

**STATE OF VERMONT
PUBLIC SERVICE BOARD**

Docket No. _____

Petition of Deerfield Wind, LLC for a Certificate)
of Public Good pursuant to 30 V.S.A. section 248,)
authorizing it to construct up to a 45 MW wind electric)
generation facility, and associated transmission and)
interconnection facilities, in Searsburg and Readsboro,)
Vermont, and operate the same.)

**PREFILED DIRECT TESTIMONY OF
ROBERT D. ROY AND WALLACE P. ERICKSON**

ON BEHALF OF DEERFIELD WIND, LLC

January 8, 2007

Summary:

Mr. Roy and Mr. Erickson describe the bird and bat surveys conducted at the proposed Deerfield Wind Project and assess the potential impact of the Project on migrating birds and migrating and resident bats. They conclude that the Project should not have any undue adverse effect on migrating or resident birds or bats.

1 **Q. Please state your names, addresses, and occupations.**

2 Response RR. Robert D. Roy (RR), Woodlot Alternatives, Inc. (Woodlot), 30 Park
3 Drive, Topsham, Maine 04086. My occupation is a wildlife biologist, and I have
4 been registered by The Wildlife Society as a Certified Wildlife Biologist.

5

6 Response WE. Wallace P. Erickson (WE), Western EcoSystems Technology Inc.
7 (WEST), 2003 Central Ave., Cheyenne, Wyoming, 82001. My occupation is as a
8 wildlife statistician.

9

10 **Q. Please briefly describe your background and experience.**

11 Response RR. I earned my Bachelors of Science degree from the University of
12 Maine in 1992. I have conducted a large number of wildlife use and impact
13 assessments projects. I first conducted avian risk surveys using radar monitoring
14 equipment in 1994. Since then, I have conducted and overseen approximately
15 three dozen seasonal migration studies using radar and observational techniques.

16 I first began conducting nighttime radar studies of bird migration in 1994
17 when investigating migration patterns in the vicinity of a proposed wind energy
18 development in the Boundary Mountains of western Maine. Since then, I have
19 conducted a large number of daytime raptor migration and nighttime radar and bat
20 detector studies in the Northeast and central Atlantic states in a variety of
21 landscape settings, including high linear ridgelines, individual mountaintops, the
22 Great Lakes plain, and rolling agricultural landscapes. In total, I have conducted
23 and overseen approximately three dozen seasonal radar migration studies from

1 Maine to West Virginia. Some of these studies have also used other methods to
2 investigate bird and bat movements and habitat use, including acoustical recording
3 devices, ceilometers, night-vision equipment, thermal imaging cameras, and visual
4 observations of morning migration movements and daytime surveys of migrants
5 foraging during stopover events.

6 In Vermont, I have conducted and overseen several radar and acoustic
7 surveys of nocturnal bird and bat migration, along with several diurnal raptor
8 migration surveys. These have occurred in northern, central, and southern
9 Vermont, including surveys at the existing wind facility at Searsburg.

10 My resume is attached as ***Exhibit DFLD-RR/WE-1***.
11 Response WE. I earned my Bachelors of Science degree in Statistics from the
12 University of Wyoming in 1989, and a Masters of Science degree from the
13 University of Wyoming in 1991. I have conducted and otherwise participated in
14 numerous wildlife studies, including several impact assessment projects. I first
15 participated in assessment of potential impacts of wind projects on wildlife in 1994
16 for two projects located in the Columbia Basin of the Pacific Northwest. Since
17 then, I have participated in numerous pre-construction and post-construction
18 impact assessments throughout the country, including bird and bat studies. I have
19 designed numerous diurnal studies of bird activity at projects in the West and
20 Midwest. I also have participated in several nighttime radar studies, including
21 designing a study of bird migration near the Stateline Wind Facility located in
22 Oregon and Washington and aiding in interpretation of results, designing both the
23 daytime and nighttime radar studies of bird migration at the proposed Mount

1 Storm, West Virginia Wind power project, and participation in the Maine Wind
2 Power Advisory Group. My resume is attached as ***Exhibit DFLD-RR/WE-2***.

3

4 **Q. Have you previously provided testimony to the Public Service Board or in**
5 **other administrative or legal proceedings?**

6 Response of Roy. Yes, in the winter of 2005, I provided testimony on behalf of
7 EMDC, LLC regarding the East Haven Windfarm. I have also provided
8 testimony, rebuttal testimony, and discovery responses on behalf of UPC Vermont
9 Wind, LLC regarding the Sheffield Windfarm. Additionally, I have provided
10 expert witness testimony regarding radar and bat detector studies I conducted on
11 behalf of proposed projects in New Hampshire and West Virginia.

12 Response of Erickson. I have not provided testimony to the PSB but have
13 provided testimony to the Washington State Energy Facility Siting Council on
14 behalf of Horizon Wind Energy, regarding the Wild Horse Windfarm.

15

16 **Q. What is the purpose of your testimony?**

17 Response. The purpose of our testimony is to describe the bird and bat surveys at
18 the proposed Deerfield Wind site, and to assess the potential impact of the Project
19 on migrating birds and migrating and resident bats.

20

21 **Q. Please generally describe any on-site work you have conducted to assess the**
22 **potential impacts of the Deerfield Wind Project to migrating birds and bats.**

1 Response. Woodlot conducted five migration studies within the Deerfield Wind
2 Project area between September 2004 and October 2006: 1) a fall 2004 radar and
3 visual migration, 2) a spring 2005 migration study similar to the previous fall except
4 it included acoustic monitoring for bats, 3) a fall 2005 radar and acoustic survey, 4)
5 a spring 2006 radar and acoustic survey, and 5) a summer-fall 2006 acoustic survey.
6 The methods and results of each of the studies have been provided in five separate
7 reports, which are attached as ***Exhibits DFLD-RR/WE-3, 4, 5, 6, and 7.***

8
9 **Raptor Migration**

10 **Q. Please describe the methods used to characterize use of the Deerfield Wind**
11 **Project area by migrating raptors.**

12 Response. Raptor migration surveys were conducted by Woodlot in the fall of
13 2004 and spring of 2005. Both seasons consisted of hawk watches from the peaks
14 of the Western Project Area and the existing Searsburg facility (See Figures 2 and
15 2-1 in ***Exhibits DFLD-RR/WE-3 and 4,*** respectively). Ten days of surveys were
16 conducted during the fall 2004 work and seven were conducted during the spring
17 2005 work, based on consultation with the U.S. Forest Service and the Vermont
18 Fish and Wildlife Department. At the time, those agencies indicated that enough
19 migration data on migrating raptors had been collected for the Project, especially in
20 light of pre-construction survey data that was conducted over two years for the
21 existing Searsburg facility, which was summarized in the fall 2004 Woodlot report.

22 Surveys at the existing facility were conducted at the base of turbine
23 number 8, near the southern end of the facility. At the Western Project Area,

1 surveys were conducted at the cleared area around the meteorological
2 measurement tower, located midway along the project ridgeline area. Surveys were
3 generally conducted from 9 am to 3 pm in order to include the time of day when
4 the strongest thermal lift is produced and the majority of raptor migration activity
5 typically occurs. Surveys were targeted for days with favorable flight conditions
6 produced by low-pressure systems bringing southerly winds and days following the
7 passage of a weather front.

8 Surveys were based on methods used by the Hawk Migration Association of
9 North America (HMANA). Raptor observations were recorded onto HMANA data
10 sheets, which summarize the data for each species by hour. More detailed notes on
11 each observation, including location and flight path, flight height, and activity of the
12 animal, were also recorded.

13 The field observations were summarized by species for each survey day and
14 for the whole survey period. This included a tally of the total number of individuals
15 observed for each species and the observation rate (birds per hour). The number
16 and species composition of raptors observed flying below and above the
17 approximate maximum height of the proposed turbines was also calculated. During
18 the fall 2004 surveys, the raptor observations were classified using two height
19 categories: below 100 m (328') or above 100 m. During the spring 2005 surveys,
20 each observation received an individual estimate of flight height. Finally, the
21 mapped flight locations of individuals were reviewed to identify any overall patterns
22 for migrating raptors.

23

1 **Q. What were the results of the raptor migration surveys within the Deerfield**
 2 **Wind Project Area?**

3 Response. The results of the fall 2004 and spring 2005 raptor migration surveys
 4 are summarized in Table 1, below. Specific details of these surveys during each
 5 season are provided in the raptor section of the reports attached as ***Exhibits***
 6 ***DFLD-RR/WE-3 and 4*** of this testimony.

7

Table 1. Summary of raptor migration survey data in the vicinity of the Deerfield Wind Project.						
Summary Information	Survey Site and Season					
	Fall 2004			Spring 2005		
	Existing Facility	Western Project Area	Total	Existing Facility	Western Project Area	Total
Number of Survey Days	10	10	20	7	7	14
Number of Species Observed	9	15	15	9	11	13
Number of Individuals	147	725	872	38	44	82
Number of Birds/Hour	2.45	12.72	7.45	0.45	0.52	0.98
% Flying < 125 m Above Ground (410')	13%*	8%*	9%	68%	93%	82%
*Fall 2004 percentages are based on a max turbine height of 100 meters (328') rather than 125 meters. Based on the data recorded, these observations could not be re-analyzed to 125 meters (410').						

8

9 Because observations were recorded from the existing facility during both fall 2004
 10 and spring 2005, some opportunities to observe the flight patterns of migrating
 11 hawks near operating wind turbines occurred and some birds were observed flying
 12 over or within the turbine string at the existing facility. These typically included
 13 turkey vultures, although two sharp-shinned hawks were also observed. Several
 14 turkey vultures were observed flying between turbines, which placed them within
 15 the blade-swept height zone. These birds were observed 'lifting up' as they
 16 approached a wind turbine, flying directly over the moving blades, and then
 17 dropping back down on the opposite side. The sharp-shinned hawks that were

1 observed flew between the turbines but at heights of only a few meters above the
2 treetops, generally at a height of approximately 15 m (50'). This placed these
3 hawks below the blade-swept area of those turbines.

4

5 **Q. How do the results of raptor surveys at the Deerfield Wind Project compare**
6 **with other studies?**

7 Response. Appendix A Table 4 in ***Exhibits DFLD-RR/WE-3 and 4*** provides
8 the results of the two migration surveys described above. This table in each report
9 also provides the results of counts at HMANA hawk watch sites in the Northeast.
10 In general, the species composition of migrating raptors observed at the Deerfield
11 Wind Project was similar to other regional hawk count locations.

12 During both seasons, however, the total number and observation rate of
13 raptors observed at the Deerfield Wind Project were much lower than the
14 HMANA counts. During the fall 2004 surveys, observation rates from other
15 regional counts were 1.5 to 9.4 times greater than those documented at the
16 Deerfield Wind Project. During the spring 2005 surveys, observation rates from
17 other regional counts were 8.7 to 70 times greater than from the project area.

18 The low number of migratory raptors and observation rates documented at
19 the Deerfield Wind Project relative to other regional counts is probably due to
20 several factors. The Project is located in a landscape of discontinuous
21 mountaintops of various heights and relatively short, broken ridgelines that are
22 oriented in a variety of directions. This is in contrast to the long, unbroken,
23 parallel ridges that occur in areas like Hawk Mountain, Pennsylvania, which

1 receives high use by migrating raptors. In addition, the project area is not located
2 near any major river system, with the Connecticut River well to the east and the
3 Hudson River even further to the west. Large river valleys such as these are
4 landscape features that can also concentrate migratory hawks. Finally, the project
5 area is not located near any coastlines, which are also landscape features known to
6 concentrate migrant raptors.

7

8 **Q. Based upon all of the relevant information from the project site, other wind**
9 **projects, and the literature, do you expect the Project to have an undue adverse**
10 **impact to any population of raptors? Please explain.**

11 Response. No. Raptor mortality at all new wind projects has been relatively low.
12 Studies at newer generation U.S. wind plants (facilities with wind turbines on
13 tubular towers with 33-meter rotor diameters and larger) have typically suggested
14 relatively low raptor mortality (0 to 0.1 per MW per year), especially when
15 compared to older wind projects such as the Altamont Pass in California.

16 At eastern wind turbine sites where some level of standardized monitoring
17 has been conducted, few raptor fatalities have been reported. During the study of
18 the Mountaineer facility in West Virginia in 2003, one red-tailed hawk fatality and
19 one turkey vulture fatality were observed during the spring and fall searches
20 (weekly), and summer searches (~ monthly) of the facility.

21 Two raptor fatalities, a sharp-shinned hawk and a turkey vulture, were
22 documented at the Mountaineer facility during an intensive bat study in August –
23 mid September 2004. The turkey vulture was found during the first search, and

1 appeared to have been there for some time. Over the course of two years of
2 monitoring of three 660 kW turbines at the Buffalo Mountain Tennessee facility,
3 one red-tailed hawk fatality was documented. No raptor fatalities were
4 documented at other smaller sites that had some, albeit not very extensive, fatality
5 monitoring efforts.

6 Few raptor fatalities have been found at other facilities in the Midwest and
7 West. In the Pacific Northwest, mortality estimates have ranged from 0 to 0.10
8 raptor fatalities/MW/year. The only new U.S. facilities with high relative raptor
9 mortality compared to other new U.S. wind projects have been facilities in the
10 Solano County, California area and a repowering project in the Altamont Pass
11 wind resource area. Mortality of American kestrels has been relatively high at two
12 new projects in the two Solano County Projects. However, the amount of use of
13 the area by American kestrels is very high (e.g., estimates of 6 to 7 times higher
14 than the Altamont Pass area). The Diablo Winds Project in the Altamont Pass also
15 has high raptor use, and raptor mortality estimates in the 0.4 to 0.6 raptors per
16 MW per year range. These estimates are approximately one-third to one-half the
17 estimates of average raptor mortality from the older turbines still in existence in
18 the Altamont Pass. This Altamont study suggests that newer larger turbines are
19 significantly less risky than the older smaller turbines in the Altamont Pass.

20 Given that the diurnal studies at the Deerfield Project did not suggest the
21 site gets high relative raptor migration use compared to other sites, and the
22 mortality data at existing new generation facilities are relatively low, raptor
23 mortality at the site will also likely be relatively low. Given the relatively small size

1 of the Project, we anticipate few raptor fatalities and, thus, no undue adverse
2 impacts to raptor populations.

3 To date, no bald eagle fatalities at wind projects have been reported
4 (Erickson et al., 2001, 2002), and many of these projects have some use by bald
5 eagles. Only two observations were made of this species during the study, and
6 negligible collision risk is anticipated for this species. No other threatened or
7 endangered raptor species were observed, and no undue adverse impacts to T&E
8 species are anticipated.

9

10 **Avian Migration Radar Surveys**

11 **Q. Please briefly describe the methods used during the radar surveys**
12 **conducted at the Deerfield Wind Project.**

13 Response. Radar surveys were conducted in the fall of 2004, the spring and fall of
14 2005, and the spring of 2006. In the fall of 2004, two x-band radars were used,
15 while in all other subsequent surveys one radar was used. The fall 2004 surveys
16 consisted of one stationary radar located at the met tower opening in the Western
17 Project Area and a second, mobile radar that was operated either from near
18 Turbine 8 at the existing Searsburg facility or from a low elevation valley site at the
19 southern end of Yaw Brook Road, approximately 2.7 km (1.7 mi) west of the radar
20 site at the Western Project Area (Figure 3 in ***Exhibit DFLD-RR/WE-3***).

21 During the spring 2005 survey, the radar site was the same one previously
22 used near Turbine 8 at the existing Searsburg facility. During the fall 2005 survey,
23 the radar site was the same one previously used at the met tower in the Western

1 Project Area (Figures 3-1 and 2-1 in **Exhibits DFLD-RR/WE-4 and 5**,
2 respectively). Finally, during the spring 2006 survey a new radar site located at the
3 northern met tower of the Eastern Project Area, just south of the existing facility,
4 was used (Figure 2-1 in **Exhibit DFLD-RR/WE-6**).

5 The survey effort was as follows:

- 6 • During the fall 2004 survey, sampling occurred at the Western Project Area on
7 28 nights between September 16 and October 29, 2004. On 14 of those 28
8 nights, the radar site at the existing Searsburg facility was also sampled, and the
9 low elevation site was sampled on 13 of those 28 nights;
- 10 • During the spring 2005 survey, sampling occurred near Turbine 8 at the
11 existing Searsburg facility on 20 nights between April 28 and May 29, 2005;
- 12 • During the fall 2005 survey, sampling occurred on 32 nights between
13 September 2 and November 1, 2005; and
- 14 • During the spring 2006 survey, sampling occurred on 26 of 30 targeted nights
15 between April 16 and June 9, 2006.

16
17 **Q. Please describe the results and significance of the nocturnal radar surveys**
18 **during each of the three seasons of survey at the Deerfield Wind Project.**

19 Response. A summary of the overall results documented during each of the four
20 seasons of radar surveys at the Deerfield Wind Project are provided in Table 2,
21 below. Data tables providing the nightly results during each season of radar survey
22 are provided in the four reports attached as **Exhibits DFLD-RR/WE-3, 4, 5,**
23 **and 6.** While the radar has the ability to detect birds, bats, and even insects, it

1 cannot readily distinguish between these different types of animals being detected.
 2 Consequently, all animals observed on the radar screen are called targets.
 3 However, targets created by insects are not removed from radar data analysis based
 4 on the true flight speed of target, which is determined by correcting the targets on-
 5 screen speed using the target's flight direction, wind direction, and wind speed. By
 6 doing this, targets flying less than 6 m/s are identified as insects and those flying
 7 faster than this speed are birds or bats (Larkin 1991, Bruderer and Boldt 2001).
 8

Table 2. Summary of Deerfield radar survey results: 2004 – 2006

Location	Season	Average Passage Rate	Range in Nightly Passage Rates	Average Flight Direction	Average Flight Height (m)	% Targets < Turbine Height ^{† 1}
Existing Facility	Fall 2004	175	7 - 519	194	438	1%
Western Project Area	Fall 2004	193	8 - 1121	223	624	7%
Valley Location	Fall 2004	150	58 - 404	214	503	1%
All 3 sites combined	Fall 2004	178	7 - 1121	212	611	4%
Existing Facility	Spring 2005	404	74 - 973	69	523	6%
Western Project Area	Fall 2005	559	3 - 1736	221	395	17%
Eastern Project Area	Spring 2006	263	5 - 934	58	435	11%

[†]Percentage of targets below turbine height for surveys in 2004 and 2006 is for below 125 m. Previous reports for those studies include an analysis for 100 m.

9
 10 The fall 2004 survey was the most comprehensive of the three seasons because
 11 two radars were used to sample three locations. The mean passage rate at the
 12 Western Project Area (193 ± 41 t/km/hr) was slightly greater than at the existing
 13 Searsburg facility (175 ± 44 t/km/hr) and the low elevation site (150 ± 30

¹ The original maximum turbine height for the Project was 100 m (328'). After the completion of the three seasons of radar surveys, a revised turbine height of 125 m (410') was proposed for the Project. The radar flight height data has been re-analyzed to calculate the percent of targets flying below 125 m, rather than 100 m. That reanalysis is represented in Table 2 but is not, however, reflected in the three survey reports (**Exhibits DFLD-RR/WE-3, 4, and 5**), as the change in turbine height occurred after the final preparation of those reports.

1 t/km/hr), though not considerably different. Flight direction ranged from $194^{\circ} \pm$
2 48° at the existing facility to $223^{\circ} \pm 56^{\circ}$ at the Western Project Area. Mean flight
3 direction at the low elevation site was $214^{\circ} \pm 55^{\circ}$. Flight height was lowest over
4 the Western Project Area, at $503 \text{ m} \pm 21 \text{ m}$ ($1,650' \pm 69'$). Flight height at the
5 existing facility was $624 \text{ m} \pm 24 \text{ m}$ ($2,047' \pm 79'$) and $611 \text{ m} \pm 10 \text{ m}$ ($2,004' \pm 33'$)
6 at the low elevation site.

7 Perhaps the most significant result of the fall 2004 survey was the
8 indication that bird movement over the project area is broad front in nature and
9 that the topography of the project area is probably not directing significant
10 numbers of birds around the ridgelines or through saddles in the ridgelines. This
11 finding is consistent with the general view among avian experts that with some
12 exceptions, that night-migrating birds fly in broad front migration patterns. The
13 spring 2005 survey provided additional evidence of this. The mean passage rate
14 ($404 \pm 14 \text{ t/km/hr}$) was considerably higher than that documented during the fall
15 2004 surveys. However, the mean flight height of $523 \text{ m} \pm 59 \text{ m}$ ($1,715' \pm 194'$)
16 was similar, though more variable, than that found during the previous migration
17 season and the mean flight direction took migrants over the ridgelines of the
18 existing Searsburg facility and the Eastern Project Area at angles perpendicular to
19 the alignment of the ridges.

20 The fall 2005 and spring 2006 surveys were generally similar to each of the
21 two previous migration seasons' data. The mean flight direction during each of
22 these seasons was nearly identical to the mean flight direction documented the two
23 previous fall and spring seasons. The mean flight height during both of these latter

1 surveys was lower than that found during the fall 2004 and spring 2005 surveys,
2 though it was still higher than the approximate height of the proposed turbines.

3 The mean passage rate documented in the fall of 2005 (559 ± 87 t/km/hr)
4 was greater than the spring 2005 and fall 2004 results and the spring 2006 passage
5 rate (263 ± 45 t/km/hr) was less than both 2005 seasonal surveys. This variation
6 in passage rates is, in part, likely due to year-to-year variation in overall migrant
7 population numbers as well as weather patterns that could be directing migration
8 movements over a larger, regional scale. The fall of 2004 was very dry and very
9 few nights included rain. Consequently, a larger proportion of the migration
10 window included nights with generally suitable weather and the density of
11 migration was probably lower, as the number of migrants could be distributed over
12 many nights. Conversely, the spring and fall 2005 migration windows included a
13 higher proportion of nights with inclement weather. During these seasons,
14 migrants had fewer nights available during which to migrate so the density of
15 migrants, or number of migrants per night of sampling, could have been increased.
16 The spring 2006 survey period included generally average weather conditions in
17 between that of the relatively dry fall of 2004 and wet spring and fall of 2005.

18
19 **Q. How do the results of the Deerfield surveys compare with other studies?**

20 Response. Table 3 provides a summary of mean passage rates and mean flight
21 heights reported from other migration studies in the eastern United States using
22 methods and equipment similar to what was used at the Deerfield Wind Project.
23 Due to the broad geographic scale represented by these studies, flight direction is

1 expected to be different across these studies, although follow directions consistent
2 with spring (generally northerly) and fall migration (generally southerly), so flight
3 direction from other studies is not included in the table.

4 The table shows that there is a fair amount of variation in mean passage
5 rates documented at other sites over the last decade. However, despite the
6 variation, the results reported from the Deerfield Project area are within the range
7 of those other studies. The same can be said for mean flight height, although there
8 is generally less variation in flight height recorded from the available studies.

Table 3. Summary of Available Radar Survey Results						
Project Site	Season and Year	Average Passage Rate (t/km/hr)	Range in Nightly Passage Rates	Average Flight Height (m)	Percent Targets Below Turbine Height	Citation
1998						
Wethersfield, NY	Fall 1998	168	N/A	N/A	N/A	Cooper & Mabee 1999
Harrisburg, NY	Fall 1998	122	N/A	N/A	N/A	Cooper & Mabee 1999
2003						
Chautauqua, NY	Spring 2003	395	15-1702	528	(125 m) 4%	Cooper <i>et al.</i> 2004a
Chautauqua, NY	Fall 2003	238	10-905	532	(125 m) 4 %	Cooper <i>et al.</i> 2004b
Mt. Storm, WV	Fall 2003	241	8-852	410	N/A	Cooper <i>et al.</i> 2004c
2004						
Franklin, WV	Fall 2004	229	18-643	583	(125 m) 8%	Woodlot 2004
Prattsburgh, NY	Fall 2004	193	12-474	516	(125 m) 3%	Woodlot 2005a
Prattsburgh, NY	Fall 2004	200	18-863	365	(125 m) 9%	Mabee <i>et al.</i> 2005a
Sheffield, VT	Fall 2004	114	19-320	566	(125 m) 1%	Woodlot 2005b
Deerfield, VT	Fall 2004	178	7-1121	611	(125 m) 4%	Woodlot 2005c
2005						
Franklin, WV	Spring 2005	457	34-240	492	(125 m) 11%	Woodlot 2005c
Sheldon, NY	Spring 2005	112	6-558	371	(125 m) 21%	Woodlot 2006a
Prattsburgh, NY	Spring 2005	277	70-621	370	(125 m) 16%	Woodlot 2005d
Prattsburgh, NY	Spring 2005	170	3-844	319	(125 m) 18%	Mabee <i>et al.</i> 2005b
Cohocton, NY	Spring 2005	371	133-773	609	(125 m) 12%	Woodlot 2006b
Dairy Hills, NY	Spring 2005	117	n/a	397	(n/a) 15%	Young 2006
Fairfield, NY	Spring 2005	509	80-1175	419	(125 m) 20%	Woodlot 2005e
Jordanville, NY	Spring 2005	409	26-1410	371	(125 m) 21%	Woodlot 2005f
Clinton County, NY	Spring 2005	110	n/a	338	(n/a) 20%	Mabee <i>et al.</i> 2006
Churubusco, NY	Spring 2005	254	3-728	422	(120 m) 11%	Woodlot 2005g
Sheffield, VT	Spring 2005	208	11-439	522	(125 m) 6%	Woodlot 2006c
Deerfield, VT	Spring 2005	404	74-973	523	(125 m) 6%	Woodlot 2005h
Sheldon, NY	Fall 2005	197	43-529	422	(120 m) 3%	Woodlot 2006d
Dairy Hills, NY	Fall 2005	94	n/a	466	(n/a) 10%	Young 2006
Fairfield, NY	Fall 2005	691	116-1351	516	(125 m) 4%	Woodlot 2005i
Jordanville, NY	Fall 2005	380	26-1019	440	(125 m) 6%	Woodlot 2005j
Clinton County, NY	Fall 2005	197	n/a	333	(n/a) 12%	Mabee <i>et al.</i> 2006
Churubusco, NY	Fall 2005	152	9-429	438	(120 m) 5%	Woodlot 2005k
Deerfield, VT	Fall 2005	559	3-1736	395	(125 m) 17%	Woodlot 2005l
Mars Hill, ME	Fall 2005	512	60-1092	424	(120 m) 8%	Woodlot 2005m
2006						
Deerfield, VT	Spring 2006	263	5-934	435	(125) 11%	Woodlot 2006e
Mars Hill, ME	Spring 2006	338	76-374	384	(120 m) 16%	Woodlot 2006f

1 There are limitations in comparing data from one site to another and even
2 from year to year. Year-to-year variation in continental bird populations invariably
3 affects how many birds migrate through an area and year-to-year variation in the
4 location of weather systems probably results in some regional variation in
5 migration activity. Additionally, different studies utilize different amounts of
6 survey effort, which can limit their comparability to some extent. The timing of
7 survey effort within a migration season, even between two surveys with similar
8 total effort, can also affect the overall results from different studies as one study
9 may sample more of the peak nights of migration than another. Finally, the
10 selection and construction of a radar sampling site is an important determinant of
11 how effectively radar can detect birds in the surrounding airspace and how low to
12 the horizon a radar can 'see'. Due to this last important, highly variable factor,
13 radar studies at different locations are not always equally comparable.

14 Results from the Western Project Area from the fall of 2004 and 2005
15 provide a good example of variation documented from radar surveys in different
16 years. During both years, the same equipment was used in the same way at the
17 same site. Additionally, data collection and analysis was performed in the same
18 way and by the same personnel. Yet, some results were different between the two
19 seasons. In particular, the passage rate in 2005 was much greater than in 2004,
20 indicating the importance that year-to-year variation and differences in survey
21 effort and timing could play in the results from these types of surveys. However,
22 information collected on the flight habits of night-migrants, such as flight direction

1 and height, indicate that these variables do not change as much from season to
2 season and are often similar between sites.

3

4 **Q. What is known about avian mortality, particularly passerines, at wind**
5 **turbines and other tall structures?**

6 Response. Several mortality studies have been conducted at constructed wind
7 projects throughout the U.S. Songbirds (e.g., warblers, vireos, thrushes, sparrow)
8 are found to account for a large percent of known fatalities reported at new wind
9 projects (Johnson *et al.* 2000, Erickson *et al.* 2002). Species composition and
10 knowledge of distribution of these species indicate both resident and migrant
11 fatalities occur and a wide variety of species have been found during mortality
12 surveys.

13 Several summaries of known nationwide avian collisions with wind
14 turbines have been published (Erickson *et al.* 2001, Erickson *et al.* 2002, NWCC
15 2004). Estimated fatality rates are often expressed as the number of
16 fatalities/turbine/year or the number of fatalities/MW/year, when MW is
17 megawatt of production capacity. Fatality rates (adjusted for scavenging and
18 searcher efficiency) at U.S. wind projects range from approximately 1 to 8
19 fatalities/turbine/year (0 to 11.7 fatalities/MW/year). Based on the studies of new
20 wind projects, an average of approximately 2.3 fatalities/turbine/year
21 (approximately 3/MW/year) was estimated. A wide variety of species have been
22 found during mortality surveys, and no single species for any of these projects
23 comprised a large majority of the fatalities.

1 Bird groups other than songbirds comprise only a small proportion of the
2 documented fatalities. Migrant and resident waterfowl, waterbirds and shorebirds
3 have been occasionally reported as fatalities, however never in very large numbers,
4 even when migrant or resident use of an area was considered high (Erickson et al.
5 2002).

6 While numerous events at communication structures have documented up
7 to several hundred avian fatalities in one night, there have been only two
8 numerous-fatality events reported at U.S. wind generation facilities, both of which
9 were reasonably small. Fourteen nocturnal migrating passerine fatalities were
10 observed at two turbines during a single night at the Buffalo Ridge wind project in
11 Minnesota, during spring migration (Johnson *et al.* 2002). Approximately 25-30
12 nocturnal migrating passerine fatalities were observed at three turbines and a well-
13 lit substation at the Backbone Mountain, WV facility during one or two nights of
14 foggy weather (Kerns and Kerlinger 2004). Data from the latter study suggest that
15 sodium vapor lamps at the substation were the primary attractant, since fatality
16 locations were correlated with turbines near the substation and the other turbines
17 away from the substation had few fatalities during the same time period. After the
18 lights were turned off at the substation, no fatality events occurred. No major
19 mortality event has been reported for the existing Searsburg facility, including
20 during the year of standardized monitoring.

21 Studies of guyed tall structures at wind projects also provide some useful
22 information for understanding collision risk. For example, average songbird fatality
23 rates were 3-fold higher at the five guyed communication towers (167 feet high)

1 compared to the 600-750 kW turbines at the Foote Creek Rim Project in
2 Wyoming. One synthesis report indicated communication tower height is
3 significantly related to the likelihood of high mortality rates (Longcore *et al.* 2005).
4 This same research suggested communication tower kills could be reduced
5 significantly using tower heights less than 500 feet, compared to 1000 feet. A
6 recent study in Michigan estimated that guyed towers 380 to 480 feet (116 m to
7 146 m) in height killed 4 times fewer birds than towers 1,000 feet in height. The
8 preponderance of radar surveys conducted at proposed wind energy developments
9 in the eastern United States have documented mean flight heights 1,000 to 2,000
10 feet (300 to 600 m) above the ground (Table 3), which is well above the height of
11 modern turbines but still within the height zone of tall, guyed, lighted
12 communications towers.

13

14 **Q. Based upon all of the relevant information from the project site, other wind**
15 **projects, and the literature, do you expect the Project to have an undue adverse**
16 **impact to any population of migrating or resident birds? Please explain.**

17 Response. No. We discussed raptors above. With respect to other species, some
18 mortality is expected at the Deerfield site. However, we do not expect the
19 proposed Deerfield Wind Project to have any undue adverse effect on migrating or
20 resident birds because of its size and location, and because of experience at other
21 wind projects. As previously stated, the positioning of the turbines does not appear
22 to be in a major flyway as birds have been observed migrating in a broad front
23 within the project area.

1 The expected level of impact is extremely small compared to the millions
 2 of birds that travel through wind farms each year, and orders of magnitude less
 3 than the hundreds of millions of birds that die due to collision with transmission
 4 lines, vehicles, buildings, communication towers, and other human-influenced
 5 activities. For example, it is estimated that a total of 80 million birds are killed on
 6 American roads each year (Erickson *et al.* 2001, 2002). Table 4 provides a
 7 summary of some causes of bird mortality across the nation and estimates of the
 8 annual number of fatalities. We updated the estimates for Wind Generation
 9 Facilities based on the number of MW of installed capacity in the U.S. as of
 10 September 30, 2006. While all these estimates are measured with a reasonably
 11 high degree of uncertainty, as the table indicates, estimates of mortality at wind
 12 energy developments are likely at least an order of magnitude lower than estimates
 13 of mortality from most of the other sources.

Table 4. Summary of nation-wide bird mortality estimates		
Structure/Cause	Total Bird Fatalities	Reference
Vehicles	60 - 80 million	1
Building and Windows	98 - 980 million	2
Powerlines	10,000 - 174 million	1
Communication Towers	4 - 50 million	1
Wind Generation Facilities	32,000 - 125,000	1
Agricultural Pesticides	67 million	3
Housecats	100 million	4
1 Erickson <i>et al.</i> 2001, updated to number of MW installed, using mean and upper range of per MW mortality estimates from U.S. studies (NWCC 2004)		
2 Klem 1991		
3 Pimentel and Acquay 1992		
4 Coleman and Temple 1993		

14
 15 At this time, it is anticipated that a post-construction monitoring study will
 16 be conducted if the wind project is built to provide direct measures of the impact.

1

2 **Bat Surveys**

3 **Q. Please describe the methods used during the bat surveys conducted at the**
4 **Deerfield Wind Project.**

5 Response. Surveys for bats were conducted in the spring of 2005, in the late
6 summer and fall of 2005, in the spring of 2006, and in the summer and fall of
7 2006. A general description of the methods used is provided below and specific
8 details of the methods and results of the surveys are provided in the two study
9 reports for these surveys (***Exhibits DFLD-RR/WE-4, 5, 6, and 7***).

10 Anabat II detectors were used for all of the surveys conducted in the
11 project areas. Anabat detectors are frequency-division detectors, dividing the
12 frequency of ultrasonic calls made by bats. A factor of 16 was used for the
13 surveys². These detectors are able to detect all bat species known to occur in New
14 England using this setting.

15 All detectors were programmed to begin recording just prior to sunset and
16 cease recording after sunrise. Call files were recorded directly onto compact flash
17 media cards using a CF ZCAIM (Titley Electronics Pty Ltd) and downloaded to a
18 computer for analysis and calculation of detection rates.

19 Detection rates indicate only the number of calls detected and do not
20 necessarily reflect the number of individual bats in an area. Additionally, the
21 species documented with the detectors are not necessarily all species occurring in
22 the project area. Those species with low intensity calls may not be picked up by

² The frequency division setting literally divides ultrasonic calls detected by the detector by the division setting in order to produce signals at frequencies audible to the human ear.

1 the detectors while others might have other flight habits that make their likelihood
2 of detection with Anabat detectors low or unlikely.

3 The overall survey effort and location of detectors during each survey
4 period was as follows:

- 5 • Spring 2005 – Two bat detectors deployed at heights of 15 and 7
6 m (50' and 22') from April 19 to June 15, 2005 (55 detector-nights)
7 at the northern met tower of the Eastern Project Area;
- 8 • Summer-Fall 2005 – Two to four bat detectors, deployed at heights
9 of 20 and 15 m (100' and 50') from July 4 to November 1, 2005
10 (153 detector-nights) either singly or in pairs at the southern met
11 tower of the Eastern Project Area and the met tower of the
12 Western Project Area;
- 13 • Spring 2006 – Five bat detectors deployed from April 14 to June
14 12, 2005 (194 detector-nights) including a pair in each of the two
15 met towers used during the summer-fall 2005 survey, with the fifth
16 deployed along a treeline at the northern end of the Western
17 Project Area; and
- 18 • Summer-Fall 2006 – Five bat detectors deployed from June 13 to
19 October 27, 2006 (421 detector-nights) in the same locations as the
20 spring 2006 survey.

21

22 **Q. Please describe the results found from the bat surveys at the Deerfield Wind**
23 **Project.**

1 Response. The results of the four seasons of surveys are provided in Table 5,
 2 below. Additionally, the details of each of the four surveys can be found in
 3 ***Exhibits DFLD-RR/WE-4, 5, 6, and 7.***

4 In general, the total number of call sequences recorded during each season
 5 varied with the two spring season surveys yielding fewer recorded call sequences
 6 than the fall surveys. In terms of detection rates, however, each season of survey
 7 documented slightly greater activity than the previous season of survey. Overall,
 8 the detection rate documented during each season was still quite low. During both
 9 fall seasons, the detection rate in the Eastern Project Area were greater than in the
 10 Western Project Area. This relationship was reversed, however, during the spring
 11 2006 survey, when the detection rate in the Western Project Area was greater than
 12 in the Eastern Project Area.

Table 5. Comparison of results from all acoustic bat surveys at the Deerfield Wind Project.							
Year:	2005			2006			
Season:	Spring	Fall		Spring		Fall	
Site:	Eastern Project Area	Western Project Area	Eastern Project Area	Western Project Area	Eastern Project Area	Western Project Area	Eastern Project Area
Guilds							
Big brown	0	18	14	5	0	28	30
Red bat/eastern pipistrelle	0	4	1		1	5	11
<i>Myotis</i>	4	7	10	3	2	50	63
Unknown	0	11	61	3	1	60	133
Total by location	4	40	86	11	4	143	237
# Nights	55	119	34	87	107	216	205
Detection rate/site	0.07	0.34	2.53	0.13	0.04	0.66	1.16
Detection rate/season	0.07	0.5		0.7		0.9	

1 With respect to the species composition of documented bat activity at the
2 Project over the last three seasons, some general trends occur. Typically, calls
3 identified as unknown typically represent a significant proportion, if not a majority,
4 of the recorded call sequences. After this, call sequences of the myotids and the
5 big brown bat guild are the next most common guilds, although the dominance of
6 one of these guilds over the others varied from site to site and season to season.
7 Calls sequences attributable to the red bat/eastern pipistrelle guild typically
8 represent a small proportion of the recorded sequences and often less than 3
9 percent.

10 During analysis of the summer-fall 2006 survey data, one call file was
11 identified as potentially that of the eastern small-footed bat (*Myotis leibii*). This
12 identification is made with caution, as the identification of most bat call sequences
13 of the genus *Myotis* using Anabat data is very difficult to make. However, this one
14 call included more of the characteristics of this one species than other calls, which
15 either had very indistinct characteristics or had characteristics that were shared
16 among several species. This was the only call sequence suspected to be of a listed
17 bat species.

18
19 **Q. How do the results of your acoustic bat surveys compare with other studies**
20 **or what may be expected in the area?**

21 Response. The surveys aimed to calculate bat call detection rate indices in the
22 vicinity of some of the proposed wind turbines for the Deerfield Wind Project.
23 Spring sampling revealed very low levels of bat activity during the two-month

1 period of sampling, while the summer/fall sampling documented a relatively higher
 2 abundance of recorded call sequences. Little information providing detection rates
 3 using the same equipment and deployment methodology are available for other
 4 sites. However, we are aware of 5 studies (See Table 6 below) that conducted bat
 5 activity surveys concurrent with fatality studies. While this sample size is relatively
 6 small, and methods may have varied some in collection of the bat activity data, the
 7 reported bat mortality rates that included some adjustments for scavenging and
 8 searcher efficiency bias correlated strongly with the indices to bat activity. Sites
 9 with the lowest bat activity have shown relatively low bat mortality while those
 10 with the highest activity levels have shown much higher rates of mortality.

Table 6. Mortality and bat activity indices for five wind projects.				
Site	Total detector nights	Survey Periods	Bat Mortality (#/turbine/survey period)	Bat activity (#/detector/night)
Mountaineer, WV	33	Fall (1)	38	38.2
Buffalo Mtn., TN	149	Spring-fall (2)	20.8	23.7
Top of Iowa, IA	42	Spring-fall (2)	10.2	34.9
Buffalo Ridge, MN	216	Summer-fall (2)	2.2	2.1
Foote Creek Rim, WY	39	Summer-fall (2)	1.3	2.2

11
 12 The overall bat activity index, the average number of bat calls per detector-
 13 night, at the Deerfield Wind Project area was 0.6 calls per detector night, which is
 14 lower than the rates of any of the five sites above. If this activity index is as strong
 15 an indicator of mortality as this information alone suggests, bat mortality at the
 16 Deerfield Wind Project is predicted to be relatively low.

17 Nine species of bats occur in Vermont, based upon their normal
 18 geographic range. These are the little brown bat (*Myotis lucifugus*), northern long-

1 eared bat (*M. septentrionalis*), Indiana bat (*Myotis sodalis*), eastern small-footed bat,
2 silver-haired bat, eastern pipistrelle, big brown bat, eastern red bat, and hoary bat
3 (Whitaker and Hamilton 1998). The Indiana bat is a federally-listed endangered
4 species, the eastern small-footed bat is a state-listed threatened species, and both
5 the silver-haired bat and the eastern pipistrelle are rare in Vermont.

6 Results of winter population surveys in 23 known bat hibernacula have
7 revealed declines in Vermont's Indiana bat wintering population, an increase in the
8 little brown bat wintering population, and few changes in the small winter
9 populations of all other species known to overwinter in the state (i.e., small-footed
10 bats, northern long-eared bat, big brown bat, and eastern pipistrelle [Trombulak *et*
11 *al.* 2001]). The largest known Indiana bat hibernaculum in Vermont is located in
12 the Town of Manchester in the southern part of the state. The Deerfield Wind
13 Project is located in southern Vermont, approximately 20 miles from the
14 hibernaculum, and is within the published normal range and known dispersal
15 distance of the Indiana bat (Whitaker and Hamilton 1998).

16 Five species and one species group (with up to three species within the
17 group) were documented during the field surveys at the Deerfield Wind Project.
18 Big brown bats and *myotids* were the most commonly recorded bats. This is not
19 unexpected, as these species and species groups are generally believed to be the
20 most common of the Northeastern bats, particularly big brown bats, little brown
21 bats, and northern long-eared bats. The migratory tree roosting bats, such as the
22 eastern red bat, hoary bat, and silver-haired bat are generally much less commonly
23 documented and often form only a small proportion of recorded calls during

1 detector surveys. The same is true for eastern pipistrelles, which were not
2 commonly detected.

3 The largest known Indiana bat hibernaculum, mentioned above, is located
4 approximately 32 km (20 mi) north of the project area, so it is possible that bats
5 from that cave could fly to the project area. Significant uncertainty in the full
6 extent and use of those flight distance ranges, however, does exist. Attempts to
7 definitively differentiate between the myotids were conducted, but any
8 identifications to species were made with extreme caution and should be
9 considered conditional. Considering the known relative commonness of the little
10 brown bat and the northern long-eared bat, *myotid* call sequences documented
11 during the detector surveys at the Deerfield Wind Project are most likely to be
12 predominantly of those two species.

13

14 **Q. Has Deerfield Wind initiated any other bat studies in support of the**
15 **proposed project? If so, please explain.**

16 Response. Yes. Arrowwood Environmental conducted a study of potential bat
17 habitat that focused on two bat species: the Indiana bat and small-footed bat. The
18 results of this study are attached as an exhibit to Michael Lew-Smith's testimony,
19 ***Exhibit DFLD-MLS-5.***

20 Arrowwood's study was a desktop analysis that was conducted using aerial
21 photographs, 1:40,000 Color Infra-red photographs, National Agricultural Imagery
22 Program true color orthophotos (2003), black and white Orthophotos (1995 –
23 1998), and USGS topographic maps. For both species, a formal study area was

1 established through consultation with the federal and state resource agencies that
2 extended for three miles around the proposed project area.

3 Habitat identification for the Indiana bat focused on characteristics of
4 summer maternity roost habitat identified in the habitat suitability index model
5 (HSI) for this species. Thirty-nine assessment areas, each 872 acres in size, were
6 established within the study area. Under the HSI model, three variables were
7 assessed within each of these assessment areas: 1. food suitability as a function of
8 cover type diversity; 2. roost suitability as a function of the density of roost trees;
9 and 3. landscape suitability as a function of forest cover.

10 Habitat Identification for the small-footed bat focused on the presence of
11 cliffs and talus areas as maternity roost habitat. Color infra-red aerial photos like
12 those used to assess Indiana bat habitat were used to find and map these areas
13 within the study area. Elevation, aspect, size, and quality of potential habitat areas
14 were also included in the assessment.

15

16 **Q. What were the results, conclusions and recommendations of Arrowwood's**
17 **assessment and mapping exercise?**

18 Response. For the Indiana bat, the landscape suitability in all 39 assessment areas
19 was found to be very low and the likelihood of Indiana bats being present in the
20 area was also low based on the relatively uniform habitat within the project area.
21 Based on federal resource agency review and recommendations [email from Susi
22 vonOettingen to Jeff Parsons, June 10, 2005], it was decided that additional
23 surveys for this species were not needed. The landscape within the project area is

1 dominated by forests and lacks the cover type diversity identified as essential
2 habitat for Indiana bats.

3 For the eastern small-footed bat, four potential locations suitable for
4 maternal roost sites were identified in the study area. It was recommended by state
5 resource agency staff that these potential locations be verified in the field and the
6 use of echolocation devices within these mapped areas be used to determine the
7 presence of any individuals of this species.

8

9 **Q. Were any of the recommendations of the study undertaken? If so, by whom**
10 **and what were the results?**

11 Response. Yes, biologists from the Vermont Department of Fish and Wildlife and
12 the Green Mountain National Forest (GMNF) conducted a follow-up study that
13 focused on the 4 locations of potential eastern small-footed bat roosting habitat.
14 These locations were visited to assess aspect, solar radiation potential, roost site
15 potential, and bat use. According to a field survey write-up prepared by Mike
16 Burbank, a biologist with the GMNF, three of the sites were identified as having
17 low potential as maternity roost habitat. Only one of the four mapped locations
18 was investigated further, which included a detector survey on the evening of June
19 22, 2005. The results of the echolocation survey review conducted by Vermont
20 Fish and Wildlife included 14 calls of bats, only 6 of which were of high enough
21 quality to identify to species. The calls were entirely those of big brown bats, with
22 the exception of one eastern red bat.

23

1 **Q. Has a plan for post-construction monitoring of birds and bats been**
2 **designed? Please explain.**

3 Response. PPM has informed us that it is committed to performing one year of
4 post-construction mortality studies. Because the approach to this type of study is
5 rapidly evolving and given some of the unique characteristics of the site, PPM
6 intends to develop details of the study design after further discussions with ANR.

7
8 **Q. Based upon all of the relevant information from the project site, other wind**
9 **generation projects, and the literature, do you expect the Project to destroy or**
10 **significantly imperil any necessary bat habitat or to have an undue adverse impact**
11 **to any population of resident or migrating bats? Please explain.**

12 Response. Based on the information obtained from the Deerfield Project Area
13 and other similar studies, the Project is not likely to have any undue adverse effect
14 on bat habitat or bat migration within the project area. Data on bat mortality
15 observed at five existing facilities and corresponding bat activity measures (see
16 Table 6) suggest a positive correlation that overall bat mortality may, in part, be
17 predicted by bat activity indices from Anabat data. Based on the low detection
18 rates found at the Deerfield Wind Project, we would expect the mortality rates to
19 also be relatively low.

20 As noted above, the habitat suitability for the Indiana bat and small-footed
21 bat indicated that the risk to these species is also expected to be relatively low.

22
23 **Q. Does this conclude your testimony at this time?**

24 Response. Yes.

1 **Literature Cited**

2 Bruderer, B., and A. Boldt. 2001. Flight characteristics of birds: I. Radar measurements
3 of speeds. *Ibis*. 143:178-204.

4 Coleman, J. and S. Temple. 1993. Rural resident' free-ranging cats: A survey. *Wildlife*
5 Society Bulletin. 21:381-389.

6 Cooper, B.A., C.B. Johnson, and R.J. Ritchie. 1995. Bird migration near existing and
7 proposed wind turbine sites in the eastern Lake Ontario Region. Report to
8 Niagara Mohawk Power Corporation, Syracuse, NY.

9 Cooper, B.A., and T. Mabee. 1999. Bird migration near proposed wind turbine sites at
10 Wethersfield and Harrisburg, New York. Niagara Mohawk Power Corporation,
11 Syracuse, NY.

12 Cooper, B.A., A.A. Stickney, and T.J. Mabee. 2004a. A radar study of nocturnal bird
13 migration at the proposed Chautauqua wind energy facility, New York, Fall 2003.

14 Cooper, B.A., T. Mabee, and J. Plissner. 2004b. Radar study of nocturnal bird migration
15 at the proposed Mount Storm wind power development, West Virginia, Fall 2003.
16 *Appendix in:* Baseline Avian studies Mount Storm wind power project, Grant
17 County, West Virginia, final report April 2004. Prepared for NedPower Mount
18 Storm, LLC.

19 Cooper, B.A., A.A. Stickney, J.J. Mabee. 2004c. A visual and radar study of 2003 spring
20 bird migration at the proposed Chautauqua wind energy facility, New York. 2004.
21 Final Report prepared by ABR Inc. Chautauqua Windpower LLC.

22 Erickson, W.P., G.D. Johnson, M.D. Strickland, D.P. Young, K.J. Sernka and R.E. Good.
23 2001. Avian collisions with wind turbines: a summary of existing studies and

1 comparisons to other sources of avian collision mortality in the United States.

2 National Wind Coordinating Committee Resource document.

3 Erickson, W.P., G. Johnson, D. Young, D. Strickland, R. Good, M. Bourassa, and K. Bay.

4 2002. Synthesis and comparison of baseline avian and bat use, raptor nesting and

5 mortality information from proposed and existing wind developments. Prepared

6 for Bonneville Power Administration.

7 Johnson, G.D., W.P. Erickson, M.D. Strickland, M.F. Shepherd, and D.A. Shepherd.

8 2000. Avian Monitoring studies at the Buffalo Ridge, Minnesota Wind Resource

9 Area: Results of a 4-Year Study. Final Report. Western EcoSystems Technology,

10 Inc. Cheyenne, Wyoming.

11 Kerns, J., and P. Kerlinger. 2004. A Study of Bird and Bat Collision Fatalities at the

12 Mountaineer Wind Energy Center, Tucker County, West Virginia: Annual Report

13 for 2003, prepared for FPL Energy and Mountaineer Wind Energy Center

14 Technical Review Committee by Curry and Kerlinger, LLC, Cape May Point, NJ,

15 Feb 14.

16 Klem, D., Jr. 1991. Glass and bird kills: an overview and suggested planning and design

17 methods of preventing a fatal hazard. Pp. 99-103 *in* Wildlife Conservation in

18 Metropolitan Environments. NIUW Symp. Ser. 2. L.W. Adams and D.L. Leedy

19 (eds). Natl. Inst. for Urban Wildlife. Columbia, MD.

20 Larkin, R.P. 1991. Flight speeds observed with radar, a correction: slow "birds" are

21 insects. *Behavioral Ecology and Sociobiology*. 29:221-224.

22 Longcore et al. 2005. "Scientific Basis to Establish Policy Regulating Communication

23 Towers to Protect Migratory Birds: Response to Avatar Environmental, LLC

1 report regarding migratory bird collisions with communication towers, WT Docket
2 # 03-187 Federal Communications Notice of Inquiry.” Prepared by Land
3 Protection Partners.

4 Mabee, T.J., J.H. Plissner, and B.A. Cooper. 2005a. A Radar and Visual Study of
5 Nocturnal Bird and Bat Migration at the Proposed Prattsburgh-Italy Wind Power
6 Project, New York, Fall 2004. Final Report prepared for Ecogen LLC, March
7 2005.

8 Mabee, T.J., J.H. Plissner, and B.A. Cooper. 2005b. A Radar and Visual Study of
9 Nocturnal Bird and Bat Migration at the Proposed Prattsburgh-Italy Wind Power
10 Project, New York, Spring 2005. Final Report prepared for Ecogen LLC, August
11 2005.

12 ND&T (Northrop, Devine, and Tarbell, Inc.). 1995a. New England Wind Energy
13 Station: Fall 1994 Nocturnal Songbird Migration Study Report. Report prepared
14 for Kenetech Windpower, Portland, ME.

15 ND&T (Northrop, Devine, and Tarbell, Inc.). 1995b. New England Wind Energy Station:
16 Spring 1994 Nocturnal Songbird Migration Study Report, January 1995. Report
17 prepared for Kenetech Windpower, Portland, ME.

18 Pimentel, D., and Acquay, H. 1992. The Environmental and Economic Costs of Pesticide
19 Use. *BioScience* 42:750-760.

20 Trombulak, Stephen C., P.E. Higuera, and M. DesMeules. 2001. Population trends of
21 wintering bats in Vermont. *Northeastern Naturalist* 8(1):51-62.

22 Whitaker, J.O., and W.J. Hamilton. 1998. *Mammals of the Eastern United States*. Cornell
23 University Press.

1 Woodlot Alternatives, Inc. 2005a. Fall 2004 Avian Migration Surveys at the Proposed
2 Deerfield Wind/Searsburg Expansion Project in Searsburg and Readsboro,
3 Vermont. Report prepared for Deerfield Wind, LLC & Vermont Environmental
4 Research Associates. April 2005.

5 Woodlot Alternatives, Inc. 2005b. A Spring 2005 Avian Radar, Visual, and Acoustic
6 Survey of Bird and Bat Migration at the Proposed Deerfield Wind Project in
7 Searsburg and Readsboro, Vermont. Report prepared for Deerfield Wind, LLC &
8 Vermont Environmental Research Associates. November 2005.

9 Woodlot Alternatives, Inc. 2005c. A Fall 2005 Avian Radar and Acoustic Survey of Bird
10 and Bat Migration at the Proposed Deerfield Wind Project in Searsburg and
11 Readsboro, Vermont. Report prepared for Deerfield Wind, LLC & Vermont
12 Environmental Research Associates. November 2005.