=bat activity not measured concurrently with bat mortality studies;
E=estimate includes incidentals;
F=number of bat fatalities/MW spring and fall survey period only;
G= number of bat fatalities/MW/spring season only

Table 3 (*continued*). Wind energy facilities in North America with activity and fatality data for bats, grouped by geographic region.

Data from the following sources:

Facility	Activity Estimate	Fatality Estimate	Facility	Activity Estimate	Fatality Estimate
Alta East, CA (09/10)	Solick et al. 2010		Buffalo Ridge, MN (Phase II; 98)		Johnson et al. 2004
High Winds, CA (04)		Kerlinger et al. 2006	Grand Ridge, IL		Derby et al. 2010f
Dillon, CA		Chatfield et al. 2009	Fowler Ridge III, IN		Johnson et al. 2010b
High Winds, CA (05)		Kerlinger et al. 2006	Buffalo Ridge, MN (Phase II& III; 02)	Johnson et al. 2004	Johnson et al. 2004
Alite, CA		Chatfield et al. 2010			
SMUD Solano, CA		Erickson and Sharp 2005	Elm Creek, MN		Derby et al. 2010d
Alta-Oak Creek Mojave, CA	Erickson et al. 2009		Wessington Springs, SD	Derby et al. 2008	Derby et al. 2010e
Stateline, OR/WA (03)		Erickson et al. 2004	NPPD Ainsworth, NE		Derby et al. 2007
Nine Canyon, WA		Erickson et al. 2003	Buffalo Ridge, MN (Phase I; 99)		Johnson et al. 2000
Biglow Canyon, OR (Phase I; 08)		Jeffrey et al. 2009a	Buffalo Ridge, SD		Derby et al. 2010c
Leaning Juniper, OR		Gritski et al. 2008	Timber Road II, OH	Good et al. 2009	
Big Horn, WA		Kronner et al. 2008	Summerview, Alb. (06)	Baerwald 2008	Baerwald 2008
Combine Hills, OR		Young et al. 2006	Summerview, Alb. (05/06)		Brown and Hamilton 2006
Hopkins Ridge, WA (06)		Young et al. 2009b	Judith Gap, MT		TRC 2008
Elkhorn, OR		Jeffrey et al. 2009b	Summerview, Alb. (07)		Baerwald 2008
Klondike III, OR		Gritski et al. 2009	Foote Creek Rim, WY (Phase I; 99)		Young et al. 2003
Stateline, OR/WA (02)		Erickson et al. 2004	Foote Creek Rim, WY (Phase I; 01/02)		Young et al. 2003
Vansycle, OR		Erickson et al. 2000	Foote Creek Rim, WY (Phase I; 00)	Gruver 2002	Young et al. 2003
Klondike, OR		Johnson et al. 2003	Buffalo Mountain, TN (06)		Fiedler et al. 2007
Hopkins Ridge, WA (06)		Young et al. 2007	Mountaineer, WV	Arnett (pers comm. 2005)	Kerns and Kerlinger 2004
Biglow Canyon, OR (Phase I; 09)		Enk et al. 2010	Buffalo Mountain, TN (00-03)	Fiedler 2004	Nicholson et al. 2005
Klondike II, OR		NWC and WEST 2007	Meyersdale, PA		Arnett et al. 2005
Wild Horse, WA		Erickson et al. 2008	Cohocton/Dutch Hill, NY		Stantec 2010
Marengo II, WA		URS Corporation 2010b	Maple Ridge, NY (06)		Jain et al. 2007
Marengo I, WA		URS Corporation 2010a	Noble Bliss, NY (08)		Jain et al. 2009d
Oklahoma Wind Energy Center, OK		Piorkowski 2006	Casselman, PA (Spring & Fall 08)		Arnett et al. 2009b
Buffalo Gap, TX		Tierney 2007	Mount Storm, WV (08)	Young et al. 2009a	Young et al. 2009a
Cedar Ridge, WI		BHE Environmental 2010	Casselman, PA (Fall 08)		Arnett et al. 2009a
Blue Sky Green Field, WI	Gruver 2008	Gruver et al. 2009	Maple Ridge, NY (07)		Jain et al. 2008
Top of Iowa, IA (2004)	Jain 2005	Jain 2005	Noble Clinton, NY (09)		Jain et al. 2010b
Fowler Ridge I, IN		Johnson et al. 2010a	Wolfe Island, Ont.		Stantec, Ltd. 2010
Crystal Lake II, IA		Derby et al. 2010a	Maple Ridge, NY (08)		Jain et al. 2009c
Top of Iowa, IA (2003)	Jain 2005	Jain 2005	Noble Bliss, NY (09)		Jain et al. 2010a
Kewaunee County, WI		Howe et al. 2002	Noble Ellenburg, NY (08)		Jain et al. 2009a
Ripley, Ont.		Jacques Whitford 2009	Noble Ellenburg, NY (09)		Jain et al. 2010c
Winnebago, IA		Derby et al. 2010b	Noble Clinton, NY (08)		Jain et al. 2009b
Buffalo Ridge, MN (Phase II& III; 01)	Johnson et al. 2004	Johnson et al. 2004	Mars Hill, ME (07)		Stantec 2008a
Crescent Ridge, IL		Kerlinger et al. 2007	Stetson Mountain, ME	Stantec 2009b	Stantec 2009b
Buffalo Ridge, MN (Phase III; 99)		Johnson et al. 2004	Munnsville, NY		Stantec 2008b
Buffalo Ridge, MN (Phase II; 99)		Johnson et al. 2004	Mars Hill, ME (08)		Stantec 2009a
Moraine II, MN		Derby et al. 2010d			

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