Appendix L9

Eagle Conservation Plan

GOLDEN EAGLE CONSERVATION PLAN FOR THE OCOTILLO WIND ENERGY FACILITY

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1.0 INTRODUCTION

1.1 Project Background

Pattern Energy, through Ocotillo Express LLC (OE LLC), is proposing a wind energy facility known as the Ocotillo Express Wind Energy Facility (OWEF) near Ocotillo, California, in Imperial County (Figure 1). The OWEF will be located primarily on Bureau of Land Management (BLM) land and a small portion of private land. The OWEF will be located on approximately 12,565 acres in the project area and consist of 112 turbines, including 6 alternate turbine locations (approximately 300 megawatts [MW]) and associated infrastructure. The diameter of the circle swept by the blades will be no more than 371 feet (113 meters). Turbines will be no more than 448 feet (136.5 meters) in height. The OWEF will connect to the new SDG&E Sunrise Powerlink 500-kilovolt (kV) transmission line scheduled for completion in June 2012 across the middle of the project site. SDG&E intends to construct and operate a switchyard independently from OE LLC and as such the post construction monitoring and mitigation measures identified for the OWEF do not apply to the SDG&E facilities. SDG&E switchyard and facilities will meet APLIC standards for electrical equipment design. The collection lines connecting one turbine to the next and to the project substation will be buried underground generally adjacent to the interior turbine access roads. The OWEF Plan of Development (POD) was tentatively finalized in February 2011 but may change in response to comments on the preliminary Environmental Impact Report/Environmental Impact Assessment (EIR/EIS).

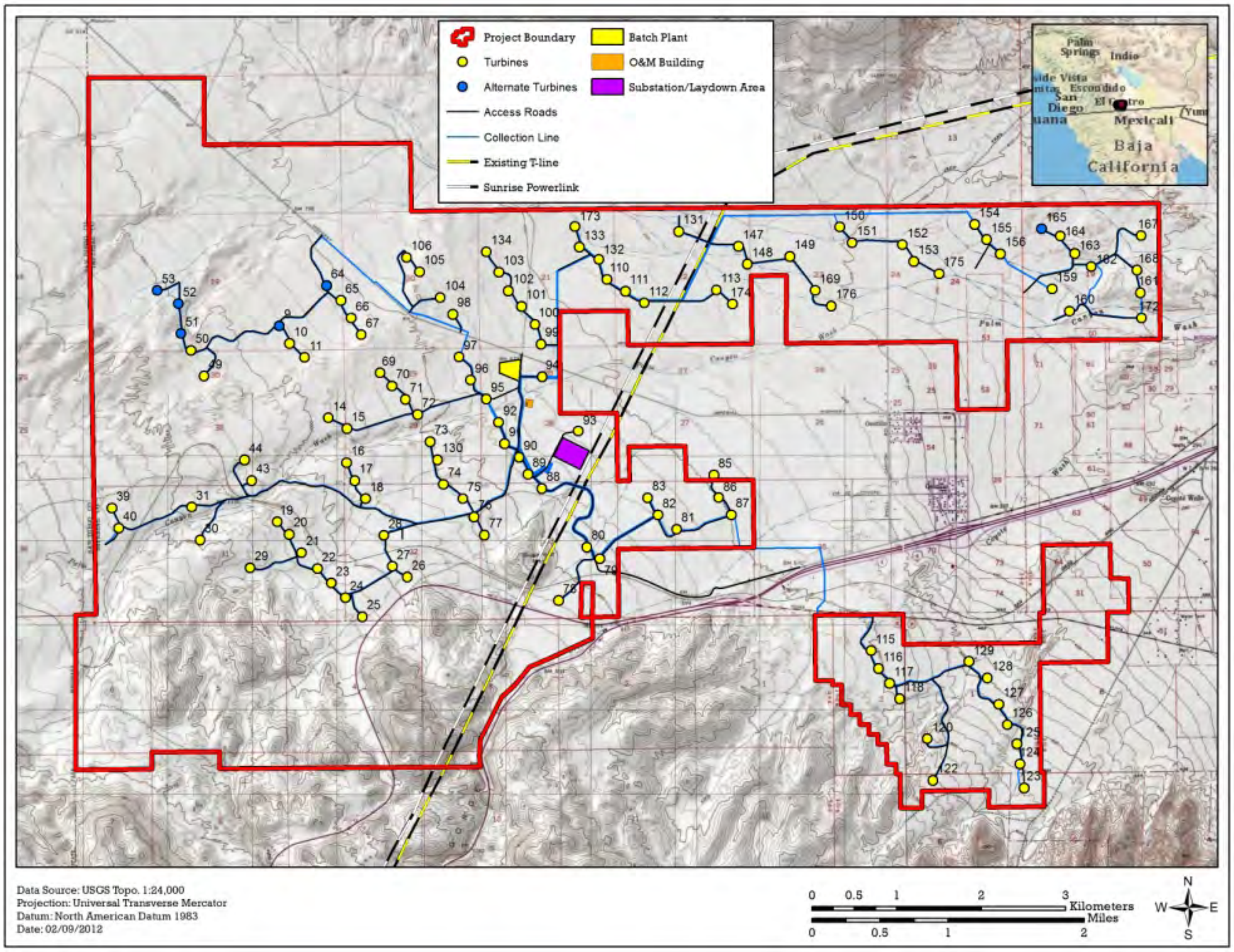

Figure 1. General location of the Ocotillo Wind Energy Facility.

1.2 Environmental Setting

The project site is located within four U.S. Geological Survey 7.5-minute quadrangle maps; Carrizo Mountain, Coyote Wells, In-Ko-Pah Gorge, and Painted Gorge. The northern portion of the site is generally situated north of Interstate 8 (I-8), with the western edge along the Imperial/San Diego County border to approximately 1.5 miles northeast of the town of Ocotillo on its eastern edge. The northern area includes several distinct features, including a portion of the I-8 Island, which is undeveloped rocky and hilly terrain between the eastbound and westbound lanes of I-8, Sugarloaf Mountain, and a portion of the San Diego and Arizona Eastern railroad tracks. County Route (CR) S2 bisects the northern project area, and I-8 passes through the southern portion of the northern project area. The southern area is much smaller than the northern area and the majority is south of State Route (SR) 98.

Vegetation on site consists of a variety of desert scrub habitat types (National Land Cover Database [NLCD] 2001; Figure 2). Several dry desert washes cut through the site, generally from west to east: Palm Canyon Wash cuts through the center of the northern project area; Myer Creek Wash cuts through the southern portion of the northern project area; a portion of Coyote Wash cuts through the northwest portion of the southern project area; and several additional unnamed washes cut through the site.

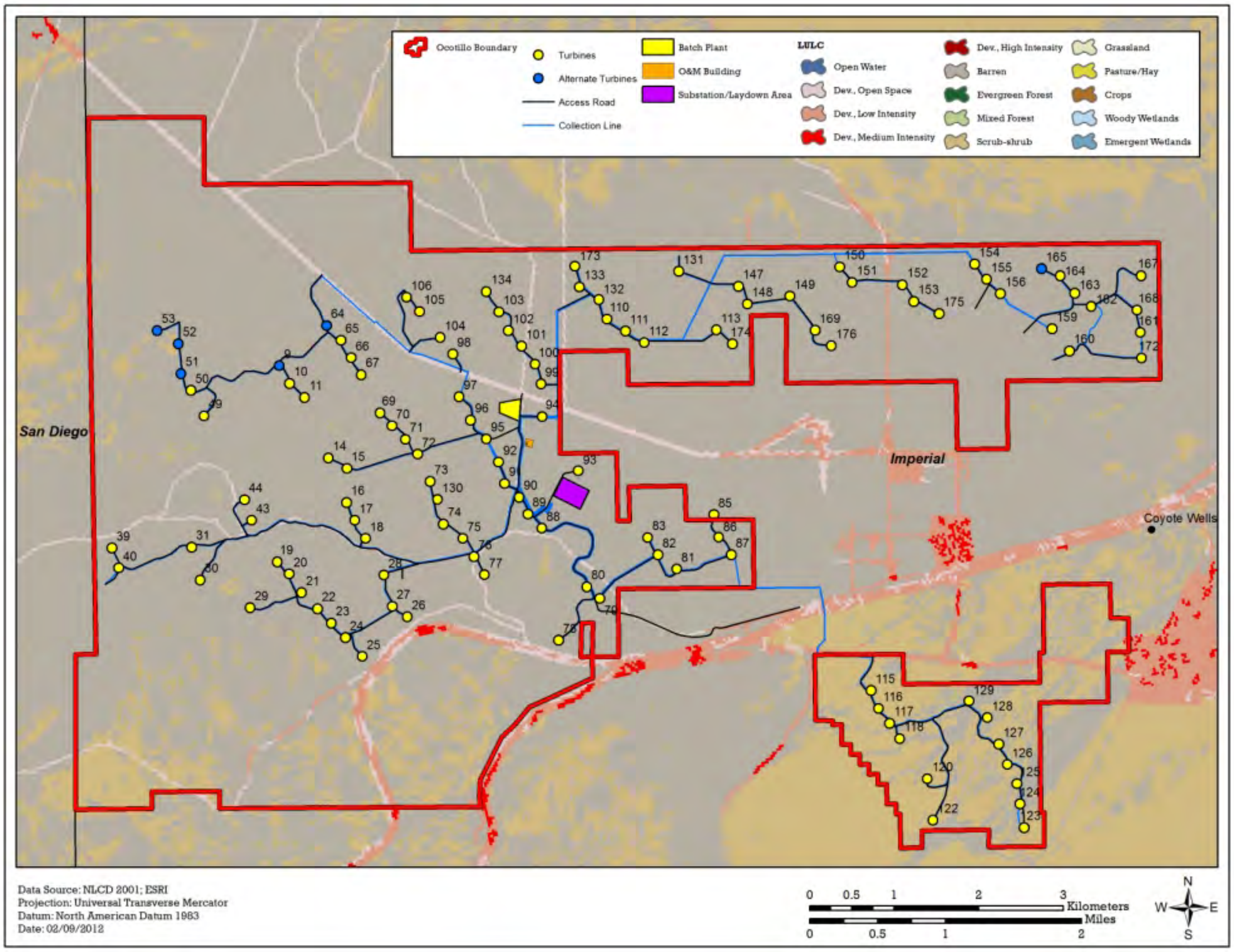

Figure 2. Landuse/Landcover information for the Ocotillo Wind Energy Facility (NLCD 2001).

Elevations on site range from approximately 300 feet above mean sea level (AMSL) in the northeast portion of the site to approximately 1,490 feet AMSL in the southwest portion of the site (Figure 3). The site generally slopes downward from the west to the east, with the Coyote Mountains to the north of the site, and the Jacumba Mountains to the west and south of the site.

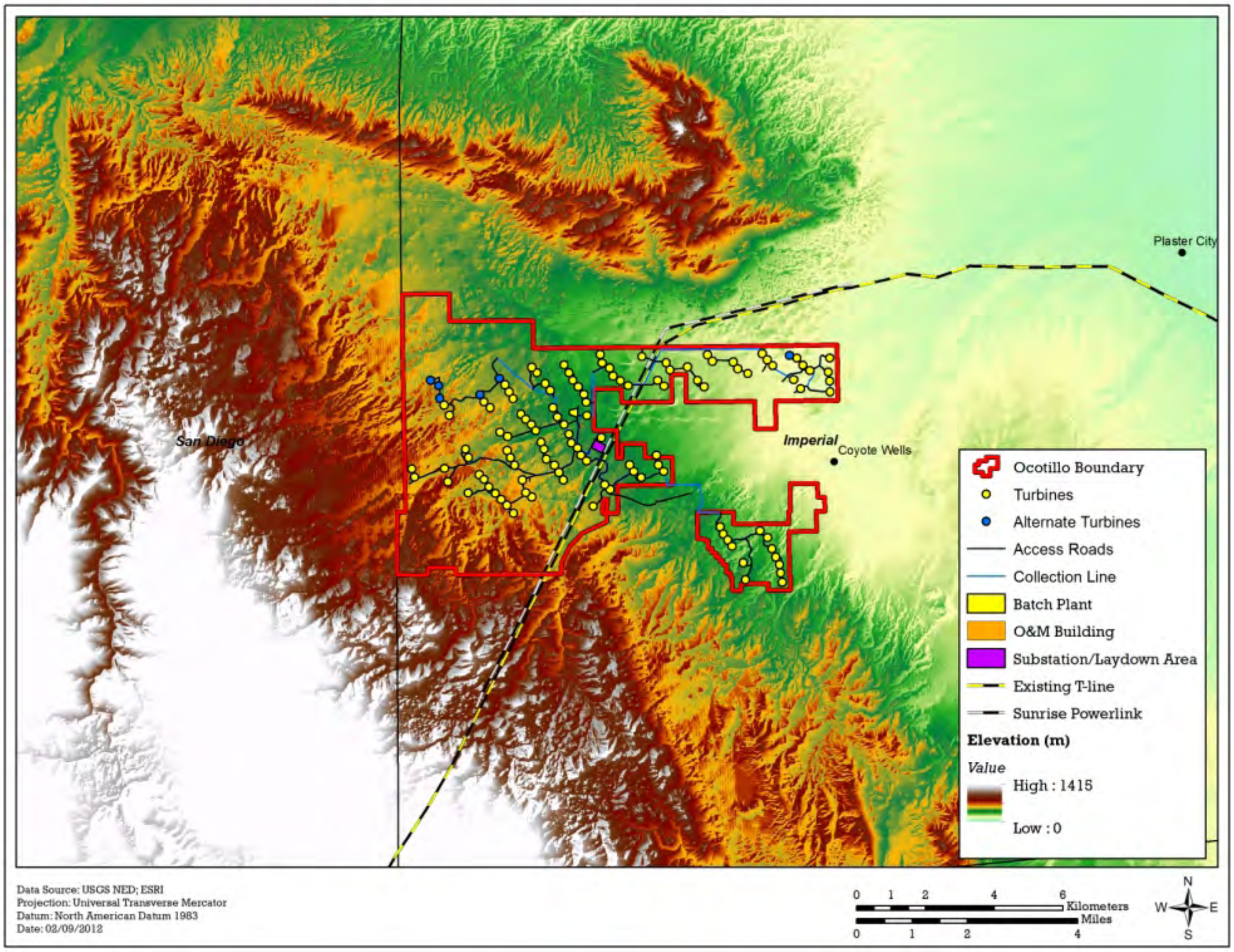

Figure 3. Digital elevation map of the Ocotillo Wind Energy Facility.

1.3 Migratory Bird Treaty Act and Bald and Golden Eagle Protection Act

The federal regulatory framework for protecting eagles includes the Migratory Bird Treaty Act (MBTA) of 1918 and the Bald and Golden Eagle Protection Act (BGEPA) of 1940. The MBTA prohibits the take of migratory birds and does not include provisions for allowing unauthorized take. This project affords substantial design measures to avoid and minimize the likelihood of take, but if take occurs, it will be reported to the U.S. Fish and Wildlife Service (USFWS) for further action. Additionally, this Eagle Conservation Plan (ECP) has been developed to meet BLM and USFWS requirements for addressing BGEPA and the MBTA as it relates to eagles. Both the BGEPA and the MBTA prohibit take as defined as pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, destroy, molest, disturb, or otherwise harm eagles, their nests, or their eggs. Under the BGEPA, "disturb" means 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. However, on September 11, 2009 (*Federal Register*, 50 Code of Federal Regulations [CFR] 13 and 22), the USFWS set in place rules establishing two new permit types: 1) individual permits that can be authorized in limited instances of disturbance and in certain situations where other forms of take may occur, such as human or eagle health and safety; and 2) programmatic permits that may authorize incidental take that occurs over a longer period of time or across a larger area. As described in the USFWS Draft Eagle Conservation Plan (ECP) Guidance dated January 2011, the USFWS recommends that project proponents prepare an ECP to avoid, minimize, and mitigate project-related impacts to eagles to ensure no-net-loss to the golden eagle population. Pursuant to BLM Instructional Memorandum (IM) 2010-156, the BLM will request "concurrence" from the USFWS that the ECP meets specific requirements. OE LLC has developed the OWEF ECP with the intent of supporting a permit application.

1.4 Pattern Energy Policy and Commitment to Environmental Protection

Pattern Energy is an independent, fully integrated energy company that develops, constructs, owns, and operates wind power projects across North America and parts of Latin America. Pattern Energy commenced operations in June 2009 as one of the most experienced and best capitalized renewable energy companies in the United States. OE LLC, through Pattern, is dedicated to delivering the highest values for their partners and the communities where they work, while exhibiting a strong commitment to promoting environmental stewardship and corporate responsibility. The OE LLC team has a proven track record of using science and ground-breaking technology to build wind projects that successfully coexist with wildlife and protect the environment. OE LLC is committed to building environmentally responsible renewable energy projects and continues to work closely with environmental agencies to develop appropriate mitigation measures to reduce impacts to wildlife.

2.0 SITE SPECIFIC SURVEYS AND ASSESSMENTS (STAGE 2)

Two years of baseline data has been collected on golden eagles in the vicinity of the OWEF beginning in the fall of 2009. Golden eagle nest surveys, raptor migration surveys, and avian point counts have been conducted (Helix 2010a, 2010b, 2011). Golden eagle nest surveys were conducted in the spring of 2010 by Wildlife Research Institute (WRI), a local firm that has extensive historical information on golden eagles nesting in the vicinity of the OWEF. Migration surveys were conducted by Helix Environmental Planning, Inc (HELIX) in the fall of 2009, spring and fall of 2010, and spring of 2011. Avian use point counts were conducted weekly over a 1-year period from September 2009 to August 2010. The following sections provide more details on the site-specific baseline golden eagle information collected for the OWEF.

2.1 Golden Eagle Nest Surveys

2.1.1 Methods

HELIX contracted with WRI to conduct surveys of golden eagle (*Aquila chrysaetos*) nest sites in eagle territories that occur within 10 miles of the project site, in accordance with the guidance provided in the U.S. Fish and Wildlife Service (USFWS) Inventory and Monitoring Protocols (Pagel et al. 2010). WRI conducted helicopter surveys in four known territories (referred to as Coyote Mountains West, Coyote Mountains East, Table Mountain, and Carrizo Gorge) in the spring 2010. A hand-held GPS was used to record the helicopter flight path and the location of each nest site. Nest-specific information was documented by two eagle biologists in the helicopter, and each nest site was photographed. In addition to helicopter surveys, WRI conducted ground surveys of an additional suspected golden eagle territory (referred to as Mountain Springs) in the spring 2010. Helicopter surveys were not allowed by USFWS in the Mountain Springs area because of potential disturbance to Peninsular bighorn sheep (*Ovis canadensis nelsoni*).

2.1.2 Results

Twenty-one golden eagle nests were observed in the five territories during nest surveys in 2010 (Figure 4). Two of the five territories were designated as active by WRI in 2010. One nest in the Coyote Mountains West territory was considered active. Two additional nests in the Table Mountain territory were considered as inactive/possibly active due to subtle signs of activity that were difficult to confirm. On September 15, 2010, a breeding pair of adult eagles was observed on the Table Mountain territory providing further support for the active designation of this territory in 2010. The remaining three territories were designated inactive in 2010.

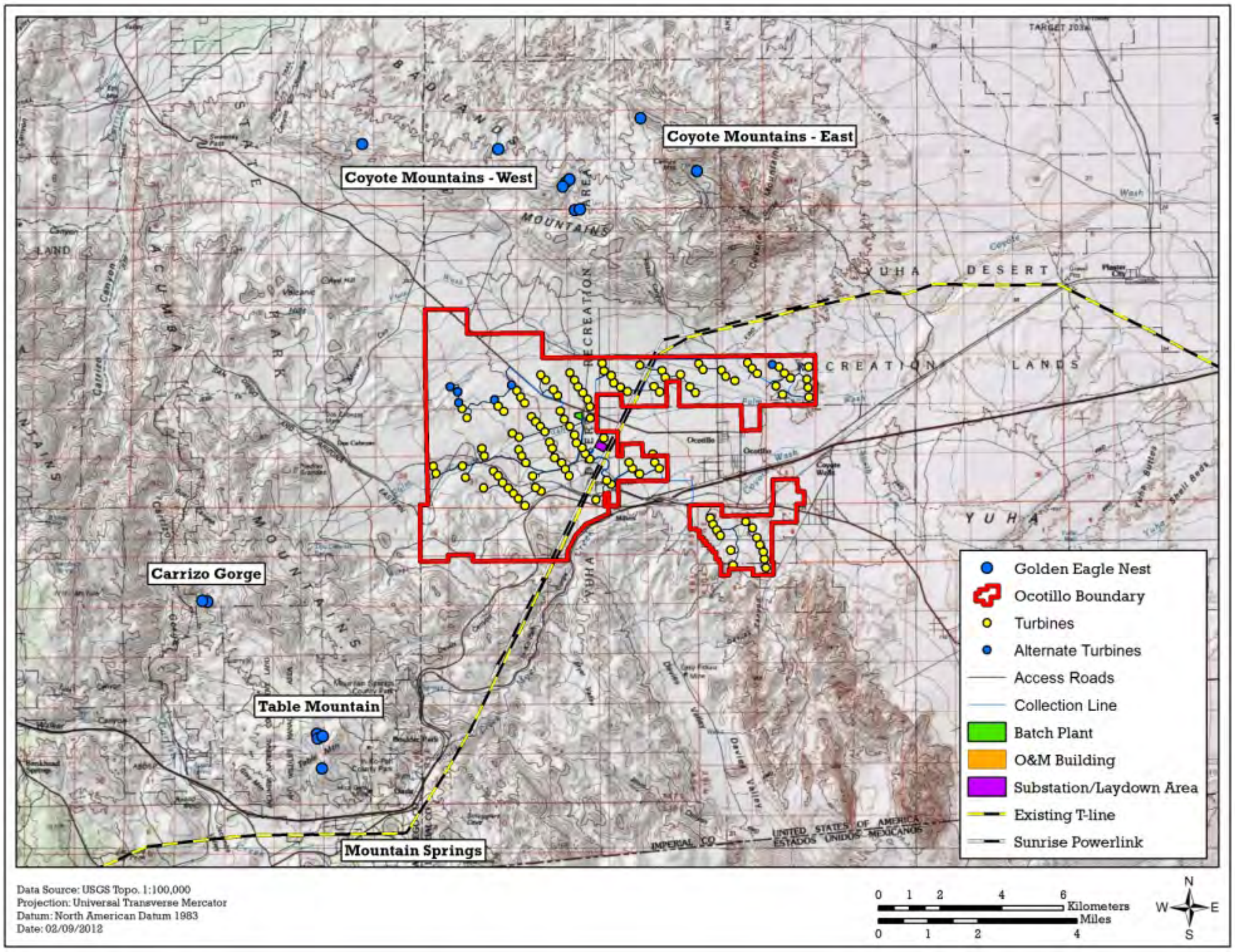

Figure 4. Location of golden eagle nests and territories within 10 miles of the Ocotillo Wind Energy Facility.

2.1.3 Discussion

According to information contained in the Avian and Bat Protection Plan (ABPP) for the Tule Wind Project, WRI conducted golden eagle nest surveys within four of the territories (excluding Mountain Springs) in 2011 (Tule Wind LLC 2011). Two of the territories (Coyote Mountains West and Table Mountain) were identified as active in 2011. Coyote Mountains West was determined to be occupied during the first round of golden eagle nest surveys. However, Coyote Mountains West was not confirmed to be productive in 2011 (Tule Wind LLC 2011).

Historical nesting information for some of the territories is available to provide further information on golden eagle activity within 10 miles of the OWEF (Helix 2010a, b). The historical nesting information has been compiled from previous work conducted by WRI and others including review of the BLM's historic documents and potentially relevant correspondence from resource agencies. Based on this historical information, the Coyote Mountain East territory has been inactive for several years. Table Mountain was successful in producing at least one chick in 2004 and Carrizo Gorge was successful in 2007. Coyote Mountain West is a newly identified territory. Mountain Springs had no sign of activity, although closer monitoring may be warranted in future years. Drought conditions and the timing of the 2010 golden eagle nest surveys limit the utility of one year of golden eagle nest surveys for anticipating impacts to nesting golden eagles from the proposed OWEF. The long-term data help in understanding use of the territories in relation to the OWEF.

Based on the golden eagle nest data from 2010 as well as the 2011 results contained in the Tule Wind Project ABPP, none of the nests identified were within three miles of proposed turbine locations. The closest active nest in either 2010 or 2011 was located 4.1 miles from proposed turbine locations (Coyote Mountains West territory). Table Mountain was determined to be active in both 2010 and 2011. No other active territories were confirmed during the 2010 or 2011 raptor nest surveys conducted within 10 miles of the OWEF.

2.2 Avian Point Counts

2.2.1 Methods

HELIX conducted Avian Point Counts (APC's) approximately weekly over a one-year period (September 1, 2009 – August 31, 2010). The APC's were conducted in accordance with the survey protocols approved by BLM (HELIX 2010a) and generally in accordance with the bird use count methods described in the California Guidelines for Reducing Impacts to Birds and Bats from Wind Energy Development (California Energy Commission [CEC] 2007). The goal of the APC's was to record bird species, abundance, behavior, and flight characteristics from selected sampling locations over a 30-minute period. A total of 50 weeks of point counts were conducted over the one-year period (APC's were not conducted the week of November 29-December 5, 2009, or the week of January 17-23, 2010). Each APC location was visited once per week (the one exception is that Location 13 was not surveyed the week of February 21-27, 2010).

Twenty-one APC locations were established approximately one mile apart throughout the approximately 15,000 acre site (Figure 5). The CEC Guidelines allow for locations to be 5,200 feet apart for large wind resource areas with good viewsheds, which is the case for the proposed Ocotillo site. The APC locations were chosen based on viewsheds, elevation, and habitat types. Each location had good visibility in all directions, with no major impediments impairing the range of view. Locations also covered a wide range of elevations, from approximately 340 ft AMSL (Location 4) to approximately 1,250 ft AMSL (Location 18). Finally, APC's were strategically located to sample different microhabitats. Although each of the locations occurred in desert scrub habitat, several of the locations were within and adjacent to dry desert washes (e.g., Locations 6, 10, 13, 14, and 21) while others were located on or adjacent to hilly topography (e.g., Locations 2, 12, 18, and 19).

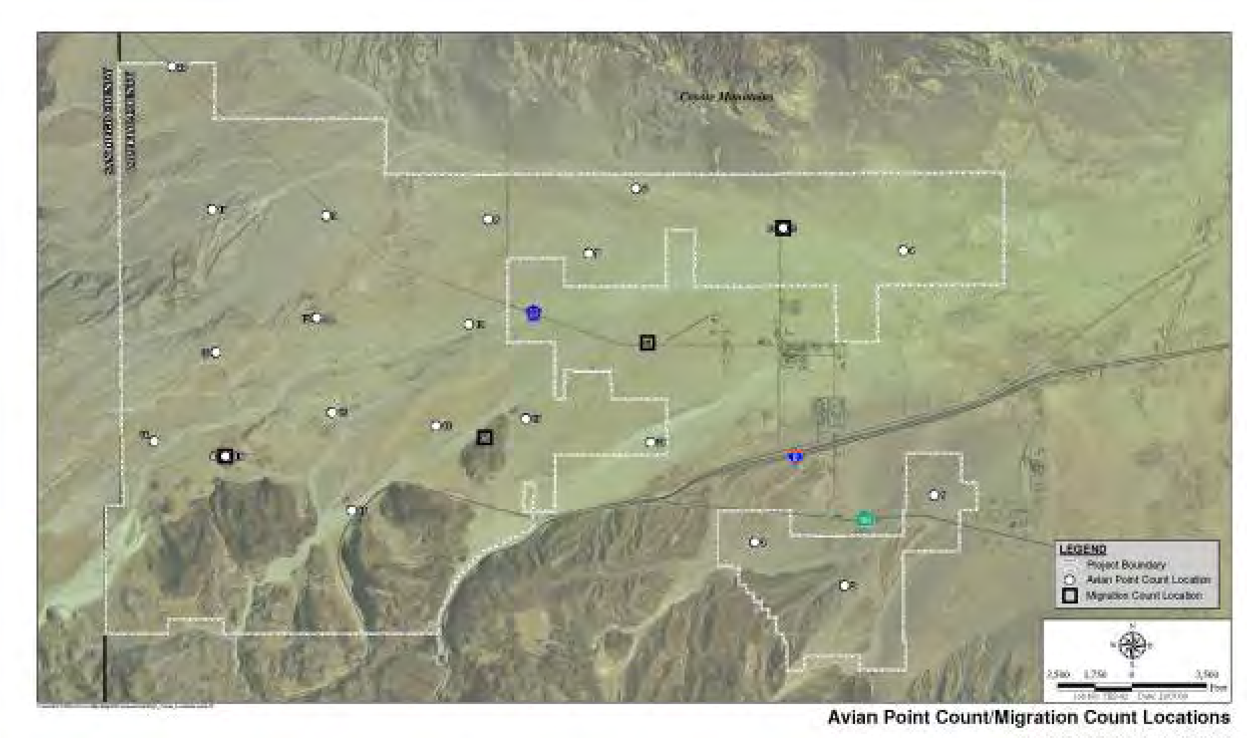

Figure 5. Avian and raptor migration point stations at the Ocotillo Wind Energy Facility.

At each APC location the species, number of individuals, flight height, flight direction, distance from observer, and behavior (e.g., directional flight, perched, flapping flight, soaring, etc.) was recorded over a 30-minute period. Weather conditions (e.g., temperature, wind speed and direction, and cloud cover) were recorded at the start and end of the 30-minute survey period using a hand-held Kestrel anemometer. Species were detected visually with the aid of binoculars and by identifying songs and call notes. All observations were recorded on standardized data sheets. APC's were conducted once per week at each location. Efforts were made to sequence observation times so that locations were surveyed both in the morning and in the afternoon and under varying weather conditions, in accordance with the CEC's Guidelines (CEC 2007).

2.2.2 Golden Eagle Results

Three golden eagles (two adults and one juvenile) were observed flying north over the western portion of the project area during Week One at approximately 1000 feet above ground level (outside the Rotor Swept Area [RSA]; Table 1; Figure 6). No other golden eagles were observed during weekly point counts, but were observed during fall 2009 migration counts (see below; HELIX 2010).

Table 1. Summary of golden eagle observations during avian point counts at the Ocotillo Wind Energy Facility, September 1, 2009 – August 31, 2010.

Date	Time of Observation	# of Individuals	Age	Flight Height (ft above ground)	Distance From Observer (ft)
2-Sep-09	1110 to 1112	3	2 Adults; 1 Juvenile	1,000	600

2.2.3 Discussion

The yearlong APC's were conducted in what was considered a typical year for the Colorado Desert. The 2009-2010 time period was considered an average rainfall year for the region and the region did not experience abnormally long hot, cold, wet, or dry periods during the 2009-2010 timeframe. As such, the results of the APC's would be considered typical for this area. The timing of migration, resident and migratory species composition and abundance, and bird behavior may vary during years when conditions are abnormally wet, dry, hot, or cold. Two years of raptor specific migration surveys (summarized below) are also used to assess golden eagle use.

Based on the data collected to date, the OWEF does not support large populations of resident golden eagles. The site does not appear to be part of a major migration corridor for golden eagles. Golden eagles were seen only once during the point counts study (September 2, 2009) and were observed flying at a height above the RSA.

Some concerns have been expressed regarding the use of avian point count surveys for assessing eagle and/or raptor use. Avian point counts are commonly used to assess raptor use (including eagles) at WRA's (Strickland et al. 2011). Comparisons of use between concurrent raptor specific surveys and avian point counts have shown similar levels of use (when the level of effort has been standardized). One example is from the North Sky River (NSR) project in Kern County, CA. Spring eagle observation surveys at the NSR project estimated eagle use to be 0.055 eagles/30-minute survey and spring avian point count surveys at the NSR project estimated eagle use to be 0.05 eagles/30-minute survey (Erickson et al. 2011). Additional raptor specific migration surveys were conducted at the OWEF and are summarized below. The raptor migration surveys at the OWEF provide further support for the low levels of golden eagle use observed during the APC's.

2.3 Golden Eagle Migration Surveys

2.3.1 Methods

HELIX conducted migration counts in the spring and fall seasons during a two year period (over an eight calendar-week period during the 2009 fall migration period [September 24-November 10, 2009], over a 10 calendar-week period during the 2010 spring migration period [March 22-May 28, 2010], over a 12 calendar-week period during the 2010 fall migration period [August 23-November 12, 2010], and over a 10 calendar-week period during the spring 2011 migration period [March 21 – May 27, 2011]). The methods of each survey were developed in coordination with the BLM and were based on the recommendations provided in the California Guidelines for Reducing Impacts to Birds and Bats from Wind Energy Development (CEC 2007). The purpose of the migration study was to document diurnal raptor activity within the proposed project area in order to provide a risk assessment for these species. HELIX stationed four surveyors throughout the site to scan the sky and record bird migration data. The four migration count locations (Locations A through D; Figure 5) were spaced approximately two miles apart, generally along a southwest-northeast axis across the site. Migration count points were located to maximize the likelihood of detecting potential north-south and east-west migration through the site.

Migration counts were focused on the time of day when raptors were observed to be most active over the site (late morning to late afternoon). The migration counts were staggered to either begin shortly after sunrise or to conclude before sundown to cover the bimodal activity of diurnal bird migrants. During fall 2009 and spring 2010, migration counts were conducted approximately 8 hours per day; during fall 2010 and spring 2011, migration counts were conducted approximately 5.5 hours per day (typically from mid morning to late afternoon).

2.3.2 Results

A total of 763 observation hours were logged during the fall of 2009. Nine golden eagle observations were recorded during the fall of 2009 (Table 2; Figure 6). A total of 952 observation hours were logged during the spring of 2010. No golden eagles were observed during spring migration counts; however, a single golden eagle was observed during a burrowing owl survey on the site on June 17, 2010 (Table 3; Figure 7). A total of 577.5 observation hours were logged in the fall of 2010, and 11 golden eagles were observed during the fall migration counts in 2010 (Table 4; Figure 8). A total of 489.5 observation hours were logged during the spring of 2011. Eleven golden eagles were observed during the spring migration counts in 2011, with just over one-third of the observations occurring on March 22, 2011 (four observations; Table 5; Figure 9).

Table 2. Summary of golden eagle observations during Fall 2009 raptor migration surveys at the Ocotillo Wind Energy Facility, September 24 – November 10, 2009.

Date	Time of Observation	# of Individuals	Age	Flight Height (ft above ground)	Distance From Observer (ft)
25-Sep-09	1440 to 1442	1	Juvenile	400	300
25-Sep-09	1545 to 1555	1	Juvenile	400 – 4,000	5,000
2-Oct-09	1315 to 1319	2	1 Adult; 1 Juvenile	800 – 1,200	1,000
22-Oct-09	1145 to 1212	2	Undetermined	200 – 500	7,000
30-Oct-09	1325 to 1335	1	Juvenile	200 – 1,000	3,000
10-Nov-09	1230 to 1330	2	1 Adult; 1 Juvenile	0 – 300	1,000 – 10,000

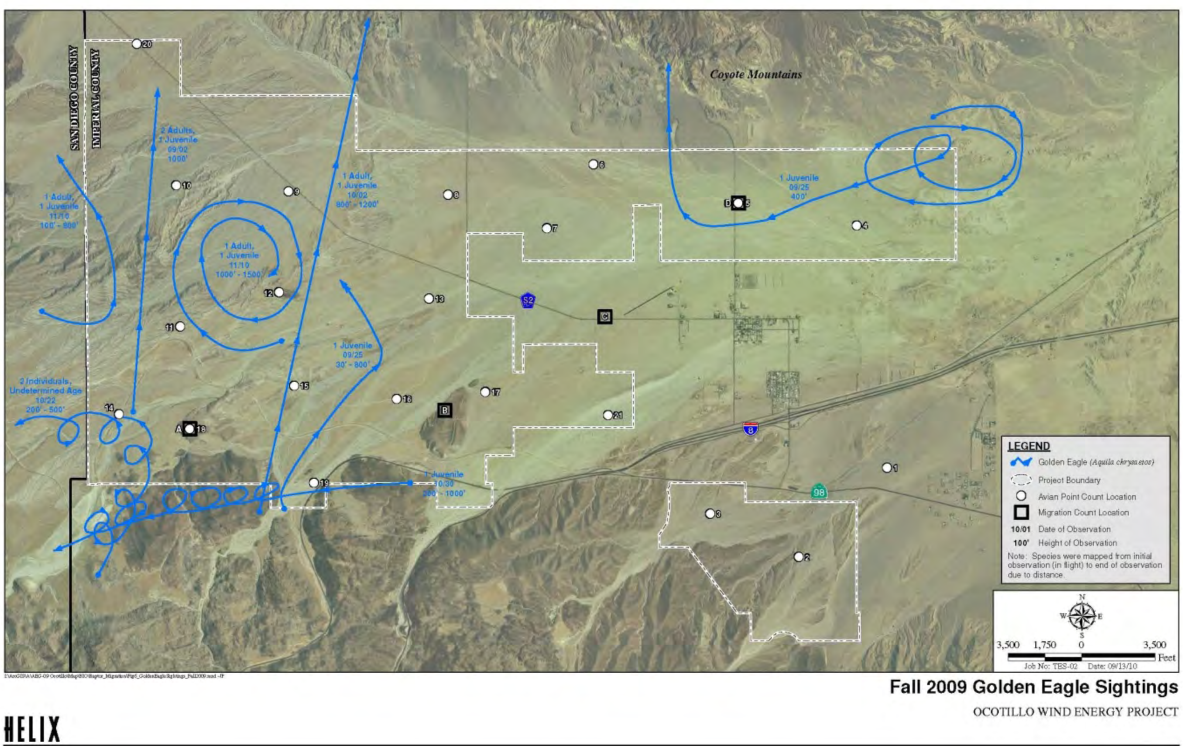

Figure 6. Mapped flight paths and perch locations for golden eagles observed during the fall of 2009 within the Ocotillo Wind Energy Facility.

Table 3. Summary of incidental golden eagle observations during Spring 2010 raptor migration surveys at the Ocotillo Wind Energy Facility, March 22 – May 28, 2010. No golden eagles were observed during Spring 2010 raptor migration surveys.

Date	Time of Observation	# of Individuals	Age	Flight Height (ft above ground)	Distance from Observer (ft)
17-Jun-10	0530 to 0532	1†	Adult	0 – 100	20
17-Jun-10	0630 to 0631	1†	Adult	0 – 20	200

† Determined to be the same individual observed separately by two biologists during burrowing owl surveys (Helix 2010b).

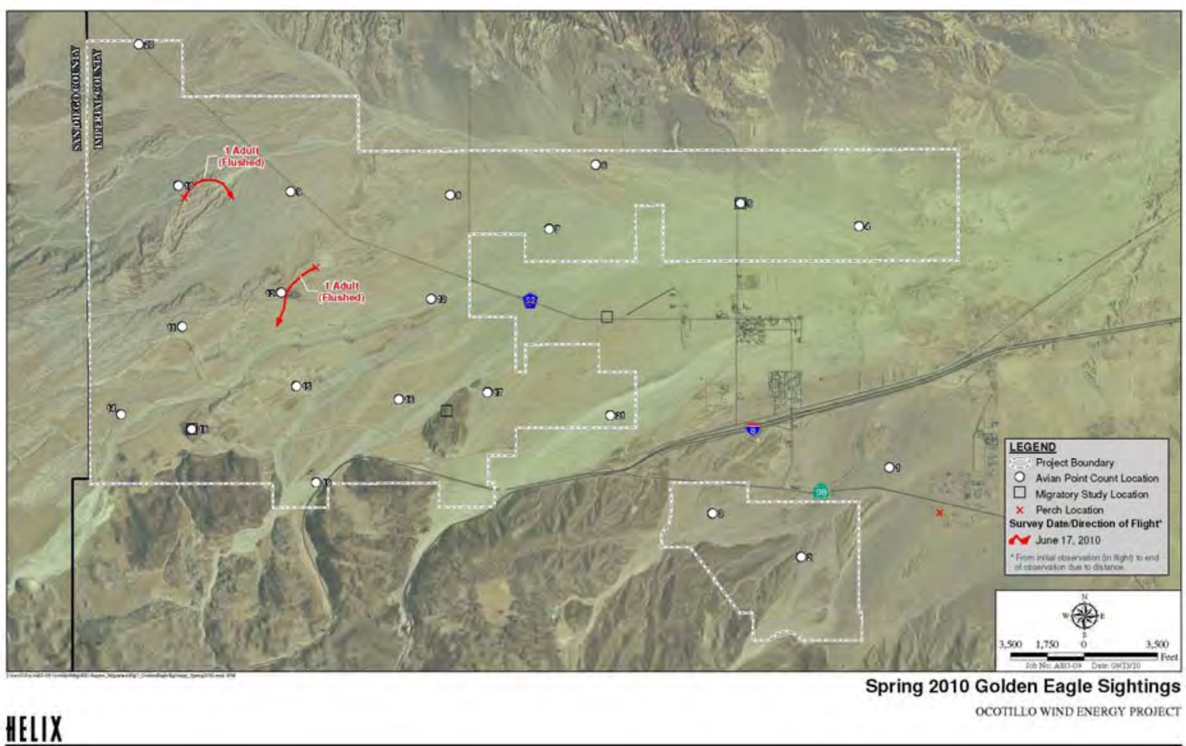

Figure 7. Mapped flight paths and perch locations for golden eagles observed during the spring of 2010 within the Ocotillo Wind Energy Facility.

Table 4. Summary of golden eagle observations* during Fall 2010 raptor migration surveys at the Ocotillo Wind Energy Facility, August 23 – November 12, 2010.

Date	Time of Observation	# of Individuals	Age	Flight Height (ft above ground)	Distance from Observer (ft)
21-Sep-10	1105-1300*	1	Undetermined	500	9,000
4-Oct-10	1053-1057	1	Juvenile	400 – 500	6,000
13-Oct-10	1156-1214	1	Adult	35 – 3,000	30 – 3,500
29-Oct-10	1050-1130	1	Adult	100 – 800	3,000 – 7,000
3-Nov-10	1145-1158	1	Undetermined	1,500 – 2,000	3,000 – 9,000
5-Nov-10	1035-1048	1	Undetermined	200 – 400	3,000 – 9,000
5-Nov-10	1220-1235	1	Undetermined	100 – 600	200 – 1,000
10-Nov-10	0940-0946	1	Undetermined	400 – 1,250	400 – 8,000
12-Nov-10	1225-1233	1	Adult	150 – 500	2,000 – 3,000
12-Nov-10	1235-1256	2	1 Adult; 1 Juvenile	150 – 1,000	4,000 – 20,000

*Includes time eagle was perched off site (80 minutes) as well as the additional time eagle was observed flying off site over the Jacumba Mountains (25 minutes)

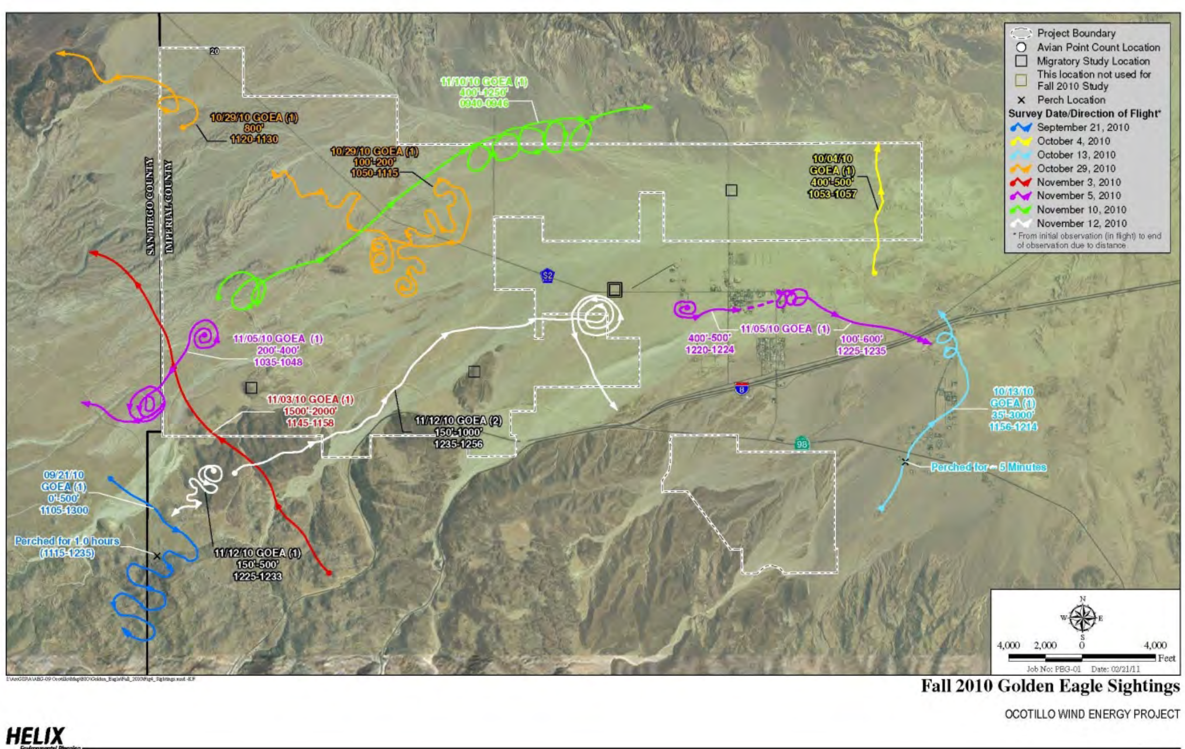

Figure 8. Mapped flight paths and perch locations for golden eagles observed during the fall of 2010 within the Ocotillo Wind Energy Facility.

Table 5. Summary of golden eagle observations during Spring 2011 raptor migration surveys at the Ocotillo Wind Energy Facility, March 21 to May 27, 2011.

Date	Time of Observation	# of Individuals	Age	Flight Height (ft above ground)	Distance from Observer (ft)
22-Mar-11	1130-1135	1	Undetermined	200 – 1,000	1,500
22-Mar-11	1326-1334	1	Juvenile	200 – 1,200	200 – 3,000
22-Mar-11	1410-1426	1	Juvenile	1,000 - 1,500	3,000 – 6,000
22-Mar-11	1450-1500	1	Juvenile	100 – 1,000	2,000
23-Mar-11	0930-0940	1	Juvenile	300 - 1,000	1,700
30-Mar-11	1050-1055	1	Juvenile	300 – 1,200	3,000
6-Apr-11	1302-1315	1	Juvenile	500 - 1,000	6,000
3-May-11	1055-1114	1	Adult	0 - 500	4,000
4-May-11	1232-1241	2	1 Adult; 1 Undetermined	100 – 2,000	7,500
16-May-11	1309-1312	1	Juvenile	100 - 200	3,500

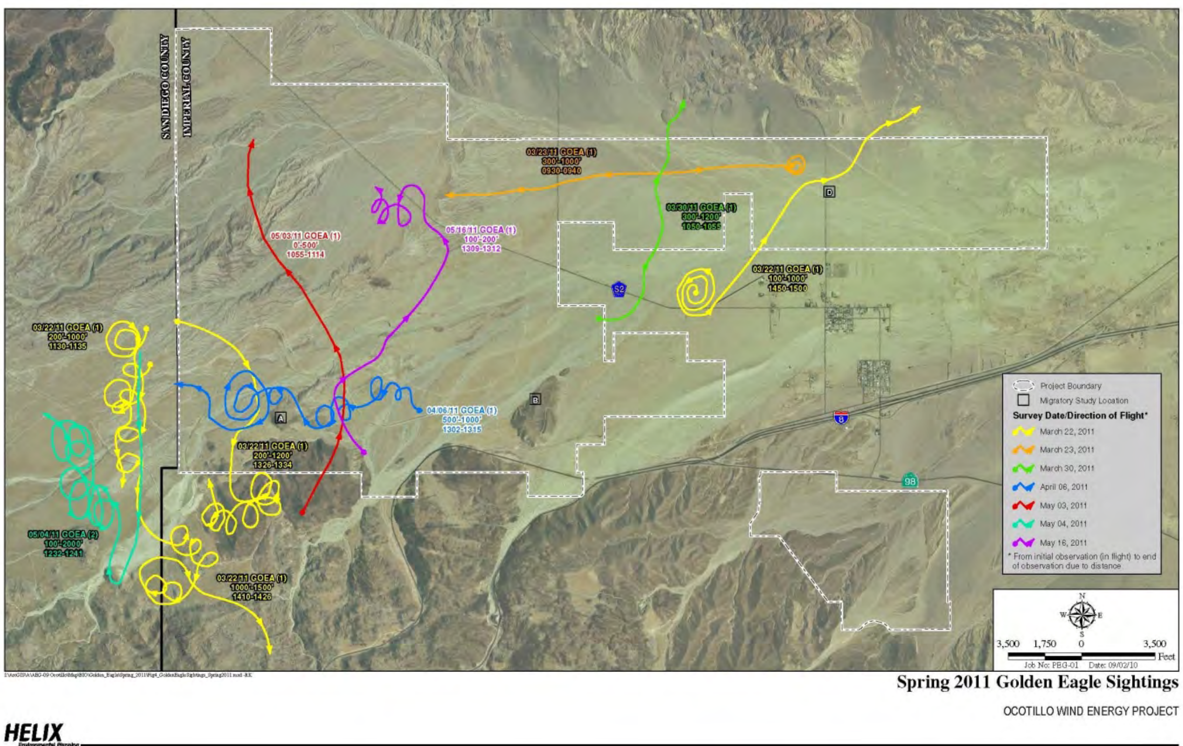

Figure 9. Mapped flight paths and perch locations for golden eagles observed during the spring of 2011 within the Ocotillo Wind Energy Facility.

2.3.3 Discussion

The OWEF is not located in a known raptor migration corridor (Aspen Environmental Group 2008; pers. comm., Unitt 2007). The majority of the project site supports desert scrub vegetation and dry desert washes. The site does not contain the appropriate topography to funnel migrating birds through the site.

With the exception of Sugarloaf Mountain and the rocky terrain in the southwest portion of the site, the project is generally flat and is located east of the Jacumba Mountains and south of the Coyote Mountains. The southwesterly prevailing wind direction would not appear to be conducive to creating updrafts in the project site that are often associated with high raptor migration areas. The site lacks a major ridgeline, water bodies, and large stands of mature trees. The closest major water body is the Salton Sea, which is 30 miles to the northeast of the site, and the irrigated agriculture fields near El Centro are approximately 15 miles to the west of Ocotillo. The results of HELIX's labor-intensive fall 2009, spring and fall 2010, and spring 2011 migration counts (two years of surveys) indicate that the OWEF site is not part of a major migratory pathway for golden eagles. Golden eagles were observed up to the end of the fall season during both the 2009 and 2010 raptor migration surveys. Results from the yearlong APC study (only 3 golden eagle observations on September 2, 2009) provide further support that the OWEF site is not part of a major migratory pathway and that the timing of the raptor migration surveys would not have missed any large influxes of migratory golden eagles (since no golden eagles were recorded during the APC surveys in November or December).

2.4 Golden Eagle Use

A total of 3,306.5 observation hours were logged and only 34 golden eagle observations were recorded, resulting in 0.01 golden eagle observations per hour (Table 6). The golden eagle use estimates suggest relatively low use of the project site during the study period, especially when compared to other projects in California (where similar methods were used to document use), such as the High Winds Wind Resource Area (0.3 eagles/30-min survey during pre-construction surveys; Kerlinger et al. 2005, 2006) and the Diablo Winds Wind Resource Area (0.3 eagles/30-min survey during the post-construction period; WEST 2008).

Table 6. Summary of golden eagle observations, raptor observations*, sampling effort, and mean use at the Ocotillo Wind Energy Facility during raptor migration surveys and avian point counts, September 1, 2009 – November 10, 2010.

Season	Species Group	Observations	Sampling Effort (hours)	Mean Use (Obs/Hour)
Raptor Migration Surveys				
Fall 2009**	golden eagles	9	763	0.01
	raptors and vultures	165	763	0.22
	Raptors	150	763	0.20
Spring 2010	golden eagles	0	952	0
	raptors and vultures	522	952	0.55
	Raptors	206	952	0.22
Fall 2010	golden eagles	11	577.5	0.02
	raptors and vultures	451	577.5	0.78
	Raptors	368	577.5	0.64
Spring 2011	golden eagles	11	489.5	0.02
	raptors and vultures	935	489.5	1.91
	raptors	479	489.5	0.98
All Seasons	golden eagles	31	2,782	0.02
	raptors and vultures	2,073	2,782	0.75
	Raptors	1,203	2,782	0.43
Avian Point Counts				
1-Sep-09 through 31-Aug-10	golden eagles	3	524.5	0.01
	raptors and vultures	227	524.5	0.43
	Raptors	139	524.5	0.27
All Surveys To Date				
1-Sep-09 through 12-Nov-10	golden eagles	36[†]	3306.5	0.01
	raptors and vultures	2,300	3306.5	0.70
	Raptors	1,342	3306.5	0.41

*Raptor data reported by HELIX Environmental Planning, Inc. included turkey vultures (Helix 2010a, 2010b, 2011, unpublished data).

**Large numbers of raptors and turkey vultures were not documented during Fall 2009 raptor migration surveys (Helix 2010)

[†]Includes two incidental observations of the same individual during Spring 2010 burrowing owl surveys.

3.0 ASSESSING GOLDEN EAGLE RISK AND PREDICTING FATALITIES (STAGE 3)

3.1 Assessing Golden Eagle Risk at OWEF

3.1.1 Nesting and Breeding

Based on the definitions used by WRI and for the purposes of the OWEF ECP, an active nest is a nest in good condition that has evidence of new material having been added during the season in which the survey was conducted. An active nest may or may not be occupied in the survey year. An occupied nest is an active nest in which an adult, young eagle, or new egg has been observed on the nest in the survey year. Lastly, an active territory is a territory for which an active or occupied nest was present or there have been observations of a breeding pair of adult eagles in the territory during the survey year.

The 2010 golden eagle nest surveys indicated that two of the five territories (Coyote Mountains West and Table Mountain; identified by WRI) were active in 2010, while the remaining three territories were considered to be inactive. Two nests in the Table Mountain territory were observed by WRI to show signs of possible activity in 2010 (i.e., shallow, poorly-formed bowls). One nest in the Coyote Mountains West territory was observed by WRI to have signs of activity, including white wash on the rock wall and a prominent bowl in the nesting materials. However, no occupied nests were identified, meaning that no incubating females, chicks, or eggs were noted within the nest sites at the time WRI conducted the helicopter and ground surveys in 2010. According to the Tule Wind Project ABPP, both Coyote Mountains West and Table Mountain were active again in 2011. Coyote Mountains West had an occupied nest in 2011 although, no production was confirmed (Tule Wind LLC 2011). Appendix A shows the history of each of the four territories that have been monitored. It is clear these territories generally have not been consistently active, occupied, or productive for the last decade. Caution should be exercised when evaluating the status of eagle territories in the desert as it is well known that desert golden eagle territories are not as productive or active as they are in other habitats (USFWS personal communication).

Turbines have been sited greater than three miles from all of the 21 historic golden eagle nests identified within a 10-mile buffer of the project (Table 7). Nine of the historic nests have at least one turbine within a five-mile buffer. The maximum number of turbines within a five-mile buffer of an eagle nest is 62. The maximum number of turbines that are located within 10 miles of an eagle nest is 118 (including alternate turbines; Table 7). This analysis includes the six alternate turbine locations and the actual number of turbines within five miles of an eagle nest may be less than 62. The actual number of turbines within 10 miles of a nest will be 112.

The approach in the Draft Eagle Conservation Plan Guidance calls for measuring nearest neighbor distances from occupied nests (USFWS 2011). Since no occupied nests were identified and only one nest was considered active, this is not possible. Instead, three approaches were used to approximate territory size in the vicinity of the OWEF. Under the first approach, the average maximum nest distance between territories closest to one another was calculated for all five territories identified in Helix (2010). This assessment assumes that the nests within 10 miles of the OWEF have been correctly assigned to their respective territories. The distance to Mountain Springs was approximated, since the actual nest locations were unknown. Table 8 shows the maximum distances between nests in territories closest to one another. The average of these maximum distances is 4.97 miles, so half that distance (2.49 miles) was the buffer used from nests to determine territory overlap with the project and characterization of the site. While this approach does not fit exactly to the ECP guidance, it would appear to be a reasonable approach for defining a buffer for initial risk characterization (Figure 10). The second approach was based on the two active territories and used the maximum distance of active (or potentially active) nests between the two active territories (Coyote Mountains West and Table Mountain). The maximum distance between active/potentially active nests between the two territories is 12.36 miles, so half that distance is 6.18 miles, which was the buffer used from nests to determine territory overlap with the project under the second approach. The second approach provides a more conservative estimate of approximate territory size (Figure 10). A third estimate of territory size, based on the 6.2-mile inter-nest distance suggested in the ECP Guidance, yields a buffer of 3.1 miles (Figure 10; USFWS 2011).

Table 7. The number of turbines within various buffers of all known nests in each of the five known territories within 10-miles of the Ocotillo Wind Energy Facility.

	Number of Turbines		
Territory-Nest #	**2-mi.**	**5-mi**	**10-mi**
Corrizo Gorge - Nest1	0	0	69
Corrizo Gorge - Nest2	0	0	69
Corrizo Gorge - Nest3	0	0	69
Corrizo Gorge - Nest4	0	0	69
Coyote Mtns. W - Nest1	0	0	101
Coyote Mtns. W - Nest2	0	0	101
Coyote Mtns. W - Nest3	0	29	118
Coyote Mtns. W - Nest4	0	11	117
Coyote Mtns. W - Nest5	0	42	118
Coyote Mtns. W - Nest6	0	44	118
Coyote Mtns. W - Nest7	0	46	118
Coyote Mtns. W - Nest8	0	62	118
Coyote Mtns. W - Nest9	0	62	118
Coyote Mtns. E - Nest1	0	1	118
Coyote Mtns. E - Nest2	0	34	118
Table Mtn. - Nest1	0	0	95
Table Mtn. - Nest2	0	0	95
Table Mtn. - Nest3	0	0	95
Table Mtn. - Nest4	0	0	92
Table Mtn. - Nest5	0	0	92
Mountain Springs – No nest locations known	0	0	Similar to Table Mountain

Table 8. Calculations of maximum distances between nests of territories closest to one another near the Ocotillo Wind Energy Facility.

Territory	**Nearest Territory**	**Maximum Distance**
Coyote Springs West	Coyote Springs East	6.77 miles
Carizo Gorge	Table Mountain	4.16 miles
Mountain Springs	Table Mountain	3.02 miles
Table Mountain	Carizo Gorge	4.16 miles
Coyote Springs East	Coyote Springs West	6.77 miles
	Average	**4.97 miles**
	Buffer (1/2 average)	**2.49 miles**

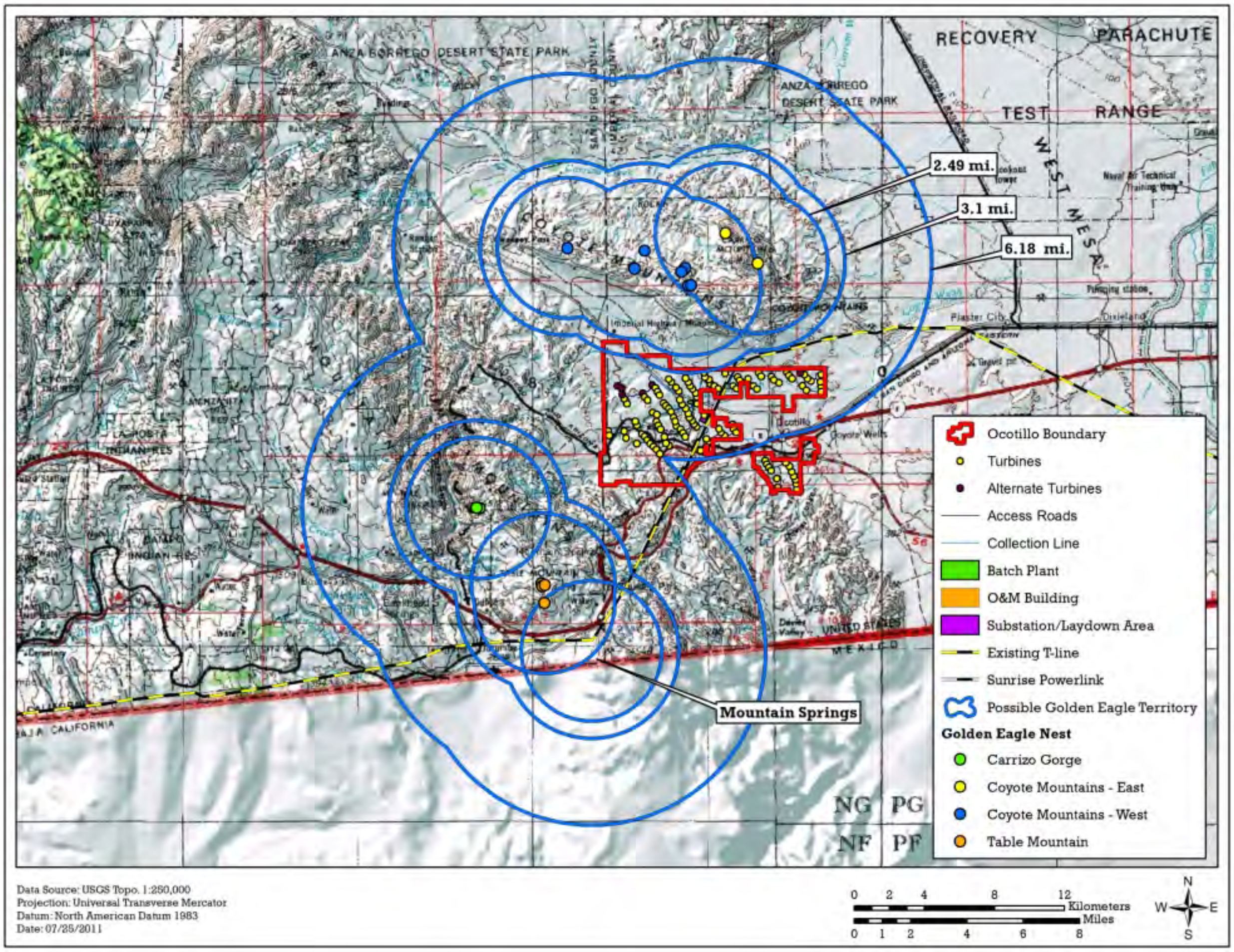

Figure 10. Nest buffers for the eagle territories within 10 miles of the Ocotillo Wind Energy Facility. A buffer distance of 2.49 miles was used based on average maximum distances between nests of territories closest to one another. A second buffer distance of 6.18 miles is also depicted and is based on ½ the maximum distance between active or potentially active nests within the two active territories. A third buffer distance of 3.1 miles, suggested in the 2011 Draft ECP Guidance, is also depicted here.

3.1.2 Concentration Areas (Communal roosts, foraging areas, migration corridors, and migration stopovers)

The golden eagle data collected to date suggests that golden eagles use the OWEF on a limited basis for foraging and during the migration season. The data suggest that there are no high golden eagle use areas or golden eagle concentration areas, including communal roosts or concentrated foraging areas, within the OWEF. The migration counts conducted to date suggest that the OWEF is not an important migration corridor or migration stopover for golden eagles.

3.1.3 Eagle Risk Factors

An assessment of the factors known or thought to be associated with increased probability of collisions between eagles and other raptors and wind turbines (from the USFWS draft eagle conservation plan guidance) for the OWEF is provided in Table 9 (located at the end of this section). The risk factors and the science behind the risk factors have been adopted from the USFWS draft eagle conservation plan guidance (USFWS 2011). The three main risk factors identified in the USFWS draft eagle conservation plan guidance are 1) the interaction of topographic features, season, and wind currents to create favorable conditions for slope soaring or kiting (stationary or near-stationary hovering) in the vicinity of turbines; 2) behavior that distracts eagles and presumably makes them less vigilant (e.g., active foraging or inter- and intra-specific interactions); and 3) residence status, with resident adults and young less vulnerable and dispersers and migrants (especially sub-adults and floating adults) more vulnerable.

TOPOGRAPHY AND WIND

The topography of the OWEF at a landscape scale is provided in Figure 3. The topography of the site is highest in the southwest corner and falls away towards the northeast. A rose diagram depicting the prominent wind direction at the OWEF is provided in Figure 11. The prominent wind direction at the OWEF is strongly oriented in a northeast direction. The orientation of the overall topography at a landscape scale and the prominent wind direction in relation to the OWEF suggest that the OWEF should be less risky to golden eagles since the OWEF is sited on the downwind side of the Jacumba Mountains and would be less likely to have conditions suitable for strong updrafts of wind.

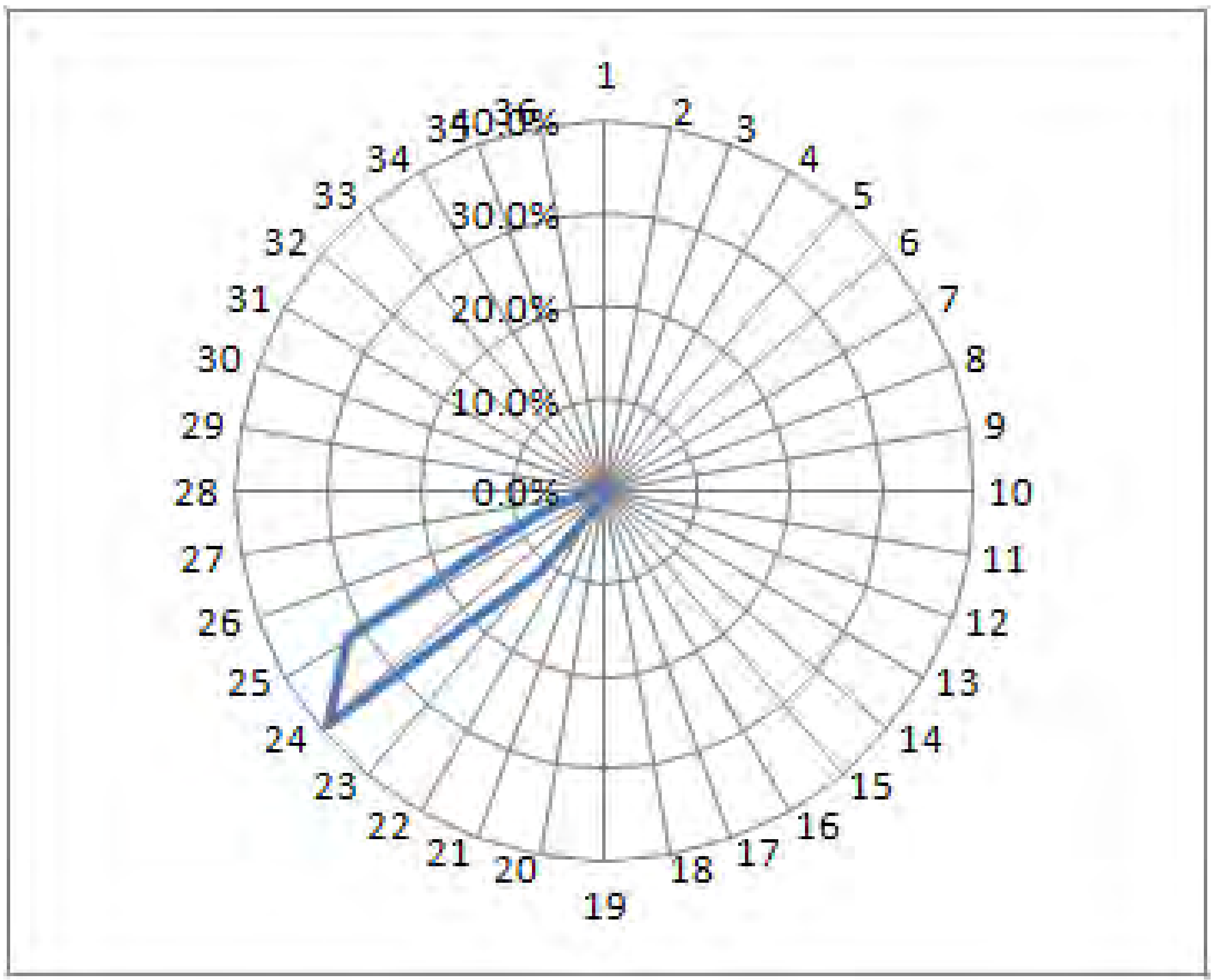

Figure 11. Rose diagram of prominent wind at the Ocotillo Wind Energy Facility.

The slope and aspect of individual turbines were reviewed and assessed on an individual turbine basis within the OWEF. Some research has suggested turbines in saddles or canyons or on the upwind side of ridges may potentially be of more risk to golden eagles. Figures 12 and 13 show the current layout relative to slope and aspect. Based on limited scientific study, it is assumed turbines on steeper slopes, especially on upwind sides of ridges and turbines in saddles or low-lying areas, may be more risky. Generally, none of the turbines are located in low-lying areas, steep slopes, saddles, or on upwind slopes (southwest and westerly aspects). Appendix B contains a list of turbines and the estimated slope, aspect, and elevation of the turbines. Only two turbines are estimated to occur on a slope greater than five percent (alternate turbine 51 and turbine 29), and aspect is northwest (332 degrees) and southeast (153 degrees; respectively). Numerous turbine locations were eliminated from these types of areas or moved to avoid these areas. For example, no turbines were placed in the saddles/drainages between turbines 30 and 31, 19 and 43, 15 and 16, 72 and 73, 95 and 92. There are no turbines sited on southwesterly aspects and very few turbines are sited on westerly or southern aspects. Only one turbine is located near steep slopes with complex topography (alternate turbine 51), but the turbine is located on top of the ridge. Based on the information provided above, turbines have been sited in areas that would not be considered high risk locations within the project.

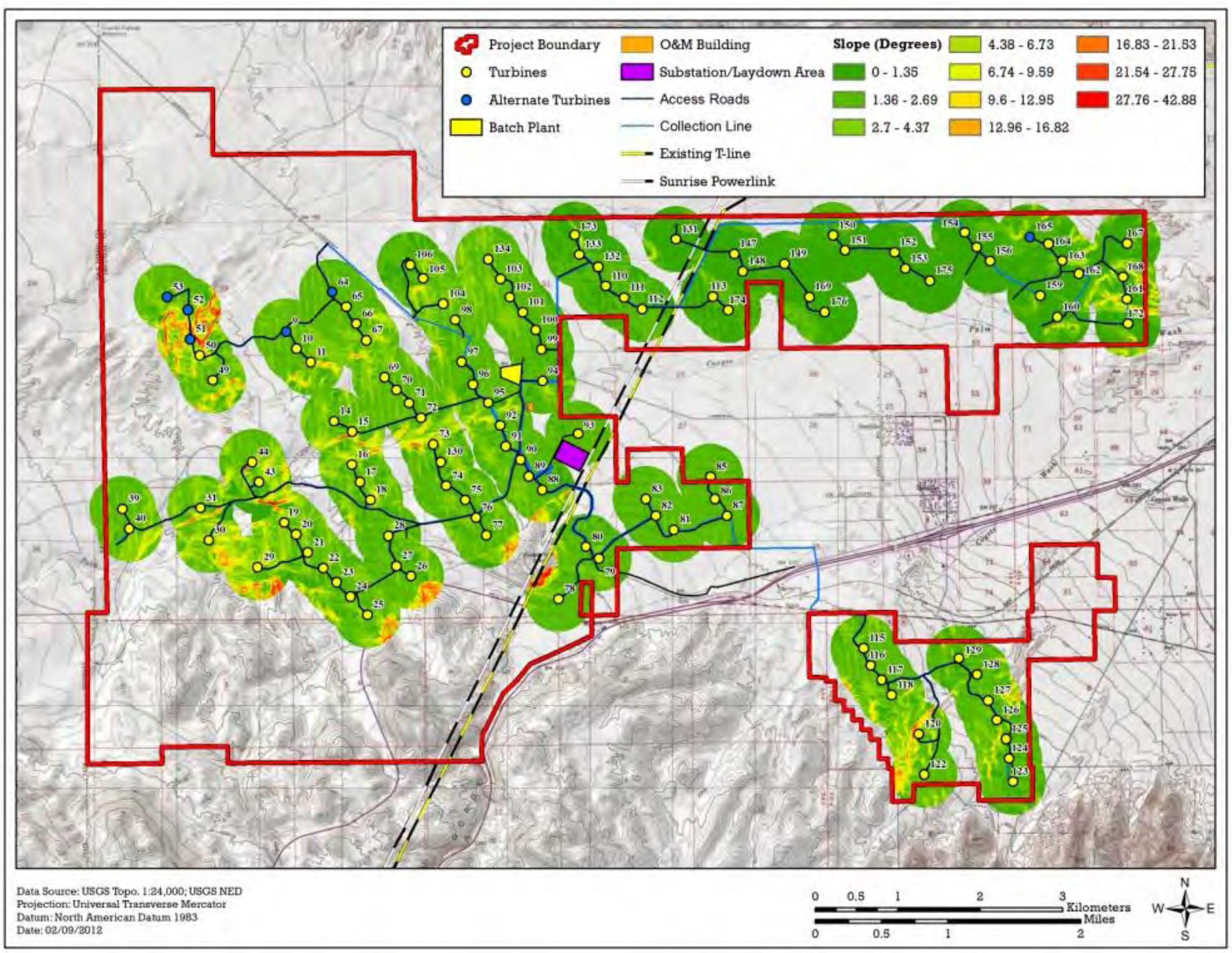

Figure 12. Slope calculations for the Ocotillo Wind Energy Facility.

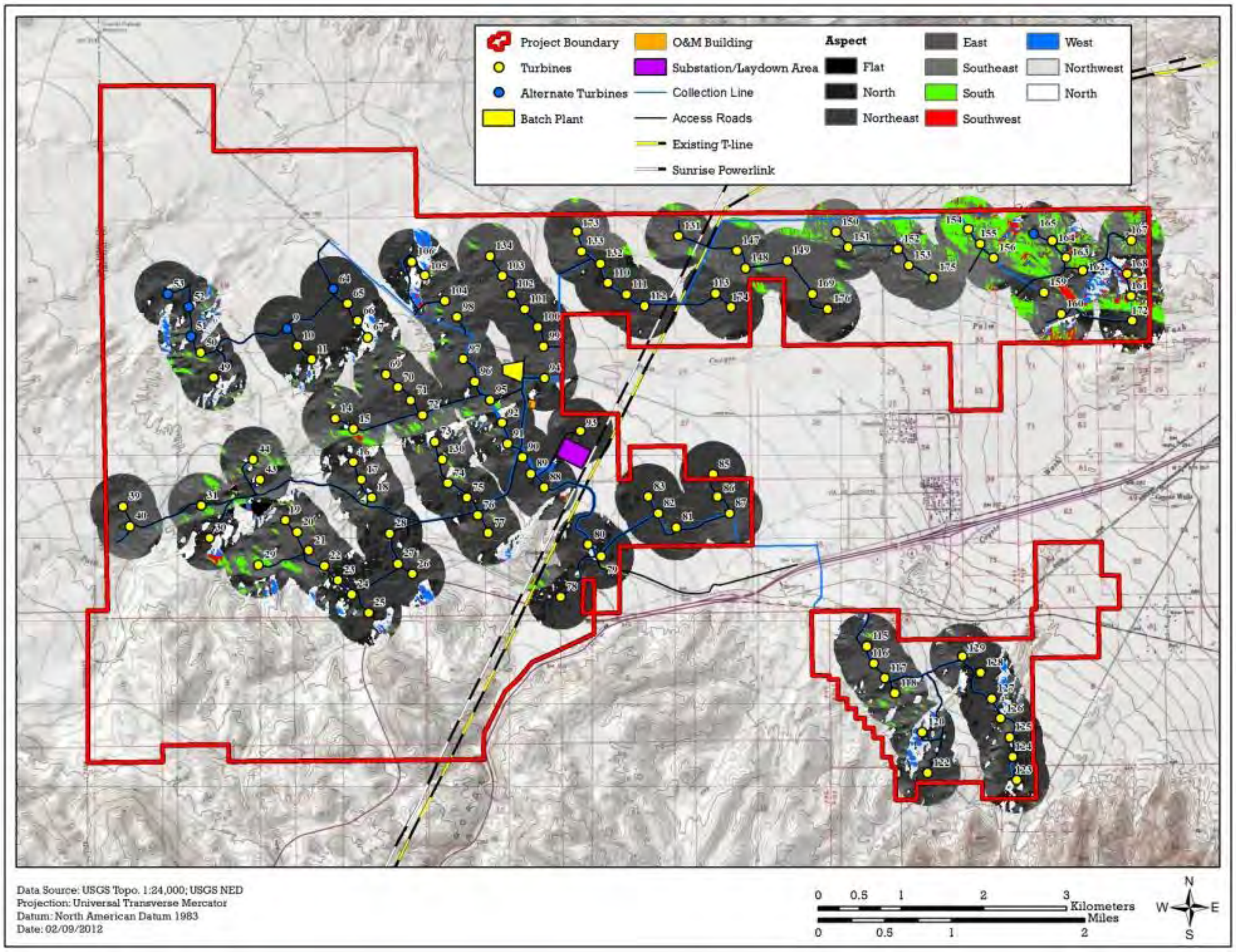

Figure 13. Aspect of the Octoillo Wind Energy Facility.

The results of the landscape-scale assessment of topography and wind as well as the individual turbine assessment suggest that topography and wind conditions at the OWEF are a low risk to golden eagles overall in relation to facility and individual turbine siting.

INTRA-SPECIFIC INTERACTIONS

Assuming that intra-specific competition and territorial defense increases collision risk, the project area has some potential for having these behaviors occur on the project between the territories to the north of the project and south of the project. While we agree that this may be a plausible risk factor, we are not aware of any studies that have clearly demonstrated that intra-specific interactions increase risk to golden eagles.

ADULT VS. JUVENILLE AND RESIDENT VS. FLOATER/MIGRANT

Of the 34 golden eagle observations during site-specific surveys to date, ten of the observations were of adult eagles, 15 were of juvenile eagles, and nine were undetermined. Overall, the age structure of eagle observations within the OWEF is fairly even between adults and juveniles with no major differences between the two age categories. The data collected to date do not allow a determination of whether the site is used more frequently by resident or floater/migrant birds and the associated level of risk is unknown.

Table 9. Risk factors listed in the Draft Golden Eagle Conservation Plan Guidance and a discussion of these factors for this project.

Risk Factor	Scientific Evidence/Support	Citations	OWEF Situation	Qualitative Assessment
Bird Density	Mixed findings; likely some relationship but other factors have overriding influence across a range of species	Barrios and Rodriguez (2004), De Lucas et al. (2007), Hunt (2002), Smallwood and Karas (2009)	Golden eagle use (abundance) of the OWEF has been determined to be less than 0.02 eagle obs./hr based on site specific data collection to date	Low
Bird Age	Higher risk to sub-adult and adult golden eagles	Hunt (2002)	Data collected to date suggest a fairly even mix of adult and juvenile eagle use at the OWEF. Low production and few eagles using the area in recent years suggest likely few sub-adults around	Low
Bird Residency Status	Higher risk to sub-adults and floating adults and lower risk to resident adults and juveniles in golden eagles	Barrios and Rodriguez (2004), Hunt (2002)	Data collected to date is insufficient to address this potential risk factor. However, the low use numbers in general suggest few floating birds around	Low
Season	Mixed findings, with general consensus that risk is higher in seasons with greater propensity to use slope soaring (fewer thermals) or kiting flight (windy weather) while hunting across a range of species	Barrios and Rodriguez (2004), De Lucas et al. (2007), Hoover and Morrison (2005), Smallwood and Karas (2009)	Golden eagles appear to be most abundant in the fall due to slightly higher use based on site-specific data collection.	Unknown
Interaction with Other Birds	Higher risk when interactive behavior is occurring, across a range of species	Smallwood and Karas (2009)	Based on the average nearest-neighbor distance of all nests in the two territories identified as occupied in 2010, there is low potential for territorial defense to occur where turbines are sited.	Low, needs further study to determine actual influence to risk
Prey Availability	High risk when hunting close to turbines, across a range of species	Barrios and Rodriguez (2004), De Lucas et al. (2007), Hoover and Morrison (2005), Hunt (2002), Smallwood et al. (2009)	Although no specific prey surveys were conducted, overall prey availability within the OWEF is considered low throughout the majority of the year due to the harsh arid conditions and the fact that prey availability is low throughout much of the desert. Exception would be a few months in the spring following the raining season. However, spring use of the site by eagles is very low based on site specific data	Low

Table 9. Risk factors listed in the Draft Golden Eagle Conservation Plan Guidance and a discussion of these factors for this project.

Risk Factor	Scientific Evidence/Support	Citations	OWEF Situation	Qualitative Assessment
			collection.	
Turbine Height	Mixed, contradictory findings across a range of species	Barclay et al. (2007), De Lucas et al. (2007)	25 of 36 eagle observations within RSH but overall numbers still very low	Moderate
Turbine Type	Higher risk associated with lattice turbines for golden eagles, higher risk with tubular towers for burrowing owls (*Athene cunicularia*)	Hunt (2002), Smallwood and Karas. (2009)	Modern, tubular towers should minimize risk to golden eagles compared to older lattice turbines. However, uncertainties still exist regarding the differences between turbine types and more work is needed to understand the differences in risk associated with modern towers.	Low
Rotor Speed	Higher risk associated with higher blade-tip speed for golden eagles	Chamberlain et al. (2006)	State of the art technology, low RPM's, more space between rotor sweeps, however tip speeds generally the same	Low
Perch Availability	Possible higher risk with higher perch availability in the general project area for golden eagles	Chamberlain et al. (2006)	Suitable perching substrates are present in within the OWEF primarily in the form of rock outcrops and man-made features such as telephone poles and the existing and proposed T-lines through the project. The new transmission line proposed through the OWEF may increase perch availability within the OWEF for golden eagles.	Moderate
Rotor-swept Area	Mixed findings; higher mortality associated with larger rotor-swept area in one study for non-raptors, meta-analysis found no effect	Barclay et al. (2007), Chamberlain et al. (2006)	25 of 36 eagle observations within the RSA. However, larger rotors generally have more space and time between sweeps	Unknown
Topography	Several studies show higher risk of collisions with turbines on ridge lines and on slopes where declivity currents facilitate slope soaring and kiting flight of soaring raptors. Also a higher risk in saddles that present low-energy ridge crossing points. Higher risk for burrowing owls in canyons.	Barrios and Rodriguez (2004), De Lucas et al. (2007), Hoover and Morrison (2005), Smallwood and Thelander (2004), Smallwood (2007)	Based on the prevailing wind direction in relation to topography including slope, aspect, and elevation.	Low
Wind Speed	Mixed findings; general pattern of higher risk in situations that favor slope soaring or kiting (high winds in some locales, low winds in other, likely depending on degree of slope and aspect)	Barrios and Rodriguez (2004), Hoover and Morrison (2005), Smallwood and Karas (2009)	Based on the prevailing wind direction in relation to topography including slope, aspect, and elevation.	Low

3.2 Fatality Predictions

In this report, we present three different approaches for predicting the expected level of mortality for the Ocotillo facility. The first approach is similar to the approach presented in WEST (2010) that looks at the level of mortality observed at wind projects in the western U.S. in comparison to the level of golden eagle use. Although this approach assumes that all sites had the same methodologies, the same level of effort, and all sites have the same detection probability (some of which may be violated), it demonstrates that sites reported to have very low and low eagle use have not had reported eagle fatalities (Figure 14). Protocols are generally similar in that points are selected to provide a good viewshed suggesting reasonable comparability. As previously described, Table 6 summarizes all the observations during the large effort that occurred during the 2009, 2010, and 2011 surveys. These observations result in a golden eagle use estimate of 0.01 golden eagles per observation hour. Overall mean golden eagle use at the OWEF, adjusted for 20-min surveys in 2009, 2010, and 2011 is low compared with other wind-energy facilities that implemented similar protocols (Figure 14). In their analysis of avian fatalities at the Tehachapi Pass wind complex Anderson et al. (2005) found a direct relationship between raptor use and raptor fatalities: areas with the most raptor use had more fatalities than areas with the least raptor use. USFWS (2011) recognized that use of large-plot, long-duration point counts, as described by Hutto et al. (1986), “appears to be standard in pre- and post-construction assessment of use of wind energy projects by large (crow size or greater) species of birds.” Fixed-point BUC surveys provide a standardized methodology or index that enable comparisons between projects.

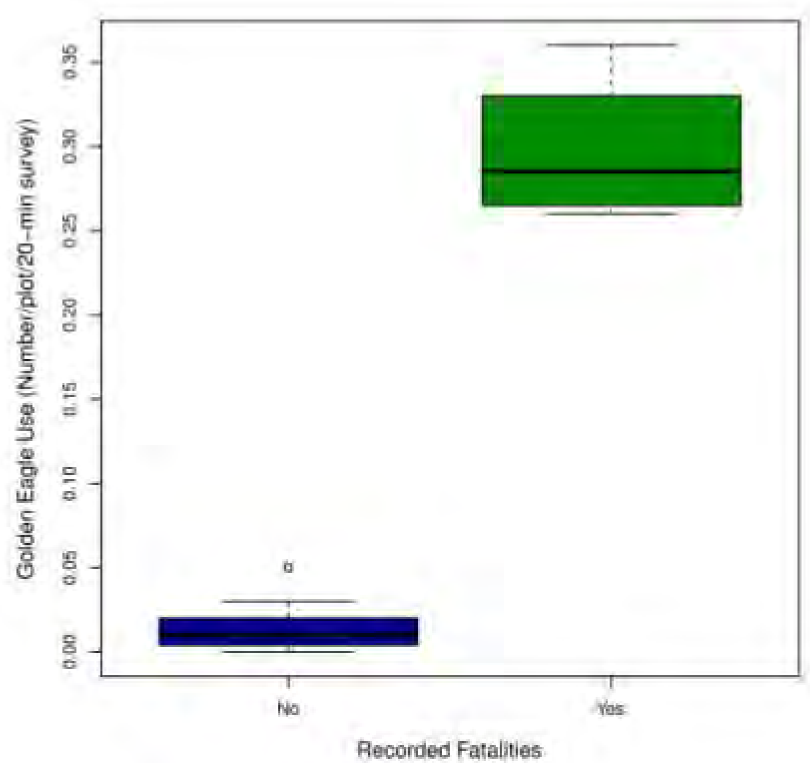

Figure 14. Average pre-construction golden eagle use values for facilities with and without observed golden eagle fatalities.
Data from the following sources:

Wind Energy Facility	Use Estimate	Fatality Estimate
Campbell Hill, WY	Taylor et al. 2008	Taylor et al. 2011
Combine Hills, WA	Young et al. 2003c	Young et al. 2006
Diablo Winds, CA	WEST 2006	WEST 2006, 2008
Elkhorn, OR	WEST 2005	Jeffery et al. 2009, Enk et al. 2011
Foot Creek Rim, WY	Johnson et al. 2000	Young et al. 2003b
Grand Ridge, IL	Derby et al. 2009	Derby et al. 2010
Hopkins Ridge, WA	Young et al. 2003	Young et al. 2007
Klondike, OR	Johnson et al. 2002	Johnson et al. 2003
Leaning Juniper, OR	Kronner et al. 2005	Kronner et al. 2007; Gritski et al. 2008
Nine Canyon, WA	Erickson et al. 2001	Erickson et al. 2003
Stateline, OR/WA	Erickson et al. 2002	Erickson et al. 2004b
Vansycle, OR	Erickson et al. 2002	Erickson et al. 2000
Wild Horse, WA	Erickson et al. 2003b	Erickson et al. 2008

The information in Figure 14 suggests that we would expect low golden eagle mortality in any given year at the OWEF. A conservative prediction would be an average of less than one eagle fatality per year assuming the level of use observed during the pre-construction studies continued. The likelihood of mortality in a given year might be influenced by whether the territories near the project are occupied and are successful. Based on the recent past, these territories are often unoccupied and production has been very low.

Another approach to estimating annual eagle fatalities at this project is to look at mortality predictions for all raptors, and then look at the percentage of raptors observed on the site that are eagles. Based on raptor use at the project (approximately 0.14/20-min survey), the estimated raptor mortality rate can be expected to be around 0.06 raptors/MW/yr. Golden eagle use comprises approximately 1/40th of the observed raptor use, so eagle mortality is expected to be 0.0015 eagles/MW/yr or approximately 0.45 per year. This approach is likely conservative because golden eagles are likely more detectable than other raptors and so the raptor use estimates of non-eagles are likely an overestimate of use relative to eagle use.

The final approach attempts to apply the modeling approach prescribed in the USFWS draft eagle conservation plan guidance (USFWS 2011). Tables 10 through 12 contain parameters used to calculate models of collision risk based on turbine specifications provided by OE LLC as a representative range of turbine types that are most likely to be used at the OWEF. An eagle exposure rate was calculated from the combined eagle use value of 0.01 eagles per observation hour (which includes data from both the APC surveys and the raptor migration surveys; refer to Table 6 in Section 2.4 above). Exposure rate (E_{rate}) is the average proportion of eagle flight minutes to minutes surveyed per square kilometer of area surveyed (USFWS 2011). Golden eagle use (u) from APC's and raptor migration surveys was calculated as the number of eagle observations seen per hour of survey. Use was converted into an exposure rate by accounting for the length of survey period (t_s), the area of the survey plot (a_p), and the average flight time of eagle observations (t_f). The area of the survey plot was based on an 800m radius even though all eagles observed during APC and raptor migration surveys were included in use estimates regardless of distance.

$$E_{rate} = \frac{u}{t_s \times a_p} \times t_f$$

The exposure rate was applied across the project area for a year period by multiplying by the turbine hazardous area (D; km^2) and the number of daylight minutes throughout the year. The turbine hazardous area for wind turbines was defined by 100-m buffers around each turbine (n) (USFWS 2011).

$$D = n \times \pi \times 0.1^2$$

Exposure of eagles within the turbine hazardous area throughout the year was then calculated by multiplying the exposure rate (E_{rate}) by the area within the turbine hazardous area (D) and total daylight minutes within the year (T_{min}).

$$E_{Hazardous\ Area} = E_{rate} \times D \times T_{min}$$

Table 10. Input values and calculations for exposure minutes within the danger zone per year.

Variables	Seimens 2.3	Seimens 3.0	GE 2.75	GE 1.6
Eagle Use (u) (34 observations / 3,306.5 observation hours)	0.01	0.01	0.01	0.01
Survey Plot Radius (assumed to be conservative and account for potential detection bias)	800	800	800	800
Averge Flight Time of Eagles within 800 m (t_F) (assumed)	5	5	5	5
Estimated Flight Minutes per observation hour (Eagle Use X Average flight time of Eagles observed during surveys)	0.05	0.05	0.05	0.05
Exposure Rate (E_{rate}) (Estimated Flight Minutes per observation hour / 60 minutes / area of survey plot)	0.00041	0.00041	0.00041	0.00041
Total Daylight Minutes (T_{min}) (365 days per year X 12 hours per day X 60 minutes per hour)	262800	262800	262800	262800
# turbines needed to approximate 300 MW (n)	130	100	109	188
Total Turbine Hazardous Area (D) (# turbines X π X [0.1 km]^2)	4.08	3.14	3.42	5.91
Exposure Minutes within the Hazardous Area per year ($E_{Hazardous\ Area}$) (Total Turbine Hazardous Area X Total Daylight Minutes X Exposure Rate)	444.844	342.188	372.984	643.313

Exposure within the hazardous area ($E_{Hazardous\ Area}$) represented the yearly flight minutes of eagles within a 100-m buffer surrounding each turbine. To estimate the number of flight passes of eagles through the rotor swept area (E_{RSA}) the exposure within the turbine hazardous area was adjusted by the proportion of the rotor swept area ($\pi \times \text{blade radius(m)}^2$) within the two-dimensional plane (100m $\times$ 175m) that bisects the turbine hazardous area It was assumed that the proportion of flight minutes below 175m was 1.0 (even though some of the observations were recorded above 175m).

$$E_{RSA} = E_{Hazardous\ Area} \times F_{Below\ 175} \times \frac{\pi \times \text{blade radius(m)}^2}{200\text{m} \times 175\text{m}}$$

Table 11. Input values and calculations for flight passes per year through the rotor swept area (RSA).

Variables	Seimens 2.3	Seimens 3.0	GE 2.75	GE 1.6
Rotor Radius (provided by OE LLC)	51.0	56.5	53.5	50.0
RSA (π X [rotor radius]^2)	8171.28	10028.75	8992.02	7853.98
Area of Risk Zone (200 m X 175m)	35000	35000	35000	35000
Proportion of the RSA in the Risk Zone (Area of RSA / Area of Risk Zone)	0.23	0.29	0.26	0.22
Proportion of Flight Minutes below 175 m ($F_{Below\ 175}$) (assumed to include all flight observations)	1.00	1.00	1.00	1.00
Estimated Flight Passes through RSA (E_{RSA}) (Exposure min within the Danger Zone [from Table 10] X Proportion of the RSA in the Risk Zone X Proportion of Flight Minutes below 175m)	103.8555	98.0489	95.8253	144.3590

The collision rate for golden eagles was modeled as the probability that an eagle is struck by the turbines blades when passing through the rotor swept area. Vance Tucker, Professor of Biology at Duke University, has performed probabilistic analyses of the effect of wind turbine rotor size and rotational speeds on risk to birds (Tucker 1996; Table 12a). These are estimates of the collision risk if an eagle passes through the rotor swept area of a turbine based on average flight behavior. The formula for average collision probability ($\bar{p}$) is as follows:

$$\bar{p} = \frac{Bb}{2\pi}\left[\frac{\Omega}{A\left|V_{Dx} + (1-a)U\right|} + \frac{4}{\pi\left(R + w_0/\Omega\right)}\right]$$ (Tucker 1996)

Table 12a. Variables for Probability of Collision in RSA calculation (Tucker 1996).

Variable	Probability of Collision if in Danger Area	Value
B	# Blades per turbine	Turbine Specific
b	Average Adult Golden Eagle Wingspan	2.1-m
Ω	Rotor Angular Speed of Turbine	Turbine Specific-radians/sec
A	Eagle Aspect Ratio (wing span/body length)	2.33
V_{bx}	Eagle Air Velocity	14-m/s
a	Axial Induction Factor (assumed)	0.25
U	Wind Velocity (Maximum Operating Speed)	Turbine Specific-m/s
R	Rotor Radius	Turbine Specific-m
v_o	Tangential Threshold Speed (assumed - speed at which when the blades are turning slower than the eagle can avoid collision)	25-m/s

Table 12b. Input values and calculations to determine the probability of an eagle collision given a pass through the rotor swept area (Tucker 1996).

Variables	Seimens 2.3	Seimens 3.0	GE 2.75	GE 1.6
# Blades per turbine	3	3	3	3
Rotor Radius (provided by OE LLC)	51.0	56.5	53.5	50.0
Rotor RPM (Maximum Operating Speed) (provided by OE LLC)	16	16	14.8	14.8
Rotor Angular Speed (Radians per Second)	1.68	1.68	1.55	1.55
Wind Velocity (Maximum Operating Speed) (provided by OE LLC)	15	15	13.5	13.5
Axial Induction Factor (assumed)	0.25	0.25	0.25	0.25
Average Adult Bird Wingspan (assumed)	2.1	2.1	2.1	2.1
Length of Birds (assumed)	0.9	0.9	0.9	0.9
Bird Aspect Ratio (Average Adult Bird Wingspan / Length of Birds)	2.33	2.33	2.33	2.33
Bird Air Velocity (assumed)	14	14	14	14
Tangential Threshold Speed (assumed as provided by Tucker 1996)	25	25	25	25
P(Collision) ($\bar{p}$) Tucker 1996	0.048	0.046	0.046	0.047

Yearly estimates of eagle mortality were estimated as the product of eagle exposure within the danger area and the collision rate. Whitfield (2009) noted that collision risk models fail to account for avoidance. An avoidance rate of 99% was used in the model following suggestions in the USFWS draft eagle conservation plan guidance (USFWS 2011), since it doesn't appear that the site (on an overall basis) has risk factors that would lead to increases in fatality (e.g. topography). Due to uncertainties with the avoidance rate, we also used a 95% avoidance rate to provide a more conservative approach (Table 13).

$$Fatalities_{project,year} = E_{RSA} \times \bar{p} \times (1 - avoidance\ rate)$$

Table 13. Predicted yearly eagle mortality

Variables	Seimens 2.3	Seimens 3.0	GE 2.75	GE 1.6
Non-Avoidance Rate (assumed)	0.01	0.01	0.01	0.01
Eagle Fatalities per Year (Estimated Flight Passes through RSA [Table 11] X Probablity of Collision [Table 12] X Non-Avoidance Rate)	0.05	0.045	0.044	0.068
Non-Avoidance Rate (assumed)	0.05	0.05	0.05	0.05
Eagle Fatalities per Year (same as above)	0.249	0.227	0.220	0.339

We present four models (one for each type of turbine likely to be used at the OWEF) and for each model, we input the number of turbines it would take to make up the approximately 300 MW OWEF with that turbine type. We acknowledge that only 112 turbines will be installed and a combination of the various turbine types (or similar turbines) will be installed at the OWEF. The actual fatality prediction would likely be somewhere between the estimates provided. We included an 800 m radius plot size for surveys and all eagle observations occurring during standardized surveys were included in the use estimate (even though some of the observations were beyond 800 m). Also, we assumed that the proportion of flight minutes below 175 m was 1.0 (even though some of the observations were recorded above 175 m). All of these factors lead to a more conservative estimate of fatalities.

Assuming all turbines were GE 1.6 MW turbines, we estimate approximately two golden eagle fatalities per five years (0.339 eagles per year) by applying the more conservative avoidance rate.

All three methods used for estimating eagle fatalities suggest less than one eagle fatality per year. The first method suggests an average of less than one eagle a year, the second method suggests 0.45 eagles/year or 3 eagles over five years, the third approach suggests 0.34 eagles/year or 2 eagles over five years. All three models are predicated on several assumptions, including eagle use continuing to be low as measured during the two years of pre-construction work. As such, a conservative approach is to assume that five golden eagle fatalities will be realized in a five year period. If nesting/territory occupancy and production were much higher than observed during the past three years in this region, then actual mortality of eagles may be higher.

Given the risk assessment and the site specific data collected to date, OE LLC plans to implement an intensive monitoring and research program and curtailment of wind turbines anytime an eagle is flying in the vicinity of turbines (discussed in further detail below). The actual number of fatalities will be monitored and evaluated at the end of the first five years of project operations (see post-construction monitoring below) and adjustments can be made for the next five year period depending on whether the actual number of fatalities is higher or lower than anticipated.

3.3 Categorizing Site according to Risk

Based on a "weight of evidence" approach using the USFWS draft eagle conservation plan guidance, the site specific data collected to date and the risk assessments, the OWEF appears to meet a Category 2 designation.

4.0 AVOIDANCE AND MINIMIZATION OF RISK USING ADVANCED CONSERVATION PRACTICES AND COMPENSATORY MITIGATION (STAGE 4)

The site-specific golden eagle data collected for the OWEF suggests the site should receive a Category 2 designation according to the USFWS draft eagle conservation plan guidance. However, OE LLC plans to implement a variety of Advanced Conservation Practices (ACPs) to reduce the risk to golden eagles from the project. The following ACPs have been implemented or are planned for the OWEF during the pre-construction, construction, and operation phase of the project.

4.1 ACPs Pre-Construction

OE LLC collected available site-specific information on golden eagle use to guide project siting to avoid and minimize impacts to golden eagles. The golden eagle data collected to date does not provide strong evidence for modifying any of the preliminary turbine locations to avoid/minimize potential impacts to golden eagles. Other ACPs implemented during the pre-construction phase of the OWEF include:

- The area and intensity of disturbances was minimized during pre-construction monitoring and testing activities.
- Existing roads and transmission corridors have been used to the extent possible while developing site plans.
- Structures are sited away from high avian use areas and the flight zones between them.
- The Avian Power Line Interaction Committee (APLIC) guidance on power line siting (APLIC 1994) was followed while planning.
- Site plans minimized the extent of the road network needed for the OWEF.
- No lattice or structures that are attractive to birds for perching are including in OWEF facility designs other than two SDG&E replacement structures needed to accommodate the switchyard.
- No guy wires will be included on permanent MET towers.
- Lighting plans for the facility are the minimum according to requirements.
- All security lighting will be motion or heat activated, instead of being left on throughout the night.
- All security lighting will be down-shield and related to infrastructure lights.
- The facility was not sited in any areas containing high concentrations of ponds, streams, or wetlands.

4.2 ACPs during Construction

The following ACPs will be implemented at the OWEF during construction:

- The area and intensity of disturbance will be minimized to the extent possible during construction.
- Existing roads will be used for access during construction to the extent possible.
- Non-operational MET towers will be dismantled during construction.
- Powerlines will be buried to the extent possible to reduce avian collision and electrocution.
- The Avian Power Line Interaction Committee (APLIC) guidance on power line construction (APLIC 2006) will be followed.
- A transportation plan will be implemented during construction that includes road design, locations and speed limits to minimize habitat fragmentation and wildlife collisions, and minimize noise effects. This will help to minimize carrion availability for golden eagles.
- A minimum of a two mile spatial and seasonal buffer will be implemented from turbines to protect all currently known nest sites and/or known roost sites during construction, such as maintaining a buffer between activities and nests/communal roost sites and keeping natural areas between the project footprint and the nest site or communal roost by avoiding disturbance to natural landscapes.

4.3 ACPs during Operation

OE LLC plans to implement an intensive operational golden eagle monitoring and research program for the OWEF. A detailed protocol will be developed for the golden eagle monitoring and research program that will identify specific hypothesis to be tested through the program. The golden eagle monitoring and research program includes implementation of a state of the art Merlin avian radar system, radar controlled video tracking system, and a full time golden eagle biological monitor to observe any golden eagles flying within the OWEF and to curtail turbines when eagles are at risk of collision. OE LLC plans to keep staff biologists on site during the day year-round to monitor the movements of eagles and other wildlife through the site for the first ten years of operations. It is the goal of OE LLC to implement a monitoring system and potentially, a compensatory mitigation package that results in no net loss of golden eagles from the OWEF over the life of its operations. Details of the intensive operational golden eagle monitoring and research program that will be implemented at OWEF are provided in Appendix C. This monitoring program is unlike anything implemented to date at a wind energy facility anywhere in the world and will not only provide a test of state of the art technological solutions and their ability to eliminate golden eagle collisions, but will also provide a unique opportunity to gain a better understanding of the interaction of golden eagles and wind energy facilities. These ACPs and this research are likely not feasible or practical at all facilities, but given the size of this facility and other factors, there are opportunities to learn and evaluate the effectiveness of the monitoring program in reducing mortality.

In addition to the intensive monitoring and research program, the following ACPs will be implemented during operation of the OWEF:

- Management activities such as seeding forbs or maintaining rock piles that attract potential prey will be avoided.
- Parts and equipment which may be used as cover by prey will not be stored in the vicinity of wind turbines.
- Any carcasses (with the exception of carcasses being used for post-construction bias trials) found within the OWEF will be removed immediately assuming the appropriate permits/authorizations have been granted to OE LLC.
- Low level speed limits (< 25 mph) will be maintained on all roads within the OWEF.
- Personnel will be trained to be alert for wildlife at all times, especially during low visibility conditions.
- Personnel, contractors, and visitors will be instructed to avoid disturbing wildlife, especially during the breeding seasons and seasonal periods of stress.
- Fire hazards will be reduced from vehicles and human activities (e.g., use spark arrestors on power equipment, avoid driving vehicles off roads, and allow smoking in designated areas only).
- Federal and state measures for handling toxic substances will be followed.
- Effects to wetlands and water resources will be minimized by following provisions of the Clean Water Act (1972).

4.4 Re-evaluation of Risk Considering ACPs

Assuming the goal of no eagle “take” for the facility is achieved through the intensive monitoring and research program and curtailment of wind turbines anytime an eagle is flying in the vicinity of turbines, it is anticipated that the OWEF may be downgraded to a Category 3 site following the first five years of operation.

4.5 Compensatory Mitigation

The OWEF ECP would be used as the basis for a programmatic eagle take permit if warranted and appropriate compensatory mitigation will be determined in coordination with the USFWS if it is determined that the initial ACPs implemented are not sufficient to avoid eagle take.

4.6 Cumulative Impacts

4.6.1 Population Status

The population estimate for golden eagles in California, according to Blancher et al. (2007), is approximately 2,000 birds using the Breeding Bird Survey (BBS) data and the Partners in Flight (PIF) population modeling. In the western US, not including California, the population estimate was 20,722 golden eagles (90% confidence interval: 16,317 – 25,948; excluding military lands, elevations above 10,000 ft [3,048m], large water bodies, and large urban areas; Nielson et al. 2010). Based on the ratio of golden eagles aged as juveniles to the total number of golden eagles observed, it was estimated that a total of 1,962 (90% confidence interval; 1,120 – 2,930) juvenile golden eagles were present in the western US (Nielson et al. 2010).

We are not aware of golden eagle population data from Imperial County, but have gathered some public data from the adjacent San Diego County. From 1997 – 2001, approximately 50-55 pairs nested in San Diego County, with approximately 20 pairs fledging young each year, and an average of 1.5 young per successful nest (Unitt 2004). The golden eagle population appears to be declining, primarily due to urban sprawl, but other factors affecting the eagles are human disturbance, especially from rock climbing, shooting, agriculture, and possibly global warming. Powerline electrocutions are determined to be the biggest source of mortality from 1988 -2003; approximately 67% of the dead eagles picked up in and near San Diego were reported as electrocutions. Other significant factors affecting golden eagles and other raptors throughout the US include secondary poisoning and prolonged drought (Unitt 2004).

4.6.2 Assessment of Cumulative Impacts Due to Other Projects

As described in the draft Environmental Impact Report (EIR)/EIS for the proposed OWEF, a cumulative impacts assessment was conducted for a geographic area extending throughout western Imperial County and southeastern San Diego County. The assessment assumed that all projects would be built and operating during the operating lifetime of the proposed OWEF. Fourteen current projects or projects considered reasonably foreseeable including other proposed or approved renewable energy projects, various BLM authorized actions/activities, proposed or approved projects within the counties jurisdictions, and other actions/activities that Lead agencies consider reasonably foreseeable were including in the assessment. For golden eagles, the cumulative impact assessment included a 10-mile buffer surrounding the proposed OWEF.

Direct and indirect impacts to golden eagle associated with the proposed OWEF combined with impacts associated with past, present, and future projects are considered a cumulative impact to golden eagle because the impacts have a potential to reduce the extent and population size of golden eagle in the cumulative impacts analysis area and because compensation for those impacts may not be achievable. Although some of the current and reasonably foreseeable projects would result in impacts to golden eagle nest sites, the proposed OWEF would not impact golden eagle nest sites and, therefore, the proposed OWEF would not contribute to cumulative impacts to such nest sites.

Impacts to golden eagle foraging habitat associated with the proposed OWEF combined with losses associated with past, present, and future projects are considered a cumulative impact to golden eagle because the impacts have a potential to limit the extent of the species within the cumulative impacts analysis area. The magnitude of the cumulative impact to golden eagle foraging habitat is small given that there is over 250,000 acres of suitable foraging habitat within the cumulative impacts analysis area. The proposed OWEF's permanent impacts to 122.1 acres of habitat amounts to less than 0.1 percent of the available foraging habitat for the species within the cumulative impacts analysis area. The proposed

OWEF and the other projects would be required to mitigate impacts to golden eagle foraging habitat. Implementation of mitigation measures (identified in this ECP and the draft EIR/EIS) would reduce the proposed OWEF's contribution to this cumulative impact.

Resident and migratory golden eagles are at risk of collision with project features associated with the proposed OWEF and past, current, and reasonably foreseeable projects in the cumulative analysis area. These features include such structures as wind turbines, meteorological towers, and overhead transmission lines. Impacts to golden eagle associated with the proposed OWEF combined with losses associated with past, present, and future projects are considered a cumulative impact to golden eagles because the impacts have potential to limit the population of golden eagles within the cumulative impacts analysis area. The proposed OWEF and the other projects would be required to minimize potential collision risk by implementing mitigation measures. For the proposed OWEF, the development and implementation of this ECP as well as other mitigation measures identified in the draft EIR/EIS would reduce the proposed OWEF's contribution to this cumulative impact.

Overhead transmission lines associated with the proposed OWEF and many of the other current and reasonably foreseeable projects also pose an electrocution risk for golden eagles (APLIC, 2006). Impacts to golden eagles associated with the proposed OWEF combined with losses of individual birds from electrocution associated with past, present, and future projects are considered a cumulative impact to these species because the impacts have potential to limit the populations of the species within the cumulative impacts analysis area. For the proposed OWEF, potential impacts associated with electrocution would be minimized through the development and implementation of this ECP, the OWEF ABPP, and designing transmission towers and lines to conform with APLIC standards. The other current and reasonably foreseeable projects would be required to implement similar mitigation to reduce potential electrocution impacts. Implementation of the proposed OWEF's mitigation measures would reduce the proposed OWEF's contribution to this cumulative impact.

Given the anticipated low level of potential eagle mortality at this site, the ACPs, and potentially a compensatory mitigation package, we anticipate the project to result in no net loss of golden eagles within a regional population level.

5.0 POST-CONSTRUCTION MONITORING (STAGE 5)

A post-construction monitoring program will be implemented at the OWEF. The post construction monitoring described in the OWEF ECP are for the OWEF only and do not apply to the SDG&E switchyard. SDG&E intends to construct and operate the switchyard independently from OE LLC. The observations made during post-construction monitoring will be reported to a Technical Advisory Committee (TAC), which will respond with appropriate management decisions depending on the results of the monitoring program. Notwithstanding the foregoing, the Parties acknowledge that fatality reduction or other measures may be required pursuant to applicable law inc1uding but not limited to the federal Endangered Species Act (1973), Bald and Golden Eagle Protection. Act (1940), Migratory Bird Treaty Act (1918) or the California Endangered Species Act (California Fish and Game Code, §§ 2050, *et seqJ*).

Since post-construction monitoring methods are constantly improving as researchers develop new and more accurate methods of survey, the TAC should consider recommendations to adopt new survey techniques and protocols as they become available. Post-construction monitoring shall include collecting field data on behavior, utilization, and distribution patterns of affected avian and bat species, in addition to fatalities. The final post-construction monitoring protocol will be developed and approved in consultation with the TAC prior to implementation.

5.1 Radar and Biological Monitoring

To advance the state of knowledge in the use of radar and biological monitors for risk reduction to eagles, OWEF has committed to developing, evaluating, and refining a potential system for real-time turbine curtailment at this site. A detailed protocol will be developed that will identify the specific hypothesis to be tested. These ACPs and this research are not practical at most facilities, but given the size of this facility and other factors, there are opportunities to learn and evaluate the effectiveness of the monitoring program in reducing mortality.

Ocotillo Express LLC proposes having a biologist on site to monitor eagle activity in real time during the first ten years of operation during the day year-round to monitor the movements of eagles and other wildlife through the site. The air-conditioned central monitoring control room on the observation tower will be equipped with radar monitors, video monitors and controls to provide the most comprehensive site monitoring system for avian activity deployed anywhere in the world. The concept is to have multiple data sources available in real time and recorded for post event (i.e., an eagle collision with a turbine) analysis, each sensor providing important details and playing to its specific strengths and also providing redundancy.

The biologist will operate during daylight hours from a central monitoring control room, mounted on a tower and affording a 360 degree panoramic view of the site. The tower, illustrated in Figure 15, will be approximately 50 feet tall. Figure 15 is a conceptual depiction of the tower and is not reflective of final design. The radar used for this application will be an Ultra High Resolution Solid State X Band Doppler radar. The radar has a five-m Slotted Waveguide antenna with about 0.4 degrees azimuth resolution. The vertical beam width is about 24 degrees. The transmitter is a solid state with a 200-watt peak power output. The receiver uses enhanced pulse compression that produces 15-m range resolution. It is the about 0.4 degrees azimuth resolution and the 15-m range resolution that make the radar Ultra High Resolution by comparison to ANY other bird radar. The radar uses a Doppler processor with 32 Doppler filters (16 inbound and 16 outbound).

The Merlin Avian Radar System uses radar tracking software which has been optimized specifically for bird tracking. This tracking software will pass off candidate eagle detections to a video monitoring system and to the biological monitor. The video cameras will be pointed in the direction of a target and then the biologist can refine the position in elevation until the target is visually acquired. Once visually acquired, the biologist can identify the target to species using very high powered binoculars and can employ video tracking software to maintain a lock on the eagle until it moves away from the site and is lost from view. The biologist will also provide a curtailment command to the operations center for the turbines if the target is projected to intersect a turbine string within the wind project. Testing will occur to determine how quickly the operations center will need to be alerted before turbine rotors can reach a low enough rpm. In addition, the biologists will investigate any observed potential turbine strikes for eagles and other raptors on the day of the observed interaction (see next section).

In addition to real-time curtailment of turbines, a large amount of data will be collected to help understand golden eagle and raptor behavior and risks in an operating wind energy facility, to help validate and possibly refine the radar, video, and curtailment technologies being tested, and to provide assessments of the efficacies of these technologies for more wide spread use. Flight paths of raptors from the radar and biological monitoring will be mapped and analyzed.

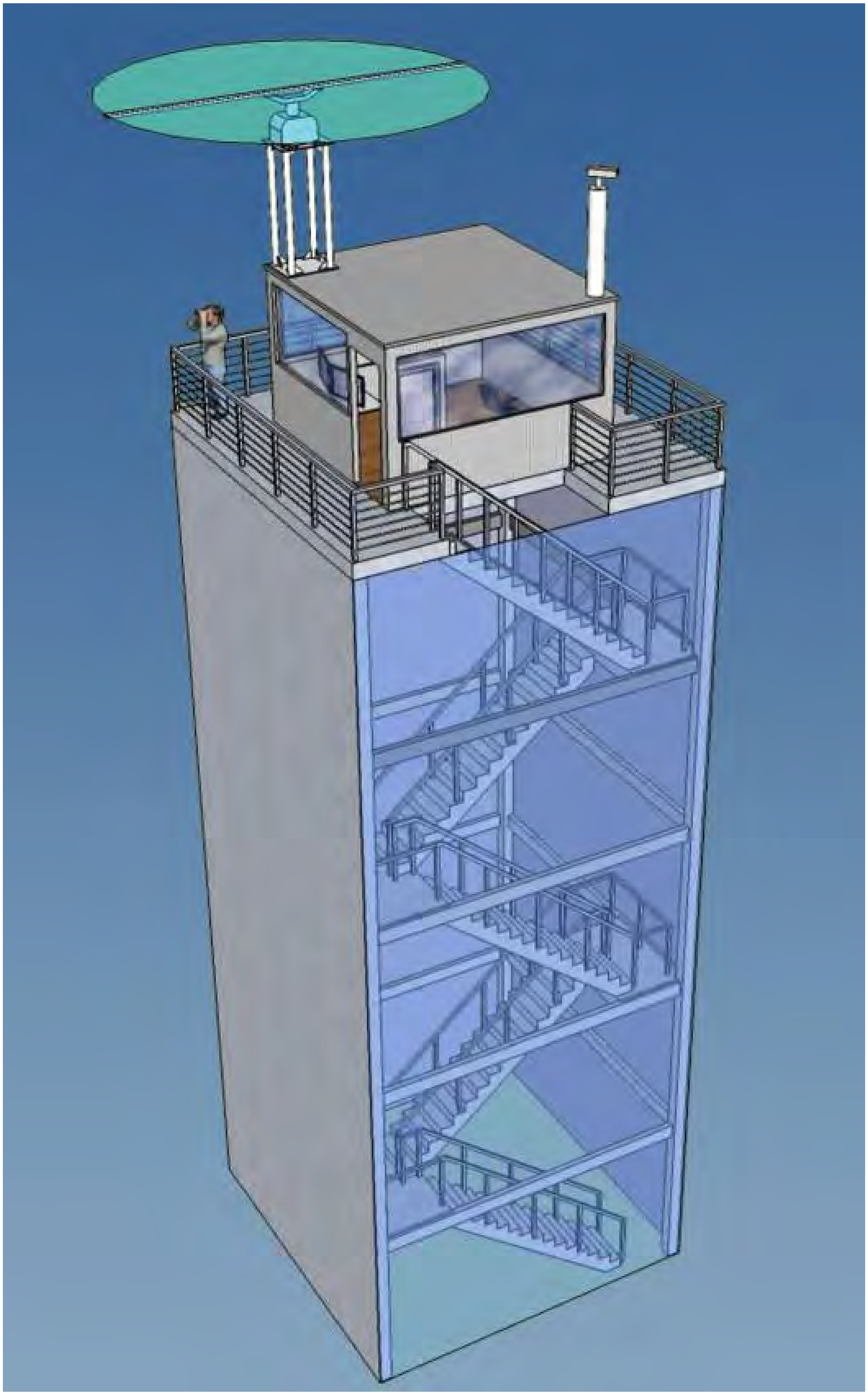

Figure 15. The observation tower (conceptual) proposed for the Ocotillo Wind Energy Facility.

5.2 Fatality Monitoring

OWEF will be subject to a minimum of three years of post-construction monitoring for golden eagles, unless additional monitoring is recommended and agreed upon by OE LLC. If the first two years of fatality monitoring do not coincide with a good rain year (i.e. good eagle reproduction), then OE LLC will conduct the third year of monitoring following a good rain year. Post-construction monitoring shall begin no later than three (3) months after the beginning of operations.

Assuming that the necessary permits have been obtained (e.g. a Special Purpose Utility Permit (SPUT) from the Migratory Bird Program), OE LLC or its consultants will remove all carcasses identified during post construction monitoring as well as for the life of operations of the OWEF (with the exception carcasses being used for post-construction bias trials). Any golden eagle mortalities will be identified through the post-construction monitoring effort. These surveys will be completed regularly to document the number and species of bird and bat fatalities attributable to the OWEF. The methods for estimating mortality at the OWEF will conform to industry standards in the U.S. As part of these mortality surveys, the searcher efficiency rate (i.e., the ability of a surveyor to locate a mortality) and carcass removal rate (i.e., the average time that a carcass persists before a scavenger removes it) will be determined for bats and small and large bird size classes. The frequency of monitoring will be informed based on the results of the carcass removal studies and will be designed to meet the objectives of the monitoring program. OWEF will initially monitor a subset of 30% of the turbines at least twice per month for the first two years of operation to quantify bird and bat mortality. During year three of monitoring, the focus will be strictly on quantifying eagle and raptor mortality and the frequency of monitoring will be designed to meet the objective of quantifying raptor (particularly golden eagle) mortality. OE LLC would like to use large raptors (e.g. golden eagles) for observer bias and scavenger removal trials if made available by the agencies. In the event that large raptors are not available hen mallards or the best available surrogates will be used for trials.

In addition to the standardized monitoring, all observations of likely collision of raptors with wind turbines documented through the radar and biological monitoring will be investigated. During the same day the interaction was documented, a technician will search the turbines where the interaction occurred.

5.3 Golden Eagle Nest Surveys

Golden eagle nest surveys will be conducted prior to the nesting season and once each month during the nesting season during the first three years of operations (assuming this frequency will not cause unnecessary disturbance to nesting eagles). OE LLC will work with the agencies to determine the appropriate frequency for golden eagle nest surveys. Aerial or ground based golden eagle nest surveys will be conducted within a 10-mile buffer of the project area focused on suitable nesting habitat, based on current USFWS guidance. The complete 10-mile search area will be limited to once at the beginning of the golden eagle nesting season, with monthly follow-up surveys only being completed for identified golden eagle or potential golden eagle nests. Nest locations found during surveys will be documented by noting the species, dates of activity, Universal Transverse Mercator (UTM) NAD 83 coordinates, nest contents (when possible), and behavior. The data will be presented to the TAC to determine whether mitigation should be recommended to reduce impacts to nesting activities. Active golden eagle nests will be monitored to track the breeding success of resident golden eagles and to evaluate the effectiveness of the mitigation measures that have been applied. OE LLC will coordinate with neighboring projects to reduce duplicating efforts and to minimize any potential disturbance to nesting eagles.

5.4 Reporting

The Monitor shall prepare interim, annual monitoring reports within three months of completing each year of post-construction monitoring, and shall prepare a final three year Monitoring Report within six months of completing three years of post-construction monitoring. If additional monitoring is conducted outside of three years of post-construction monitoring, the reporting schedule will be determined in consultation with the TAC.

All monitoring reports, including all raw monitoring data upon which the reports are based, shall be made available to members of the TAC. All monitoring reports shall report annual fatalities for golden eagles on a per-turbine, per-megawatt, and per-megawatt hour basis. The monitoring reports shall also summarize the results of the golden eagle nesting, behavior and use studies, as applicable. The Monitor shall supplement the final three year Monitoring Report with subsequent monitoring data collected. As part of the reporting process, all mortalities will be reported to the USFWS Law Enforcement Branch BIMRS mortality database and all eagle injuries or fatalities will be reported to USFWS, BLM, and CDFG within 24 hours of discovery for their direction on collection and/or sending carcasses to the national eagle repository.

Primary contacts for agency personnel include:

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6.0 ADAPTIVE MANAGEMENT

The adaptive management techniques described in this section have been developed to ensure that potentially significant levels of mortality from operation of the OWEF are effectively mitigated. This section describes the adaptive management process that will be applied for golden eagles. Changes in federal, state, and/or BLM status for golden eagles may result in the addition of, or changes to, adaptive management strategies, as determined by the BLM through TAC recommendations.

6.1 Adaptive Management Process

The TAC Lead will be provided a running mortality count every two weeks for review. The TAC will meet to discuss mitigation needs if the TAC Lead determines that a unique or significant event has occurred. At a minimum, the TAC will meet annually to review data and determine whether mitigation is necessary. If the TAC determines mitigation is necessary, the TAC will be responsible for identifying and recommending suitable mitigation(s). One or more mitigation measures may be applied if a unique or significant event occurs or more than 5 golden eagle fatalities are realized at the OWEF during the first five years of operation. A summary of ACPs is provided in Table 14.

Table 14. Summary of Advanced Conservation Practices.

Step	Trigger or Threshold	Advanced Conservation Practices typically recommended by the USFWS	Advanced Conservation Practices adapted for Ocotillo Express Wind Project.
ECP	Agreement	Conduct a minimum of three (3) years post-construction avian and bat mortality monitoring, using the USFWS Eagle Conservation Plan protocols for determining searcher efficiency and scavenging adjustments to the monitoring effort. If the initial 3 years of survey do not capture a good rain year (i.e. good eagle reproduction; a good rain year is defined as greater than annual rainfall of 10.6 inches in Campo, CA; WRCC-DRI 2009), then an additional 2 years of data collection will be conducted such that the surveys are conducted during a good rain year. Submit an annual report of mortality data and, in consultation with the TAC, devise and implement APCs derived from analysis of the monitoring data. Apply for a programmatic eagle take permit.	Conduct a minimum of three (3) years post-construction avian and bat mortality monitoring, using the USFWS Eagle Conservation Plan protocols for determining searcher efficiency and scavenging adjustments to the monitoring effort. If the initial 2 years of survey do not capture a good rain year (i.e. good eagle reproduction; a good rain year is defined as greater than annual rainfall of 10.6 inches in Campo, CA; WRCC-DRI 2009), then the 3rd year of post-monitoring will be conducted following a good rain year. Implement ACPs including: 1) deployment of Merlin avian radar system for the life of operations, 2) radio controlled video tracking system; 3) deployment of full time biological monitor to observe any eagles flying within the OWEF and to curtail turbines when eagles are at risk of collision for 10 years from COD. Submit an annual report of mortality data and, in consultation with the TAC, review and evaluate the mortality data along with the APCs that have been implemented. Based on the assumption that the ACPs implemented at this stage will avoid take of eagles, a programmatic eagle take permit may not be necessary at this stage.
Step I	One eagle taken.	Initiate consultation with the TAC to identify appropriate advanced conservation measures to minimize likelihood of future take. Conduct three (3) additional years of mortality monitoring.	Continue to implement ACPs 1) deployment of Merlin avian radar system for the life of operations, 2) radio controlled video tracking system; 3) deployment of full time biological monitor to observe any eagles flying within the OWEF and to curtail turbines when eagles are at risk of collision for 10 years. In addition to continuing to implement the relevant ACPs described in this section 4.0 and applicable adaptive management measures set forth in section 6.0, OE LLC would immediately enter discussions with FWS to determine whether future take can be avoided through changes in ACPs or adaptive management measures or whether OE LLC should initiate the application process for a programmatic eagle take permit. If the latter determination is made, OE LLC would expect to continue operating the project (with any mutually agreed upon interim, temporary ACPs or adaptive management measures) during preparation and processing of the permit application, and both

Table 14. Summary of Advanced Conservation Practices.

Step	Trigger or Threshold	Advanced Conservation Practices typically recommended by the USFWS	Advanced Conservation Practices adapted for Ocotillo Express Wind Project.
			OE LLC and the FWS would use this document as the foundation for the permit, along with any specific ACP, adaptive management measure, or compensatory mitigation that addresses the potential for future fatalities at the site, to the maximum degree technically and economically achievable. In consultation with the TAC, ensure that two (2) year of eagle mortality monitoring is conducted following the mortality. This may be conducted by qualified personnel of OWEF.
Step II	Two eagles taken within any 12 month period or three eagles taken within a 5 year period.	Intensify eagle monitoring studies, including flight path monitoring or telemetry, to define seasonal and diurnal flight patterns to inform development and/or implementation of the ACPs. Initiate advanced conservation measures involving visual and/or auditory deterrence procedures, or latest technology and methodologies, to minimize the likelihood of future take. Consult with TAC on design of APCs and how effectiveness will be evaluated. Conduct three (3) additional years of mortality monitoring.	Continue to implement ACPs 1) deployment of Merlin avian radar system for the life of operations, 2) radio controlled video tracking system; 3) deployment of full time biological monitor to observe any eagles flying within the OWEF and to curtail turbines when eagles are at risk of collision for 10 years from COD. In consultation with the TAC, review and evaluate the ACPs that have been implemented. Consider having the onsite biological monitor incorporate additional observational studies into the existing on-site monitoring program. In consultation with the TAC, ensure that two (2) years of eagle mortality monitoring is conducted following the implementation of new ACPs to assess the effectivnes of these measures. if the mortality follows the initial 3 year mortality monitoring period, two (2) additional year of mortality monitoring. This may be conducted by qualified personnel of OWEF.
Step III	Three eagles taken within any 12 month period or four eagles taken within any 5 years period.	Biological monitors or approved advanced technology and methodologies will be employed on site during daylight hours. The method selected will have the ability to curtail turbine(s) when an eagle(s)/large raptor(s) approach the RSA. A sufficient number of qualified monitors advanced technology devices will be stationed throughout the site, so as to provide unimpeded views of eagles/large raptors that may approach within one mile of any turbine. Additionally, monitors will report and remove carrion as it is encountered. TAC will refine and evaluate the curtailment protocol utilizing data from monitoring efforts initiated in Step II. Extend or reinitiate eagle movement studies and mortality monitoring by three (3) years to evaluate fatalities in the presence of ACPs.	Continue to implement ACPs 1) deployment of Merlin avian radar system for the life of operations, 2) radio controlled video tracking system; 3) deployment of full time biological monitor to observe any eagles flying within the OWEF and to curtail turbines when eagles are at risk of collision for 10 years from COD. In consultation with the TAC, review and evaluate the advanced conservation measures that have been implemented. Consider extending/reinitiating the eagle behavioral studies and evaluating the behavioral data in relation to the fatalities. In consultation with the TAC, ensure that three (3) years of eagle mortality monitoring is conducted following the implementation of new ACPs to assess the effectiveness of these measures. If the

Table 14. Summary of Advanced Conservation Practices.

Step	Trigger or Threshold	Advanced Conservation Practices typically recommended by the USFWS	Advanced Conservation Practices adapted for Ocotillo Express Wind Project.
			mortality follows the initial 3 year mortality monitoring period, three (3) additional years of mortality monitoring. This may be conducted by qualified personnel of OWEF.
Step IV	Four eagles taken within any 12 month period or five eagles taken within any 5 years period.	Deploy radar system(s) or approved advanced technology designed to curtail turbine blade rotation as eagle(s)/large raptor(s) approach RSA. In consultation with the TAC, design and implement a protocol for determining the effectiveness of a radar system(s). Conduct a minimum of three (3) years mortality monitoring to evaluate fatalities in the presence of ACPs.	Continue to implement ACPs 1) deployment of Merlin avian radar system for the life of operations, 2) radio controlled video tracking system; 3) deployment of full time biological monitor to observe any eagles flying within the OWEF and to curtail turbines when eagles are at risk of collision for 10 years from COD. In consultation with the TAC, consider implementing additional ACPs including but not limited to the installation of cameras at the neighboring nests sites at a safe distance (to avoid disturbance) to indicate the presence of eagles at the nest site and more importantly indicate when they leave so the biologist can be cued to activity and inactivity of the eagles." In consultation with the TAC, ensure that three (3) years of eagle mortality monitoring is conducted following the implementation of new ACPs to assess the effectiveness of these measures. This will be any remaining years of the initial 3 years mortality monitoring OR, if the mortality follows the initial 3 year mortality monitoring period, three (3) additional years of mortality monitoring. This may be conducted by qualified personnel of OWEF.
Step V	Five eagles taken within any 24 month period or six eagles taken within the first 5 years of operations.	Initiate consultation with TAC to determine curtailment schedules based upon evaluation of data collected in previous steps. Options may include curtailment in 1) appropriate season or 2) at identified problem turbines/strings; or 3) during certain portions of the day. Extend or reinitiate eagle movement studies and compatible mortality monitoring by three (3) years.	Continue to implement ACPs 1) deployment of Merlin avian radar system for the life of operations, 2) radio controlled video tracking system; 3) deployment of full time biological monitor to observe any eagles flying within the OWEF and to curtail turbines when eagles are at risk of collision for 10 years from COD. In consultation with the TAC, evaluate data and determine the feasibility of curtailment during the appropriate season at certain portions of the day at identified problem turbines. Consider installing a second radar unit and/or an additional full time biological monitor to extend/reinitiate the eagle behavioral studies In consultation with the TAC, ensure that three (3) years of eagle morality monitoring is conducted following the mortality. If the mortality follows the initial 3 year mortality monitoring period,

Table 14. Summary of Advanced Conservation Practices.

Step	Trigger or Threshold	Advanced Conservation Practices typically recommended by the USFWS	Advanced Conservation Practices adapted for Ocotillo Express Wind Project.
			three (3) additional years of mortality monitoring. This may be conducted by qualified personnel of OWEF.
Step VI	Seven eagles taken within a five year period.	In consultation with the USFWS and BLM, determine other appropriate actions necessary to minimize and compensate for additional impacts to eagle populations.	In consultation with the USFWS and BLM, determine other appropriate actions necessary to minimize and compensate for additional impacts to eagle populations.

6.2 Additional ACPs

The following is a list of possible ACPs that may be considered for implementation depending on the results of the post-construction monitoring programs (both the intensive golden eagle monitoring and research program and the general post construction monitoring studies) and discussions with the TAC.

- Development of a long-term (greater than three year) eagle monitoring program for the facility.
- Modification and implementation of the curtailment strategies developed during the three years of post-construction monitoring, including consideration of possibly other technologies.
- Placement of visual and/or auditory bird flight diverters in critical locations.
- Conduct prey base surveys within the OWEF. If fossorial mammals are found to be a major prey species for golden eagles occupying the area, and are found burrowing near turbines, burrows may be filled and the turbine pad may be surrounded within gravel at least two inches deep.
- Installing perch guards on overhead electric lines in the vicinity of the OWEF if eagles are shown to regularly use the lines.
- Wildlife rehabilitation - Contribute funding to one or more regional raptor rehabilitation centers. Golden eagles face threats from a variety of sources (disease, natural causes, poisoning, electrocution, power line collision, and other anthropomorphic causes), and supporting a rehabilitation center can save eagles. Funding would only be provided to rehabilitation centers that posses valid USFWS MBTA rehabilitation permits.
- Identify highly disturbed nest sites in the region and promote and find ways to protect those nests from disturbance, which should lead to an increase in reproduction potential.
- While not currently considered an ACP by the USFWS, OE LLC may consider contributing funding for regional eagle population studies. A better understanding of the regional eagle population would help to assess the level of impact to the regional eagle population as well as to inform ACPs that could be focused on those impacts which have the biggest influence on the regional eagle population.

6.3 Agency Interaction

The development of an effective and successful ECP for the OWEF will depend on frequent coordination between agency biologists and OE LLC. Many of the ACPs implemented at OWEF will be tested for the first time and will need to be reviewed and evaluated for effectiveness. As the OWEF will likely be one of the first projects that implements the USFWS draft ECP guidance (2011), it is anticipated that the process will evolve and that modifications to the process may need to be made while ensuring that the goal of stable or increasing breeding populations of eagles is achieved. As suggested in the USFWS draft ECP guidance, OE LLC, plans to allow service personnel access to the site to monitor the effects and effectiveness of the ACPs and mitigation measures that have been implemented.

7.0 PUBLIC OUTREACH

OWEF will coordinate with key interest groups within the community to determine how capital contributions from the project can go toward worthwhile community projects. In addition, a project fact sheet describing the project and measures that have been put in place to address avian and bat issues will be prepared and made available at the local BLM El Centro District Office.

8.0 CONCLUSION

This document was written to provide guidance for all required golden eagle mitigation and monitoring prior to, during, and after construction of the OWEF. The measures described in this document are intended to help protect and reduce potential impacts to golden eagles, as well as to monitor potential impacts to golden eagles following implementation of the OWEF. It is anticipated that this golden eagle conservation plan (ECP) will adaptively manage potential golden eagle impacts from the OWEF based on findings following construction.

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Appendix A: History of Golden Eagle Territories within 10 Miles of the OcotilloWind Energy Facility.

Appendix A. History of golden eagle territories within 10 miles of the Ocotillo Wind Energy Facility.

Carrizo Gorge

Dates/Earliest Record	Name on Record	Egg Collection/ Number of Young	Nest Location/ Nest Number	Young Banded/Type of Transmitter
1995	Mike Graham	?	Adult GEs seen on a regular basis; YNG seen	N
1996	P. Jorgenson	?	Adult GEs seen hunting 1 mi South of the mouth of Carrizo Canyon	N
1997	R West/JO	?	Walked the RR tracks from the south near I-8 and saw GE's and Randy reported seeing a nest	N
1998	R West	1 YNG	Walked the RR tracks and found a nest and saw a young in the nest	N
1999	JDB/ J Muench	0 YNG	Flew in Park Plane to find the nests	N
2000	JDB/ J Muench	0 YNG	Flew in Park Plane to find the nests	N
2001	JDB/ J Muench	0 YNG	From Park Plane we found nests but no young	N
2002	JDB/ R. West	0 YNG	Aerial survey found 5 nests; nest located above RR trestle (R. West, ground)	N
2003			Not surveyed	N
2004			Not surveyed	N
2005	JDB	1 YNG	3 wks old in nest on South face	N
6-Apr-2006	JD Bittner	1 YNG + Egg	aerial survey; 1 2wk old YNG and 1 egg; banding attempted, but failed due to hiking difficulty	N
11-May-2007	JDB/JH	1 YNG + Egg	used higher of the two nests; 1 egg and 1 YNG	Y - VHF
9-Apr-2008	JDB	0 YNG	5 nests; all empty. Bighorn sheep herd by nests	N
28-Apr-2009	JDB/JW/CM	0 YNG	5 inactive nests	N
6-Apr-2010	JDB	0 YNG	5 nests; red-collared Bighorn ewe near nests	N

Coyote Mountain

Dates/Earliest Record	Name on Record	Egg Collection/ Number of Young	Nest Location/ Nest Number	Young Banded/ Type of Transmitter
1970s	Culver	?	T15 S., R8 E., SE.35, SE 1/4 on side of mountain	
1992	JD Bittner/Culver	0 YNG	report adult GEs on territory	
2001	JDB/L. Oakley	0 YNG	Aerial Survey found 6 nests-none active; nests on all sides of the mtn.	
2002	JDB/L. Oakley	0 YNG	1 Nest RTH	
2003	JDB/L. Oakley	0 YNG	Aerial survey found nest activity but no young	
2004		?	Not surveyed	
2005		?	Not surveyed	
2006		?	Not surveyed	
11-May-2007	JDB/JH	0 YNG	1 nest, two raven nests on Mtns	
2008		?	Not surveyed	
28-Apr-2009	JD Bittner	0 YNG	1 GE nest; 2 Prairie Falcons in pothole; additional GE territory found to the West (Coyote Mtn West)	
30-Mar-2010	JDB/CM/RR	0 YNG	aerial (heli) survey; 2 nests	

Coyote Mountain - West

Dates/Earliest Record	Name on Record	Egg Collection/ Number of Young	Nest Location/ Nest Number	Young Banded/ Type of Transmitter
28-Apr-2009	JDB	0 YNG	Discovered by helicopter survey; unknown in the past	
30-Mar-2010	JDB/CM/RR	0 YNG	aerial (heli) survey; 9 nests, one active (new material); Bighorn Sheep and 2 pairs of Prairie Falcons on territory	

Table Mountain

Dates/ Earliest Record	Name on Record	Egg Collection/ Number of Young	Nest Location/ Nest Number	Young Banded/Type of Transmitter
1920s	Bittner/West/I. Oakley	?		
1991	JD Bittner/I. Oakley	1 YNG	3 nests on cliffs	
1992	JDB/IO	2 YNG		
1993	JBD/JO	1 YNG		
1994	JBD/JO	0 YNG		
1995	JBD/JO	2 YNG		
1996	JBD/JO	1 YNG	Adults seen early in nesting season; shooters at cliff during nesting season; chick died.	
1997	JBD/JO	0 YNG		
1998	JBD/JO	0 YNG		
1999	JBD/JO	1 YNG		Y- no transmitter
2000	JBD/JO	0 YNG		
2001	JBD/JO	1 YNG		Y- no transmitter
2002	JDB/JH	2 YNG	1 YNG shot on nest	
2003	JDB	1 YNG	Nest with 1 young located by fixed wing aerial survey-Anza Borrego St. Pk	N
14-Mar-2004	JH/ B Erickson	1-2 YNG	RTH nesting in southernmost GE nest	
13-Feb-2005	JH	0 YNG	3 new nests discovered 3/4 mile SW of old nests; extensive whitewash is evidence of 2004 nesting; RTH courting around old GE nest sites	
6-Apr-2006	JD Bittner	0 YNG	6 nests checked	N
13-Mar-2007	JH	0 YNG	3 new nests southwest of old nest sites; 3 nests checked	N
9-Apr-2008	JDB	0 YNG	Nests present at old nest site; RTH on one; 6 nests checked	N
28-Apr-2009	JDB/JW/CM	0 YNG	7 nests; RT Hawk nesting on north set of nests	N
6-Apr-2010	JDB	0 YNG	6 nests; GHO w/ yng on old GE nest	

Appendix B: Elevation, Slope, and Aspect Characteristics of Proposed Turbines at Ocotillo.

Appendix B. Elevation, slope, and aspect characteristics of proposed turbines at Ocotillo.

Turbine	Elevation (m)	Slope (Degrees)	Aspect (Degrees)	Aspect (Direction)
9 ALT	283.31	2.16	47.85	northeast
10	284.07	3.00	47.26	northeast
11	286.37	2.83	33.29	northeast
14	295.23	3.87	80.58	east
15	292.04	2.80	89.31	east
16	293.32	2.59	266.30	west
17	290.69	3.03	86.16	east
18	293.48	1.62	186.17	south
19	336.48	2.99	87.55	east
20	328.26	2.33	103.43	southeast
21	323.17	4.04	73.81	northeast
22	318.86	0.87	97.96	east
23	318.35	2.07	355.51	north
24	323.06	2.49	28.61	northeast
25	324.05	1.81	64.07	northeast
26	298.16	1.60	65.74	northeast
27	300.44	3.33	42.15	northeast
28	292.00	3.28	10.12	northeast
29	343.48	5.86	153.05	southeast
30	362.71	4.07	26.31	northeast
31	358.61	1.32	129.10	southeast
39	399.84	1.81	74.19	northeast
40	399.51	2.86	71.41	northeast
43	331.91	2.35	8.05	north
44	342.25	0.47	97.43	east
49	326.88	1.74	69.49	northeast
50	332.07	4.38	25.94	northeast
51 ALT	330.68	6.08	332.47	northwest
52 ALT	307.66	4.85	38.68	northeast
53 ALT	308.62	2.04	35.82	northeast
64 ALT	253.41	2.13	37.91	northeast
65	253.10	2.00	52.46	northeast
66	254.38	1.66	25.12	northeast
67	263.53	3.55	334.72	northwest
69	266.62	2.35	92.76	east
70	261.70	2.32	83.00	east
71	258.14	2.06	72.17	northeast
72	256.86	2.53	60.73	northeast
73	257.07	2.03	332.28	northwest
74	258.36	1.79	30.99	northeast
75	257.21	2.29	18.20	northeast
76	261.00	2.22	46.27	northeast

Appendix B. Elevation, slope, and aspect characteristics of proposed turbines at Ocotillo.

Turbine	Elevation (m)	Slope (Degrees)	Aspect (Degrees)	Aspect (Direction)
77	260.46	1.83	46.10	northeast
78	255.62	2.57	17.14	northeast
79	233.59	1.55	44.68	northeast
80	231.51	2.09	49.48	northeast
81	203.76	2.73	67.84	northeast
82	207.15	2.08	36.80	northeast
83	204.27	2.12	35.99	northeast
85	179.32	1.74	44.90	northeast
86	183.60	1.60	40.83	northeast
87	183.08	1.65	80.65	east
88	230.48	2.01	68.44	northeast
89	229.93	1.59	40.72	northeast
90	228.82	1.67	80.60	east
91	232.04	1.77	59.99	northeast
92	227.88	4.25	43.08	northeast
93	204.06	1.88	34.89	northeast
94	200.56	2.44	69.10	northeast
95	223.11	1.55	88.07	east
96	227.70	1.91	35.02	northeast
97	228.42	1.64	69.66	northeast
98	225.14	2.37	92.27	east
99	198.73	1.25	71.01	northeast
100	195.26	1.12	29.84	northeast
101	193.97	1.44	47.87	northeast
102	195.10	1.69	67.65	northeast
103	196.58	2.37	82.59	east
104	230.91	3.43	79.49	northeast
105	230.48	1.78	353.24	north
106	224.72	2.82	4.21	north
110	170.78	1.77	43.20	northeast
111	168.15	1.39	59.91	northeast
112	165.50	1.46	74.23	northeast
113	145.94	1.21	63.23	northeast
115	186.20	2.95	56.48	northeast
116	185.69	2.12	80.11	east
117	182.11	1.38	84.15	east
118	183.65	1.41	90.55	east
120	189.90	1.91	349.38	northwest
122	202.85	2.67	35.76	northeast
123	169.24	1.87	9.55	north
124	163.66	1.64	18.73	northeast
125	158.13	0.91	67.07	northeast

Appendix B. Elevation, slope, and aspect characteristics of proposed turbines at Ocotillo.

Turbine	Elevation (m)	Slope (Degrees)	Aspect (Degrees)	Aspect (Direction)
126	162.08	1.63	54.00	northeast
127	158.30	2.35	35.93	northeast
128	152.35	1.92	16.69	northeast
129	153.17	1.54	22.44	northeast
130	257.08	1.51	343.31	northwest
131	150.43	1.22	109.52	southeast
132	166.56	1.82	38.81	northeast
133	169.75	1.91	74.73	northeast
134	199.81	2.30	82.62	east
147	138.87	1.16	95.77	east
148	136.77	1.16	102.30	southeast
149	130.54	0.78	106.87	southeast
150	125.77	0.78	136.92	southeast
151	121.65	0.91	145.85	southeast
152	117.55	0.47	77.30	northeast
153	115.13	1.21	107.72	southeast
154	113.78	1.23	174.51	south
155	109.87	1.00	155.04	southeast
156	106.34	0.92	159.83	southeast
159	99.81	1.34	116.14	southeast
160	97.12	0.42	123.03	southeast
161	105.40	2.44	170.94	south
162	97.72	0.23	106.26	southeast
163	100.96	4.44	176.38	south
164	104.44	1.01	156.64	southeast
165 ALT	109.83	1.30	137.18	southeast
167	97.75	1.79	183.14	south
168	104.34	0.00	60.06	northeast
169	125.90	0.57	91.53	east
172	91.94	0.81	47.39	northeast
173	172.07	0.89	60.15	northeast
174	143.41	1.07	70.88	northeast
175	110.37	0.80	141.76	southeast
176	124.23	1.08	46.10	northeast

Appendix C: Radar and Video Tracking and Real Time Collision Risk Assessment for Golden Eagles

APPENDIX C

Radar and Video Tracking and Real Time Collision Risk Assessment for Golden Eagles

Purpose

This document outlines the technology proposed to monitor the movement of large soaring birds such as the Golden Eagle (*Aquila chrysaetos*) over Pattern Energy's planned Ocotillo wind farm site to provide for real-time curtailment capability of the turbines when necessary to minimize the potential for a Golden Eagle collision.

Background

The wind energy development proposed for Ocotillo occurs in the distribution range of Golden Eagles. However, Golden Eagle occurrence on the site, based upon preconstruction surveys, is limited and when it does occur is of short duration (2 – 30 minutes with an average of approximately 12 minutes). All activity noted at the site is confined to daylight hours generally between 1130 and 1600 at flight heights generally between 100 – 1,500 ft AGL (flight height ranged from 0 to 4,000 ft AGL). The project is in proximity to 5 nesting territories (2 of the 5 territories were determined to be active during the 2010 Golden Eagle nest surveys). The closest active nest is approximately 3.2 miles to the north of the project, in the Coyote Mountains.

Generally there has been no eagle mortality at sites with golden eagle use estimates similar to that observed at the Ocotillo site in 2009 and 2010. Projects that have documented golden eagle mortality (mortality reported in the cited reports) have golden eagle use estimates from pre-construction surveys that are much higher than the use observed at the Ocotillo project site.

Collision Prevention Technology Overview

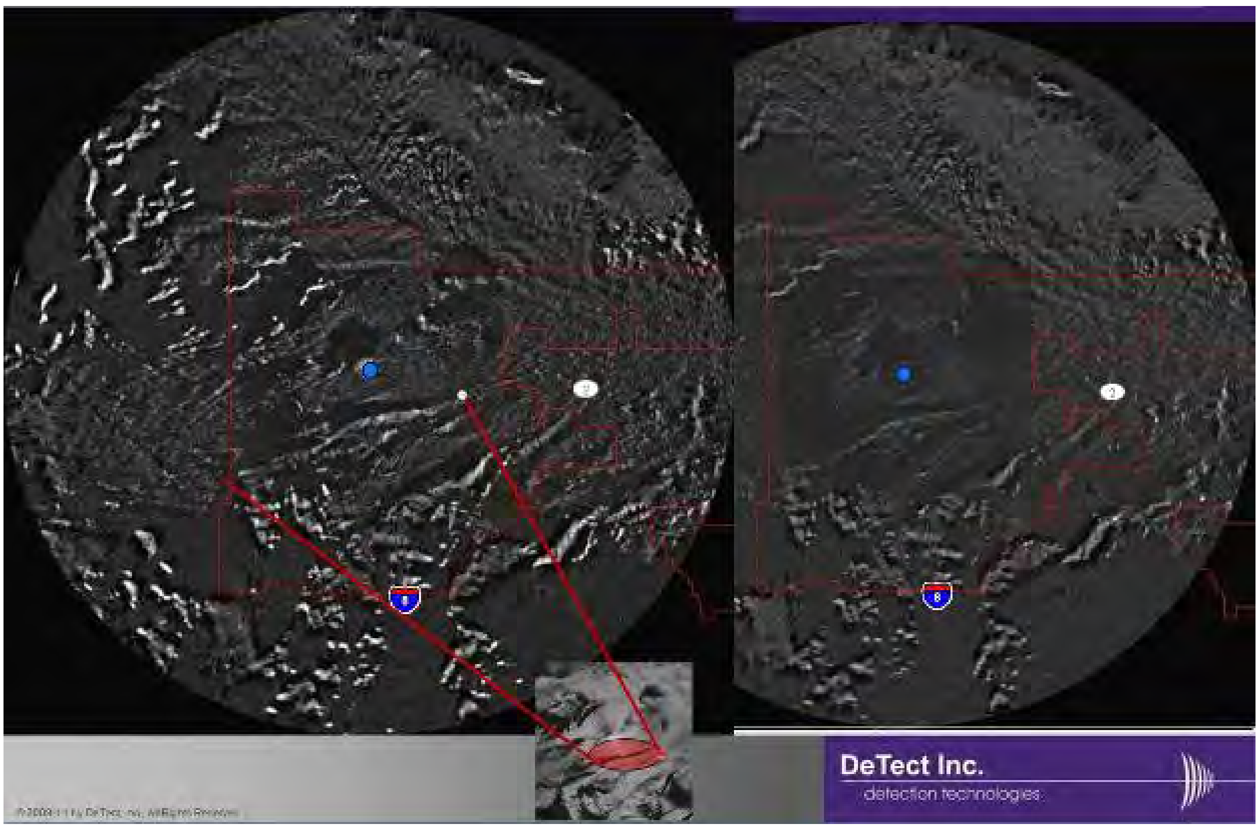
As outlined above, the occurrence of eagles on the site is low, but to further minimize collision risk to a very low rate, OE LLC proposes having a biologist on site to monitor eagle activity in real time and to curtail turbine operations when eagles are present on or over the site. The biologist will operate during daylight hours from a central monitoring control room, mounted on a tower and affording a 360 degree panoramic view of the site. (See Exhibit A illustrating visibility coverage at hub height).

The air conditioned central monitoring control room on the observation tower will be equipped with radar monitors, video monitors and controls to provide the most comprehensive site monitoring system for avian activity deployed anywhere in the world. The concept is to have multiple data sources available in real time and recorded for post event analysis, each sensor providing important details and playing to its specific strengths and also providing redundancy. .

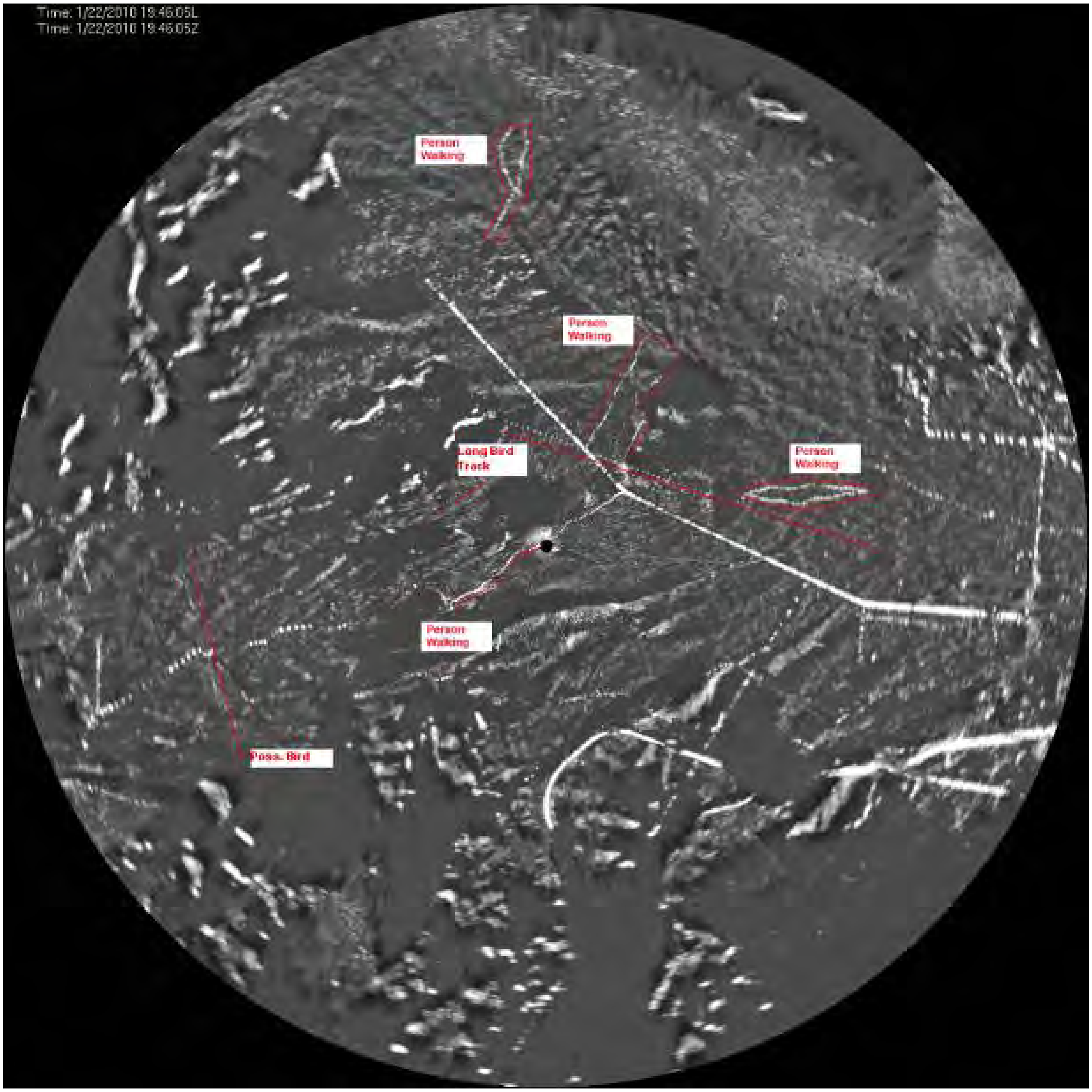
The system will be furnished by DeTect-Inc of Panama City, FL. DeTect-Inc provided the Avian Radar System used by NASA to monitor the air space before each Space Shuttle launch and which was successfully used on the past 17 launches at the Kennedy Space Center in FL. Detect-Inc also provides avian monitoring systems to the United States Air Force, the New International Airport in Durban South Africa as well as many wind energy sites worldwide including Pattern Energy's Texas Gulf Wind facility in Kenedy County, TX.

Pre-construction Phase

In the pre-construction phase of the project a Merlin mobile avian radar system has been deployed to the site. This is a unique system that not only is equipped with S and X band radars but also a state of the art night vision video system to document activity of ground mammals such as Bighorn Sheep on the site. (Note that this radar and video system is focused primarily on Bighorn Sheep during the pre-construction and construction phases, and will be shifted to focus primarily on eagle activity during the operational phase of the project. The solid state radar system being employed is unique in that it can be reprogrammed to optimize detection for different types of target; currently it is optimized for very slow moving sheep through soaring eagles, but refinements could be made to optimize specifically for eagles if the sheep monitoring function is no longer required). The original radars were magnetron based systems, but to overcome issues with strong ground clutter at the site generated by the vegetation and to gain experience for eagle monitoring the site radar is being upgraded to replace the horizontal magnetron S band radar with an Ultra High Resolution Solid State X Band Doppler radar. This decision was made after initial tests at the site showed that a substantial performance increase was possible with this cutting edge technology. The horizontal radar provides the coordinates of slow moving targets and slews the video system to record and document surface movements in the project site. This will be the first deployment of this type of radar equipment for wildlife detection in the world.



In the image above the left hand image shows the ground clutter visible to the ultra high resolution X band Doppler radar with no filtering applied. The brighter the shade of gray, the stronger the ground clutter at that location. The small inset image in the center shows the substantial ground clutter visible to the older technology magnetron S band radar system; such strong clutter precludes observing birds over much of the site. The image to the right shows the ground clutter visible when the ultra high resolution X band Doppler radar is filtered to remove all returns with zero radial velocity. The Doppler capability provides a substantial increase in the amount of area in which birds and other targets are visible on the site.

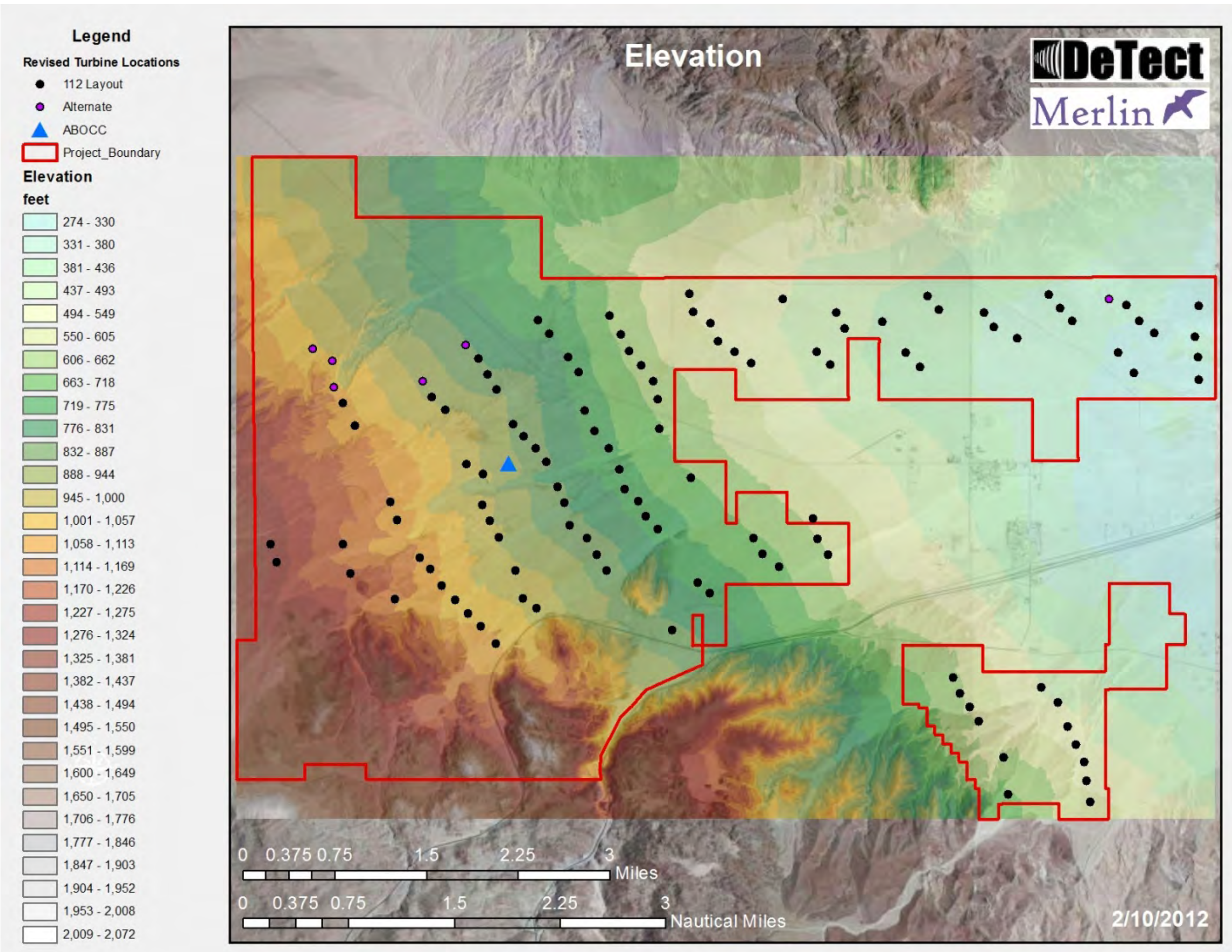


This image above shows the capability of the new radar to detect small targets even on the ground and walking through the vegetation that is the cause of the strong ground clutter returns in the lower resolution, magnetron radar systems. This is a composite image from a long period of time (~ 1 hour) showing target detections within 4nm of the radar. During that time several individual human targets were detected walking on the ground; in addition one bird (unknown species) and one suspected bird movement were also detected.

The High resolution Doppler radar capability shown above opens up the potential for monitoring Eagles in a way not previously possible. Previously 20-30% of the site would be visible and now with the new Doppler radar only a small percentage of the site, in the field of view, has ground clutter returns strong enough to prevent the detection of large soaring birds (bright white areas in the above image not associated with moving targets). As this technology has been tested and achieved this capability on the site we have a very high confidence that this type of eagle monitoring is technically possible.

Post Construction
The mobile radar system will be replaced by a multi radar system to provide a comprehensive site radar monitoring system permanently mounted on a tower. The radars will be state of the art with Doppler processing and Solid State Transmitters as previously used on the upgraded mobile radar system. Each radar will be tower mounted to ensure it has optimal visibility of the site.

GIS Software was used in the planning phase to minimize beam blockage and ensure selection of a site that will give us a high percentage of visibility (over 96%), and thus high probability of target detection of eagles approaching the site.



The map above shows the proposed turbine locations and symbols for the selected site modeled for viewshed analysis.

The map of the view sheds for the selected location is shown in the ***appendix below***. High resolution LIDAR elevation data was utilized in this analysis to maximize accuracy.

The state of the art solid state radars, unlike magnetron radar systems used in other bird studies, provide for the use of Doppler clutter filters and tailoring of the transmitted waveforms to provide optimal eagle target detection even in the presence of heavy ground clutter. The degree of refinement of the radar system for eagle detection that can be made with just a firmware update is unprecedented in the field of radar ornithology. Previously such optimizations would have required a new hardware design. With this reprogrammable system the radar can see a constant evolution in capability during the course of a project as the strengths and weakness of the radar configuration are determined on the site. When future upgrades, such as range azimuth gating (RAG Map), become available for the system these can also be deployed as simple firmware updates. A reprogrammable radar system is cutting edge technology the day it is delivered and can remain that way through progressive firmware updates.

The Merlin Avian Radar System uses radar tracking software which has been optimized specifically for bird tracking. This tracking software will pass off candidate Eagle detections to the video monitoring system in the same way that the night vision system is employed to detect Bighorn Sheep on the current mobile radar system. The video cameras will be pointed in the direction of a target and then the biologist can refine the position in elevation until the target is visually acquired. Once visually acquired the biologist can employ video tracking software to maintain a lock on the eagle until it moves away from the site and is lost from view.

Radar Controlled Video Tracker- existing technology, but state of the art video camera technology exists that is currently being used to track aircraft, where the video camera is automatically steered by an algorithm to keep the designated target close to the center of the video image, until the target is lost from view. This technology can track high speed aircraft in flight so acquiring and tracking slower moving eagles will be easier by comparison.

The technology employed to keep the video camera on the eagle is Real-Time Video Tracking software, which automatically controls Pan-Tilt-Zoom video cameras to keep the eagle near the center of the video frame and can be used to record avi video files of the eagles as it moves about the site allowing for avoidance behavior to be studied in detail.

One of the limitations of the radar technology is it cannot tell you it is specifically tracking an eagle, only that it is a large target, moving at speeds and in a way consistent with an eagle. Pattern has committed to having a biologist on-site to confirm species identification.

Cameras may be used for monitoring the eagles to determine if they are active. If an active eagle nest is found within five miles of the project, cameras will be installed at the neighboring nests sites at a safe distance (to avoid disturbance) to indicate the presence of eagles at the nest site and more importantly indicate when they leave so the biologist can be cued to activity and inactivity of the eagles. This will be an important data input to indicate when a juvenile is about to leave the nest to ensure that it is afforded maximum protection as it learns to navigate the environment.

In addition to a state of the art avian radar tracker on the Merlin Radar system, Merlin also has a unique capability to assess the collision risk of all targets in real time with multiple targets. This capability has been developed to reduce the collision risk of vultures with wind turbines in Spain and will shortly become operational but will be relatively mature capability by the time this system is installed at the Ocotillo project. By assessing the collision risk of an eagle or other track with each turbine, alarms can be sounded and curtailment operations automated to reduce the complexity and support the decision making process to the biologist on the site. By assigning each track a risk assessment to every turbine on the site at each update of the radar (every 2-3 seconds) an unprecedented ability to asses and synthesize collision risk is available in real time. Displays can be color coded to show the highest risk birds and the turbines they can potentially collide with to provide the biologist with situational awareness.

The risk assessment looks at both the proximity to a turbine as well as the flight direction. A bird flying away from a turbine is at lower risk than flying towards it even at the same range. This situation is reflected in the pioneering collision risk assessment system being introduced by Detect-Inc.

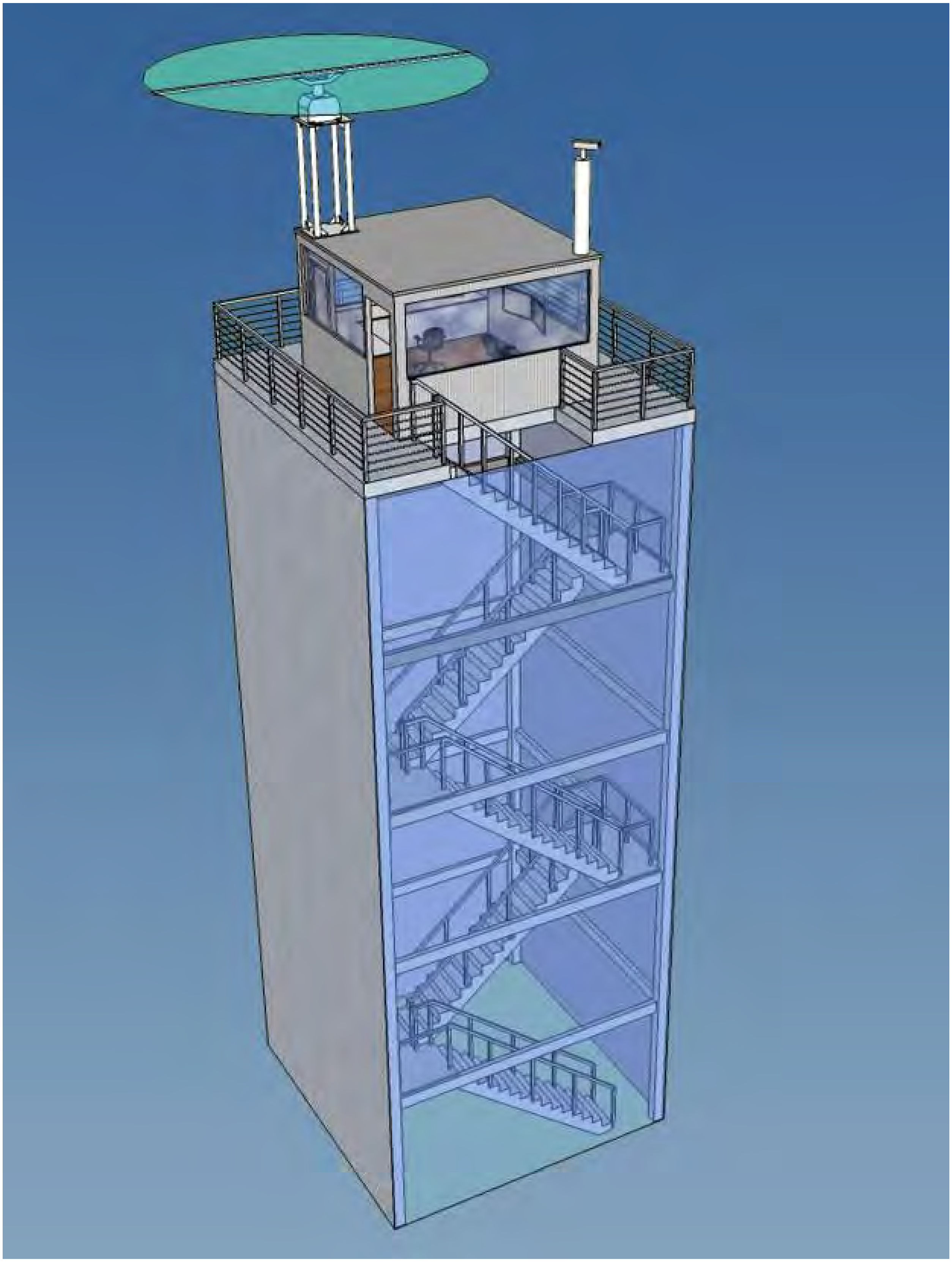
Control interface used in Spain to manually curtail turbines in real time based upon the proximity of a bird to the turbine. Curtailment can be for individual turbines by clicking on them as in the illustration or optionally for a group of clustered turbines in a small region.

The Advanced Biological Operations Command and Control Center ("ABOCC")

OE LLC proposes to place an observatory platform on the site to be the control room for the biologists where they can have a commanding view of the entire site with 360 degree vision and be able to monitor the data feeds from the radar and video tracker feeds in real time while remaining out of the direct sunlight, in an air conditioned environment, to provide ideal working conditions for the on duty biologist.

Long-Range Observation Binocular

In addition to the video tracking system the observer in the ABOCC will be able to conduct independent observations with a pair of Long-Range Observation Binoculars. These binoculars have rotating ocular turrets that allow for wide-angle viewing at 25x magnification, and high-power viewing at 40x magnification. The apparent field of view is a very wide 67° at 25x magnification; overcoming the drinking straw effect of looking for birds at high magnification and long range. Once acquired at wide angle the observer can rotate the ocular turrets and make detailed close up observations without the eye strain of using a spotting scope and closing one eye. A 7x50mm finder-scope can also be used for rapid acquisition of targets without the need to rotate the ocular turrets, depending on the observer's preference for operation and observation of targets. These Long-Range Observation Binoculars provide a flexible approach to acquiring small targets at range but affording detailed observations.



The observation tower proposed for the site. (Conceptual)

Concept of Operations

By having the radar system cue the video cameras to a target(s) and automating the subsequent tracking of targets the workload on a single biologist is kept at a minimum so they can focus on the task of curtailing the motion of turbine blades before the eagles approach them. This decision making is further supported by the collision risk assessment available for each radar track and the presence of species of concern, the Golden Eagle can be confirmed for marked individuals by the on-site biologist. The availability of this data will make it possible for the biologist to curtail operations before the eagle gets close to the turbines and keep them curtailed until the eagles have left the area.

For the first ten full years of operations it is proposed to keep a staff biologist on site during the day year-round to monitor the movements of Eagles and other wildlife through the site..

Sensor Strengths and Redundancy

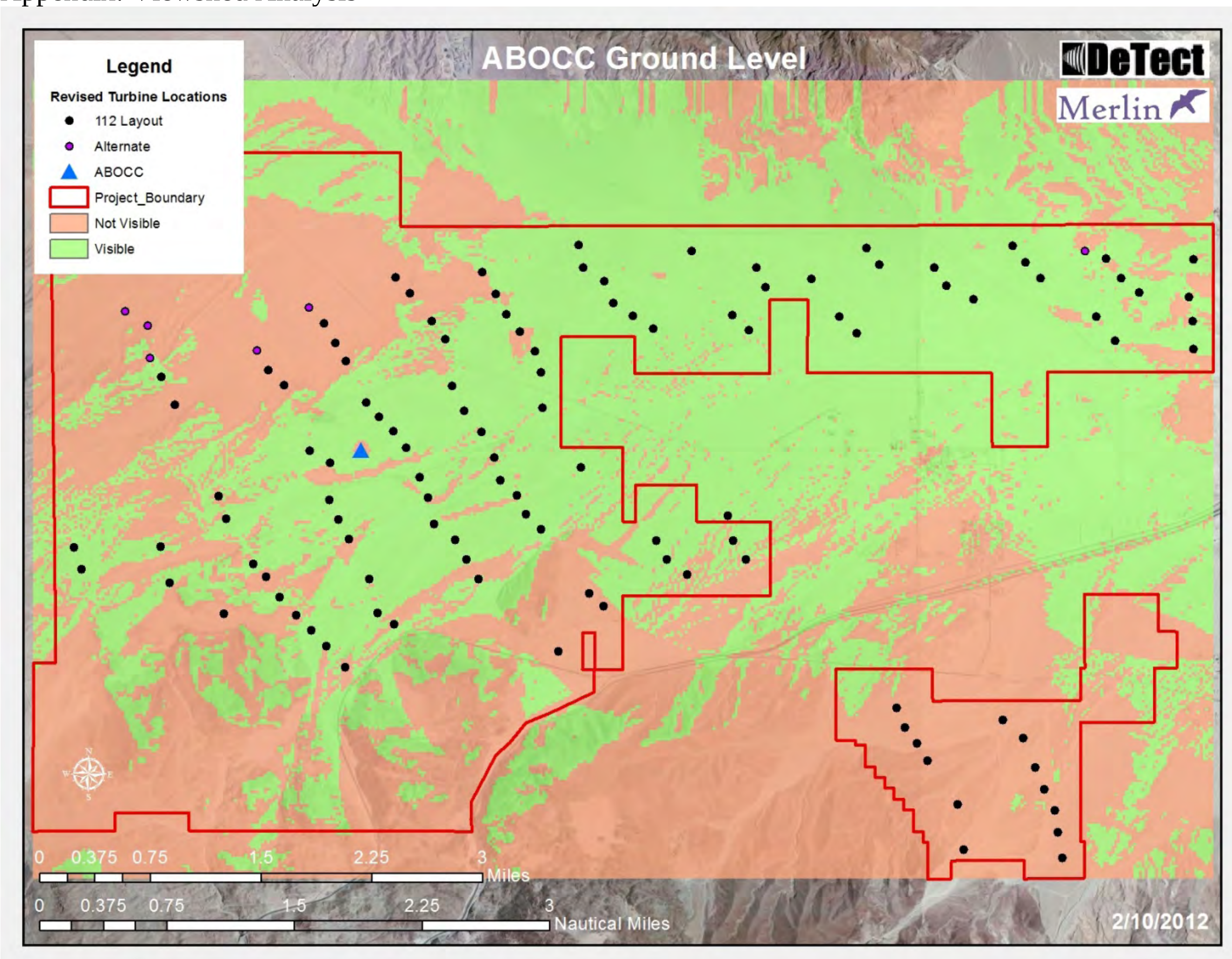
Each of the sensors outlined for this project has strengths and weaknesses. None of the sensors has 100% probability of detection, The radar has the ability to detect unmarked eagle-like birds, but not to identify them positively. The on-site biologist and video cameras can confirm species. The video camera can follow a specific individual while in line of site in azimuth and elevation, where as the radar can track multiple targets in range and azimuth, line of site. In other words the suite of sensors provides for the fullest information on the presence and activity of Eagles at the site and redundancy if any sensor fails to detect the eagle for any reason.

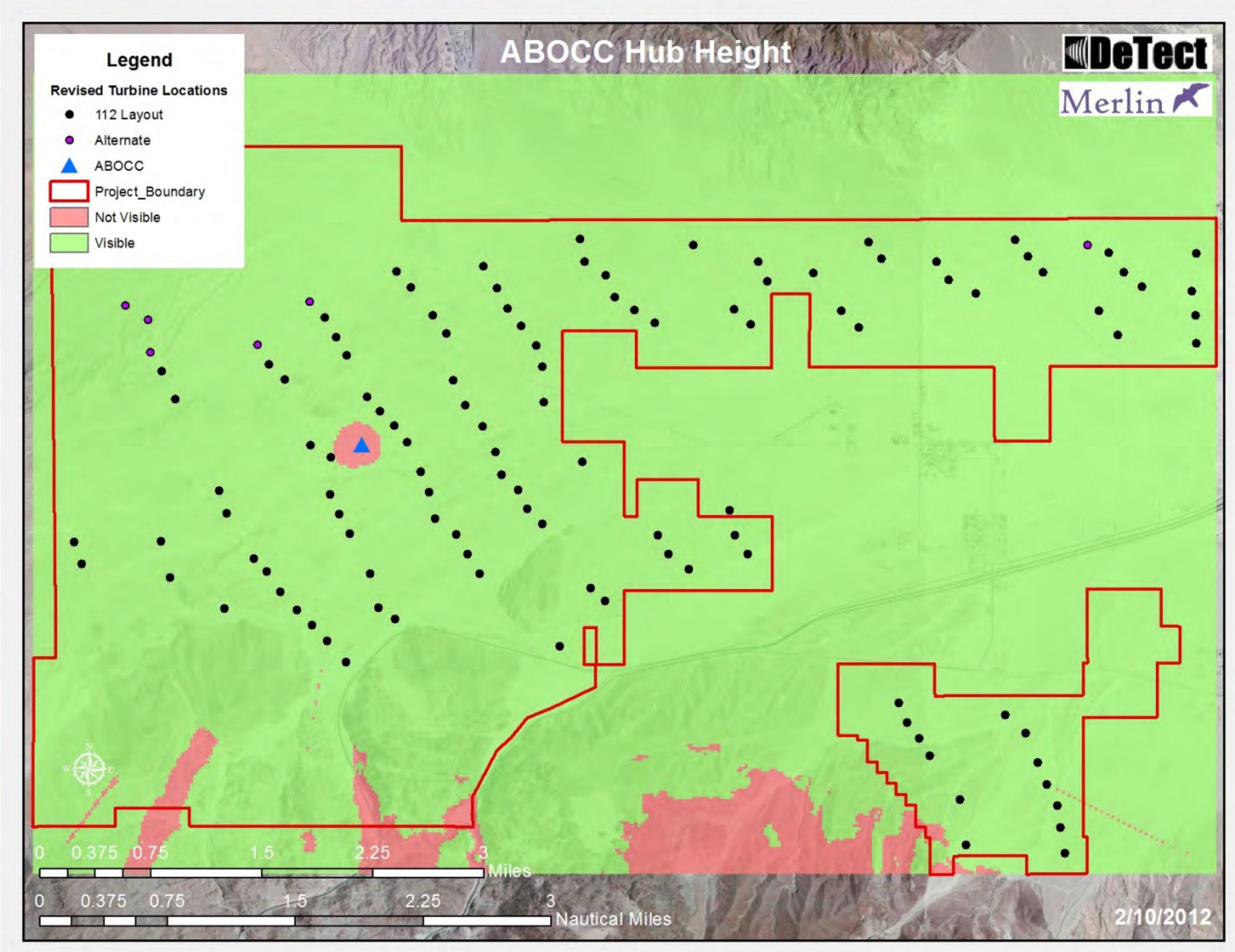
Comprehensive System Design

The system proposed and outlined here is the most comprehensive system built anywhere in the world to monitor birds and is built upon proven technology that has been used elsewhere. The Solid State radars - although new technology - are being used at multiple sites worldwide for bird detection and tracking, including for Vultures in Spain at a wind energy site. The video tracker technology is proven technology in military and civilian applications. We also have a history of use of video cameras for monitoring vultures with the NASA Launch system at the Kennedy Space Center. The only new part of the system design here is the use of all the data in real time to determine the need to curtail wind energy production when eagles are present on the site. This comes down to training and practice for the biologists with the equipment. The site is known to have intermittent activity by Turkey Vultures which will provide surrogate for the biologist to practice monitoring with the video and radar sensors and simulate the curtailment decision-making process i.e. they will provide as targets of opportunity regular drills in tracking and monitoring so that it is a reflex response when Eagles arrive at the site. The low number of eagles known to use the site and the limited duration they spend at the site (2-30 minutes average 10 minutes) on the limited number of occasions they are present will require this surrogate training. But we feel confident that such a curtailment process for these limited duration events will be effective in minimizing the collision risk potential.

This site will be the most heavily instrumented site in the world for monitoring the activity of large birds and provides an unprecedented opportunity to learn about the activity of large birds on and near a large wind site.

Appendix: Viewshed Analysis





ABOCC Hub Height
DeTect
Merlin
Legend
Revised Turbine Locations
112 Layout
Alternate
ABOCC
Project_Boundary
Not Visible
Visible
0 0.375 0.75 1.5 2.25 3 Miles
0 0.375 0.75 1.5 2.25 3 Nautical Miles
2/10/2012