Post-Construction Monitoring Plan for Spion Kop Wind Farm

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February 22, 2016

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Table of Contents

Acknowledgements

An earlier version of this monitoring plan was prepared by Elizabeth M. Madden and Alan R. Harmata in January 2013, independent of the Bird and Bat Conservation Strategy that they also prepared. Their version was used as a template for this document and some original text remains unchanged. I thank Beth and Al for their extensive research and efforts in preparing a comprehensive draft plan. I also thank the following individuals for reviewing drafts of this document and providing helpful feedback:

Kristina Smucker, Montana Fish, Wildlife and Parks

Michael Schirmacher, Bat Conservation International

Thanks are due to each member of the Technical Advisory Committee as well for their review of this post-construction monitoring plan.

1 Foreword

Post-construction monitoring (PCM) is a component of the U.S. Fish and Wildlife Services (USFWS) Land-Based Wind Energy Guidelines (WEG) as Tier 4 out of 5 Tiers. The studies that take place during PCM are designed to assess whether the predicted impacts to species of concern in Tier 3 are realized (see BBCS, pg. 14, section 6). These studies include assessment of both direct impacts, such as fatalities of birds and bats as a result of collision with wind turbines, as well as indirect impacts, such as change in behavior and/or use of the area by wildlife, including those that are sensitive to habitat change, such as Sharp-tailed Grouse. This document outlines the post-construction studies using the most up to date methods and recommendations as of 2016, such as but not limited to: the project Bird and Bat Conservation Strategy (BBCS), the WEG, Eagle Conservation Plan Guidance (ECPG), and several other publications and contacts with other professionals in wind energy.

2 Introduction

NorthWestern Energy (NWE) has contracted Montana Fish, Wildlife & Parks (FWP) to plan and implement the PCM at Spion Kop Wind Farm (SKWF), 7 miles northeast of Raynesford, Judith Basin County, Montana (Figure 1). The Project includes 25 General Electric 1.6 megawatt (MW) wind turbines for a maximum capacity of 40 MW. FWP has prepared the following plan for post-construction studies, focusing on species groups of concern as listed in the BBCS, which includes raptors, bats, and grassland birds. This plan details methods of 1) fatality monitoring, including bias trials, 2) data analysis and

reporting, 3) other studies of impact and risk, such as grouse lek surveys and eagle use, and 4) project management and long-term corporate monitoring. With wind energy growing in Montana, it was NWE's intention to have FWP complete this work to increase the state's knowledge of monitoring at wind farms and therefore better advise other in pursuit of green energy production. FWP will work with NWE to make all documents, reports and data from this project publicly available.

3 Wind Energy and Montana Fish, Wildlife & Parks

Interest in wind energy development in Montana began building in the late 1990s and NorthWestern Energy issued the first request for proposals in 2002. The first wind farms came online in 2006 – 2008. The degree to which FWP personnel have been contacted and involved in consultations on proposed wind projects has been highly variable depending on the developer. Contact with FWP staff has been primarily at the local level, meaning that over a dozen biologists have had to take the time to self-educate on wind-wildlife issues. When NWE approached FWP about designing and implementing post-construction monitoring at Spion Kop Wind Farm we saw an opportunity to gain on the ground experience with monitoring impacts to wildlife. Lessons learned will be shared department wide. We expect this experience to increase the department's ability to critically evaluate wind development proposals and post-construction reports. In addition we will produce standard monitoring protocols that wind developers in Montana can use as a resource.

3.1 Key Personnel and Experience

Kimberly Linnell, Conservation Technician for MT FWP Region 4, will serve as the key planner and implementer of this post-construction monitoring project. During her undergrad at Utah State University, Kim took a special interest in human-wildlife interactions and conflicts, and was awarded three scholarships for her efforts in this area. She received her Bachelor's of Science in Wildlife Science May of 2013, and has since been working in the field of wildlife management and conservation. Before her position with FWP, Kim worked as a Biological Science Technician for the United States Department of Agriculture (USDA) Animal and Plant Health Inspection Services (APHIS) Wildlife Services (WS) National Wildlife Research Center (NWRC), Ohio Field Station, focusing on wildlife and aviation conflicts. In this position, Kim was heavily involved with the literature search, study design, data collection, analysis and final report writing of all studies at the research center. During her time there, she was involved

with four different studies on animal behavior in context to human/abiotic factors, and was solely responsible for the study design and spatial/GIS component of a study relevant to wind farm work. This study investigated the scavenging rates of different bird species carcasses in regards to the use of surrogate species in post-construction monitoring at wind farm facilities to adjust fatality estimates. She currently has coauthored two publications and has four papers in review, one as primary author, and was awarded a Certificate of Merit from USDA twice for her research efforts at the Ohio Field Station. Her experience includes avian surveys, raptor surveys, raptor trapping and relocation, bat surveys by both acoustic devices and mist-netting, and several other wildlife field methods. In this position she will design and write the PCM plan, present this plan to the Technical Advisory Committee, communicate project efforts and goals to professional groups, agencies and other interested parties, execute the field studies, collect and manage data, analyze data, and write final reports.

Kristina Smucker, Wildlife Biologist for MT FWP Region 4 will supervise Kim and serve in an advisory capacity on all aspects of post-construction monitoring. She will work closely with Sam Milodragovich on contract and budget issues and to schedule TAC meetings. Kristina received her Bachelor's of Arts in Biology from Earlham College in Richmond IN (1996) and her Master's of Science in Wildlife Biology from the University of Montana (2003). She has worked for FWP for 2 years; before that she was the Assistant Director of the Avian Science Center at the University of Montana for 10 years. Kristina has a strong background in bird research and monitoring and experience with a wide range of nongame and furbearer species. She has over 15 years of experience designing research and monitoring programs, developing and adapting field protocols, conducting field investigations, database management, data analysis, and preparing reports and manuscripts.

4 Technical Advisory Committee

A Technical Advisory Committee (TAC) has been formed to provide advice and recommendation for developing and implementing effective measures to monitor, avoid, and minimize impacts to wildlife and their habitats during operations of SKWF. The TAC will review the PCM plan and evaluate reports to help ensure that negative impacts to avian and bat species do not reach levels that are significant, either here or cumulatively with other projects as a result of routine operation. The TAC consists of volunteer representatives from USFWS, FWP, and Montana State University, etc. Each

provides different expertise in the conservation of wildlife and habitats, specifically in interest of birds and bats.

After the first two meetings regarding the project and PCM plan approval, the TAC will meet annually unless data reveal that fatality thresholds or other trigger points are exceeded (see BBCS, pg. 27, section 9). NWE and FWP will be responsible for scheduling and coordinating meetings and providing agendas, but other entities may request additional meetings or provide input to the TAC. Duties and responsibilities of the TAC will include but not be restricted to:

- Attend and participate in TAC meetings as well as be available for advice and assistance.
- Review PCM plan and updated BBCS and provide recommendations.
- Review results of fatality and use monitoring, both the annual report as well as the final report.
- Make recommendations based on best available science to address specific issues resulting from the project.
- Provide sufficient flexibility to adapt as more is learned about project impacts (or lack thereof) as well as mitigation strategies.
- Provide recommendations to NWE regarding threshold adjustments if needed.
- Develop and recommend additional mitigation measures or research if pre-construction measures are found ineffective or if significant fatalities occur.

5 IMPLEMENTATION PLAN

5.1 Fatality Monitoring (WEG Tier 4a)

Standardized Carcass Searches

Standardized carcass searches are designed to search the Project area systematically for bird and bat fatalities that result from collision with wind turbines at SKWF. Searches will be conducted primarily by Kim Linnell and all additional personnel involved with searching will be trained in proper search techniques. There are 25 wind turbines at SKWF and 40% of those will be searched, as defined in the BBCS (see BBCS, pg. 22, section 8.2.1), for a total of ten searched turbines. The ten turbines have been randomly selected and include turbines 2, 3, 5, 6, 11, 13, 14, 21, 23, and 25 (see Figure 2). However, as discussed in the first TAC meeting January 2016, turbine 6 will be dropped because it is

located in an alfalfa field, making searching very difficult if not impossible during the crop season. Turbine 18 has been selected in its place.

Search Schedule

Standardized carcass searches will begin in April 2016 and will be conducted for at least two years to evaluate fatality levels from operation of SKWF. This is based on the pre-construction risk analysis rating of Moderate in Tier 3 planning (see BBCS, pg. 22, section 8.2). Each turbine described above will be searched weekly spring (weather permitting) through fall. Due to harsh winter conditions making travel unsafe and field protocols for fatality estimates very difficult, turbines will not be systematically searched in the winter. Instead, all turbines will be scanned with binoculars out to 200m once per month to check for any large bird fatalities. Estimations cannot be made from these methods and therefore only estimates of the spring through fall season will be provided. The dates that define these seasons are:

Weekly Searches	April 15 – October 15
Monthly Scans	November 15 – March 15

According to the USFWS WEG, fatality monitoring should occur over all seasons of occupancy for the species being monitored. Weekly search intervals are conducted spring through fall to monitor for fatalities during spring migration, breeding season, and fall migration of birds and bats. Estimations of fatality are only valid for the season that is surveyed for carcasses; therefore it is important to keep the search intervals consistent during time of use by species of concern, providing a more accurate yearly estimate. Scan intervals decrease in intensity during the winter for monitoring fatalities of migrating and resident raptors using the Project Area. Raptor carcasses persist much longer than small birds and bats, and searching does not need to occur as frequently when small birds and bats are less active. Bias trials will account for seasonal changes that may affect both searcher efficiency and carcass removal by scavengers. These intervals may be modified if results and bias rates prove necessary.

Search Plots

Research suggests that greater than 80% of bat fatalities fall within half the maximum distance of turbine height to ground (Erickson et al. 2004) and at Judith Gap Wind Farm in Montana (~67 mi. SE of SKWF), 78% of all carcasses were found

within 70m of turbines (Poulton and Erickson 2010). The USFWS WEG recommends a minimum plot width of 120m, but suggest larger if raptors are a concern, with the minimum size being twice the turbine height to ground. If bats are the main concern a smaller, more intensely searched plot is recommended. Because both birds (raptors and passerines, etc.) and bats are of concern at SKWF, plot sizes will be 160m X 160m square, centered at the turbine bases. Each wind turbine at SKWF is 80m to hub height, thus this size is adequate to observe the majority all bat, small bird and large bird carcasses. Each plot will be searched by walking parallel transects approximately 6m apart at a rate of approximately 30 – 45m per minute, searching 3m out on both sides for bird and bat carcasses, completing a plot in 1.5 – 2 hours. Staying consistent in search rate is important to reduce bias, all levels of vegetation and visibility will be searched at the same rate. A Garmin Montana 650 GPS unit as well as a compass will be used by searchers to stay on course. The actual searchable area varies per plot and per season, for example, patches of dense/tall grass in some plots make searching impractical due to the time it takes to do an effective search. As such, plots may not be searched to their entirety consistently. Each search will be tracked with a GPS unit to accurately delineate area searched for each turbine and adjust fatality estimates based on the actual area searched. Habitat visibility classes will also be established in each plot to account for detectability differences and these classes will be based on percentage of bare ground, as established by Hein et al. 2013:

Easy:	≥ 90% bare ground
Moderate:	≥ 25% bare ground with ≤ 15 cm ground cover height (GCH)
Difficult:	≤ 25% bare ground with ≥ 30 cm GCH
Very Difficult:	little to no bare ground, 25% of ground cover and ≥ 30 cm GCH

Anything classified as “Very Difficult” visibility class will not be searched for bird and bat carcasses. Searching in such cover is often very inefficient and can even lead to overestimates in some cases. Difficult visibility class will be searched unless searcher efficiency rates drop below 20-25%, in which case this class will also not be searched. Having visibility classes will require that bias trial rates be calculated for each visibility class but will result in efficiency and removal rates within each class, as well as total number of fatalities per class. Total area searched within each visibility class will also be calculated and used to adjust fatality estimates. These fatality estimates can then be summed for the total area sampled regardless of the actual area searched. Unsearchable area (Very Difficult

Visibility) will be mapped and searches will be tracked by a Garmin Montana 650 GPS unit.

Documentation and Handling of Fatalities

For each turbine searched, the date, turbine number, searcher(s), general weather information, start time, end time, total number of carcasses found as well as the identification number of each one and what was done with the carcass (left, collected, etc.) will be recorded. The carcass will be flagged and returned to for processing once the entire plot is searched. When processed, each carcass will be given an identification number consisting of the date, species, turbine number, and number found that day at that turbine (ex. 9/10/2015_LANO_13_1). The searcher who found the carcass will be recorded as well as the processor of the carcass (i.e. person who collected data on the carcass). Date collected regarding the turbine will include date, time found, turbine number, plot quadrant (NE, SE, NW, SW), degree from the turbine, and distance from the turbine in meters. For data on the vegetation within 1 m^2 of the carcass, dominant cover type, percent vegetation cover, vegetation height max and average in cm, and whether the carcass was found on a road or pad will be documented. The visibility class (see above, pg. 8) will also be recorded. Regarding the transect, the transect number where the carcass was located, the perpendicular distance of the carcass to the closest transect, and whether the carcass was found within or outside of the search plot will be recorded. For carcasses found we will record bird or bat species (when species ID is possible), a band/tag number if applicable, alive (injured) or dead, and whether it was released or euthanized if found alive. Photos of each fatality will be taken with a Garmin Montana 650 unit and photo numbers will be recorded. If available, age (adult, subadult, juvenile), sex, and reproductive status (i.e., bats specifically: pregnant, lactating, post-lactating, scrotal, or non-reproductive), position of the carcass, condition, infestation, and estimated time of death will all be recorded. For bats, wing scores will be recorded on a 0-3 scale (0 fewer than 5 scar spots, 1 <50% wind depigmented, 2 >50% wing with scar tissue, 3 deteriorated wing membrane and necrotic tissue and isolated holes > 0.5 cm). Data collection specifics are derived from Hein et al. 2013 methods.

If the appropriate federal permits to collect and/or salvage carcasses are issued for the project, carcasses will be collected and stored in a freezer onsite in the substation to be used in bias trials. All carcasses will be handled with gloves to reduce human scent bias for carcass removal trials. Carcasses will be collected in a

re-sealable plastic bag and labeled with the carcass identification number, turbine number, and date put in freezer. For all carcasses found, a copy of the fatality's data sheet will be kept with the carcass. For analysis purposes, all injured birds and bats observed will be counted as a fatality. If no permits are obtained, all carcasses found will be flagged to avoid double counting and checked on for carcass removal rates.

Bird feather spots constitute as a fatality if two or more primary feathers and/or 10 or more body feathers are found. Fatalities can include whole/intact carcasses, carcasses that have been dismembered/scavenged, or carcass parts such as a head, foot, wing, etc. Fatalities found not during a formal search or found outside of a search plot will be counted as incidental and the same data on non-incidental finds will be recorded as applicable. Incidental finds will not be included in the fatality estimates but will be included in all reports.

Injured birds and bats will be captured and transported to Montana WILD rehabilitation center if it is determined that rehabilitation is a possibility. If rehabilitation is not likely, the injured bird or bat will be humanely euthanized. The same data for fatalities will be recorded for injured birds and bats as their injuries are likely caused by collision with a wind turbine and as such will be used in fatality estimates.

Safety

Fatality searches will not be conducted in hazardous conditions such as thunderstorms, ice on turbine blades, snow storms or during high wind warnings, or during any other unsafe conditions. If the facility is closed down for any reason, searches will be suspended. Searches will also not be conducted at turbines where workers are up-tower doing maintenance. FWP field personnel will communicate with the project manager to assess working conditions.

5.2 Bias Trials

Searcher Efficiency Trials

Searchers may have varying abilities to find a carcass and therefore searcher efficiency rates must be estimated for each surveyor to adjust raw carcass counts and correct for detection bias. Searcher efficiency trials will be conducted simultaneously with fatality monitoring and carcasses will be placed within the

plots being searched for dead birds and bats. No more than four carcasses will be placed per turbine per trial date to avoid over seeding and the possibility of attracting scavengers. Trials will occur at least once per season (spring, summer, and fall) to account for seasonal changes, if possible. Searcher efficiency will be estimated by size of carcass (bat, small bird, medium bird, and large bird) and visibility class (easy, moderate, and difficult), if possible.

Trials will begin after the first search interval and will be conducted by FWP personnel who are not searching. Searchers will not be aware of when trials are taking place. During the spring, summer and fall seasons, 10 carcasses of each size class (4) within each visibility class (3) will be used once per season (3) for at least 270 searcher efficiency trial carcasses per year of monitoring. Where possible and if permits are in place, native species found onsite or turned into FWP will be used for efficiency trials. Surrogates, such as commercially available and nonnative species, will be used in place of native species if permits are not held by NWE and/or if additional sample size is needed. Commercially available brown chickens, mallards and pheasants will represent large birds (i.e. raptors, waterfowl, grouse, etc.), Rock Doves will be primarily used for medium birds and European Starlings, House Sparrows and commercially available juvenile *Coturnix* quail will represent small birds. When bat surrogates are needed, black, brown or gray house mice (*Mus musculus*) will be used. All carcasses used in efficiency trials will be discreetly marked with electrical tape on the leg so as to not be confused with actual fatalities. Again, all carcasses will be handled with gloves to decrease human scent.

Searcher efficiency carcasses will be randomly placed within search plots prior to the carcass search, no longer than 24 hours in advance. Carcasses will be dropped from shoulder height, and the carcass size class, visibility class, date, turbine number, location and carcass number will be recorded. Once a searcher has completed a search, the number of each carcass per size class, visibility class and searcher will be recorded. Management of searcher efficiency carcasses and data will be kept by the person responsible for distributing the carcasses.

Carcass Removal Trials

Another potential bias of fatality monitoring is the removal of carcasses by scavengers, making carcass observations incomplete. The average time a carcass

persists in the search area needs to be included in the fatality estimates to adjust for this factor.

Similar to searcher efficiency trials, carcass removal trials will be conducted once each season, using native species as much as possible if permits are in place. If permits are not in place, bird and bat carcasses found beneath turbines will be left and checked on for removal every day for the first four days, and then on day seven, day 10, day 14, day 20 and day 30 or until removed.

If the collecting and moving of carcasses in the area is permitted, the same carcasses that are used for the searcher efficiency trials will be used for the carcass removal trials, using native species as available and supplementing with surrogates as needed (see above in searcher efficiency trials). Per appropriate season, 10 carcasses of each size class (4) within each visibility class (3) will be used for each season (3) for a total of 270 carcass removal trial carcasses, as stated above. Once searcher efficiency carcasses are located, they will be moved to turbines not being searched to be used for carcass removal trials. This is to avoid over-seeding search turbines and confusion with actual turbine fatalities. They will be randomly placed, dropped from shoulder height, and checked on in the same schedule as above. Remains will be removed if they persist until the end of the 30-day period. This schedule may vary considering weather and other logistics issues, but will be followed as closely as possible.

5.3 Statistical Analysis

Analyses will include estimates of fatality for birds as well as bats. These estimates will be based on:

1. Average observed fatalities in search plots during the monitoring year.

2. Carcass persistence rates, the estimated average probability of a carcass remaining in the study area and being present for detection by a searcher during carcass removal trials.

3. Searcher efficiency rates, the proportion of planted carcasses found by searchers during searcher efficiency trials.

4. Visibility class and carcass size, covariates that likely bias the number of carcasses detected.

5. Density weighted proportion, the estimated fraction of carcasses landing in sampled areas.

After correcting for the above factors, we will estimate the total number of bird and bat fatalities per monitoring period at SKWF.

Estimation of Carcass Persistence

The probability of a carcass persisting in the search area before being removed can be modeled as an exponential, weibull, loglogistic or lognormal distributed random variable (Hein et al. 2013). It may be necessary to fit bird and bat carcass persistence data with and without visibility class as a covariate into each model and use Akaike's Information Criterion (AIC) model selection in the Fatality Estimator software (Huso et al. 2012) to determine which is best to use (Hein et al. 2013). This allows for flexibility and will likely provide more accurate estimates.

Estimation of Searcher Efficiency

The probability of a carcass being observed by a searcher given persistence, *p*, which depends on its individual characteristics such as size, time since death and the vegetation surrounding it, is a simple model of observability:

$$p = \text{number observed/number available}$$

Where *p* is the proportion of searcher efficiency carcasses observed out of the number of trial carcasses planted. However, since we cannot measure time since death, in most monitoring efforts a carcass's observability is considered constant during the search interval, which is unlikely (Warren-Hicks et al. 2012). After carcass persistence is accounted for, searcher efficiency will be estimated by fitting bird and bat trial data separately into a logistic regression model using the Fatality Estimator software (Huso et al. 2012). To account for covariates such as carcass size and visibility, each searcher efficiency for birds and bats will include both carcass size and surrounding vegetation visibility classes and model fit will be assessed using AIC (Burnham and Anderson, 2002).

Density Weighted Proportion and Actual Area Searched

The actual area searched within the maximum plot size varies due to vegetation, topography, etc., and according to Kerns et al. 2005, the density of carcasses diminishes with increasing distance from the turbine. Therefore, applying a simple adjustment to fatality that is based on actual area searched alone would lead to over estimates, since unsearched areas are generally farthest from turbines. To estimate the fraction of carcasses that land in the sampled areas (excluding Very Difficult Visibility), DWP will be estimated by calculating searchable area within 5m bands from the base of each search turbine as well the proportion of carcasses we find within each 5m band. The sum of the product of searchable area and proportion of carcasses for each 5m band will be the estimate of DWP, and will vary by search turbine. Ideally, if there is enough fatality data, this can be done by modeling the change in density with distance instead (Huso, conversation).

Estimation of Fatality

To estimate bird and bat fatalities at SKWF, the Huso (2010, 2015) Fatality Estimator will be used. The Fatality Estimator software (Huso et al. 2012) is sensitive to search interval time and carcass persistence, assumes that if a carcass is missed on an initial search, it will not be found in a subsequent search because it will not persist until then. This contrasts with other frequently used estimators, which assume that if a carcass is not found on an initial search it will eventually be found in subsequent searches. This means that only "fresh" carcasses (i.e., killed since the previous search) can be used in the Huso estimator. However, because Huso's estimator does not assume exponential persistence distribution and allows the user to select the best distribution along with set of covariates, it will likely result in a more accurate estimate of fatality.

5.4 Assessing Other Impacts (WEG Tier 4b)

The USFWS WEG suggests assessing direct and indirect impacts of habitat loss, degradation and fragmentation to species of concern within the Project Area in Tier 4b studies. The objective of Tier 4b monitoring is to evaluate earlier Tier 3 predictions of indirect impacts to certain species of concern. Also, this is an opportunity to evaluate if mitigation efforts taken during project design and construction were effective (see BBCS pg. 18, section 7), and whether any further mitigation is necessary.

Eagle Use Point Counts

The USFWS Eagle Conservation Plan Guidance (ECPG), which suggests methods to assess eagle use within a wind farm facility and estimate risk of an eagle strike, was published in 2013 after the construction of SKWF. Though these studies are meant to be done before construction, the methods will be adopted at SKWF for post-construction management purposes. The eagle point counts already established will be adjusted to cover at least 30% of the Project Area without overlap. They will be conducted once per month for an hour long each. Surveys are completed in 1-2 days with a random starting point so that each count is surveyed at different times throughout the year. The date, observer, start time, wind direction and speed, cloud cover and temperature will be taken for each point count. The surveyor will record all eagles within an 800m radius and 200m height, mapping their location on either a Trimble Juno 3b unit or aerial photo, noting the time and direction first seen, species, flying above, within or below the turbine blade zone, behavior, and age. The surveyor will record the same data for each new minute of observation for each individual eagle until the eagle has left the point count plot, at which the time and direction will be recorded. Eagles outside of the 800m radius will be noted as well as other raptor species seen within the point count. Surveys will not be conducted in dangerous weather conditions, or when visibility is less than 800m out and 200m in height.

Eagle Telemetry Studies

Due to the recent discovery of an active Golden Eagle nest just .7 miles north of Turbine 25, telemetry studies on home range and movements on one or both of the adults may be implemented in the first year of monitoring. Because fatalities are most common in juvenile birds, it may also be useful to put a signaling device on a young bird captured in the nest. This work is dependent on recommendations from USFWS and the TAC, and would be contracted to Al Harmata and Eric Johnston if approved.

Raptor Nest Monitoring

All eagle nests within a 10-mile radius of the center of the Project Area will be located and monitored for occupancy and productivity via aerial and ground surveys for a minimum of five years. If new territories develop < 5 km from the Project Footprint, home range and movements studies may be implemented based on determination of the TAC.

Surveys of all raptors in the Project Footprint (Figures 2 and 3) will be completed during the breeding season using the same methods used during pre-construction

surveys (AMEC 2011c). Beginning in March, all known nests will be located and the status of each updated. Any new nest located will be assigned coordinates and mapped. During April to July, all nests will be monitored until fledging to determine nest success. Nests of ground-nesting raptors (Short-eared owl, Northern Harrier, some Ferruginous Hawks) are difficult to locate systematically, but any observations of courtship displays, prey deliveries/exchanges, or other indicators of breeding will be noted and general use areas mapped.

Sharp-Tailed Grouse Lek Surveys

One previously known Sharp-tailed Grouse lek occurs in the Project Area (Figure 4). Surveys to locate additional leks and monitor Sharp-tailed Grouse breeding activity in the Project Area will be conducted following the methods in Strickland et al. 2011 (pg. 47-48), during mid-April through May. The effects of facility development on prairie grouse may take several years to detect, therefore it is recommended that these surveys be done for a minimum of five years and carefully follow recommended protocols (Strickland et al. 2011).

When conducting lek searches from the ground, observers will stop every 800m (0.5 mile) along roads or along pedestrian transects spaced one mile apart, and listen for displaying males for at least five minutes per stop. Ground surveys will be conducted only when winds are light (< 12 kph) with no precipitation, from ½ hour before sunrise to one hour after sunrise. Binoculars will be used to scan suitable habitat for birds on leks. Three surveys will be spaced at least seven days apart. At all leks identified, we will conduct 3 independent counts separated by 7-10 days. Counts will be conducted for an approximate 15-30 minute period in the early morning (½ hour before to one hour after sunrise). Count duration is dependent on visibility and ability to obtain an accurate count. In some cases it may be necessary to flush the grouse from the lek to obtain the best count. Data collected will include GPS location, maximum number of males, females, and unknown gender birds observed, time, date, habitat, weather information and behavioral observations. Results will be provided to FWP Area Biologist to contribute to state-wide grouse survey efforts.

In addition to ground searches, aerial surveys (helicopter or fixed-wing) are an effective method to pinpoint lek locations. Any aerial eagle or raptor nest surveys conducted will also incorporate lek surveys if timing is appropriate.

Bat Activity and Species Occupancy Monitoring

NWE is participating in Montana's collaborative, long-term bat monitoring program (MTNHP 2012) and has funded two Wildlife Acoustics SM3 bat detectors placed on-site at SKWF for three years of year-round data collection, beginning in June 2015. Currently, one SM3 detector is located at the shore of the reservoir west of turbines 1-5. This reservoir is likely a foraging area for bats and will be useful in detecting which species occur in the Project Area. For comparison, the second SM3 detector has been placed near the base of turbine 3, directly up a draw from the reservoir. This detector may be useful in determining which species are utilizing the turbine area, however, to specifically assess species activity in the actual wind-swept area, this detector will be moved up to the nacelle of turbine 3. Data collected from this detector may be useful in guiding curtailment decisions if necessary, as well as potentially correlating bat fatalities with bat activity. FWP will maintain the reservoir SM3 detector and SKWF operations personnel will maintain the detector on the nacelle. Data will be collected once a month and sent into Montana Natural Heritage Program (MTNHP) to be analyzed. MTNHP will provide a report to NWE, FWP, and members of the TAC annually.

In addition to acoustic monitoring, capture of bats by mist-netting may also be utilized for data on sex and age ratios, reproductive status, and monitoring for illness such as white-nose syndrome. There are many small, isolated ponds within the Project Area that have potential for capturing bats, providing data in an area of the Highwoods that has never been sampled.

5.5 Reporting

Initial Post-Construction Monitoring

Annual reports will be completed in the first quarter of each subsequent year and provided to the TAC for review. Adjusted fatality estimates for all bats and birds, as well as estimates for raptors, large birds and small birds, will be presented per MW per year, and per turbine per year. In addition, species-specific data will be presented as raw data and will not be estimated based on correction factors. Reports from others studies of indirect impact will also be provided and discussed with the TAC. A meeting will be held with the TAC within 30 days of submittal to discuss findings and any further mitigation measures necessary.

Long-Term Monitoring Reporting

All incidental avian and bat fatality data will be logged in a tracking spreadsheet maintained by the on-site Project Manager and presented in annual reports to the USFWS and FWP.

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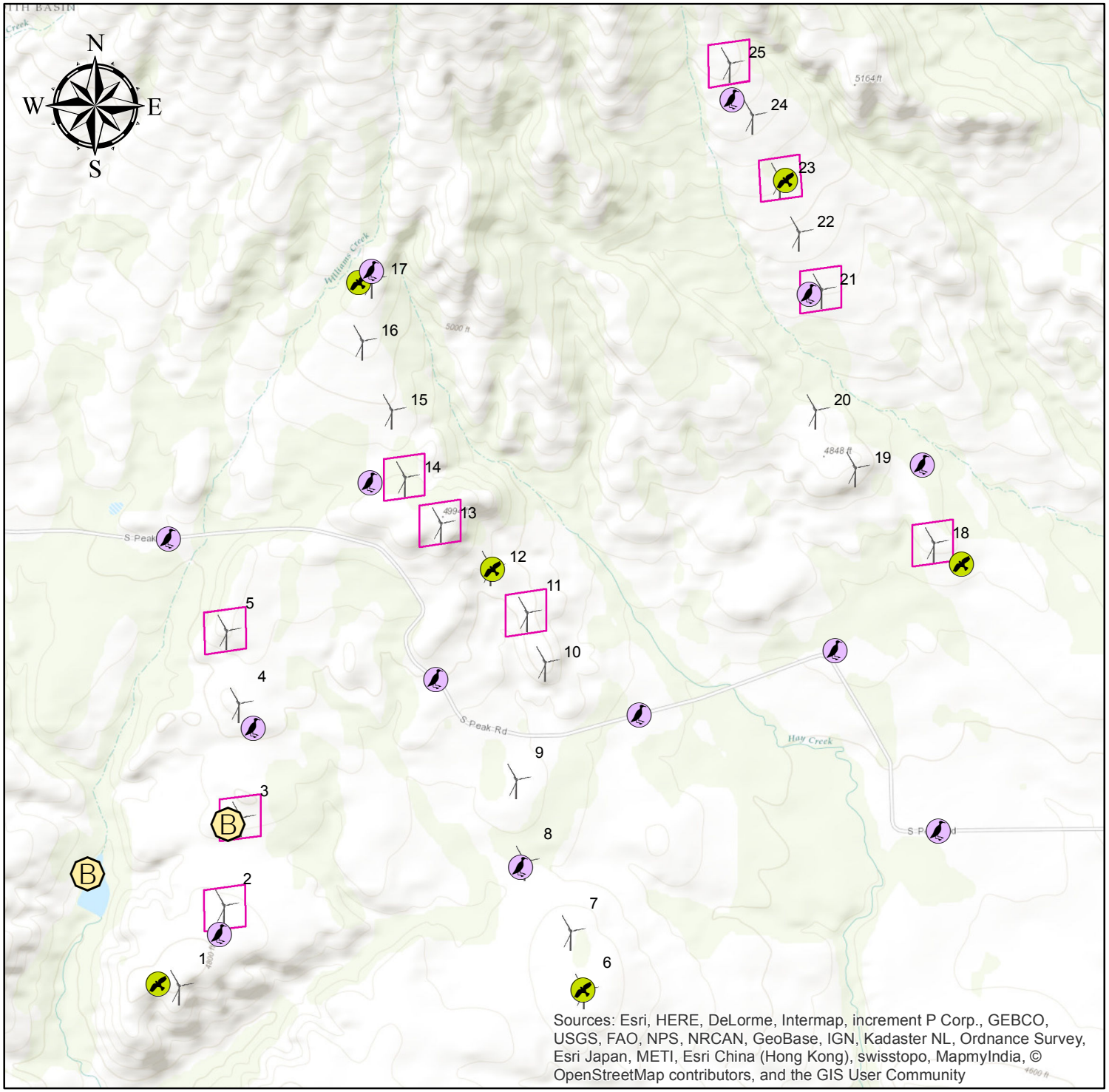
Spion Kop Wind Farm Post-Construction Monitoring Summary of Studies

Judith Basin County

Montana



Legend

- Sharp-tailed Grouse Listening Stop
- SM3 Bat Detector
- Eagle Point Count
- 160m Search Plot

Study Frequency and Season

Sharp-tailed Grouse Surveys:
3x during March, 7 days apart

Bat Acoustic Activity:
Deployed June 2015,
Collects data year-round

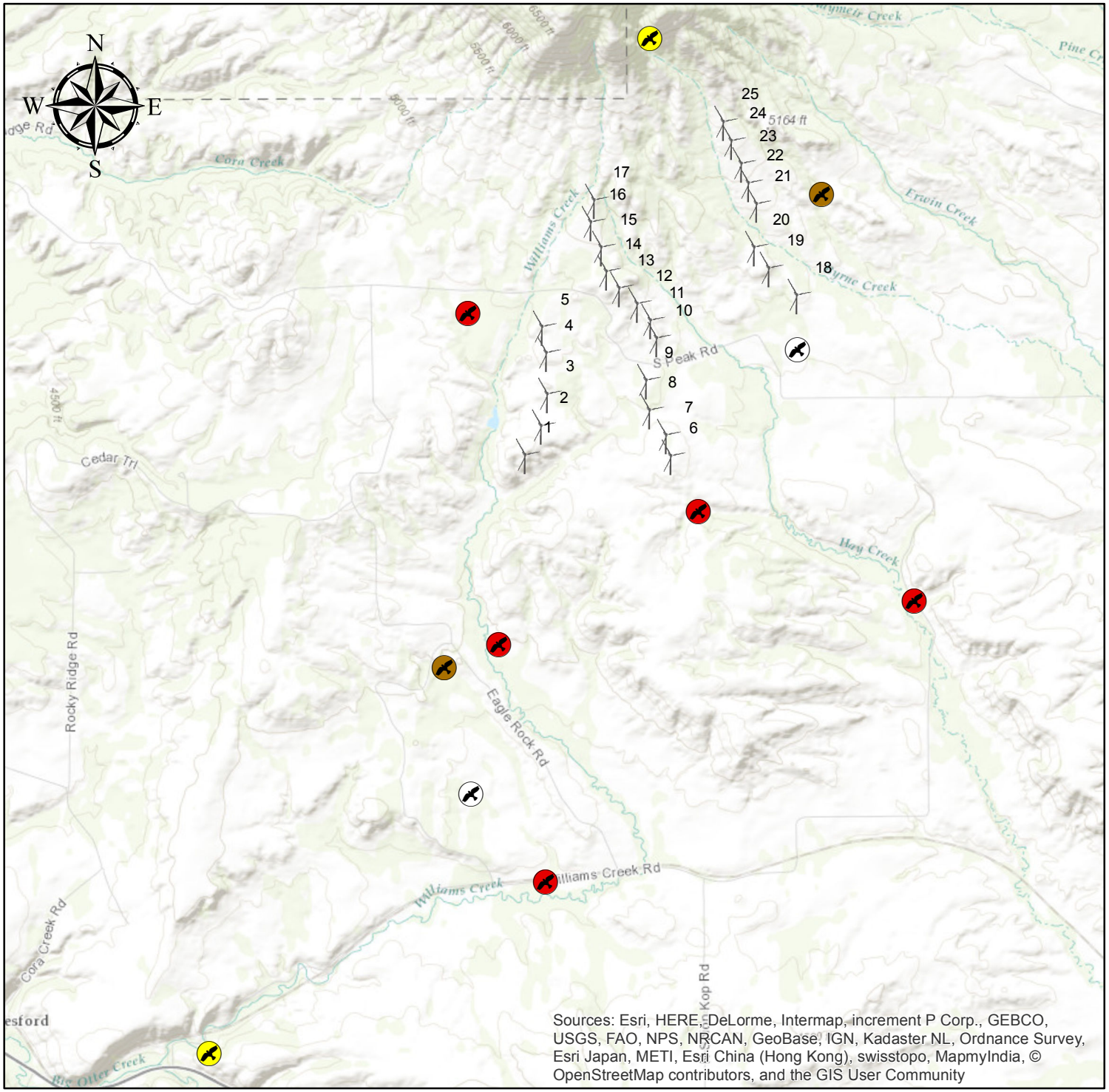
Eagle Point Counts
1x per month, year-round

Fatality Search Plots
1x per week, April 15th- October 15th

April 2016

Montana Fish, Wildlife & Parks

Miles
0 0.25 0.5 1



Spion Kop Wind Farm Post-Construction Monitoring Raptor Nests

Judith Basin County

Montana

Legend

- Red-Tailed Hawk Nest
- Ferruginous Hawk Nest
- Swainson's Hawk Nest
- Golden Eagle Nest

Nests Discovered in 2015

Red-Tailed Hawk Nest
on William's Creek Rd

Red-Tailed Hawk Nest
South of South Peak Rd

Red-Tailed Hawk Nest
South of Turbine 6

Golden Eagle Nest
Northwest of Turbine 25

Miles
0 0.5 1 2

April 2016

Montana Fish, Wildlife & Parks