MINUTES

MEETING OF THE TECHNICAL COMMITTEE ESTABLISHED BY THE NEW HAMPSHIRE SITE EVALUATION COMMITTEE IN DOCKET NO. 2006-01: APPLICATION OF LEMPSTER WIND, LLC ORDER AND DECISION ISSUED JUNE 28, 2007

March 4, 2010

The Lempster Wind, LLC Technical Committee meeting began at 1:20 pm. on Thursday, March 4, 2010. The following Committee members were present: New Hampshire Audubon Society (represented by Carol Foss); New Hampshire Fish and Game Department (represented by Mike Marchand); United States Fish and Wildlife Service (represented by Maria Tur); New Hampshire Office of the Attorney General (represented by Allen Brooks); Iberdrola Renewables (represented by Kristen Goland and Jerry Roppe); and New Hampshire Office of Energy and Planning (represented by Joseph Broyles). David Tidhar of WEST. The following matters were discussed.

1. **Study Summary**. Kristen Goland convened the meeting and David Tidhar summarized the findings of the first year of study. David read from a prepared study summary. For meeting summary accuracy, the prepared written summary is not represented in the minutes but is attached to them. Overall 598 searches were conducted over 47 days in the spring and 109 days in the fall. A total of 13 birds and 12 bats were found. 85% of all fatalities were found within 50 meters of a turbine and no fatalities were found over 70 meters from a turbine. All of the species were common species. No listed species were found. The site had a high level of searcher efficiency and the carcass removal was very low.

2. **Clarification**. Carol Foss provided written comments ahead of the meeting. Mike Marchand verbally provided his comments for further clarification.

2. **Discussions.** The Technical Committee (TC) provided both written and verbal comments to help clarify portions of the report and analysis. Additional questions were asked regarding the usefulness of an analysis of potential contributing factors including topographic features, search plot size, land cover, and weather that may be considered a mortality factor among the searched turbines. David Tidhar replied that at some project sites these variables can be a factor but that at the Lempster site it was impossible to determine. Because the mortality rate was low, a meaningful analysis could not be achieved. Because of the small sample size, a quantitative statistical analysis did not yield statistically significant results. Additional discussions took place regarding the inability to determine speed of turbine at time of death because of the variability in the wind between search periods and the unknown exact time of death due to next day searches. Restrictions of search plot size due to limits of clearing and difficult search habitat were discussed as potential limiting factors for accurate estimation. David Tidhar explained that when he looked at the influence of land cover/visibility and plot size, the estimators were low indicating that there is not a strong over estimation of fatality.

3. **Discussion of 2010.** TC members briefly discussed the 2010 study which, per project permit, include spring and fall survey efforts. Carol Foss recommended a sampling effort

which included the northern and southern most turbine on a more frequent basis to examine potential spatial distribution. Kristen Goland indicated that, because the first year of data was a more robust study design than recommended by the TC and because the site did yield expected low mortality, the second year focus on the permit requirements for fatality monitoring and no additional research.

4. **Next Steps.** David Tidhar agreed to provide a written summary of potential study options with the pros and cons associated with each one within one week. TC members agreed to review and provide recommendations to the protocols and rationale for why a particular protocol should be implemented. TC members will do this via e-mail within the following week. Kristen will research meeting requirements for a protocol approval meeting and discuss with the committee.

The meeting was adjourned at 3:30 p.m.

Submitted by Kristen Goland and circulated to the Technical Committee on March 10, 2010. Corrections are required not later than close of business on March 15, 2009. Please submit all corrections via e-mail to Kristen Goland and cc the entire Technical Committee.

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Iberdrola Renewables Lempster Wind Project, 2009 Monitoring Study
Key Findings

Prepared for: Iberdrola Renewables

Prepared by: WEST Inc.

March 4, 2010

The following contains a brief outline of key findings from the 2009 study at Lempster – this is the outline of points made verbally by WEST during the March 4, 2010 Technical Committee Meeting. Please see the Lempster Final Report for 2009 (Tidhar et al 2010) for comprehensive results and discussion of findings.

1. KEY FINDINGS

Standardized Carcass Surveys

Survey effort
598 turbine searches were completed. 47 days in the spring; 109 days in the fall; 13 birds found (9 Scheduled Carcass Searches [SCS], 4 Incidental) and 12 bats (10 Scheduled Carcass Searches [SCS], 2 Incidental). The proportion of SCS detections to searches was 0.036 carcasses per search.

Species composition
No casualties of state-or federal listed bird or bat species were documented as casualties either during carcass searches or incidentally. Bird and bat species found during year 1 have been commonly documented at other monitoring studies both regionally and nationally.

Temporal patterns of fatalities
Observed fatalities were much higher for the fall compared to the spring for both birds and bats. The vast majority (11/12; 92%) of bats were detected during fall migration season. The majority (n = 5; 71.4 %) of bird carcasses found during scheduled carcass searches occurred between September 7 and September 20; corresponding to the peak fall migration period for nocturnal passerines . Between August 13 – 23, 55.5 % (n = 5) of the total number of fall bat casualties

were detected. These temporal patterns are consistent with other studies. It is not anticipated that temporal patterns of fatalities would vary during the second study year.

Spatial patterns of fatalities

Eight (44%) of carcasses were detected at turbine 1, five (27%) at T5 and T8, and one (6%) at T9. Most of the casualties occurred during the fall migration period and T1 is located at the northern-most portion of the project area. The number of casualties found at a search plot was not correlated with search plot size. The total searchable area of T1 was 6229.58 m^2, which although greater than the mean search plot area (5691 m^2), was less than the searchable area for both T5 (8038.68) and T8 (6311.33). The number of casualties found does not appear correlated with the proportion or area of Easy visibility class - classified searchable area.

The T9 and T5 plots were affected and adjusted during the 2009 study due to vegetation growth (primarily vines, ferns, grasses and shrubs). Searchable areas at turbines are likely to shrink further during the 2010 study year as vegetation re-growth following post-construction reclamation continues and shrub, vine and tree regrowth occurs.

Almost 85 % of bird fatalities were found within 50 m of the search turbine and no bird carcass were found beyond 70 m. Distance from turbine results are consistent with other studies. Although these results may be partially an artifact of the search plot characteristics found at the site, which are generally described as small, irregularly shaped plots. All turbines at Lempster have both relatively small searchable areas (relative to many other monitoring studies), and varying area/distance relationships relative to aspect from turbines. These characteristics, coupled with the low number of carcasses found, limit the capacity to analyze spatial distribution of fatality patterns at the site.

Landcover and Visibility Class

Sixteen carcasses (84%) were found on turbine pads or roads – all areas classified as Easy and three were located in grasslands (Moderate). All grassland/moderate visibility detections occurred at T8, where grassland/moderate areas were most abundant relative to other search plots. The influence of landcover and visibility class on detection rates, removal rates and fatality estimates was limited because of the low number of casualties found during the study. It is unlikely that during the second year of study the relative abundance of carcasses would be sufficiently high within non-Easy/non-pad & road areas to test the influence of landcover or visibility class on the fatality estimate at Lempster.

Fatality Estimate

The fatality estimate for small birds was 0.82 birds/turbine (0.41 birds per MW) in the spring and 5.94 birds/turbine (2.97 birds per MW) in the fall; while for bats it was 0.68 bats/turbine (0.34 bats per MW) in the spring and 5.48 bats/turbine (2.74 bats per MW) in the fall. The fatality estimate for both seasons combined was 6.76 small birds/turbine and 6.16 bats/turbine. Turbines within the LWPP have a 2.0 MW capacity, therefore the combined fatality estimate per MW at the site is 3.38 fatalities/MW for small birds and 3.08 fatalities/MW for bats.

Compared with fatality estimates in the northeast, the per MW fatality estimate for birds is slightly lower than estimates derived for Maple Ridge 2006 and 2007 (NY), slightly higher than for Noble Bliss 2008 (NY), and higher than for Noble Clinton 2008 (NY), Mars Hill 2007 and 2009 (ME), and Noble Ellenberg (NY). The range of overall bird fatality estimates at 14 eastern and northeastern wind energy has ranged from 0.00 to 13.93. When compared with other regional and national monitoring studies, the overall fatality estimate for birds appears moderate.

The estimated bat fatality at LWPP of 3.08 bats/MW/year would be considered low when compared to other wind-energy facilities in North America, and is below average based on the regional average for reported bat fatality estimates at wind energy facilities in the northeast. At 13 other Eastern and Northeastern wind energy studies, bat fatality estimates ranged from 1.51 to 39.70 bats/MW/year. Of the aforementioned northeastern studies, the only study which had a fatality estimate lower for bats (when accounting for SE) was Mars Hill 2008.

The parameters incorporated into the fatality estimate were analyzed in order to determine which, if any, had a significant effect on increasing or decreasing the estimate. This analysis suggests that none of the parameters incorporated into the model used to determine the fatality rate (Shoenfeld's) were outside "normal" range, based on data from other studies (largely not publically available). The value for the Shoenfeld estimator suggests that the probability for availability and detection of carcasses was quite high (see Searcher Efficiency section below). The correction for proportion of area searched seems to have played the biggest role, relatively speaking, in increasing the estimate. One issue was that several of the carcasses for both birds and bats were found in areas relatively far from the turbine where very little of the potential search plot could be searched, because of the presence of woodland. For example, there was one bat found in the 50 to 60 meter distance band from the turbine, where only 13.8% of the area was possible to search. The correction factor takes this into account, and assumes that since we found one bat in this band, but only searched 13.8% of the area, if we had been able to search the entire area, we would have been able to find approximately 7 bats. This assumption likely overestimates the number of bats for the outlying distance bands. That said, however, the multiplier (A) was only 2.08, which is not unusually high. At other studies A multipliers of upwards of 20 are required, particularly in agricultural settings where transects are cut into row crops to allow searchable area below turbines.

The analysis for fall 2009 bats is shown below as an example:

Parameters:

$\hat{c} = \frac{\hat{p}}{\hat{q}} = 2.25$ = total number of carcasses per turbine for the sampling period

Tbar = 7.88 days = average carcass removal time

I = 1.03 days = average search interval

P_{det} = 0.53 = probability of observer detection given that the carcass remains

A = 2.08 = Correction for proportion of area searched

Shoenfeld's estimator for probability of availability and detection:

$$\hat{\pi} = \frac{Tbar * Pdet}{I}\left(\frac{\exp\left(\frac{I}{Tbar}\right) - 1}{\exp\left(\frac{I}{Tbar}\right) - 1 + Pdet}\right)$$

$$M = A * \frac{C}{\hat{\pi}}$$

For Lempster Fall bats:

$$\hat{\pi} = \frac{7.88 * 0.53}{1.03}\left(\frac{\exp\left(\frac{1.03}{7.88}\right) - 1}{\exp\left(\frac{1.03}{7.88}\right) - 1 + 0.53}\right) = 0.84$$

$$M = 2.08 * \frac{2.25}{0.84} = \boxed{5.57}$$

(Slight variation from what is in the report (5.55) due to rounding.)

Searcher Efficiency Trials

Sixteen searcher efficiency trials were conducted, during which a total of 191 carcasses (54 large birds, 129 small birds, and eight bats) were deployed. The level of effort expended for SE trials was relatively high compared with other monitoring studies of similar scope. Observer detection rates were highest for large birds (77.4 %) and similar for small birds and bats (53.9 and 57.1 %, respectively). Searcher efficiency rates were good (above average compared to other studies), indicating that observer (searcher) detection rates of carcasses were not biased low based on personnel used in the study, terrain or other factors. Inter-observer differences were also not significant suggesting individual personnel did not substantially influence detection rates of carcasses. Two of the three observers used at Lempster are returning for the second season; based on performance in 2009, inter-observer differences are not anticipated to be significant (both between study years and compared with other projects) and searcher efficiency rates are anticipated to be similar to 2009. Seasonal differences in detection rates were minor, suggesting that frequency/temporal distribution of fatalities, seasonality and other temporal influences were not-significant factors for observer detection rates of carcasses.

Carcass Removal Trials

A total of 136 carcasses were placed within the study area throughout the duration of the monitoring period. This included 40 small birds and 18 large birds in the spring, and 54 small birds, six bats, and 24 large birds in the fall. Carcasses were monitored for a maximum of seven days. Overall for both seasons, by day seven, approximately 70 % of the bats, 60 % of large birds, and 35 % of small bird carcasses remained. The number of carcasses used for this trial was high relative to other studies, when adjusted for effort expended on a per study plot basis.

Weather Analysis

Primarily due to small sample size of observed fatalities, there were no significant correlations between weather (Table 3) and bat mortality. Correlations of each weather variable and mortality yielded a maximum adjusted R^2 value of 0.027, and a best Pearson's r value of -0.19. The low number of fatalities detected during the study limited the ability to analyze for potential influence of weather variables on fatality patterns at Lempster. It is unlikely that during the second year of study the number of carcasses would be sufficiently high to allow analysis of weather on patterns of carcass distribution or occurrence at Lempster.

Meteorological Tower

No carcasses were detected at the project met tower. The project met tower is un-guyed. Vertical un-guyed structures are not believed to be responsible for significant collision mortality, compared to guyed structures or wind turbines.