

Appendix 3. Post-Construction/Post-Permit Eagle Fatality Monitoring Plan

STUDY PLAN

Post-Construction Eagle Fatality Monitoring for the Apple Blossom Wind Farm

1. INTRODUCTION

Apple Blossom Wind, LLC (the Owner) is operating the Apple Blossom Wind Farm (Project) in Huron County, Michigan. The Project is a 100-megawatt (MW) wind energy facility consisting of 29 3.45-MW turbines with operations beginning at the end of 2017. To follow the recommendations included in the U.S. Fish and Wildlife Service's (USFWS) *Land-based Wind Energy Guidelines* (USFWS 2012) and meet the commitments included in the site-specific Eagle Conservation Plan (ECP) prepared for the Project, post-construction monitoring studies will be conducted once the Project is operational. The objective of post-construction eagle monitoring at the Project is to systematically search the turbine locations for eagles that are potentially attributable to collisions with Project facilities.

2. STUDY PLAN

The initial post-construction third-party eagle fatality monitoring will be completed over a two-year period, and will be conducted by qualified third-party biologists, as described below in Section 2.a. The second year of monitoring will follow the same general approach as described for the first year. However, the procedures may be modified by the Owner in consultation with USFWS based on the results of the first year of monitoring.

After the first two years of third-party monitoring, operations and maintenance (O&M) staff will conduct eagle fatality monitoring at the Project during years 3, 4 and 5 of the first 5-year permit period when third-party monitoring is not being conducted. The approach to these O&M Monitoring surveys is described below in Section 2.b.

For the remaining 25 years of the permit term, third-party monitoring will occur at five year intervals (for a 1-year duration each) for the operational life of the Project (Years 6, 11, 16, 21 and 26), following the same general approach as described below for the first year. In the years when third-party monitoring is not conducted in the remaining 25 years, operations staff will visit each turbine at least quarterly; during visits, the staff will inspect roads, pads and any other cleared area in the immediate vicinity of turbines visible from their vehicle by binoculars (out to approximately 150 m). Any eagle carcasses that are discovered by operations staff or incidentally observed will be reported to the Service within 48 hours. Monitoring requirements (timelines, parties to be notified) will be detailed in the permit conditions.

a. Third-Party Eagle Post-Construction Monitoring Surveys

Visual Monitoring

The primary objective of this monitoring is to scan the area surrounding Project turbines for injured or dead eagles. Scans will be conducted for the first two years after the eagle take permit is received. Searches will be conducted of all 29 Project turbines twice monthly resulting in a

total of up to 24 search events per year, including the initial search constituting a clearing search. The initial search for any surveys will clear the search plot of any old carcasses prior to conducting searches. Searches may be seasonally halted when biologists confirm during a site visit that crops are greater than 12 inches high and/or significantly obstruct the view. Twice-monthly checks will begin again when operations and maintenance (O&M) staff notify the biologists that crops have been harvested.

All of the Project turbines will be surveyed using visual searches from the turbine pad in all directions. Personnel will walk at a casual walking rate of approximately 45-60 meters per minute around the turbine pad, scanning all allowable terrain from the turbine out to 150 meters. Personnel will stop at each of the cardinal compass points and scan the landscape for carcasses out to 30 m, and then using binoculars, will make successive scans until all areas out to 150 m have been searched. Once each season, searchers will map viewshed complexity on the landscape. Viewshed complexity refers to the amount of visual clutter on the landscape and can influence searcher efficiency, so the extent and location of different viewshed complexity classes needs to be accounted in the analysis. Areas that are “unviewable” due to topographic screening or robust vegetation growth will also be mapped so that the analysis can account for these unsearched areas.

Should bald eagle remains be located, a qualified biologist will complete a data sheet and take photographs of the remains in the field. The remains will be immediately reported to the USFWS Office of Law Enforcement, USFWS East Lansing office, and the Migratory Bird Permit office, followed by the Owner. FWS will direct project owner where eagle remains should be transported, and will be detailed in the permit conditions. All other dead or injured wildlife species will also be recorded.

Incidental detection

If a dead eagle is found incidentally in a search area (such as by a farmer, member of the public, or law enforcement officer), USFWS recommends replacing it with an eagle surrogate to see if that surrogate is then found during a systematic search or by the O&M staff. If the Owner or the third-party contractors determine it is feasible to replace an incidentally found eagle fatality with a decoy to determine if it would be detected by a naïve searcher on a subsequent search, the Owner will do so.

Searcher Efficiency Trials

The objective of the searcher efficiency trials is to estimate the percentage of carcasses which are found by searchers. Searcher efficiency trials will be conducted in the same 150-meter plots where the eagle scans occur. Trials will be conducted throughout the survey period where searcher efficiency will be estimated by viewshed complexity class (e.g., tilled ground, crops). Searcher efficiency trials will begin when scans begin. Personnel conducting the monitoring will not know the location or timing of the detection trials.

To estimate searcher efficiency for the scanning searches, about 25 eagle-sized carcasses or turkey decoys will be placed in each viewshed complexity class in each season during which

searches occur. Surrogate eagle carcasses will consist of raptors, if available; black domestic turkeys (*Meleagris gallopavo*); ring-necked pheasants (*Phasianus colchicus*), mallards (*Anas platyrhynchos*); and/or fully-feathered turkey decoys, if an insufficient number of carcasses are available. All carcasses will be placed within 150 meters of turbines prior to the scan on the same day. Trial carcasses will be placed using a weighted random draw that puts relatively more trials further from turbines; putting more trials further from turbines improves the ability to fit detection functions, and results in more precise estimates. Carcasses will be dropped from shoulder height and allowed to land in a random posture. Each trial carcass will be discreetly marked with a black zip-tie around the leg. The number and location of the detection carcasses found during the carcass search will be recorded. The number of carcasses available for detection during each trial will be determined immediately after the trial by the person responsible for distributing the carcasses. Undetected carcasses will be retrieved after the trial has occurred.

Carcass Removal Trials

The objective of carcass removal trials is to estimate the likelihood that a carcass is available and not removed, as a function of the time (measured in days) since the trial carcass was placed in the field. Carcass removal includes removal by predation/scavenging or removal by other means such as being plowed into a field. Up to approximately twenty-five eagle surrogate carcasses (e.g., legally obtained raptor carcasses as available) will be placed within the 150-meter scanned plots in each season; Because raptor carcasses can be difficult to obtain, all efforts will be made to obtain a minimum of eight raptor carcasses per season for carcass removal trial carcasses. The Project will coordinate with the Migratory Bird Permit Office if they encounter difficulty obtaining raptor carcasses for trials. Only fresh carcasses will be used for carcass removal trials. As there can be differences in the persistence rates between raptors and large game bird carcasses such as pheasants, WEST will attempt to obtain raptor carcasses from the USFWS or local rehabilitation facilities as much as feasible. Raptor surrogates will be left to monitor for up to 90 days if needed.

Trial carcasses for the Carcass Removal Trials placed in search plots will be marked clearly to avoid confusion with fatalities. Carcasses will be dropped from shoulder height and allowed to land in a random posture. Each trial carcass will be discreetly marked with a black zip-tie around the leg prior to dropping so that it can be identified as a study carcass if it is found by other searchers or wind facility personnel.

Personnel conducting carcass searches will monitor the trial birds over a 90 day period according to the following schedule as closely as possible. Carcasses will be checked on day 1, 2, 3, 4, 7, 10, 14, 20, 30, 40, 50, 60, 75, 90. This schedule may vary depending on weather and coordination with the other survey work. Experimental carcasses will be left at the location until the end of the carcass persistence trial. At the end of the 90 day period, any evidence of the carcasses that remains will be removed from the search plot.

Carcass persistence is a measure of the availability of carcasses to searchers. Because the study proposes to use distance detection, a more conservative standard will be adopted for carcass availability. Feather spots will only be considered available for detection if they cover a 60 cm

by 60 cm area. Smaller feather spots might not be detectable from 100 – 150 m and will be considered removed.

Trial Schedule

The following table describes the approximate dates for seasons used in the study, along with a list of what activities are proposed:

Season	Dates	Activities
Winter	November 16 – March 14	Eagle scans, SEEF, CPT
Spring Migration	March 15 – May 14	Eagle scans, SEEF, CPT
Summer	May 15 – July 30	Eagle scans, SEEF (until crops too high, likely first part of June); CPT (continue through high crop time period)
Fall Migration	August 1 – November 15	Eagle scans, SEEF, CPT (not until crops harvested, likely late October)

b. Operations Staff Monitoring Surveys – Years 3, 4 and 5 of Permit Term

At the end of Year 2 of the Permit Term, the Owner's O&M staff will be trained, by the third-party monitors, on the eagle monitoring protocol that will be implemented in Years 3, 4 and 5. In Years 3 through 5 of the Permit Term, the Owner's O&M staff will visit each of the operating turbines on a quarterly basis and inspect roads, pads and any other area visible by binoculars (out to approximately 150-m) from a vehicle. The frequency and number of turbines visited may be increased or reduced if deemed appropriate by both USFWS and Apple Blossom after the first two years of O&M monitoring.

Prior to implementing an O&M staff monitoring program, O&M staff searcher efficiency will be tested by a third-party (e.g., as part of the formal two-year fatality monitoring program described in Section 1.a). These searcher efficiencies (and carcass removal rates measured during the two-year third-party fatality monitoring program) will be estimated for at least one year in every 5-year period of the 30-year permit. Because searcher efficiency may vary among searchers, searcher efficiency will be estimated for any new O&M staff if they begin work more than 1 year before the next scheduled searcher efficiency trials. The searcher efficiency and carcass persistence estimates will be used along with the number of eagles discovered during monitoring to estimate overall actual eagle fatality numbers using Evidence of Absence fatality estimator or another software program agreed to by the Service and the Owner. Fatality estimation to update permit numbers and ensure permit compliance will be determined by the USFWS. Changes to the scheduled searcher efficiency and carcass persistence trials (such as increasing or decreasing the number of trials, number of carcasses, years studied, etc.) can be made if agreed to by the Service and the Owner.

STATISTICAL ANALYSIS

Quality Assurance and Quality Control

Quality assurance and quality control (QA/QC) measures will be implemented at all stages of the study, including in the field, during data entry and analysis, and report writing. Following field

surveys, observers are responsible for inspecting data forms for completeness, accuracy, and legibility; if the DWM tablet system the observers will make sure that the data has been properly uploaded at the end of the day. Irregular codes or data suspected as questionable will be discussed with the observer and/or project manager. Errors, omissions, or problems identified in later stages of analysis will be traced back to the raw data forms, and appropriate changes in all steps will be made.

Data Compilation, Storage and USFWS-Access

WEST will use the DWM software for the Project, at the request of Apple Blossom Wind, LLC. A database on WEST's server, such as Microsoft® ACCESS or MSSQL will also be developed to store, organize, and retrieve survey data. Data will be downloaded from DWM into WEST's electronic database using a pre-defined format to facilitate subsequent QA/QC and data analysis.

To comply with the 2016 Eagle Rule, the USFWS will have direct access to the data collected during the third-party eagle fatality monitoring study. WEST and the Owner will work with the USFWS to develop an agreed-upon method for the third-party monitor to provide the information to the USFWS.

Fatality Rate Estimation

Fatality estimation is a complex task due to a number of variables present in every study. Fatalities occur at an unknown rate, persist for variable amounts of time, and can be detected with varying levels of success based on carcass characteristics and ground cover. Carcasses may also fall beyond the bounds of searched areas. All of these variables influence the overall probability of detection, which is needed to make a fatality estimate.

Estimates of facility-related fatalities are based on:

- (1) Observed number of carcasses found during standardized searches during the monitoring year for which the cause of death is either unknown or is probably facility-related;
- (2) Persistence rates expressed as the estimated average probability a carcass is expected to remain in the study area and be available for detection by the searchers during persistence trials:
- (3) Searcher efficiency expressed as the probability that a carcass that is available for detection is discovered by a searcher; and
- (4) Search area adjustment based on the plot size and carcass density.

Cumulative (i.e. since the inception of the study) fatality estimates will be provided for eagles. The total number of eagle fatalities will be estimated using the Evidence of Absence fatality estimator (Huso 2010, Dalthorp et al 2017), or another estimator that is suitable for rare-event estimation.

Evidence of Absence

The Evidence of Absence Estimator (Huso 2015) and associated software (v2.0; Dalthorp et al 2017) are described in detail elsewhere but the components of detection probability will be treated briefly here.

Estimation of Carcass Persistence Rates

Estimates of carcass persistence rates are used to adjust carcass counts for removal bias. Carcass persistence can be modeled as a function of a variety of variables including ground visibility, size, season, and the interactions between these variables. The average probability of persistence of a carcass, \hat{p} , is estimated from an interval censored carcass persistence model (Therneau 2015, Therneau and Grambsch 2000). Exponential, log-logistic, lognormal, and Weibull distributions are fit and the best model is selected using an information theoretic approach known as AICc, or corrected Akaike Information Criteria (Burnham and Anderson 2002).

Estimation of Searcher Efficiency Rates

Carcass detection probability for scanning searches are estimated by estimating the probability that a carcass is detected, based on its distance from the observer and the viewshed complexity. This can be accomplished using logistic regression, or using a modified approach to classical distance sampling. Carcass detection and carcass density both typically decrease as distance from the turbine increases. Searcher efficiency is estimated by multiplying the detection function by a carcass density function (e.g. Hull and Muir 2010, Huso and Dalthorp 2010) and taking the average over the searched area.

EAGLE FIND REPORTING

As stated above, the USFWS will be provided all of the data associated with the eagle-monitoring study at the Project. In the event that eagle remains or an injured eagle is found at the Project by the third-party monitors, the monitor will first notify the USFWS Office of Law Enforcement, Migratory Bird Permit Office, USFWS East Lansing Office by phone, followed by the Owner. In the event that the USFWS does not answer or respond immediately, the biological monitor will proceed to report the find to the Owner.

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