Appendix A
Eagle Conservation Plan

Draft No. 4

Conservation Plan for the Avoidance and Minimization of Potential Impacts to Golden Eagles

Alta East Wind Project

Submitted to

Bureau of Land Management

U.S. Fish and Wildlife Service

Submitted by

Alta Windpower Development, LLC

May 2013

Prepared by

CH2MHILL

With Technical Assistance by

WEST Inc.

TETRA TECH

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Acronyms and Abbreviations

ACP	advanced conservation practice
agl	above ground level
AOCM	Alta-Oak Creek Mojave
APLIC	Avian Power Line Interaction Committee
AWD	Alta Windpower Development, LLC
BCR	Bird Conservation Region
BGEPA	Bald and Golden Eagle Protection Act
BLM	U.S. Bureau of Land Management
BMP	best management practices
CEC	California Energy Commission
CFR	Code of Federal Regulations
ECP	Eagle Conservation Plan
EIS	Environmental Impact Statement
MW	megawatt(s)
NEPA	National Environmental Policy Act
NSR	North Sky River Wind Project
PT	Pine Tree Wind Project
SR	State Route
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WEST	Western Ecosystems Technology, Inc.
WTG	wind turbine generator

SECTION 1.0

Introduction

Alta Windpower Development, LLC (AWD) proposes to construct the Alta East Wind Project in the Tehachapi region of southern California. Portions of the project would be located on land managed by the U.S. Bureau of Land Management (BLM) and privately owned land under the jurisdiction of Kern County. AWD is preparing an Eagle Conservation Plan (ECP) to demonstrate the actions taken to avoid and minimize project impacts on golden eagles to the maximum degree achievable, and is pursuing a programmatic take permit under 50 Code of Federal Regulations (CFR) 22.26. AWD requests take authorization for an estimated total of three eagles over a 5-year permit duration based on an upper 80 percent interval limit estimate of golden eagle take for the project of 0.496 eagle per year (i.e., 2.478 eagles over 5 years).

1.1 Project Description

The project is proposed to be located on approximately 2,274 acres on the southern side of State Route (SR) 58 in southeastern Kern County, California, within and adjacent to an area of existing wind development. The project area is approximately 3 miles northwest of the town of Mojave and approximately 11 miles east of the city of Tehachapi.

The project layout initially proposed by AWD was a 318-megawatt (MW) project consisting of up to 106 wind turbine generators (WTG) on 2,591 acres. However, in response to BLM and U.S. Fish and Wildlife (USFWS) concerns about golden eagle risk, AWD substantially reduced the scope of the project to reduce the potential risk of eagle mortality posed by the project (Figure 1). Alternatives to project siting specific to layout and land use were evaluated and published in the Final Environmental Impact Statement (EIS) in February 2013 (BLM, 2013), and BLM EIS Alternative C was specifically designed to address golden eagle impacts by reducing land area and excluding development in the northern portion of the proposed project footprint. BLM Alternative C eliminates the turbines north of SR 58 to reduce risk of eagle take and allows a maximum of 97 WTGs and 291 MW output.

In response to the review and input provided by USFWS and BLM, the project was reduced to a maximum generation of 145.35 MW with 51 WTGs over a 2,274-acre area. The revision was carefully planned to optimize generation capacity while minimizing the potential risk to eagles as identified in resource studies and to conform with BLM EIS Alternative C. Modifications include a reduction in the number of WTGS (from 106 to 51) and a change in turbine model (from Nordex N117 2.4 MW turbine with a 58.5-meter-rotor radius [N117] to the General Electric 103m RD 2.85 MW with a 51.5-meter-rotor radius [103RD]). These substantial modifications to the project result in an approximately 63 percent reduction in the level of predicted eagle take on an annual basis. The original 106 WTG layout proposed by AWD and the revised 51 WTG layout evaluated in this ECP are presented and compared in Figure 1.

The proposed development evaluated in this ECP is a wind energy facility with a nameplate capacity rating of approximately 145.35 MW of wind turbine generation and includes ancillary facilities, supporting infrastructure, and up to 51 WTGs (Figure 2). The project site includes private and federal lands. Federal lands within the project area are under BLM jurisdiction, and private lands are under the jurisdiction of Kern County. Approximately 76 percent of the project's area (1,999 acres) and 42 of the 51 WTGs would be located on land managed by BLM. The location of the project site is shown on Figure 2, Project Area Map.

1.2 Background

BLM is the lead agency for review of the project under the National Environmental Policy Act (NEPA); however, USFWS is the lead for NEPA analysis related to authorization of a Programmatic Take Permit under the Bald and Golden Eagle Protection Act (BGEPA).

1.3 Purpose of the Conservation Plan

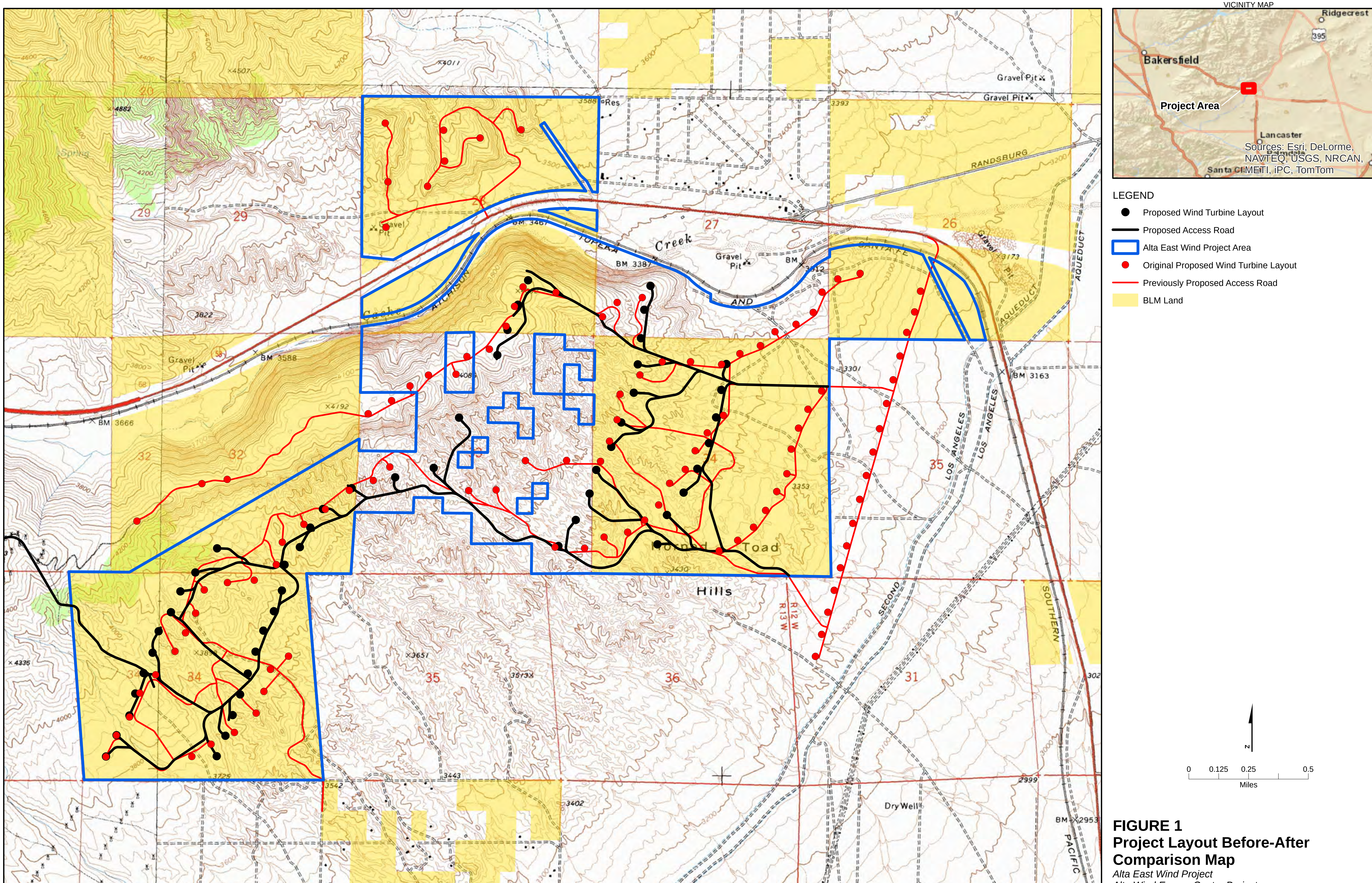
The project may have the potential to affect golden eagles or their habitat. USFWS made the initial assessment in a letter dated November 1, 2012, that this project poses a moderate risk of eagle take, given that other nearby projects in the Tehachapi Wind Resource Area have taken eagles, thus designating it a Category 2 project under the *Eagle Conservation Plan Guidance, Module 1 – Land-based Wind Energy, Version 2*("Guidance"; USFWS, 2013). Category 2 projects are described as presenting high to moderate risk to eagles but opportunities exist to mitigate impacts to eagle populations (USFWS, 2013). Therefore, this ECP follows the five-stage process outlined in the Guidance to avoid and minimize project impacts on golden eagles to the maximum degree achievable, and presents strategies for AWD to meet its obligation to qualify for an eagle take permit under 50 CFR 22.26, which includes application of any necessary advanced conservation measures to reduce golden eagle take and implementation of compensatory mitigation measures to result in no net loss of eagles at the Bird Conservation Region (BCR) scale.

This ECP has been developed in coordination with USFWS and BLM to evaluate options to avoid and minimize project impacts on golden eagles and address siting, construction, operations, and monitoring.

This ECP has been developed to meet BLM and USFWS requirements for addressing the BGEPA. The BGEPA prohibits take of eagles, which is defined as any action to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, destroy, molest, disturb, or otherwise harm eagles, their nests, or their eggs. The BGEPA defines "disturb" as "*to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available: (1) injury to an eagle; (2) decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior; or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior*." USFWS set in place rules establishing two new permit types: (1) incidental take of bald and golden eagles, which is associated with an activity but not the purpose of the activity; and (2) purposeful take of eagle nests that pose a threat to human or eagle safety (September 11, 2009; *Federal Register*, 50 CFR 13 and 22). This ECP is submitted to USFWS as part of the requisite material for a programmatic take permit.

1.4 Interagency Coordination and Communication History

April 29, 2010	AWD provided USFWS with the biological resources study plan for review and input.
November 29, 2010	Representatives from AWD met with Ashleigh Blackford and Danielle Dillard of USFWS and Justin Sloan of the California Department of Fish and Wildlife. Jacqui Kitchen of the Kern County Planning Department participated via telephone. The project was introduced and the results of baseline wildlife studies completed to date were presented.
November 30, 2010	AWD received correspondence from USFWS regarding the baseline study plan presented to USFWS in April 2010.
December 10, 2010	AWD responded to correspondence from USFWS regarding the baseline study plan.
March 22, 2011	ECP Draft 1 was submitted to USFWS.
January 2011	Draft ECP Guidance released USFWS.
September 26, 2011	Comments on draft ECP received from USFWS.
March 8, 2012	ECP Draft 2 provided to USFWS for review.
August 1, 2012	ECP Guidance Module 1 Technical Appendices released by USFWS.
October 31, 2012	Conference call with AWD and USFWS to discuss the draft ECP.
January 8, 2013	AWD provided revised draft ECP to USFWS for discussion.
February 19, 2013	Conference call with AWD, BLM, and USFWS to discuss required revisions to the draft ECP.
February 27, 2013	AWD submitted a revised ECP Draft 3
Feb. 28 to April 19, 2013	Weekly calls to discuss details of ECP and finalize document.
April 26, 2013	AWD revised and re-submitted ECP Draft 3
May 21, 2013	AWD submitted ECP Draft 4



VICINITY MAP

LEGEND

- Proposed Wind Turbine Layout
- Proposed Access Road
- Alta East Wind Project Area
- Original Proposed Wind Turbine Layout
- Previously Proposed Access Road
- BLM Land

0 0.125 0.25 0.5 Miles

FIGURE 1
Project Layout Before-After Comparison Map
Alta East Wind Project
Alta Wind Energy Center Project

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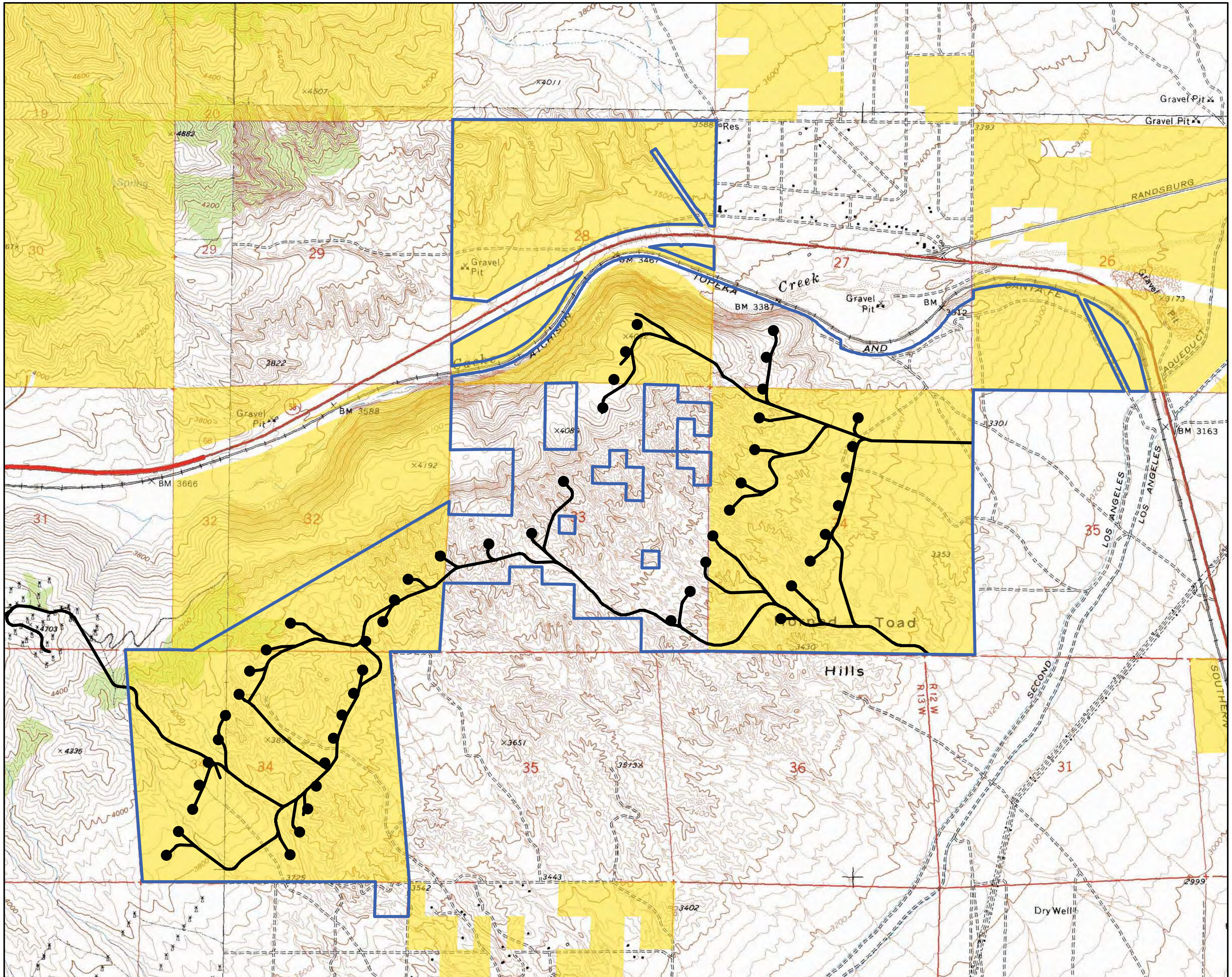
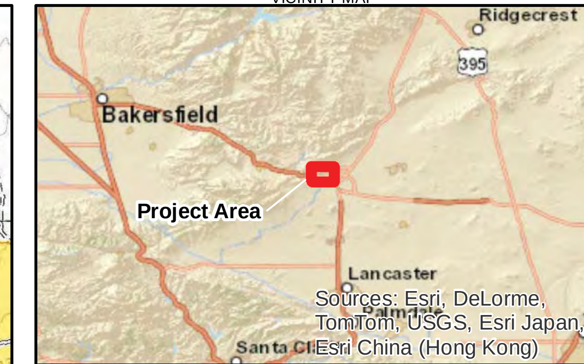


VICINITY MAP



LEGEND
- Proposed Wind Turbine Layout
- Proposed Access Road
- Alta East Wind Project Area
- BLM Land

0 0.125 0.25 0.5
Miles

N

FIGURE 2
Project Area Map
Alta East Wind Project
Alta Wind Energy Center Project

SECTION 2.0

Eagle Conservation Plan Development

2.1 Stage 1 – Initial Site Assessment

In July 2009, AWD completed an initial site assessment to evaluate potential constraints or risks related to the project and its impacts on golden eagles. The Tehachapi area was specifically selected for evaluation because of the extensive existing wind energy development in the region, the lack of critical habitat for federally endangered species, and the apparently manageable issues related to other special-status species potentially present onsite. Based on pre-field review of publicly available resources (California Natural Diversity Database [California Department of Fish and Game, 2009], California Native Plant Society database [2009], BLM special-status species management manual [BLM, 2001], and the California Desert Conservation Area Plan [BLM, 1999]), as well as reconnaissance surveys conducted at the site between 2006 and 2009 and during a March 19, 2009, site visit specifically designed to evaluate potential resource issues, it was determined that investment in site-specific resource studies was warranted to evaluate the extent of golden eagle use and potential impacts to the species.

2.2 Stage 2 – Site-specific Surveys and Assessment

Consistent with the Stage 2 recommendations for site-specific surveys and assessment presented in the USFWS Guidance, AWD has considered golden eagles and their habitat in its baseline characterization studies of the project area. AWD applied the *Interim Golden Eagle Technical Guidance: Inventory and Monitoring Protocols and other Recommendations in Support of Golden Eagle Management and Permit Issuance* ("Protocol and Recommendations"; Pagel et al., 2010) and additional onsite studies of eagle use, completed in accordance with *The California Guidelines for Reducing Impacts to Birds and Bats from Wind Energy Development* (California Energy Commission [CEC], 2007), to evaluate eagle use at the project site. Additionally, AWD coordinated its baseline study plan with USFWS in April 2010.

Baseline eagle studies completed to date for the project include 30-minute point counts conducted at approximately 1-week intervals throughout the area proposed for development, from May 2009 through June 2011, and helicopter surveys were completed in April and May 2010, and February, April, and June 2011, to identify potential eagle nesting territories within 10 miles of the project area. The nest survey analysis area was determined in accordance with the Protocols and Recommendations (Pagel et al., 2010) as requested by USFWS in the November 29, 2010, meeting. Site-specific survey methods and results are summarized below, and complete avian reports that include detailed discussion of methods and results are presented in Chatfield et al. (2010a, 2011).

2.2.1 Avian Point Count Surveys

The objective of the fixed-point bird use surveys was to estimate the seasonal and spatial use of the study area by birds, particularly diurnal raptors, which include golden eagles. Fixed-point surveys (variable circular plots) were conducted using methods described by

Reynolds et al. (1980). All birds, with a focus on raptors and large birds, observed during each 30-minute fixed-point survey were recorded. These surveys are standard assessment techniques used to assess most wind energy projects in California and are completed in accordance with CEC guidelines (CEC, 2007). However, in general, it is recognized that bird population estimates based on observed counts can underestimate or overestimate population numbers, creating a bias, because not all species are equally detectable. (Thompson, 2002). Point counts of 30-minute duration were the industry standard for assessing raptor use during the avian surveys for the project, and no empirical evidence is available at this time to indicate that 30-minute points would under- or over-represent eagle activity. The point count data gathered for the project provides the ability to calculate mean eagle use, an index of eagle activity that reflects the likelihood the species will use the particular area over a set unit of time. The point count data can also be used to predict eagle fatality rates using the USFWS Bayesian model.

Six points were selected to survey representative habitats and topography, while providing relatively even coverage of the area that was proposed for development in May 2009 (see Figure 3). A viewshed analysis of the six 800-meter plots was completed and 83.7 percent of the airspace 33.5 meters above ground level (agl) was visible from these points, indicating that eagles using the survey area would be observed in most, if not all, cases (Appendix A). All eagles observed during surveys were recorded; however, only eagles observed within 800 meters of each survey point were used in estimates of mean use and fatality rates. If eagles were observed, flight paths were mapped across the survey plot.

The project boundary was modified to include additional area in June 2010, so the locations of three of the six avian use survey points evaluated for the first year were modified to more specifically assess the area anticipated for project development (see Figure 4). Avian survey point 4 was moved approximately 0.5 mile south to allow the assessment viewshed to encompass the entire parcel located north of SR 58. Point 5 was moved approximately 0.5 mile south of SR 58 and Point 6 was moved approximately 2 miles southeast of SR 58 to enable full assessment of eagle use along the ridge located south of SR 58 and the southwestern portion of the new project area. The effect of relocating these avian survey points during Year 2 preclude direct comparison of mean use from Year 1 to Year 2 for these three points; however, the relocation substantially enhances the ability to understand eagle use of the area planned for WTG installation, and thus enables more comprehensive assessment of the potential risk that the project, as proposed, would pose to golden eagles using the project area. A viewshed analysis of the six 800-meter plots evaluated in the Year 2 study was completed and 86.3 percent of the airspace 33.5 meters agl was visible, indicating that eagles using the survey areas would be observed in most, if not all, cases (see Appendix A).

Because of their large size, eagles are visible and able to be identified at distances out to at least 2 kilometers (Dunne et al., 1998); therefore, the viewshed at this distance from the survey points was also assessed to represent a conservative estimate of the area that was evaluated for eagle use from any given survey point. During Year 1, 69.9 percent of the 2-kilometer radius plots above 33.5 agl were visible, and during Year 2, 74.3 percent was visible from each observation point (see Appendix A).

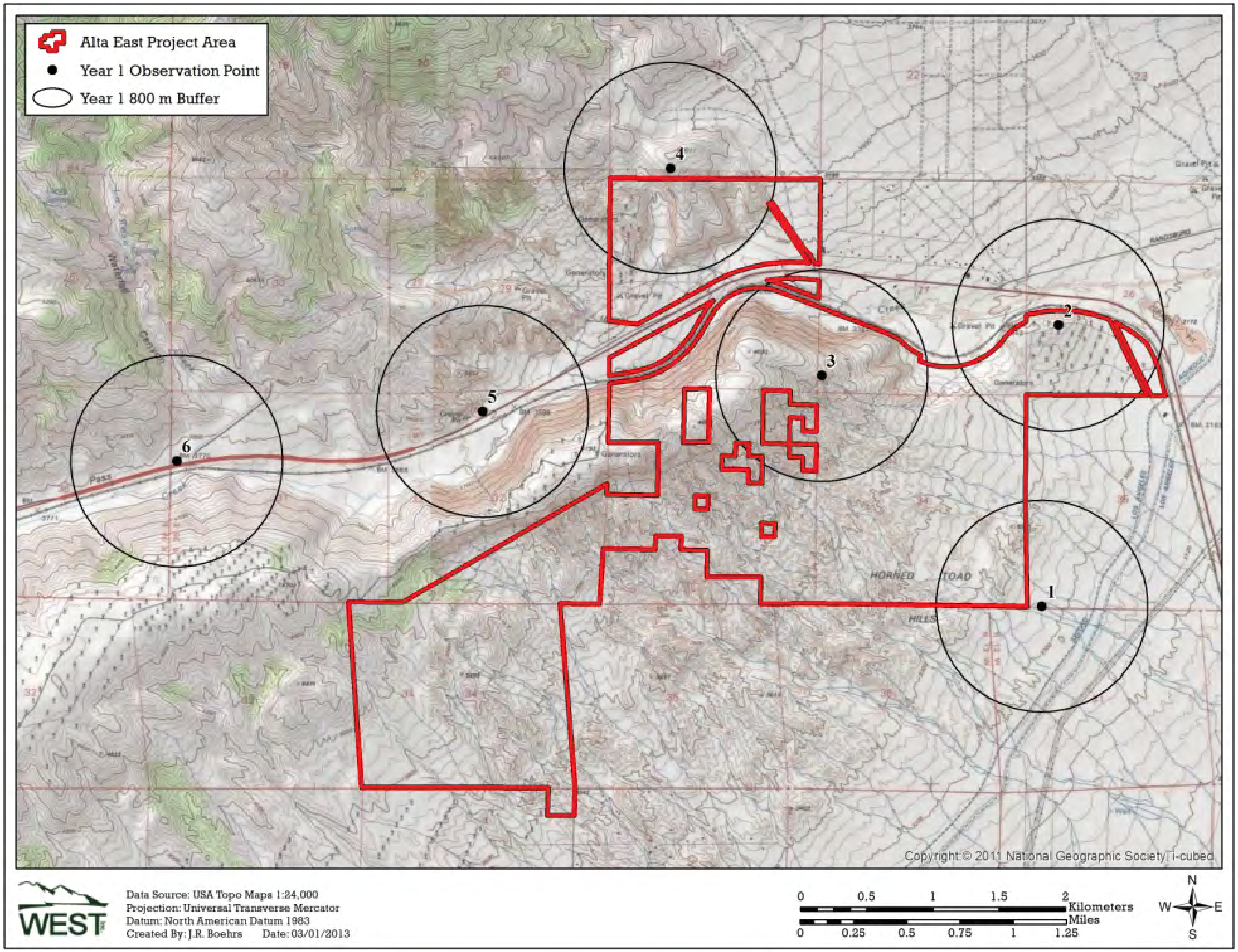


FIGURE 3
Avian Use Survey Points from May 11, 2009 to May 6, 2010

Alta East Wind Project
Alta Wind Energy Center Project

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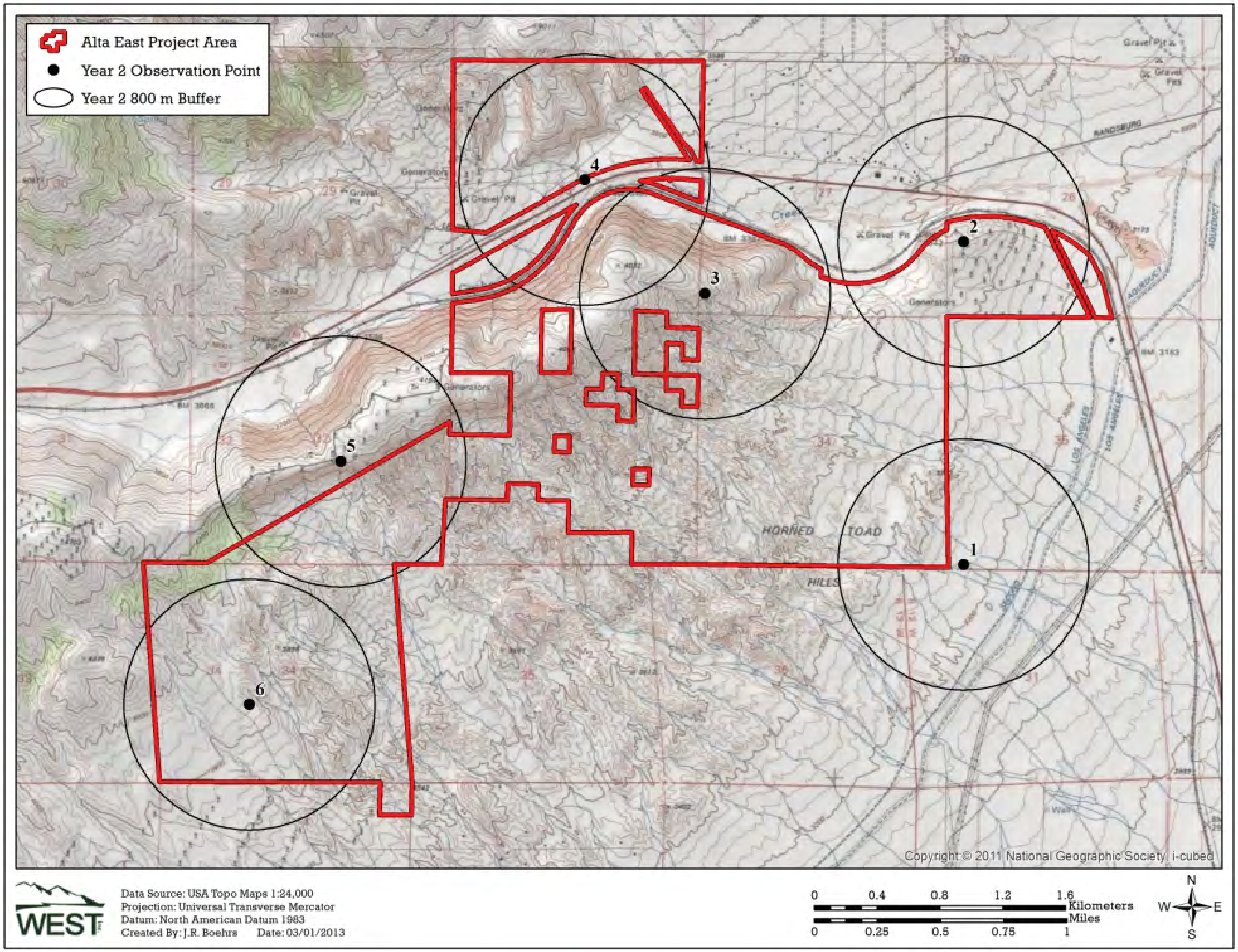

FIGURE 4
Avian Use Survey Points from July 10, 2010 to to June 1, 2011
Alta East Wind Project
Alta Wind Energy Center Project

A total of 311 30-minute fixed-point bird use surveys were conducted during 52 site visits, from May 2009 through May 2010 (Year 1). A total of 7 golden eagle groups with 11 individual sightings were recorded during this sampling effort. However, all observations occurred off the project area at survey points 4, 5, and 6 (see Figure 5). Observations were recorded during all seasons (spring, n=1 eagle; summer, n= 1; fall, n= 3; winter, n= 6) and indicate potentially higher use of these offsite areas in winter (see Table 1). At least 3 separate birds were observed (1 juvenile observed alone and 2 adults observed together); however, it cannot be determined from the data collected if the 7 observations of 11 eagles during Year 1 are repeat sightings of these same three birds or individual sightings of unique birds, or if these detections were local, resident, or floaters.

TABLE 1
Golden Eagle Observations during Year 1 (May 11, 2009 to May 6, 2010)
Alta East Wind Project

Date	Point*	Age	No. Individuals	Height Above Ground (meters) Highest	Height Above Ground (meters) Lowest	Activity	Location
5/26/2009	4	Juvenile	1	150	150	Gliding	Offsite
7/21/2009	4	Unknown	1	N/A	N/A	Perching	Offsite
9/17/2009	6	Juvenile	1	75	50	Soaring	Offsite
10/8/2009	5	Adult	2	500	100	Soaring	Offsite
12/31/2009	4	Adult	2	200	50	Soaring	Offsite
1/5/2010	5	Adult	2	200	25	Soaring	Offsite
1/5/2010	6	Adult	2	250	250	Gliding	Offsite

*Results in this table reflect Year 1 point locations as presented in Figure 3 and Figure 5

The eagle use documented in the May 2009 to May 2010 studies is potentially explained by the existence of eagle nesting territories north and west of the project as described in Section 2.2.2, Nesting Territory Surveys. During the survey period, all eagle use was off the project site, away from areas proposed for project development, and associated with higher elevation and rugged topography north and west of the project. Using all avian survey data, from all Year 1 survey plots, mean use by eagles (number of individuals observed per 800-meter plot per 30-minute survey) ranges from 0.01 eagles in spring to 0.07 eagles in winter. In other words, during Year 1 surveys, golden eagles were only detected north and west of the currently proposed project area. This Year 1 finding led AWD to abandon development plans for lands where eagles were seen and to focus on lands where no eagles were observed.

A total of 260 30-minute fixed-point bird use surveys were conducted during 47 site visits, from July 10, 2010, through June 1, 2011, at the six avian use points evaluated during Year 2. No eagle observations were recorded during studies conducted from July 10, 2010, through September 2010; however, seven golden eagle groups consisting of eight eagle observations were recorded from October 7, 2010, through March 10, 2011 (see Table 2; Figure 6). These observations were associated with the escarpment edge running east-west along the northern portion of the project, and concentrated around survey points 3 and 4, with one occurring at Point 5. It is evident from these data that at least three separate individuals were recorded based on the observation of single adults, single birds of undetermined age, and an observation of two juveniles together); however, it cannot be determined whether these eight detections included a local, resident, or floaters. Assuming each bird recorded was a unique individual, a total of eight different eagles may have been detected using the project area during fall 2010 and winter 2010–11. All eight of these fall and winter observations were of flying eagles, indicating movement through the project area. No perching eagles or those actually feeding on prey items have been recorded within or near the project boundary.

Golden eagle mean use in Year 2 was 0.0 birds/30-minute count during spring and summer, 0.02 birds/30-minute count in fall, and 0.08 birds/30-minute count in winter. Golden eagles constituted less than 2 percent of all birds observed during any of the four seasons evaluated. The eagle use documented in the fall and winter of the Year 2 study is potentially explained by seasonal or annual variation in the use of the project area by eagles. No strong association with topography is evident within the main project area, with the exception of use documented along the escarpment edge running east-west along the northern portion of the project.

TABLE 2
Eagle Observations During Year 2 (from July 10, 2010 through June 1, 2011)
Alta East Wind Project

Date	Point*	Age	No. Individuals	Height Above Ground (meters)		Activity	Location
				Highest	Lowest		
10/7/2010	3	Adult	1	400	200	Soaring	Onsite
11/30/2010	3	Juvenile	1	110	40	Gliding	Onsite
12/7/2010	1	Unknown	1	45	25	Gliding	Offsite
1/20/2011	3	Adult	1	85	20	Soaring	Onsite
2/17/2011	4	Juvenile	2	125	40	Circle Soaring	Onsite
2/25/2011	3	Unknown	1	40	40	Gliding	Onsite
2/25/2011	5	Unknown	1	40	25	Gliding	Offsite

Source: Chatfield et al., 2011

*Results in this table reflect Year 2 point locations as presented in Figure 4 and Figure 6. Points 3 and 4 are located near Points 3 and 4 from the Year 1 surveys. These point locations were modified for Year 2 to more accurately assess the modified project boundary and results cannot be compared directly to Points 3 and 4 from Year 1 surveys. Point 6 is a new point, added for Year 2 surveys.

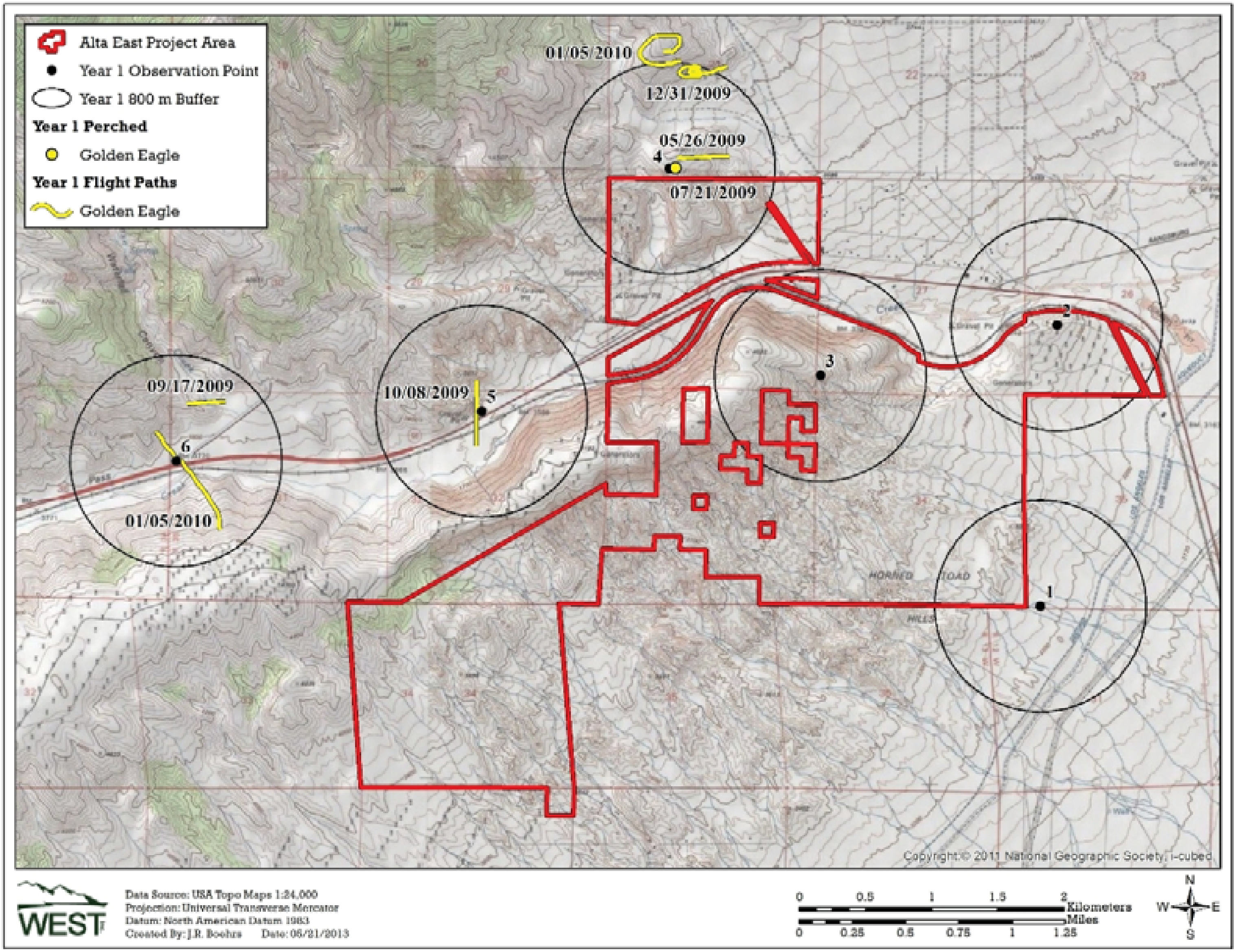

FIGURE 5
Golden Eagle Observations from May 11, 2009 to May 6, 2010
Alta East Wind Project
Alta Wind Energy Center Project

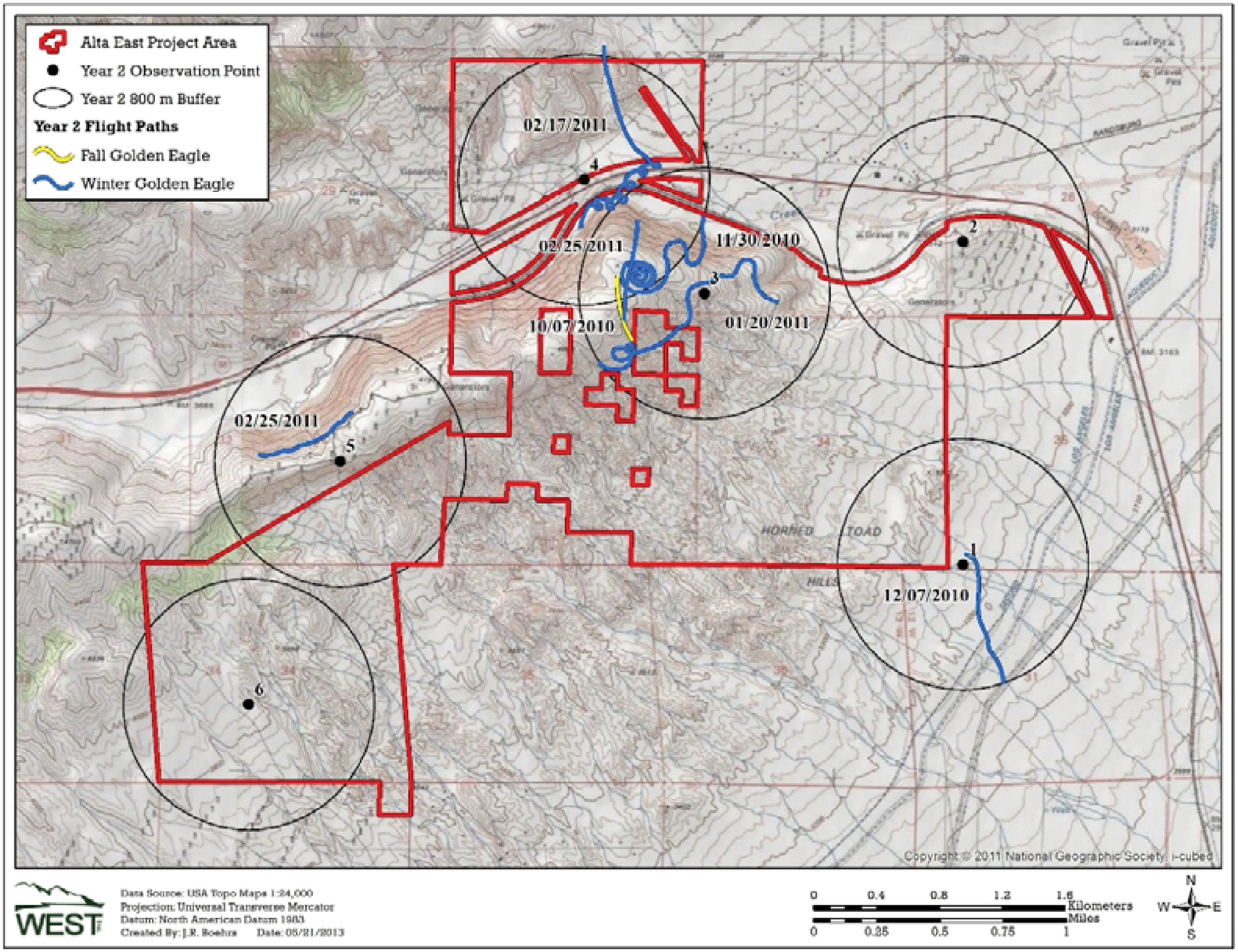

FIGURE 6
Golden Eagle Observations from July 10, 2010 and June 1, 2011
Alta East Wind Project
Alta Wind Energy Center Project

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2.2.2 Nesting Territory Surveys

Aerial eagle nest surveys were conducted via helicopter on April 13 and May 24, 2010, and again on February 22, April 12, and June 1–2, 2011 (Chatfield et al., 2010a; 2011). The objective of the surveys was to locate nests that may be subject to disturbance or displacement effects from project construction or operation. While active (eggs, young, or incubating adults observed) and inactive (no eggs, young, or incubating adults observed) nests of all raptor species were recorded, the survey specifically targeted golden eagles and was consistent with the USFWS Guidelines (Pagel et al., 2010). The survey area for golden eagle nests included all eagle nesting habitat within a 10-mile radius of the project.

No active eagle nests were located within the project boundary in 2010 (see Figure 7). One active golden eagle nest was observed on a cliff ledge approximately 4.2 miles from nearest proposed WTG. This nest was located on the northeastern side of a large rock outcrop in a side drainage off of Oil Canyon within the Freemont Basin. Two nestlings were observed in this nest on May 24, 2010. A second active golden eagle nest was observed in a live gray pine (*Pinus sabineana*) approximately 10.9 miles west of the nearest proposed turbine. One adult was observed on this nest on April 13, 2010, and two adults were observed perched in the nest vicinity on May 24, 2010. Single adult golden eagles were observed perched at two additional locations within the survey area during the 2010 surveys, approximately 7.0 miles northeast and approximately 7.5 miles south of the project area. Additionally, nine inactive nests that could have potentially been constructed or used by golden eagles were documented within the survey area, the closest of which was approximately 2.3 miles northwest of the nearest proposed WTG.

No active eagle nests were located within the project boundary in 2011. One aerial eagle nest survey was conducted in late February 2011 for the area within 10 miles of the project site. The nests identified in the 2010 surveys were present; however, no eagles were observed and the nests were determined inactive at this time. Eight additional inactive nests of varying condition were documented in the February 2011 survey that may have been initially constructed or historically used by golden eagles. A second survey was completed in April 2011 and three active golden eagle nests were identified within 10 miles of the project (see Figure 8). The nest nearest the proposed project site was very close to the nest documented as active in 2010 (approximately 100 feet to the east), and was located on the northwest side of a large rock outcrop in a small drainage off of Oil Canyon, approximately 4.1 miles northwest of the nearest proposed turbine location. The second nest was located on the northwest side of large rock outcrop above an unnamed drainage approximately 4.5 miles north of the nearest proposed turbine location. The third nest was located on a north-facing cliff above a side drainage off of Pine Tree Canyon approximately 7.6 miles north of the nearest proposed turbine location. The northwestern nest was confirmed to have failed and the two nests to the north of the project site were confirmed active on a follow-up survey completed on June 1, 2011, in which two young were observed in the nest 7.6 miles to the north and one chick was observed in the nest 4.5 miles to the north. The young were estimated to be between 7 to 8 weeks old. An additional 14 nest structures that could potentially be used by golden eagles were documented during the 2011 nest survey, the closest of which were 2.3 and 4.0 miles from the nearest proposed turbine.

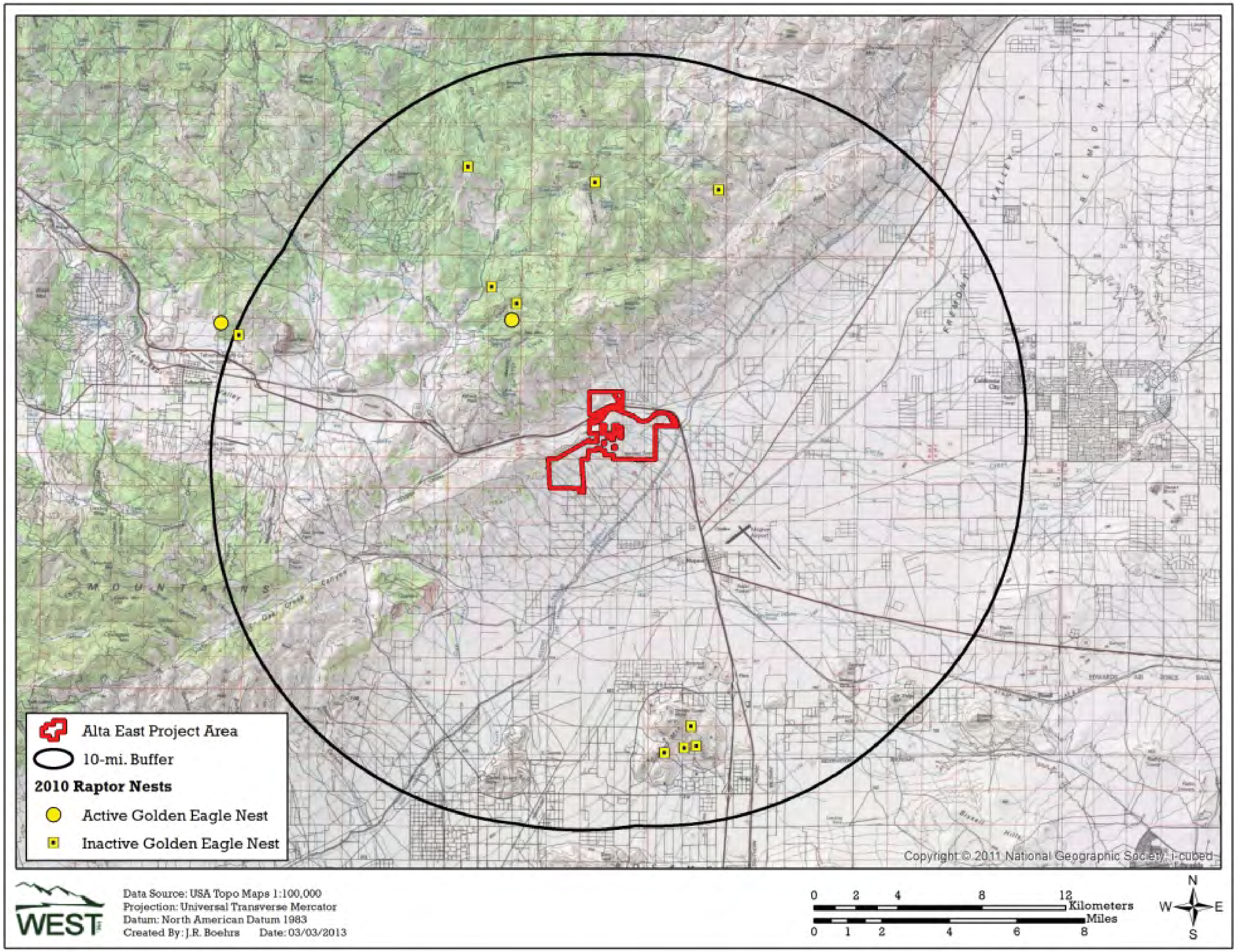

FIGURE 7
Golden Eagle Nesting Territory Survey Results, April 13, 2010 and May 24, 2010
Alta East Wind Project
Alta Wind Energy Center Project

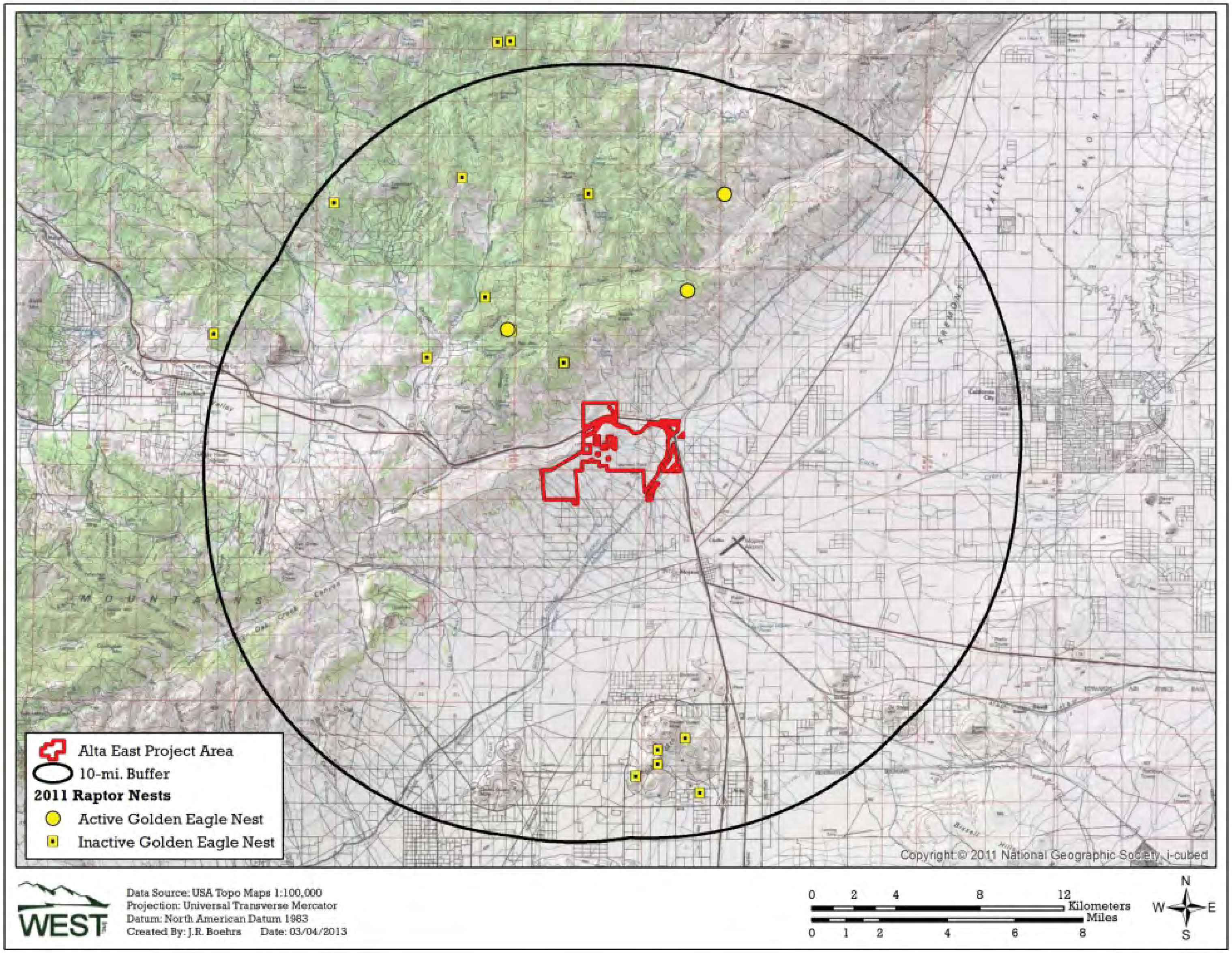

FIGURE 8
Golden Eagle Nesting Territory Survey Results, February 22, April 12, and June 1-2, 2011
Alta East Wind Project
Alta Wind Energy Center Project

2.2.3 Assessment of Nonbreeding Habitat

According to the National Land Cover Database (U.S. Geological Survey, 2001), the dominant cover type within the project area is scrub-shrub, which constitutes approximately 96.7 percent of the study area. Grasslands and low-intensity developed areas represent approximately 1.3 percent and 1.0 percent of the project area, respectively.

Studies in California indicate that golden eagles select grasslands and oak savanna, with fewer eagles selecting oak woodland and open shrublands (Hunt et al., 1998). The Hunt et al. (1998) study is of the Altamont Pass wind resource area and was completed in response to USFWS concern that fatalities might adversely affect the golden eagle population in the region. It was not specifically a food/habitat selection study, but documents some of the highest nest densities in California and thus the habitat described indicates fairly optimal conditions. The Alta East project area differs from the Altamont Pass wind resource area in that it has few perches. Primary prey species for golden eagles are rabbit, hare, and rodents, but golden eagles also take other mammals, birds, reptiles, and scavenge a limited amount of carrion (Olendorff, 1976). California ground squirrels (*Spermophilus beecheyi*) and black-tailed jackrabbits (*Lepus californicus*) are the among the most important prey species for the golden eagle (Hunt et al., 1998). Eagles generally hunt prey from favored perches near regular updrafts, which allow soaring to heights sufficient for them to efficiently scan their hunting areas (Johnsgard, 1990). Prey studies were not conducted for the Alta East project; however, eagles were observed infrequently and those observed were not hunting or foraging. Additionally, no prominent or used perches were detected after careful evaluation of the project area.

A potential indicator of the risk to golden eagles is the extent of use relative to other areas on the landscape. Data collected to evaluate the Alta East project area indicate that during the first 12-month period of evaluation (Chatfield et al., 2010a), eagle use within the project area was distinctly different from the area observed to the north and west, where eagle use was documented (Figure 5; 11 eagles observed offsite and 0 observed onsite). Of the seven golden eagle groups (n = 11 birds; Table 1) observed during the Year 1 study, all were north and west of the area currently proposed for development and outside the project boundaries at survey points 4, 5, and 6. Observations were recorded during all seasons (spring, n=1 eagle; summer, n= 1; fall, n= 3; winter, n= 6) and indicate potentially higher use of these offsite areas in winter because no eagles were recorded at the survey points 1, 2, and 3 located onsite (Figure 5). This difference in eagle use could be associated with lower-quality foraging habitat, lack of perch sites or foraging opportunities, less desirable thermal or wind characteristics, or general land use activity differences that make the project area less attractive to eagles than the surrounding landscape. This difference in eagle use is measurable in the data collected during this period.

Eight eagles were documented within the project site between October 7, 2010, and February 25, 2011 (Table 2; Figure 6). Observed eagle use was primarily outside of the nesting season for this species; nest construction typically occurs in February and egg-laying occurs March through mid-May (Polite and Pratt, 1990). No use was recorded during the 2010 nesting season, and four observations were made very early during the 2011 nesting season. While the winter observations may or may not have included eagles from nesting territories in the project vicinity, most eagle use on the project site occurred during the period in which eagles were not actively nesting, incubating, or rearing chicks (Figure 6; Table 2).

2.3 Stage 3 – Predicting Eagle Fatalities

The USFWS draft ECP guidance (USFWS, 2011) presents factors potentially associated with wind turbine collision risk for eagles. Some of these factors may be present during operation of the project and may include bird density, age, residency status, season, flight style, interaction with other birds, and hunting or presence of foraging opportunities. Information that conclusively defines the functional relationship of these factors to actual eagle mortality during operation is, for the most part, unavailable; however, these risk factors make intuitive sense and are therefore considered in AWD's assessment of risk. AWD's assessment and conclusions related to risk are based on the data collected from March 2009 to June 2011. Risk analysis and conclusions are summarized in Table 3 and described in more detail in the following sections.

TABLE 3
Assessment of Golden Eagle Risk Factors
Alta East Wind Project

Risk Factor	Analysis	Conclusion
Bird Density	Eagle use is low when compared to other facilities with similar preconstruction data (see Chatfield et al., 2010a; 2011).	Low risk
Age	Age of individuals was estimated during point count surveys; however, inconsistent age determination and infrequent detection preclude understanding of the age structure of eagles occasionally using the project area. Although age is an unreliable stand-alone indicator of risk for a variety of reasons, each age class may have its own particular vulnerabilities that are dependent on a variety of other risk factors and circumstances.	Unknown Risk
Residency Status	Distance of nests from the project indicates nesting eagles occur in reasonable proximity to the site to present risk. Nesting territory occupants, and adult and juvenile floaters, may comprise the population of eagles using the site; however, this cannot be determined from the data available. No evidence of foraging or territorial behavior was observed on the project site. According to Hunt (2002), subadults and floating adults are highly vulnerable to turbine blade strikes, which would be associated with higher risk than for resident adults.	Moderate to High Risk
Season	A potential relationship of eagle use with fall and winter season is evident based on the fall 2010 and winter 2010–11 avian use data. Foraging, perching, or consistent use of specific areas was not documented; however, seasonal and annual variability was evident.	Potential Seasonal Variation in Risk

TABLE 3
Assessment of Golden Eagle Risk Factors
Alta East Wind Project

Risk Factor	Analysis	Conclusion
Flight Style	Soaring and gliding is documented in and out of the altitudes above ground level associated with WTG collision risk; however, infrequent detection of eagles and no higher-risk flight behaviors, such as hunting, kiting, or stooping were observed.	Moderate Risk
Interaction With Other Birds	With the exception of two juvenile eagles observed on February 17, 2011, all observations of onsite eagles were of individual birds. No evidence of territoriality or interaction with other eagles was observed.	Low Risk
Hunting	Not observed.	Low Risk
Presence of Foraging Opportunities	Not observed.	Unknown Risk
Topographic Features for Slope Soaring	The majority of the project area is flat, and rugged topography is limited to the north and western edges.	Risk may vary with topography
Topographic Features for Flight Corridors	The majority of the project area is flat, and rugged topography is limited to the north and western edges; however, observed use was infrequent and not specific to a particular feature or corridor	Low Risk
Perch Structures	No perching eagles were detected onsite. Additionally, no unique perch sites associated with topography or artificial structures are present on the project site.	Low Risk

2.3.1 Collision Risk

Eagle density, age, residency status, time spent in zone of risk, season, flight style, interaction with other birds, and hunting or presence of foraging opportunities all may influence the likelihood of an eagle colliding with a WTG or other project features. However, to date, the information required to estimate eagle fatalities based on these criteria is currently lacking. Thus, a higher-level approach is required to estimate potential eagle fatalities. The following discussion evaluates fatality estimates using three different approaches: regression analysis, eagle use / mortality rate comparison, and modeling using the USFWS-recommended Bayesian collision risk model (USFWS, 2013).

2.3.1.1 Regression Analysis

One method of estimating site-specific mortality predictions for eagles is to look at mean use for all raptors, and then look at the proportion of the overall raptor use attributed to golden eagles. Using methods described in Chatfield et al. (2010a, 2011), a regression analysis of raptor use and mortality for 20 new-generation wind energy facilities, where similar methods were used to estimate raptor use and mortality, found that there was a strong correlation between use and mortality (R^2 = 65%). Using this regression to predict overall raptor collision mortality at the project (based on mean raptor use [adjusted from 30-minute to 20-minute survey intervals] of 0.09 raptors/800-m/20-min survey) yielded an estimated fatality rate of less than 0.01 fatalities/MW/year or approximately 1.45 raptor fatality per year for the 51 turbine project as proposed (WEST, 2012). A 90 percent prediction interval around this estimate is zero to 0.19 raptor fatalities/MW/year.

Golden eagle use accounted for approximately 22.2 percent of the observed raptor use at the project site during the 2 years of study; therefore, assuming the proportion of eagles observed is related to the proportion of eagle mortality that would be expected, an eagle mortality rate of 0.0022 eagles/MW/year (0.0066 eagles/turbine/year), or 0.320 eagle fatalities per year would be estimated for the proposed 145.35-MW (51 WTG) wind energy project. Using this prediction, project-wide eagle mortality would be approximately 1.6 eagles for the duration of the 5-year permit. This approach may be conservative because golden eagles are easier to detect than some other raptor species; therefore, the proportion of raptor use attributed to golden eagles may be overestimated. It is also probable that collision risk for eagles is different than for other raptors, introducing further bias to this estimate, though the direction of this bias is uncertain.

2.3.1.2 Eagle Use / Mortality Rate Comparison

By comparing mean use values of eagles at 13 projects in western and midwestern states where fatality monitoring results have been reported, no take has been documented where annual eagle use values are less than 0.05/20-minute survey period (Figure 9). Overall mean golden eagle use recorded at the Alta East project site during the 2 years of study (0.020 eagles/800-m plot/20-min survey) is within the range of preconstruction eagle use values estimated for projects with no documented take of eagles during operation.

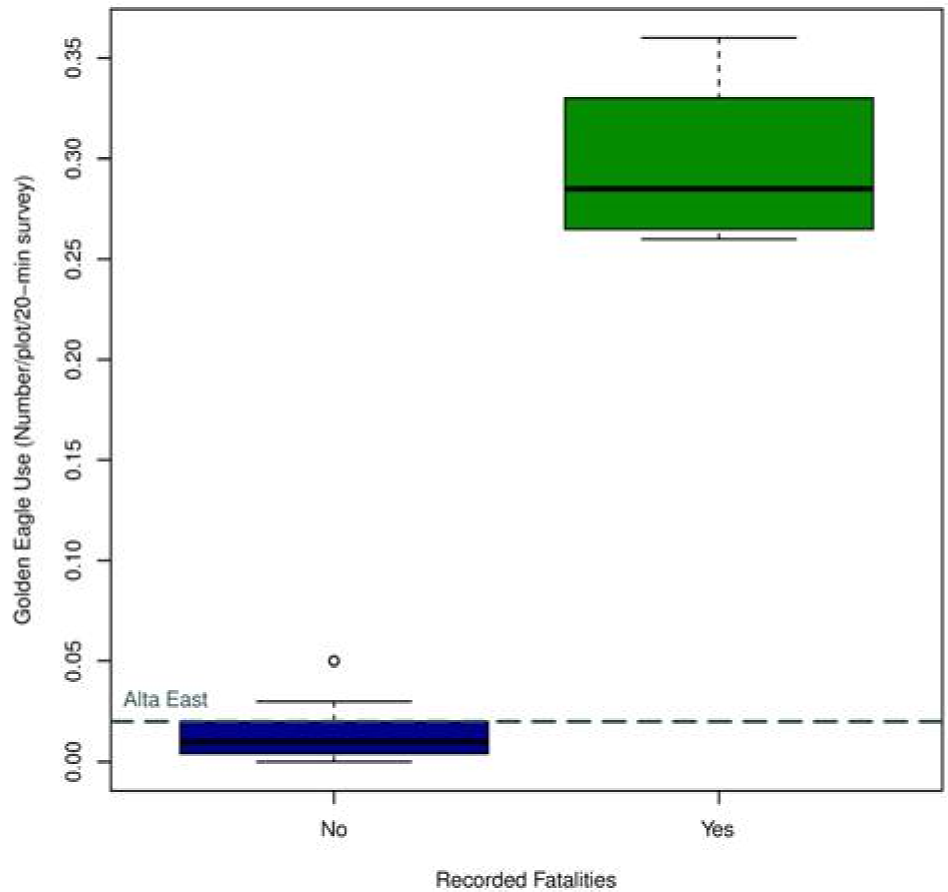

FIGURE 9
Average Preconstruction Golden Eagle Use (per 20-min survey) Values for Wind Energy Facilities With and Without Observed Golden Eagle Fatalities as Compared to Alta East

Data from the following sources:

Wind Energy Facility	Golden Eagle Use	Use Reference	Golden Eagle Fatality Recorded?	Fatality Reference
Alta East, CA	0.02	Chatfield et al. 2010a, 2011		
Campbell Hill, WY	0.36	Taylor et al. 2008	Yes	Taylor et al. 2011 In Press
Diablo Winds, CA	0.3	WEST 2006	Yes	WEST 2006, 2008
Elkhorn, OR	0.27	WEST 2005	Yes	Enk et al. 2011 In Press
Foot Creek Rim, WY	0.26	Johnson et al. 2000	Yes	Young et al. 2003a
Wild Horse, WA	0.05	Erickson et al. 2003a	No	Erickson et al. 2008
Combine Hills, WA	0.03	Young et al. 2003b	No	Young et al. 2006
Leaning Juniper, OR	0.02	Kronner et al. 2005	No	Kronner et al. 2007; Gritski et al. 2008
Hopkins Ridge, WA	0.01	Young et al. 2003c	No	Young et al. 2007a
Stateline, OR/WA	0.01	Erickson et al. 2002	No	Erickson et al. 2004
Vansycle, OR	0.01	Erickson et al. 2002	No	Erickson et al. 2000
Klondike, OR	>0.01	Johnson et al. 2002	No	Johnson et al. 2003
Nine Canyon, WA	>0.01	Erickson et al. 2001	No	Erickson et al. 2003b
Grand Ridge, IL	0	Derby et al. 2009	No	Derby et al. 2010

2.3.1.3 Collision Risk Modeling

A third approach to attempt to predict the frequency of eagle fatalities associated with a wind project is to use the modeling approach prescribed in the USFWS Guidance (USFWS, 2013). The model assumes that a functional relationship exists between preconstruction eagle use, behavior, and risk of collision. The USFWS Bayesian collision risk model assumes that higher site-specific eagle flight activity will correspond to higher annual eagle mortality once the wind energy facility is operational (USFWS, 2013). Under this assumption, predictions of annual eagle mortality were modeled as the preconstruction measure of eagle exposure within areas of potential eagle-wind turbine interactions, multiplied by a collision correction factor as described in the USFWS ECP Guidance and detailed in Appendix B.

In order to evaluate the benefits from the project siting decisions, AWD evaluated the predicted eagle fatalities for the original 106-turbine layout and the current 51-turbine layout for both turbine types being considered. Credible interval limits (a Bayesian confidence interval) were calculated using a simulation of 10,000 Monte Carlo draws from the posterior distribution of eagle exposure and the collision probability distribution (Manly, 1991). The product of each of these draws with the exposure area corresponding to the N117 and 103RD turbine models were used to estimate fatality using all avian survey data collected for the project. Inclusion of these eagle survey data results in upper 80 percent credible interval limit take estimates for the 106-WTG layout of 1.33 eagles per year for the N117 WTG and 1.03 eagles per year for the 103RD WTG. For the 51-WTG layout, upper 80 percent credible interval limits are 0.64 eagles per year for the N117 WTG and 0.50 for the 103RD WTG (Table 4).

TABLE 4
Summary of Fatality Estimates Using All Avian Survey Data from May 11, 2009 through June 1, 2011
Alta East Wind Project

	106-Turbine Layout		51-Turbine Layout	
Fatality Estimate	**N117**	**103RD**	**N117**	**103RD**
Annual Fatalities (5-year total)	0.901 (4.505)	0.698 (3.491)	0.434 (2.168)	0.336* (1.680)*
Upper 80% Credible Interval Limit (5-year total)	1.331 (6.656)	1.031 (5.153)	0.641 (3.203)	0.496* (2.478)*

*Fatality estimate for proposed project analyzed in this ECP and Resource Equivalency Analysis.

2.3.1.4 Fatality Risk Summary

Each analysis presented above involves substantial assumptions and does not take into account further siting decisions and advanced conservation practices that may be incorporated during the Environmental Assessment and programmatic take permitting processes currently underway; however, the three approaches generate project-wide fatality estimates for golden eagles ranging from near zero to 0.496 eagles per year, or from near zero to 2.48 eagles for the 5-year duration of the programmatic take permit. Although some golden eagle fatalities may occur, based on the use data and prediction models currently available to estimate operational take based on preconstruction eagle use data, it appears that the number of fatalities would likely be small and mitigable should they occur. Overall eagle use of the project area is infrequent, and fatality of eagles would be estimated using the Bayesian model to be 0.496 eagles in a given year.

2.3.2 Impacts to Nests or Nesting Territories

The nearest known, recently active eagle nest is located approximately 4.1 miles northwest of the nearest proposed wind turbine. This nest was active during the 2011 nest survey and likely was the same nesting pair or territory as the nest documented within 0.10 mile of this nest in 2010. Additionally, one inactive nest was documented in 2011 approximately 2.3 miles northwest of the nearest turbine. No eagle nests were documented within the project area, and measures of eagle use of the project site are low; however, a nesting territory or territories may overlap the project area.

Historical nest and territory data or population status or assessment data are not available from USFWS to evaluate historical eagle territory locations in and near the project area or the current status of golden eagles in the region (Blackford, 2011, pers. comm.); however, AWD has assessed the potential impacts on golden eagles in the absence of these data. Its conclusion is that impacts to nesting golden eagles are unlikely during construction due to the distance between documented nests and project activities (Suter and Jones, 1981). Additionally, the potential for low levels of take during operation exists, but such low level of take can be fully mitigated if it occurs, as described in Section 2.4.7.

It is generally understood that nonbreeding eagles use areas on the margins of territories occupied by breeding adults (Watson, 1997; Hunt, 1998; Caro et al., 2010). These "floaters" have been shown to be more vulnerable to collision with turbine blades at wind energy projects than locally breeding adults and juveniles are (Hunt et al., 1999; Hunt, 2002); however, Hunt (2002) associates this risk with hunting of live prey behavior, which was not observed and is not common at the project site based on the data collected for the project. WTGs sited near eagle nesting territories may pose risks to eagle populations because population stability is likely influenced by a robust nonbreeding cohort in the form of floaters to replace breeding individuals that die. Based on studies completed to date, it is appropriate to conclude that risk of project impacts to nesting eagles, or floaters of any age, does exist.

2.3.3 Foraging Habitat Loss

During the first 12 months of evaluation, eagle use within the project area was distinctly different from that in the area observed to the north and northwest, where eagle use was documented. Subsequent data collected in fall 2010 and winter 2010–11 indicate that eagles use the project area during the nonbreeding season and use the project area differently between seasons and years. It is possible that established territories could expand or shift to include the project area in response to prey fluctuations. No hunting or foraging behavior was observed onsite in 2 years of study.

2.3.4 Wintering Habitat Use

Potential for seasonal variability in use of the project area exists, and data indicate that the project area may support more eagles in the fall and winter than during other times of the year or that repeated use by the same individuals may be occurring. Based on studies completed to date, it is appropriate to conclude that potential project impacts on wintering habitat for eagles are expected to occur.

2.3.5 Cumulative Impacts

USFWS is required to evaluate and consider the effects of programmatic take permits on eagles at the eagle management unit, local area, and project area population scales, including cumulative effects, as part of its permit application review process (50 CFR 22.26 (f)(1) and USFWS, 2009). Therefore, AWD presents general information that is publicly available regarding threats to eagles and operating projects in the vicinity.

Based on the USFWS Guidance (2013), USFWS is required to evaluate the effects of programmatic take permits on golden eagles at three different scales: (1) the BCR, which is USFWS's designated management unit for golden eagles, (2) the local area population, and (3) the project area population. BCRs are ecologically distinct regions in North America with similar bird communities, habitats, and resource management issues (NABCI, 2013), and these regions represent the largest area of the three population scales. The local area population is defined in the USFWS Guidance (USFWS, 2013) as the total number of golden eagles estimated to occur within a 140-mile radius of the project boundary, inclusive of the proposed project area. Because take is being mitigated to a no net loss standard, the project will not contribute to the cumulative impacts at the BCR or local area population scale region. The project area population has been assessed in detail in this ECP.

There are a variety of current and foreseeable future actions that are known to result in unauthorized take and that could potentially occur within a 140-mile radius of the project boundary. Lethal take of golden eagles is commonly caused by electrocution associated with power lines (Benson, 1981; Hunt, 2002); collision with power lines (Avian Power Line Interaction Committee [APLIC], 2012), communication towers and guy wires (USGS, 2010), wind turbine blades (Hunt, 2002; Smallwood and Karas, 2009), and vehicles (Phillips 1986, Russell and Harden, 2009); lead poisoning (Craig et al., 1990); secondary poisoning from predator control efforts (Bortolotti, 1984); secondary poisoning from pesticides (Henny et al., 1984; Mineau et al., 1999); and illegal shooting (Ellis et al., 1969; Phillips, 1986). Other causes of lethal take include collision with trains (Hunt, 2002) and aircraft (FAA, 2013), and unintentional trapping (Bortolotti, 1984; Phillips, 1986).

Typical activities that may be disruptive or detrimental to eagles occurring throughout the project region, although very limited on the project area, include illegal shooting, off-highway vehicle activity, loss of habitat to development through non-wind-industry-related development, and general encroachment into nesting territories. AWD has not obtained information regarding the specific extent of these detrimental activities; however, each likely contributes to negative impacts on the regional eagle population.

Wind energy power generation is common in the Tehachapi region and AWD is aware that eagle fatalities have been documented at the North Sky River (NSR) Wind Project located 10.5 miles north, the Pine Tree (PT) Wind Project located approximately 7 miles north, and the Alta-Oak Creek Mojave (AOCM) project located approximately 3 miles to the south. Although specifics about the date and age of the individual(s) killed are not available at each project, with the exception of AOCM where a fatality was documented on November 29, 2011, it is possible that these impacts could influence the eagle territories documented within 10 miles of the project site and thus influence the dynamics of the local eagle population.

The NSR project is located approximately 10.5 miles north of Alta East, within topography substantially more rugged than that at the Alta East site. Vegetation is typified by pinyon-juniper woodland and oak woodland on the west side of the project and grasslands and chaparral scrub on the east side of the project. Two substantial drainages lie between Alta East and NSR, and the NSR project is located near eagle nests discovered during the Alta East eagle nest surveys. AWD is aware of one eagle fatality having occurred at this project in January 2012, occurring less than 2 months after start of operations. Although take has been documented at NSR, this project differs substantially from Alta East in terms of site characteristics and with respect to suitability for golden eagle use. The final environmental impact report documents over 50 sightings of golden eagles in one year of surveys covering four seasons in 2010–11 (County of Kern, 2012a), 22 eagle sightings during spring surveys (132 hours of observation between March 15 and May 26, 2011) (Erickson et al., 2011), and 36 additional observations during a full year of avian use surveys. Due to the difference in site characteristics, eagle risk between the NSR and Alta East projects is not comparable.

The PT project is located approximately 7 miles north of Alta East, and immediately south of NSR, and is also located within more rugged topography than Alta East and much closer to the eagle nests detected during surveys for the Alta East project than either the Alta East or NSR projects. While no preconstruction eagle use data are available for comparative analysis, eight eagle fatalities has been documented at the PT project as of April 13, 2013, per USFWS. Due to the difference in site characteristics, eagle risk between the PT and Alta East projects is not comparable.

The AOCM project is located approximately 3 miles to the south and consists of up to 720 MW of wind energy generation capacity with 150 WTGs (300 MW) installed during 2010 and an additional 140 WTGs installed during 2011. AOCM was granted state and county permits. The AOCM project is sited to minimize impacts on eagles and incorporates appropriate measures to detect or mitigate impacts on eagles should they occur. Baseline eagle use at the AOCM project site was very low relative to other projects in the geographic range of golden eagles, and comparable to that documented at Alta East.

The Alite Project is located approximately 3.75 miles southwest of the Alta East project and consists of eight 3.0-MW turbines constructed in 2008. It is located at the interface of the Western Mojave Desert and Tehachapi Mountains ecological regions, in juniper-woodland-dominated habitat with some areas of perennial native grassland, rabbitbrush scrub, and Joshua tree woodland. This is similar to the northern and westernmost turbine locations of the Alta East project; however, fatality studies conducted from June 15, 2009, to June 15, 2010, at the Alite Project estimated overall bird fatality rates of 0.55 birds/MW/year and no golden eagle fatalities were reported during one year of robust surveys (weekly during spring and fall migration and biweekly in summer and winter) around all turbines (Chatfield et al., 2010b).

With the project take estimated by this ECP, cumulative impacts on golden eagles could occur from past, present, and reasonably foreseeable future actions in the vicinity of the project. However, estimated eagle take at Alta East will be offset with required mitigation. Construction and operation best management practices (BMP) are presented in this plan to minimize risk of project-related impacts and measures in this ECP and via the programmatic take authorization process is designed to mitigate impacts, if necessary.

2.4 Stage 4 – Avoidance and Minimization of Risk and Compensatory Mitigation

The project's ECP documents how siting, design, and planned operation will achieve the following results: 1) minimization and avoidance of golden eagle take to the maximum degreed achievable; 2) application of any necessary advanced conservation practices to reduce golden eagle take to that which is unavoidable; and 3) implementation of any compensatory mitigation necessary to result in no net loss of eagles or even a net conservation benefit at the BCR scale.

The analyses and documentation provided in this ECP show the project's risk to eagles is predicted to be approximately 0.496 eagles per year and will result in mitigable levels of potential take. This minimal risk can be further reduced through siting, construction, and operation measures, including mortality monitoring during operation and a plan of action if eagles are taken during construction or operation. These advanced conservation practices (ACP) are presented in the following sections.

2.4.1 Project Macrositing

2010 Boundary Revision. The Alta East project area was originally selected for development based on analysis of existing data as described in Section 2.1, Stage 1 – Initial Site Assessment. However, site-specific studies documented eagle nesting and use in the areas north and west of the project boundary. In response, the project boundary was modified in June 2010 to eliminate areas in the north and west, and include additional areas extending southward from the golden eagle use areas and extending development into the flat, nonrugged topography to reduce potential impacts to golden eagles.

Low levels of eagle use were subsequently documented during fall 2010 and winter 2010–11 in the second year of surveys within the revised project boundary, indicating potential annual variation in eagle use of the project area.

Project Planning. Alternatives to project siting specific to layout and land use were evaluated and published in the Final Environmental Impact Statement in February 2013 (BLM, 2013). Alternative C was specifically designed to address golden eagle impacts by reducing land area and excluding development in the northern portion of the proposed project footprint. Areas excluded from development in Alternative C shifted project activities farther south and away from nests and documented eagle activity north of the project. Alternative C was selected as the Preferred Alternative for having the least potential for impacts to golden eagles (BLM, 2013). In response to agency concerns, and as a result of the selection of BLM EIS Alternative C as the Preferred Alternative, AWD made significant modifications to the layout to further address this risk by reducing the number of turbines to 51 and selecting a different turbine model with a smaller blade radius to minimize risk of eagle collision with turbines to the maximum extent practical (discussed in Section 2.4.2).

2.4.2 Micrositing of Project Features

Based on 2 years of eagle survey data, some eagle use of the project area may occur during construction or operation, although it is not expected to be common. No unique habitat features such as prominent perch sites (rock outcrops, cliffs, trees) or unique concentrations of prey are evident; however, WTG locations were revised to avoid areas of documented eagle use.

2013 Project Modification. In February 2013, AWD substantially reduced the scope of the project in response to BLM (2013) and USFWS concerns about golden eagle risk. The initially proposed 318-MW, 106 WTG project was reduced to 145.35 MW with 51 WTGs through careful revision to optimize generation capacity while minimizing turbines located in areas posing a relatively higher risk to eagles as identified in resource studies. The turbine model was changed from the N117 2.4 MW (58.5-meter-rotor radius) to the 103RD 2.4 MW (51.5-meter-rotor radius) to allow fewer turbines with a greater generation capacity. The revised layout is shown in Figure 2 and has been discussed throughout this ECP, and it is compared to the original project in Figure 1. The original fatality estimate for the 106-WTG layout using N117 WTG was 0.901 eagle fatalities per year with an upper 80 percent credible interval limit of 1.331. The revised 51-WTG layout with the 103RD WTG results in a take estimate of 0.336 eagle fatalities per year with an upper 80 percent credible interval limit of 0.496. This substantial modification to the project results in estimated take that is only 37 percent of that predicted for the original layout; in other words a 63 percent reduction in estimated take on an annual basis.

Other Micrositing Measures. All other project features have been located away from the higher elevation and rugged topography that are associated with the eagle use documented to the north, west, and central areas of the project. In addition, project design includes installation of approximately 25.5 miles of underground collection lines, which eliminates approximately 450 aboveground power poles and associated aboveground collection lines that could have otherwise posed electrocution or collision hazard to eagles and other birds.

2.4.3 Construction Measures

Appropriate site-specific measures for avoidance of impact to golden eagles have been identified by AWD and include measures specified in the Final Environmental Impact Statement (BLM, 2013) and Final Environmental Impact Report (County of Kern, 2012b) published for the project. These measures are consistent with those identified in BLM right-of-way grants received by the Applicant on nearby wind development projects, and applicable measures from the adjacent AOCM project. Potentially applicable measures from the above references are listed below. The *Final Programmatic Environmental Impact Statement on Wind Energy Development on BLM-administered Lands in the Western United States* (BLM, 2005) also includes BMPs and mitigation measures for a plan of development and project design. Upon completion of the USFWS programmatic take permitting and NEPA review, applicable mitigation measures will be refined, and additional mitigation measures may be incorporated with input from BLM and USFWS.

The following specific measures that are required by BLM and the County of Kern to minimize impact and risk to a variety of wildlife species and habitat areas will have the added benefit of minimizing potential for impacts to eagles during construction:

Nesting Impact Avoidance. Because eagle courtship and nesting areas are not located in the project vicinity (greater than 4 miles), construction activities would not need to be scheduled to avoid important periods of eagle nesting. However, if new nests or eagle use of inactive nests are detected during project construction, AWD will coordinate with the USFWS regarding timing and avoidance measures to be implemented.

Designated Biologist. AWD will employ a Designated Biologist who will be responsible for ensuring compliance with all applicable mitigation measures and requirements as set forth by the appropriate regulatory agencies, including the authority to halt any project activities that are in violation of the terms of the applicable mitigation measures and requirements; daily compliance inspections; federal law; and various reporting requirements. The Designated Biologist will be appropriately qualified to oversee eagle conservation and impact avoidance actions proposed in this ECP during construction.

General Impact Avoidance and Minimization. AWD will minimize the area required for temporary construction work and operational activities. A speed limit of 15 miles per hour will be enforced on all dirt access/maintenance roads, and all vehicles will be restricted to designated access/maintenance roads to minimize the risk of vehicle collision with eagles on roads and to reduce excessive airborne dust.

Worker Education Awareness Program. AWD will implement a mandatory worker education awareness program for all construction and operational personnel, which will educate staff about the sensitive biological resources on or potentially occurring on the project site, including golden eagles; federal and state regulations applicable to the resources onsite and the consequences of non-compliance with these regulations; actions and reporting procedures to be used if golden eagles are encountered in accordance with procedures explained in section 2.5.1 Incidental Fatality Monitoring; fire protection measures; measures to minimize the spread of weeds during construction; hazardous substance spill prevention and containment measures; who to contact at the on-call biological services provider in the event of the discovery of dead or injured wildlife; driving procedures and techniques to reduce mortality of wildlife on roads; and project mitigation requirements.

Preconstruction Surveys for Nesting Birds. AWD will conduct preconstruction surveys and implement impact avoidance measures for nesting eagles.

2.4.4 Minimizing Potential Habitat Disturbance

The following measures will be implemented to minimize habitat reduction or alteration during construction:

Reduce the Number of Turbine Pads. The size of all disturbed areas will be minimized due the reduction in the number of WTGs from 106 to 51. By eliminating construction of 55 turbine pads, ground disturbance associated with turbine installation and turbine pads is reduced by approximately 52 percent.

Limit Traffic. Vehicles will be restricted to designated access/maintenance roads, which will reduce the extent of habitat disturbance. Additionally, foot and vehicle traffic through undisturbed areas will be limited.

Use Existing Roads. Existing roads and utility corridors will be used to the maximum extent feasible.

2.4.5 Minimizing Potential Collision and Direct Disturbance

The following measures will be implemented to minimize direct disturbance to golden eagles:

Buried Collector Lines. In addition to significant modifications to the project design to relocate high-risk features, approximately 25.5 miles of electrical collector lines will be buried to eliminate the need for approximately 450 aboveground power poles and associated aboveground collection lines, which could pose potential electrocution or collision risk to eagles.

Perch Deterrents. Permanent meteorological towers, remaining transmission towers, and other facility structures will be designed to discourage eagles and other birds from perching or nesting on them (for example, non-lattice towers, follow APLIC [2006, 2012] standards). Meteorological towers placed on BLM-managed lands will adhere to BLM guidelines (BLM, 2011).

Flight Diverters. All guy wires installed on project structures, such as temporary meteorological towers, will be marked with bird flight diverters to minimize collision risk for eagles and other birds.

Free-standing Permanent Meteorological Towers. All permanent meteorological towers will be free-standing without the use of guy wires.

Minimize Electrocution Risk. Power lines will be configured to minimize the potential for electrocution of birds, by following established guidelines (APLIC, 2006).

Limited Use of Explosives. Explosives will be used only at specified times and at specified distances from eagles or eagle nests, and other sensitive wildlife or surface waters as established by BLM (2013).

Preconstruction Survey. Prior to initial construction activities (for example, mechanized clearing or rough grading), a qualified biologist will conduct a preconstruction survey of the project site for golden eagle use, which will include inspecting the project area for eagles, nests, or signs of nesting or courtship behavior. If an eagle, nest, or sign of nesting is discovered, avoidance and construction timing measures will be implemented in coordination with USFWS to ensure that no impacts to these nests or individuals occur during construction.

Environmental Training. AWD will provide environmental training to all personnel working on the site during project construction. The training will include a review of golden eagle identification and ecology to promote awareness and facilitate implementation of appropriate measures if an eagle is encountered or killed. If an eagle is encountered or killed, the appropriate employee will be required to contact the on-call biological services provider for the project. AWD will report an injured or dead eagle to USFWS, BLM, and the Kern County Planning Department within 24 hours of discovery.

2.4.6 Operation Measures

Environmental Training: As part of AWD's mortality monitoring and reporting program outlined in the project's Bird and Bat Conservation Strategy, AWD will provide environmental training to all personnel working onsite during project operation. The training will include a review of golden eagle identification and ecology to promote awareness and facilitate implementation of appropriate measures if an eagle is encountered or killed. The importance of onsite staff is significant in that they are onsite daily, can become familiar with how eagles and other wildlife move through and use the project site and vicinity, are the eyes and ears of environmental staff for identifying project risk or impact issues, and can help identify ways to reduce unexpected impacts or risks if they are detected.

Carcass Removal: Onsite management efforts, such as removing large animal carcasses, will reduce attractants to eagles.

Full-time Biological Monitor: A full-time qualified biological monitor will be employed by the project during operation for the life of the project. The daily activities of the monitor will include intensive observation of the site during daylight hours 365 days per year, removing road-killed animals, and monitoring and recording all observations of eagles and eagle behavior to inform ACP decisions if adaptive management is necessary. The monitor will record all observed occurrences and behaviors of eagles onsite and in the project vicinity. Data will be compiled in the annual report provided to USFWS, and will be used to help inform additional conservation measures and ACP decisions if adaptive management if necessary as described in Section 3.0, Adaptive Management. Monitoring may be intensified and modified to be a more systematic data collection process if needed, to define seasonal and diurnal flight patterns within the project area to inform development and implementation of future ACPs. Such modifications to the monitoring program would be made in response to eagle take exceeding the permitted threshold as presented in Section 3.0.

Informal Operational Monitoring: Informal operational monitoring will be performed during the life of the project as a course of business by all AWD operations staff. Staff will be required to report all eagle observations, nesting behavior, and nests, and record fatalities and injuries. While this monitoring will not be statistically based (i.e., systematic sampling), it will allow detection of issues that may potentially occur onsite year-round for the life of the project. If an injured or dead eagle is encountered during project operations, the employee involved will be required to implement the appropriate response protocol, which will include notifying USFWS. Specifics of the response protocol are presented in Section 2.5.1, Incidental Fatality Monitoring.

Formal operational monitoring. Formal operational monitoring and reporting measures will also be implemented and are described in detail in Section 2.5, Stage 5 – Post-construction Monitoring.

2.4.7 Compensatory Mitigation

AWD commits to mitigation measures that will include, but not necessarily be limited to, the following:

Power pole retrofitting. An analysis of power pole retrofitting through Resource Equivalency Analysis to determine the level necessary to fully mitigate anticipated take is presented in Appendix B. The USFWS model and excel spreadsheets were used to estimate the number of pole retrofits expected for the level of eagle mortality predicted for this project, which is determined to be 51 poles (upper 80 percent confidence interval limit of 74 poles) poles for the predicted level of take anticipated for the 5-year permit duration (0.336 eagles per year with an upper 80 percent credible interval limit of 0.496 eagles per year).

Other mitigation measures may be evaluated in the USFWS NEPA document. These might include other compensatory mitigation, in lieu of power pole retrofitting, as determined to be appropriate, such as a contribution to a lead abatement program or a financial contribution to a National Fish and Wildlife Foundation fund specific to power pole retrofitting described above.

2.5 Stage 5 – Post-construction Monitoring

As part of AWD's mortality monitoring and reporting program, AWD will complete post-construction monitoring and reporting to determine whether estimated eagle fatalities are consistent with operational outcomes. Post-construction monitoring will enable AWD to document eagle fatalities if they occur and identify factors associated with eagle fatalities that might warrant additional ACPs to specifically address the identified risk factor. The USFWS Region 8's ACP Stepwise Table was modified to address adaptive management responses to project-specific levels of take (see Section 3.0).

The monitoring program is explained below.

2.5.1 Fatality Studies

AWD or its representatives will perform post-construction eagle mortality monitoring during the first three consecutive years of operation to evaluate if the risk assessment was correct and if the project is in compliance with the level of eagle take authorized by the USFWS. Fatality study results will be used as part of an adaptive management framework to implement increasingly rigorous ACPs as described in the ACP Stepwise Table presented in Section 3.0.

Post-construction mortality monitoring will include four types of surveys: (1) general avian mortality and injury surveys consisting of transect surveys at 33 percent of the WTGs twice per month, (2) eagle-specific surveys consisting of transect surveys at the remaining 67 percent of the WTGs twice per year, (3) monthly visual inspection of the area around all WTGs once per month, and (4) incidental fatality monitoring consisting of opportunistic discovery of fatalities. Details of the mortality surveys are as follows:

1) **General Avian Mortality and Injury Surveys**: Qualified biologists will conduct mortality monitoring of 33 percent of the WTGs at biweekly (twice per month) intervals under the direction of a USFWS approved Lead Biologist overseeing all avian fatality monitoring activities. General avian mortality and injury monitoring will follow CEC guidelines (CEC, 2007). Details of the general avian mortality and injury monitoring are presented in Table 5. However, if improved field or data analyses methods become generally accepted practice by the wind and wildlife scientific community, and are deemed acceptable by AWD's avian biologists, such methods will be implemented for the project in coordination with USFWS, BLM and Kern County.

TABLE 5
Basic Search Parameters for Alta East General Avian Mortality and Injury Survey

Topic	Details	Comments
Number of Turbines Searched	17 (33% of total)	
Survey Interval	Every other week	Subject to adjustment in response to scavenger removal rates as determined during scavenger removal trials.
Plot Size	250 meters x 250 meters square	Search plot based on distance from the tower that is equal to the maximum blade tip height (125 meters) per USFWS guidelines (USFWS, 2012).
Transect Spacing	Approximately 6 to10 meters*	Spacing may vary for searchers to maximize visibility considering vegetation density and topography (CEC, 2007; USFWS, 2012).
Transect Length	250 meters	
Rate of Travel	1.7 to 2.2 miles per hour	Slow pace to allow careful visual inspection on each side of transect.
Duration of Surveys	During first 3 years of operation	As required per Kern County Environmental Impact Report Mitigation Measures (County of Kern, 2012b) and BLM conditions (BLM, 2013).

*Transect spacing of 6 to 10 meters is selected based on experience surveying for avian fatalities in low-growing desert vegetation and topography comparable to conditions present in the facility area. Six to 10 meters is a standard and generally accepted for fatality monitoring at other wind energy projects in similar vegetation and topography. The CEC guidelines recommend 6-meter spacing with adjustments based on vegetation and topographic conditions (CEC, 2007). Additionally, USFWS (2012) recommends spacing at 4- to 10-meter intervals based on vegetation and topography.

- **Carcass Persistence and Searcher Efficiency Trials**: Carcass persistence trials will be conducted concurrently with the other study components during the study period. The approach presented in this field study is modified from and consistent with those described in Smallwood (2007), Huso (2009), Strickland et al. (2011), and Warren-Hicks et al. (2013). Approximately 100 carcasses of small birds, 50 carcasses of medium to large birds, and 30 bat carcasses, if available, will be randomly placed within the general mortality and injury survey plots, for a total of approximately 180 trial carcasses throughout the entire year. Searcher efficiency trials will be completed concurrent with the scavenger trials using the same test subjects. The carcasses will be placed on a minimum of two dates during each season (spring, summer, fall, and winter), thereby spreading the trials throughout the survey period to incorporate the effects of varying weather, climatic conditions, and scavenger types and densities. Carcasses will be dropped from waist high or higher and allowed to land in a random posture. Each trial carcass will be discreetly marked (with tape or thread) prior to placement so that it can be identified as a study carcass if it is found by observers or wind facility personnel, particularly if the carcass is moved by a scavenger. Observers conducting carcass searches will monitor the trial birds over a 40-day period according to the following schedule as closely as possible. Carcasses will be checked every day for the first 4 days, and then on days 5, 7, 10, 14, 18, 25, and 40. This schedule may vary slightly depending on weather and coordination with the other survey work. At each visit, the observer will note the condition of the carcass (e.g., intact, scavenged, feather spot [i.e., more than 10 feathers], or absent [less than 10 feathers]). Trial carcasses will be left at the location until the end of the 40-day trial or until the carcass is removed entirely by scavengers. After 40 days, any remaining evidence of the carcasses will be removed.

These carcass removal and searcher efficiency trials will not be used to adjust estimates of eagle fatalities due to the potential difference in scavenger removal and detection rates between the test subjects and eagles, but are instead intended for adjustment of fatality rates for other species as described in the Bird and Bat Conservation Strategy. Searcher detection of eagles or eagle remains is assumed to be near 100 percent due to the sparse vegetation and the long persistence times of large raptors (Smallwood, 2007).

2) **Eagle-specific Surveys**: Every 6 months a thorough search will be conducted for dead or injured eagles at the remaining 67 percent of WTGs not evaluated in the general avian mortality and injury surveys described in Table 5. These survey will use standardized transect methodology and square search plots that are 250 meters by 250 meters, as used in the general avian mortality and injury surveys, and assume that at least partial eagle remains will persist for up to 6 months. Transects will be spaced from 6 to 30 meters apart depending on vegetation and topography to allow complete visual inspection of the search plot. Transect spacing will be set to allow the assumption of near 100 percent detection probability for eagles due to their large size.

3) **Monthly Visual Inspections:** Monitoring will also include short-duration monthly inspections of areas visible from drivable surface (roads, pads, and open areas) at all turbines for the life of the project or until cessation is approved by USFWS and BLM. These searches will be completed by onsite environmental and operational staff.

4) **Incidental Fatality Monitoring**: In addition to the standardized monitoring during the first 3 years of operation required as permitting conditions for BLM and Kern County, if the biologists or any operational staff incidentally detect an injured or dead eagle, the incident will be reported as outlined below.

   a. All golden eagle fatalities will be reported to USFWS, BLM, and Kern County within 24 hours of detection. Fatality reports will include GPS location, photographs, and related information describing the incident. Any detected eagle will be left in position, without disturbance or handling, pending USFWS evaluation of the circumstances surrounding the detection and further direction from USFWS.

   b. Upon authorization from USFWS, any injured eagles detected during surveys or incidentally will be carefully captured by an observer authorized and qualified to do so safely and humanely, examined to determine type and extent of injury, and transported to the nearest wildlife rehabilitation center or veterinary clinic in a timely manner. The avian rehabilitation facility identified to care for injured eagles potentially detected during the program is the Facility for Animal Care and Treatment, California State University, Bakersfield Biology Department, 9001

Stockdale Highway, Bakersfield, California, 661-654-3167, or via the Bird Rescue Hotline: 661-654-BIRD (2473).

5) **Reporting**: The results of the mortality analysis will be provided to USFWS, BLM and Kern County annually. The mortality analysis will note species, number, location, distance from the WTG for each recovered eagle, and apparent cause of mortality. At a minimum, the mortality analysis will consider the following:

   a) Number of annual eagle mortalities per turbine and facility
   b) Comparison to existing public data on wind farm mortality at projects with similar habitats and study methodology.

USFWS (2013) requests targeted monitoring that is sufficient to yield a reasonable estimate of eagle fatalities for the project. The multi-tiered approach of targeted and opportunistic monitoring is designed to enable absolute counts of eagle fatalities instead of estimations of average fatality rates and to avoid the bias associated with applying statistical adjustments to small sample sizes (Huso, 2012, pers. comm.). Monitoring protocols may be modified based on the results of the efforts in the first 2 years. These surveys will continue for 3 years or until cessation is approved by USFWS and BLM.

For all eagle injuries or deaths determined to be caused by project activities or operation, AWD will consult with USFWS in accordance with the Step-wise Response process outlined in Section 3.0, Adaptive Management. If after the post-construction eagle mortality monitoring is completed, data indicate that the project is resulting in unanticipated levels of eagle take, AWD or its representatives will consult with USFWS, as described in Section 3.0, Adaptive Management, as well as with BLM and the Kern County Planning Department to address the impacts through additional permitting or mitigation.

2.5.2 Nesting/Breeding Monitoring

AWD or its representative will conduct post-construction breeding monitoring of eagle territories within 10 miles of the project during the first 3 years following the project's initial operation. All known nests within the 10 miles will be visited at least two times per year to establish if they are active and to determine productivity. Post-construction breeding monitoring will include aerial surveys completed in accordance with the USFWS Protocol and Recommendations (Pagel et al., 2010). Survey results will be provided annually to BLM and USFWS.

SECTION 3.0

Adaptive Management

All study results, including methods and analysis, pertaining to golden eagles will be provided to USFWS and BLM on an annual basis for review. If eagle take occurs, it will be reported within 24 hours of discovery so that the opportunity for real-time response is available to address unforeseen issues or levels of take that may warrant concern.

Use of the decision framework and threshold-based response process provided in Table 6 provides the defined protocol for agency coordination and adaptive management planned for the Alta East Wind Project. Adaptive management will be implemented immediately if take exceeds the identified response thresholds.

In addition to adaptive management, AWD commits to mitigation measures that will include, but not necessarily be limited to, power pole retrofitting at a level determined necessary through the Resource Equivalency Analysis (presented in Appendix B) and the USFWS Programmatic Take Permit/Environmental Assessment process, and to other offsetting measures as required by USFWS to ensure no net loss to the regional population as a result of project activities.

TABLE 6
Summary of Advanced Conservation Measures using a Step-wise Approach
Alta East Wind Project

Step	Threshold or Trigger	Advanced Conservation Measures
Step I	One eagle taken	Assess eagle fatality to determine if cause or risk factor can be determined (e.g., season, time of day, weather, presence of prey/carrion, fire, or other event) and management response is warranted. Consult with USFWS. Take is within permitted level and fully mitigated.
Step II	Two eagles taken within any 36-month period.	Assess eagle fatality to determine if cause or risk factor can be determined (e.g., season, time of day, weather, presence of prey/carrion, fire, or other event) and management response is warranted. Of primary concern is if there are common elements between the two eagle fatalities that indicate more concentrated evaluation of the cause of mortality should be performed. Consult with USFWS to determine if 1) Immediate response or management action is needed 2) A longer term action plan or management response plan should be developed 3) Study plans should be modified or extended Take is within permitted level and mitigated

TABLE 6
Summary of Advanced Conservation Measures using a Step-wise Approach
Alta East Wind Project

Step	Threshold or Trigger	Advanced Conservation Measures
Step III	Three eagles taken within the 5-year permit period	Assess eagle fatality to determine if cause or risk factor can be determined (e.g., season, time of day, weather, presence of prey/carrion, fire, or other event) and management response is warranted. Consult with USFWS. If appropriate (e.g., threshold is reached within 3 or 4 years of permit duration), the following ACMs will be considered for implementation in consultation with USFWS. • Employ onsite biological monitor(s) during daylight hours to curtail turbine(s) when an eagle approaches the turbines. Monitors will be stationed within the highest areas of measured or perceived risk. Consult with USFWS on development of curtailment protocol. • Deployment of a radar-based or other system to potentially deter eagles from approaching turbines or curtail turbines when an eagle approaches the turbines. Consult with USFWS to evaluate the development and deployment of the system. • Initiate eagle behavior studies (eagle point counts at high-risk locations, sample interval and season determined based on existing fatalities and operational eagle use data). Conduct a minimum of 1 year of mortality monitoring designed specifically to evaluate the effectiveness of the biological monitor, or deterrent or curtailment system. Take is within permitted level and mitigated for up to 3.0 eagles over the 5-year permit period.
Step IV	Four or more eagles taken within the 5-year permit period	Initiate consultation with USFWS to determine curtailment schedules based on evaluation of data collected to date. Options may include limited curtailment based on spatial and temporal locations of eagles. Focused eagle movement and mortality monitoring will be implemented for a minimum of 1 year to enhance ability to identify and respond effectively to the risk issues. Deploy radar-based or other deterrent or curtailment system if determined effective, or initiate/continue development of radar-based or other deterrent or curtailment system. In consultation with USFWS and BLM, determine other appropriate actions necessary to minimize and compensate for additional impacts to eagle populations and/or modify Programmatic Take Permit to make mitigation commensurate with identified impacts.

With the publication of draft policies in the *Federal Register* on February 18, 2011, regarding golden eagle take permitting and ACPs, it is understood that commitments made in this ECP may require adaptation relative to the forthcoming guidance and may warrant modification for permit renewal after 5 years. AWD will work collaboratively with BLM and USFWS to apply necessary policy changes to the project ECP throughout the life of the project.

SECTION 4.0

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Appendix A
Viewshed Analyses for Avian Survey Plots

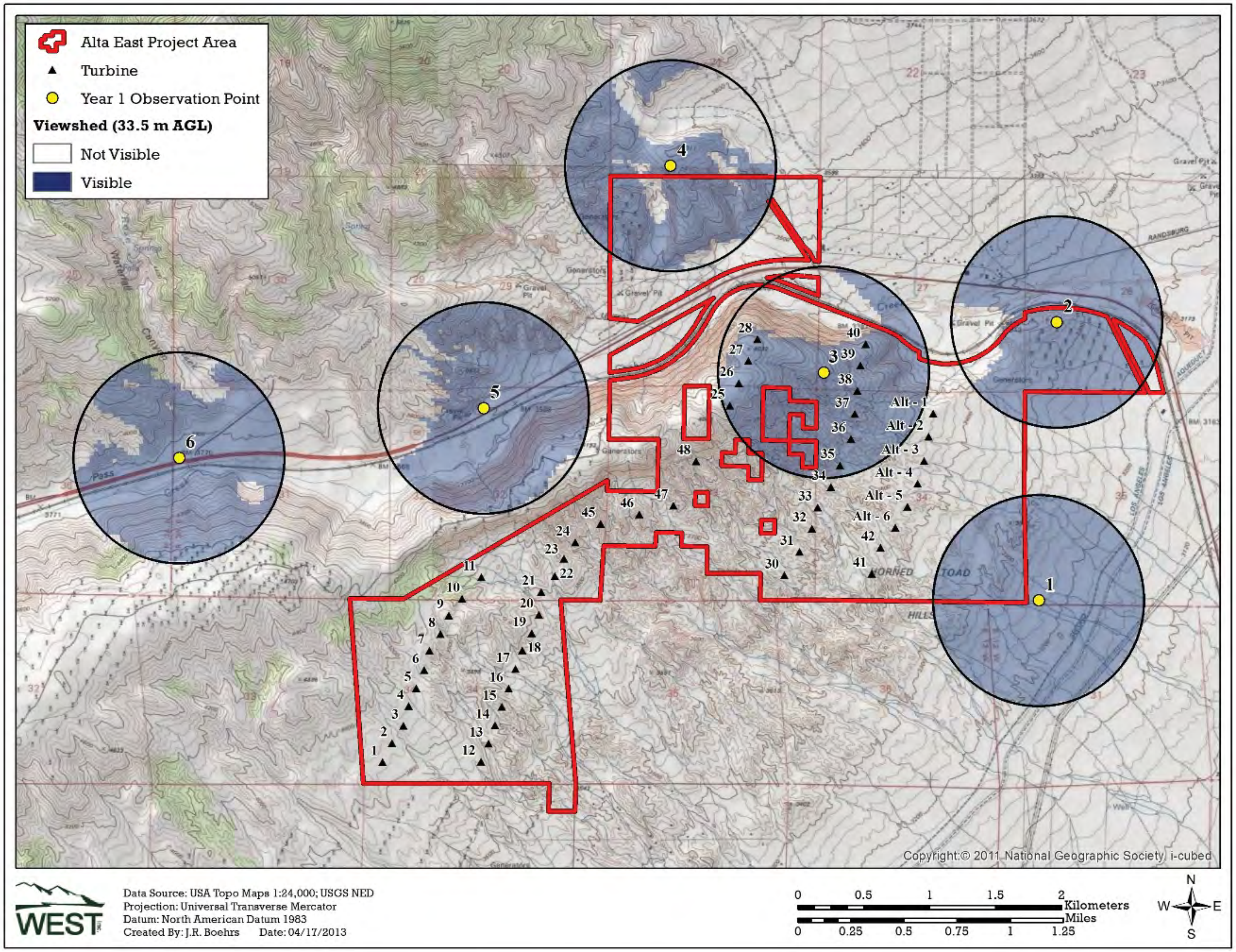

FIGURE 1
Alta East Viewshed 800 m - Year 1
Alta East Wind Project
Alta Wind Energy Center Project

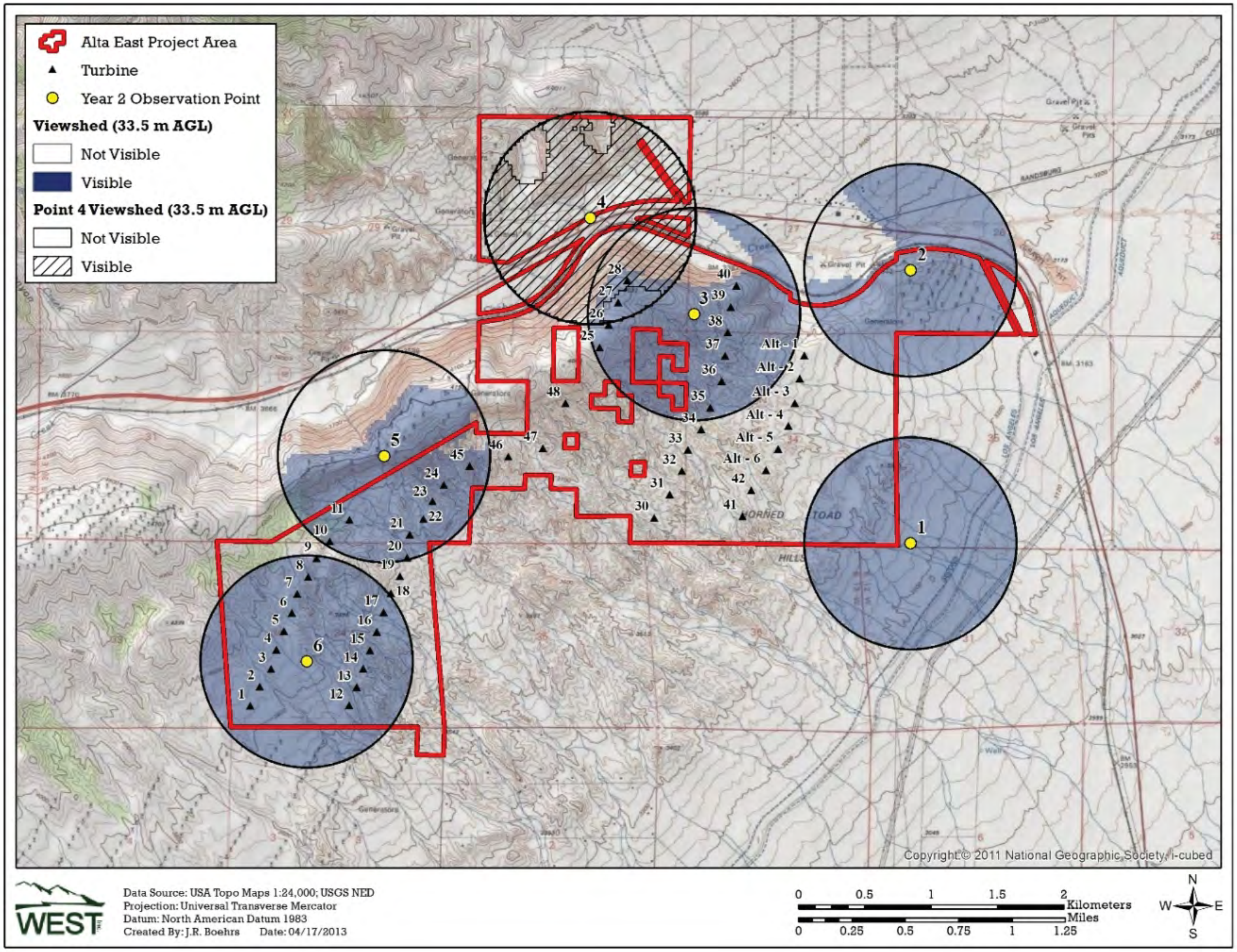

FIGURE 2
Alta East Viewshed 800 m - Year 2 Crosshatch
Alta East Wind Project
Alta Wind Energy Center Project

TABLE A-1

800-meter Viewshed Analyses Results for Alta East Avian Survey Plots

Alta East Wind Project

Survey Point	Year	Area Visible (acres)	Area Non-visible (acres)	Total Area (acres)	Percent Visible	Percent Non-visible
1	1	496	0	496	100.00%	0.00%
2	1	452	44	496	91.13%	8.87%
3	1	379	117	496	76.41%	23.59%
4	1	338	158	496	68.15%	31.85%
5	1	407	89	496	82.06%	17.94%
6	1	418	78	496	84.27%	15.73%
TOTAL		**2490**	**486**	**2976**	**83.67%**	**16.33%**
1	2	496	0	496	100.00%	0.00%
2	2	422	74	496	85.08%	14.92%
3	2	379	117	496	76.41%	23.59%
4	2	439	57	496	88.51%	11.49%
5	2	335	161	496	67.54%	32.46%
6	2	496	0	496	100.00%	0.00%
TOTAL		**2567**	**409**	**2976**	**86.26%**	**13.74%**

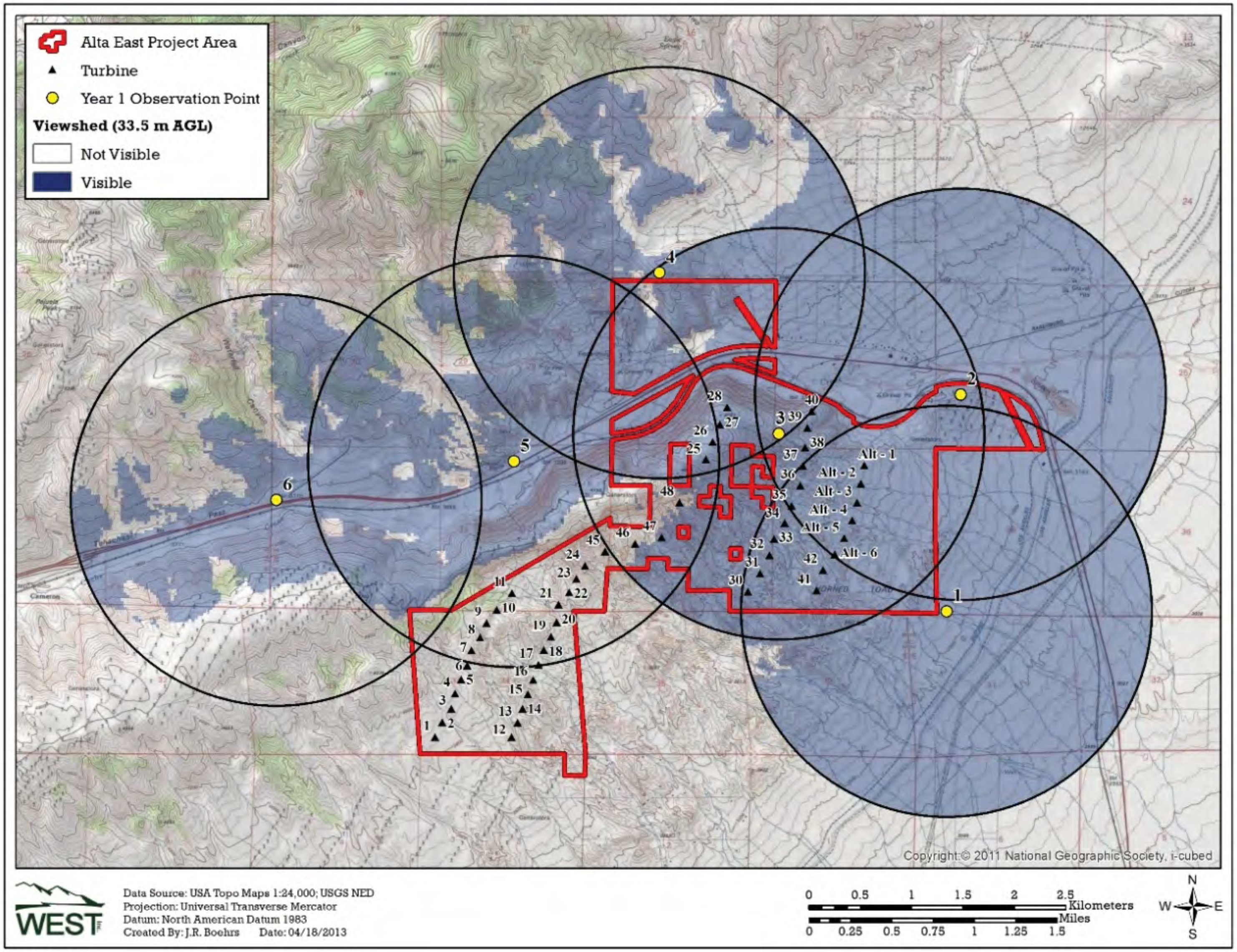

FIGURE 3
Alta East Viewshed 2 km - Year 1
Alta East Wind Project
Alta Wind Energy Center Project

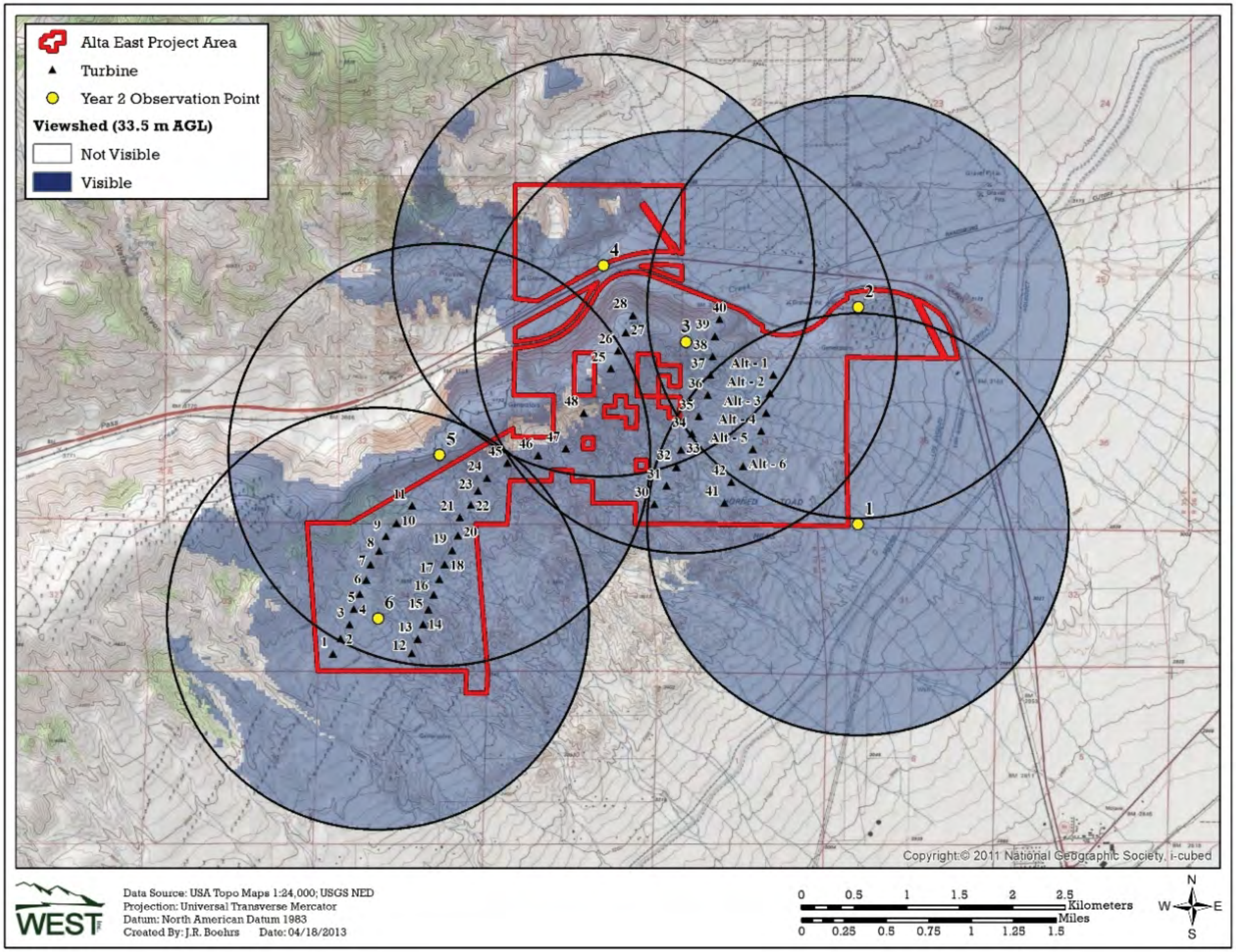

FIGURE 4
Alta East Viewshed 2 km - Year 2
Alta East Wind Project
Alta Wind Energy Center Project

TABLE A-2

2-kilometer Viewshed Analyses Results for Alta East Avian Survey Plots

Alta East Wind Project

Survey Point	Year	Area Visible (acres)	Area Non-visible (acres)	Total Area (acres)	Percent Visible	Percent Non-visible
1	1	2905	201	3106	93.53%	6.47%
2	1	2909	197	3106	93.66%	6.34%
3	1	2280	826	3106	73.41%	26.59%
4	1	2325	781	3106	74.86%	25.14%
5	1	1187	1919	3106	38.22%	61.78%
6	1	1417	1689	3106	45.62%	54.38%
Total		**13023**	**5613**	**18636**	**69.88%**	**30.12%**
1	2	2905	201	3106	93.53%	6.47%
2	2	2872	234	3106	92.47%	7.53%
3	2	2279	827	3106	73.37%	26.63%
4	2	1649	1457	3106	53.09%	46.91%
5	2	1730	1377	3107	55.68%	44.32%
6	2	2413	693	3106	77.69%	22.31%
Total		**13848**	**4789**	**18637**	**74.30%**	**25.70%**

Appendix B
Golden Eagle Fatality Predictions and Resource Equivalency Analyses

NATURAL RESOURCES ◆ SCIENTIFIC SOLUTIONS

Western **E**co**S**ystems **T**echnology, Inc. ◆ 415 W 17th St, Suite 200 ◆ Cheyenne, Wyoming 82001
Phone: 307.634.1756 ◆ Fax: 307.637.6981 ◆ Website: www.west-inc.com

TECHNICAL MEMORANDUM

Golden Eagle Fatality Predictions and Resource Equivalency Analyses for the Proposed Alta East Wind Resource Area Kern County, California

Submitted by:

Western EcoSystems Technology Inc.

May 10, 2013

Introduction

From May 11, 2009 through June 1, 2011 Western EcoSystems Technology, Inc. (WEST) conducted baseline avian studies at the proposed Alta East Wind Resource Area (AEWRA) in Kern County, California. These surveys were designed to document avian use patterns, identify potential risk issues, and assist with siting turbines to minimize impacts to avian resources. Because use of the AEWRA and adjacent areas by golden eagles (*Aquila chrysaetos*) was documented, and golden eagle nests were located in the surrounding landscape WEST, was contracted to provide golden eagle fatality predictions using the current USFWS Bayesian Collision Risk Model (USFWS 2013) based on the two years of site-specific baseline avian use data collected at AEWRA. In addition, a resource equivalency analysis was performed to evaluate the number of power pole retrofits required to offset the estimated eagle fatalities due to the operation of the Alta East Wind Project.

Collision risk modeling attempts to estimate the number of annual golden eagle fatalities that might be expected at a proposed wind-energy facility from flight activity recorded during on site avian use surveys. Assuming that eagle mortality is proportional to pre-construction eagle activity a Bayesian correction factor has been established by the USFWS based on pre- and post-construction surveys conducted at four wind energy facilities. Bayesian analyses incorporate a prior belief (or best guess) about model parameters as supporting evidence in determining a posterior distribution of eagle exposure and mortality. In order to obtain an estimate of golden eagle fatalities at AEWRA using the USFWS methodology, the following information was used: 1) the level of golden eagle use observed during baseline avian use studies at AEWRA; 2) the quantity and rotor radius of the turbines proposed for use at AEWRA; and 3) the prior Bayesian collision correction factor as recommended by the USFWS (2013).

Site-Specific Avian Use Surveys

This golden eagle risk assessment is based on golden eagle observations collected from fixed point surveys of 800-m radius plots over two years. Surveys at each point consisted of 30-minute surveys, in which all eagle use was recorded. Eagles observed at any distance were recorded; however, only those observed within the 800-m radius plots are used in estimates of mean use and Bayesian fatality modeling.

Six points were selected across representative habitats and topography of the study area while providing relatively even visual coverage of the area proposed for development. Due to changes to land access and changes to the project boundary, points 2, 4, 5, and 6 were relocated for the second year of surveys to more accurately assess the area currently planned for wind turbine installation (Figure 1).

A total 285.5 hours of fixed-point surveys were conducted from May 11, 2009 through May 6, 2010 and from July 10, 2010 through June 1, 2011. Surveys were conducted approximately once per week during daylight hours, with varying start times approximately covering all daylight hours.

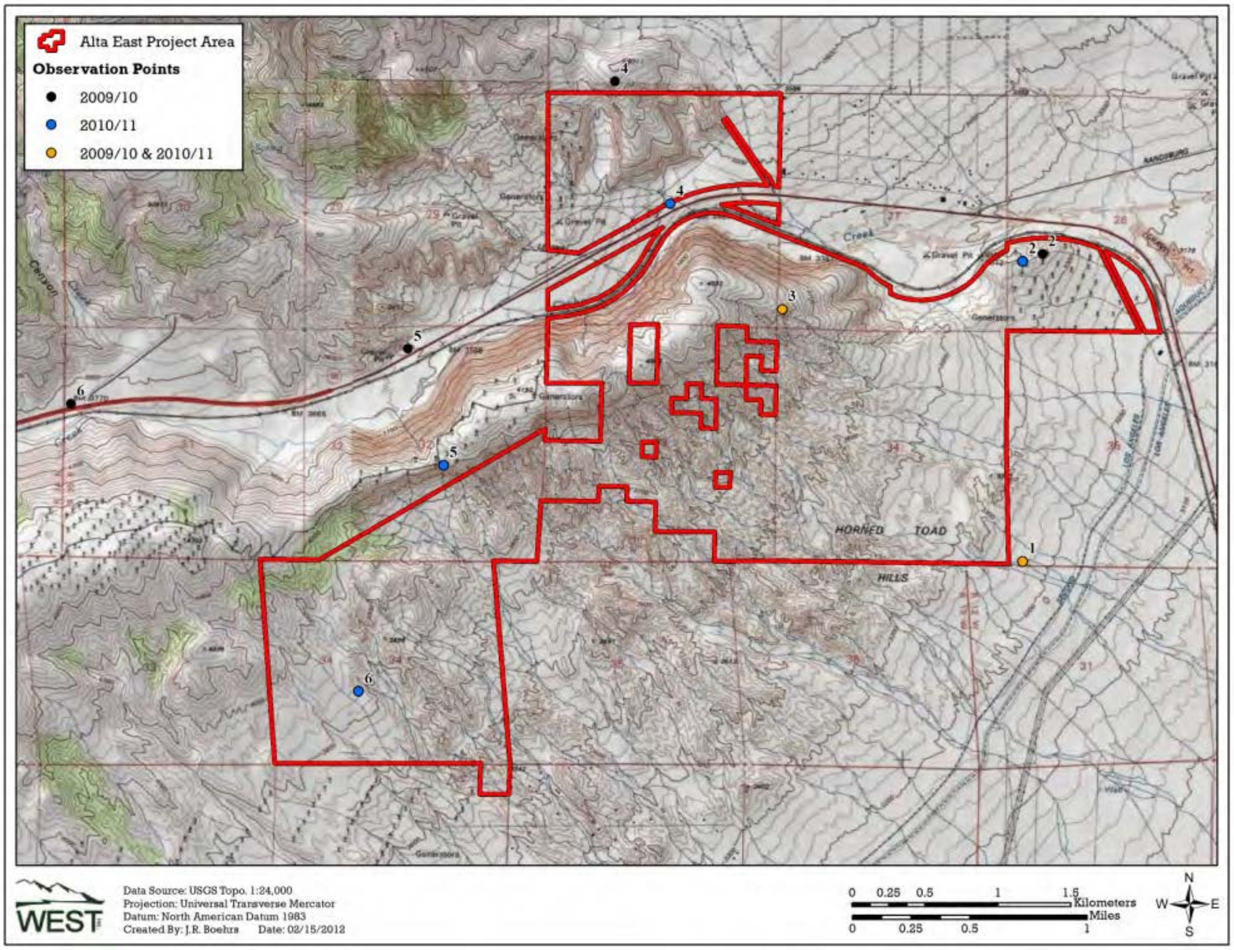

Figure 1. Locations of fixed-point bird use survey stations during 2009 through 2011 surveys conducted at Alta East Wind Resource Area

Exposure Rate Calculations

Exposure rate (λ), as defined by the USFWS (2013), is the expected number of flight minutes below 200 m per daylight hour across the surveyed area (km^2). A total of 17 golden eagle observations were recorded within fixed-point plots during 571 30-minute surveys for a total of 285.5 hours (Table 1). A $Gamma(\alpha = 0.97, \beta = 2.76)$ prior distribution with mean (0.352) and standard deviation (0.357) was recommended by the USFWS. A posterior distribution of golden eagle use at AEWRA was estimated as $Gamma$ distributions with parameters equal to the sum of the prior α and β with total flight minutes below 200 m and effort (hours of surveys x km^2 of area surveyed). This resulted in a posterior distribution for an exposure rate at AEWRA; G*amma*(17.97,576.79); mean 0.0312 eagle flight minutes observed per hour of survey in a single square km respectively (Table 1). Since total minutes in flight was not recorded for observations made during point-count surveys, one minute of flight was assigned to each eagle observation. This assumption is consistent with the current USFWS Eagle Conservation Plan Guidance Technical Appendices which state that most observations will likely equal one eagle-minute (USFWS 2013).

Table 1. Estimated Exposure Rate (λ) from golden eagle observations made during point-count surveys at Alta East Wind Resource Area during 2009 through 2011 studies.

Variable	Nordex N117/103 RD
1) Recorded Flight Minutes below 200	17
2) Number of Surveys	571
3) Length of Surveys	0.5
4) Survey Hours	285.5
5) Survey Radius (meters)	800
6) Eagle Flight Minutes (α: Line 1 + 0.97)	17.97
7) Effort (β; survey hours x sq km of area surveyed + 2.76)	576.7918
8) Mean Exposure Rate (Line 6 / Line 7)	0.0312

Expansion Factor

A facility-specific expansion factor is multiplied by the eagle exposure rate $\left(\frac{\text{eagle flight minutes}}{\text{hour}\cdot\text{km}^2}\right)$ to estimate the potential annual eagle-wind turbine interactions (minutes of flight within the turbine hazardous area). The expansion factor scales the exposure rate to daylight hours (τ) within a year across the total hazardous areas (δ_i) surrounding all proposed turbines (n_t; USFWS 2013).

$$\varepsilon = \tau \sum_{i=1}^{n_t} \delta_i$$

The USFWS has defined the turbine hazardous area (δ_i) as the rotor-swept area around each turbine or proposed turbine location (km^2; USFWS 2013). Expansion factors (ε) were calculated based on two proposed turbine layouts. The two layouts proposed consist of 51 and 106 turbine locations each using Nordex N117 - 2.4 MW with a rotor radius of 58.5 m, or alternatively a 103 RD with a rotor radius of 51.5 m (Table 2).

Table 2. Expansion Factor (ε) for the proposed turbine layout at the Alta East Wind Resource Area.

	51 Turbines		106 Turbines	
Variable	N117	103 RD	N117	103 RD
9) Hours per Year	4383	4383	4383	4383
10) Rotor Radius (meters)	58.5	51.5	58.5	51.5
11) Turbine Hazardous Area (pi × radius of turbine in km^2)	0.0108	0.0083	0.0108	0.0083
12) Number of Turbines	51	51	106	106
13) Expansion Factor (Line 9 x Line 11 x Line 12)	2403.274	1862.542	4995.040	3871.165

Collision Correction Factor

The collision correction factor (collision probability; C) was defined as the probability of a golden eagle colliding with a turbine given each minute of golden eagle flight in the turbine hazardous area. The prior distribution for collision probability was developed by the USFWS using the four previous fatality studies reported in Whitfield (2009). A weighted mean of the estimated flight minutes within the turbine hazardous area versus recorded collision events at those facilities was used to determine a $Beta(2.31, 396.69)$ prior distribution for collision probability with mean and standard deviation of 0.0058 and 0.0038 eagle fatalities per minute of flight in the turbine hazardous area, respectively (Table 3). No site specific information regarding collision probability is used at the time of pre-construction permitting. As post-construction monitoring is completed at AEWRA a posterior, site specific, estimate of collision probability can be estimated.

Table 3. Collision correction factor (*C*).

Variable	Value
14) Prior Fatalities	2.31
15) Prior exposure events not resulting in fatality	396.69
16) Prior mean collision correction factor (Line 14/(Line 14 + Line 15))	0.0058

Fatality Estimation

The USFWS Bayesian collision risk model assumes that higher site-specific eagle flight activity will correspond to higher annual eagle mortality once the wind energy facility is operational. Under this assumption, predictions of annual eagle mortality (F) were modeled as the pre-construction measure of eagle exposure (λ) within areas of potential eagle-wind turbine interactions (ε) multiplied by a collision correction factor(C):

$$F = \varepsilon\lambda C$$

Credible intervals (i.e., a Bayesian confidence interval) were calculated using a simulation of 1,000,000 Monte Carlo draws from the posterior distribution of eagle exposure (λ) and the collision probability distribution (C; Manly 1991). The product of each of these draws with the exposure area corresponding to Nordex 117 and 103 RD turbine models was used to estimate the distribution of possible fatality at AEWRA. The upper 80th percentile of this distribution has been recommended by the USWFS as the estimated take for a proposed project (USFWS 2013).

For the 51 turbine layout the predicted number of golden eagle fatalities per year using the USFWS Bayesian Collision Risk Model was 0.434 (upper 80th credible interval limit = 0.641) when modeling Nordex 117 and 0.336 (upper 80th credible interval limit = 0.496) for the 103 RD. For the 106 turbine layout, the predicted number of golden eagle fatalities per year using the USFWS Bayesian Collision Risk Model was 0.901 (upper 80th credible interval limit = 1.331) when modeling Nordex 117 and 0.698 (upper 80th credible interval limit = 1.031) for the 103 RD (Table 4).

Table 4. Eagle fatalities per year (F).

	51 Turbines		106 Turbines	
Variable	N117	103 RD	N117	103 RD
Estimated Annual Eagle Fatalities (Line 8 x Line 13 x Line 16)	0.4335	0.3359	0.9010	0.6982
Upper 80th Credible Interval Limit	0.6406	0.4956	1.3311	1.0306

Resource Equivalency Analysis

A resource equivalency analysis was performed to evaluate the number of power pole retrofits required to offset the estimated eagle fatalities due to the operation of the Alta East Wind Project. Based on proposed 51 turbine layout of the 103 RD to be used at the Alta East project site, the estimated golden eagle take was 0.3359 eagles per year, with an upper 80% credible interval limit of 0.4956 eagles per year (Table 4).

Using these take values, an eagle resource equivalency analysis was performed using the REA spreadsheet models provided by USFWS. The calculations assumed a 5-year permitted take, and power pole retrofits to be maintained for 10 years. Based on these assumptions, the total debt owed for the length of the 5-year permit was 21.21 bird-years in present value for the estimated mean annual rate, and 31.29 bird-years in present value (PV) for the upper 80% credible interval limit (Table 5).

Table 5. Debit summary: Total debit with foregone reproduction.

Lost Bird-Years: 1-Year Permitted Take of Golden Eagle		
Source of Bird-Years	**Estimated Mean Annual PV Bird-Years**	**80% Credible Interval PV Bird-Years**
Direct Loss:	2.03	2.99
Indirect Loss—1st Gen	1.60	2.36
Indirect Loss—2nd Gen	0.87	1.29
Subtotal Indirect Loss:	2.47	3.64
Total Debit (Direct+Indirect):	**4.50**	**6.63**
Total Debit: 5-year Permitted Take of Golden Eagle		
Year	**PV Bird-Years**	**PV Bird-Years**
2014	4.50	6.63
2015	4.37	6.44
2016	4.24	6.25
2017	4.11	6.07
2018	3.99	5.89
Total PV Bird-Years	**21.21**	**31.29**

Credits were also calculated using the USFWS REA spreadsheet models. According to this model, the total relative productivity of a retrofitted power pole over the 10-year maintenance cycle was 0.423 bird-years in present value (Table 6).

Table 6. Credit summary: Relative productivity.

Retrofitting Lethal Electric Poles for Avoided Loss of Golden Eagles	
Source of Bird-Years	**PV Bird-Years**
Avoided Direct Loss:	0.02
Avoided Indirect Loss—1st Gen	*0.02*
Avoided Indirect Loss—2nd Gen	*0.01*
Avoided Indirect Loss:	0.03
Total Credit (Direct + Indirect):	**0.05**
Relative Productivity With Foregone Reproduction	
Year	**PV Bird-Years/pole**
2014	0.048
2015	0.047
2016	0.045
2017	0.044
2018	0.043
2019	0.042
2020	0.040
2021	0.039
2022	0.038
2023	0.037
Total PV Bird-Years	**0.423**

Note: Assumes 10 years of avoided loss per retrofitted pole.

Once total debits and credits were calculated, total mitigation owed was also found using the USFWS REA spreadsheets. The total debit was divided by the total credit from one power pole retrofit to get the total number of poles to be retrofit to achieve no net loss of golden eagles. Based on the estimated mean annual rate, approximately 51 power poles would need to be retrofitted and maintained for 10 years to achieve no net loss of golden eagles for the 5-year permit cycle (Table 7). When the upper 80% credible interval limit was used, this number increased to approximately 74 power poles to be retrofitted.

Table 7. Mitigation owed with foregone reproduction.

Credit Owed for a 5-Year Permitted Take of Golden Eagle (assuming 10 years of avoided loss from retrofitted poles)			
	Estimated Mean Annual	**80% CI**	
Total Debit	21.21	31.29	PV bird-years
÷ Relative Productivity of Lethal Electric Pole Retrofitting	0.42	0.42	Avoided loss of PV bird-years/pole
= Credit owed	**50.09**	**73.91**	**Poles to be retrofitted to achieve no net loss of golden eagle**

Based on information from some utilities, effectiveness of retrofits are believed to last longer than the 10 years assumed in this model. Therefore, the credit owed in Table 7 would be conservative (too high) for retrofitted poles that last longer than 10 years. For example, if the retrofits are believed to last 30 years, or are kept or maintained for 30 years, the number of poles to be retrofitted would be 22 (estimated mean) to 33 (upper 80% credible interval limit) poles.

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