increased in the context of the existing road network. Livestock grazing currently occurs on private land along the primary access road to Echanis, and the improvement of existing roads and construction of new roads may increase ease of access for livestock along creeks in or near the Project area, which could cause more unstable soils in riparian zones and increase sedimentation in creeks, notably Mud Ck.

WILDLIFE RESOURCES

Permanent effects on wildlife resources from the Echanis Project would be from the wind turbines, the overhead power collection system, the operations and maintenance (O&M) building, substation, and access roads. The Echanis Project would affect habitat, general wildlife, big game, and special status species as described below.

HABITAT

Approximately 91.7 to 92.7 acres of land would be permanently converted to facility use, including 56.2 to 57.2 acres of sagebrush habitat and 20.1 acres of juniper woodlands (Table 3.5-8). The loss of habitat from construction of permanent facilities would increase habitat fragmentation and directly displace individuals from developed areas. Construction and improvement of the main access road to the Echanis site, and the on-site access roads (i.e. string roads), would result in the permanent loss of 88.3 acres of vegetative cover. The loss of cover would include 53.6 acres of sagebrush habitat, 7.9 acres of aspen stands, and 21.1 acres of juniper woodlands. The introduction of new access roads would further fragment the existing Project Area, reducing the size of contiguous sagebrush, juniper, and riparian habitats where new or improved roads divide contiguous cover.

Noise would be generated by the wind turbines and operational maintenance activities associated with vehicles and personnel. Each wind turbine would generate from 58 to 62 dB(A) at 50 meters from the source, which is the same as conversational speech at 1 meter (BLM 2005). The turbine arrays would generate more noise than an individual turbine, but at winds above 10 meters per second the wind-generated noise would be higher than the aerodynamic turbine-generated noise (BLM 2005). At speeds below 10 meters per second the turbine noise would be higher than the wind-generated noise, and become more distinct at lower wind speeds as the background noise fades. However, less sound is generated at lower wind speeds from the turbines.

GENERAL WILDLIFE

Permanent site features would directly and indirectly reduce the availability of wildlife habitat for foraging, courtship and breeding, rearing young, and cover for many general wildlife species. Noise and human activity associated with operations would displace individuals throughout the year, and during the spring, maintenance vehicles could disrupt breeding of some species. Operational noise from the turbines at ordinary wind levels would not be detectible above background noise levels to birds more than 82 feet from turbine bases (Dooling 2002). Less mobile or burrowing non-game species would be susceptible to mortality from increased vehicular use on the Echanis site.

The Echanis Wind Energy Project would include from 40 to 69 wind turbines arrayed in multiple strings across the site. Operation of the wind turbines would cause mortality to bird and bat species. Some bat species are vulnerable to mortality from wind turbines because they hunt at altitudes within the rotor-swept area, and either collide with blades or experience barotrauma[1] from flying very close to the blades (Kunz et al 2007, Baerwald et al 2008). Tree-dwelling migratory species account for the majority of bat fatalities (75 percent), led by the hoary bat, eastern red bat, and silver-haired bat. Bat fatality at wind developments in the Pacific Northwest at five locations ranged from 0.7 to 3.4 bats per turbine per year and is an order of magnitude lower than bat fatalities recorded in the eastern U.S. (Arnett et al 2008). Based on the fatality

[1] Barotrauma occurs near rapidly spinning rotors where the air pressure is decreased substantially, causing fatal lung tissue damage.

range for Pacific Northwest wind developments, the 40 to 69 turbines at the Echanis site would cause from 28 to 235 bat deaths per year. Of bats found within the Project Area, hoary bats and silver-haired bats would be most likely to comprise the majority of the bat fatalities on-site. Two other bat species present within the Project Area have been found during post-construction mortality studies at other wind developments in the U.S.: big brown bat and little brown bat, but they have comprised a small proportion (less than or equal to ten percent) of total bat mortality at other wind developments in the Pacific Northwest (Arnett et al 2008).

Raptor species vary in their susceptibility to collision with wind turbines, but red-tailed hawks, American kestrels, and golden eagles are the species most commonly found during post-construction mortality studies in areas where these raptor species are present (NWCC 2001) Although raptor use in an area is not strongly correlated with raptor mortality from wind developments, species that are more susceptible to collision with turbines generally have higher mortality in areas where they are more abundant (Orloff and Flannery 1992; Kerlinger et al 2005)

Raptor use, a metric developed for comparison across pre-construction surveys at proposed wind developments, was monitored at eight points immediately west of the Project Area. Use was highest in summer and lowest in winter, and compared with 36 other pre-construction use estimates in the midwest and west, was categorically low to moderate (Derby et al 2008). In a review of raptor mortality at 13 wind developments in the Columbia Plateau Ecoregion, raptor mortality varied from 0.00 to 0.32 (mean of 0.12) raptors/turbine/year (NWC 2010c) three of the 13 sites had no raptor mortality.

Based on these findings, raptor mortality at the Echanis site could vary from 0 to 22 raptors per year from collision with wind turbines. Additionally, locating turbines at least 500 feet from the cliff-top edge would reduce the potential for collisions with raptors. Monitoring at one point on the east edge of Echanis yielded numerous fall migratory observations of raptors which were using the cliff-wall updraft to conserve energy during their long flights south. Given the potential for elevated raptor mortality along the eastern turbine string at the Echanis site, post-construction monitoring would be important for determining whether additional protective measures would need to be implemented.

Waterfowl and shorebirds likely would be affected only minimally by the Echanis Project because of the lack of suitable habitat at the Echanis site, and the presence of extensive open water and wetlands away from the Echanis site at MNWR. Sites where waterfowl and shorebirds have had notable mortality are located in flat agricultural areas in Minnesota and Wisconsin (NWCC 2001). Given that surveys of the Echanis site and the area immediately west of Echanis yielded very few observations of waterfowl or shorebirds (NWC 2007, 2010c), the potential for collision is very low. The northern edge of the main access road to the Echanis site passes through some lower elevation areas where waterfowl or shorebirds are more likely to be present, but road improvement in this area would cause only a negligible amount of habitat loss for these species. Additional vehicle use associated with operation and maintenance of Echanis may cause an undetectable increase in vehicular related mortality.

Passerines comprise the majority of bird mortality at wind developments outside of California, ranging from 67 to 91 percent of the total number of documented fatalities with a mean of 78 percent (NWCC 2001)[2]. Although migrant species comprise the majority of bird fatalities, the absence of large overnight bird kills at wind development sites indicates that most fatalities are not occurring during migrations (NWCC 2001), although further research is on-going (Kunz et al 2007). At thirteen wind developments within the Columbia Plateau Ecoregion with similar habitat types to the proposed Project, fatality of all birds varied from 0.6 to 10.0 (mean of 3.68) deaths per turbine per year (NWC 2010c). Extrapolated to the Echanis site, the fatality estimate would be from 24 to 690 bird deaths per year, of which 19 to 538 would be passerine species (based on the 78 percent average). Of the 13 studies, only two sites had bird fatalities greater than 5.0

[2] Reference to studies outside California are made because the older Altamont, Tehachapi Pass, Montezuma Hills, and San Gorgonio wind developments (in California) have inordinately high avian mortality and are not appropriately comparable to the newer developments.

birds/turbine/year. The native species most vulnerable to collision based on the percent composition of birds found during mortality studies were horned lark (32 percent), golden-crowned kinglet (6.1 percent), and western meadowlark (3.3 percent); all other species comprised less than three percent of the total (NWC 2010c).

The only overhead transmission line common to all alternatives would be a 1.18 mile power collection line between the easternmost turbine string and the Echanis substation. Permanent effects on wildlife would primarily be injury and death to passerine and raptor bird species from collision with the overhead line (USFS 2005). No fatality estimate is possible given the dearth of studies and variability of estimates available, but the short length of the line would suggest that only minimal effects on bird species would occur.

BIG GAME

The Echanis Project Area overlaps elk winter range (2,379 acres) and occupied bighorn sheep habitat (1,268 acres). The proposed access road to the Echanis site overlaps mule deer winter range (7.43 miles (7.4 acres) improved, 14.49 miles (14.5 acres) new), and elk winter range (4.95 miles (18.0 acres) new construction). On-site access roads (i.e. string roads) between turbine locations would overlap 0.77 mile (1.5 acres) of elk winter range and 2.77 miles (5.3 acres) of bighorn sheep range, and the overhead power collection line would cross 0.93 mile of sheep range where an access road would be constructed in 1.8 acres of sheep range. Initially, bighorn sheep at the Echanis site would likely avoid the area when vehicles or pedestrians are present. Eventually, if not harassed, Bighorn sheep would likely acclimate to the presence of the Project and use most of the occupied area. Elk and mule deer winter ranges are important habitat during colder and snowier winter months when forage availability is reduced. Vehicle activity on the site could displace animals or cause additional movement of elk and mule deer at a time when they have a high need to conserve energy, and would reduce habitat use in the areas surrounding the new and improved roads (Wisdom et al 2005). The direct loss of forage availability for big game from the Project footprint would be limited to 91.7 to 92.7 acres. With the implementation of the noxious weed control plan (see Section 3.3), adjacent areas could continue to provide forage of similar quality as currently found on site. The effect of widening the main access road to the Echanis site on pronghorn antelope would be minimal, since there would be very little direct loss of forage habitat and the animals are likely acclimated to vehicular traffic at present. Permanent loss of mule deer winter range, elk winter range, pronghorn antelope winter range, and bighorn sheep habitat would all be less than one percent within their respective game management units.

SPECIAL STATUS SPECIES

PREBLE'S SHREW

Preble's shrew has been captured in wetland marsh and upland sagebrush habitats on Steens Mountain, but specific habitat requirements and behavior have been very poorly studied (Verts and Calloway 1998). Permanent effects are likely limited for Preble's shrew, because once new construction is completed Project support activities (including travel) would be primarily restricted to developed areas which would not be inhabited by this species.

CALIFORNIA WOLVERINE

Wolverines are extremely rare and private creatures whose aversion to anthropogenic activity would make it likely that they would be directly affected by the Echanis Project during the operational phase if they enter the disturbed areas. Their rarity suggests they would have a low probability of crossing Project lands, but if they were to be present, they likely would be displaced from areas with active use. The wolverine would be indirectly affected by project maintenance activities and the presence of vehicles and pedestrians in the Project Area by displacing individuals that may enter the Project Area.

maintenance vehicles could disrupt breeding of some species. ~~Operational noise from the turbines at ordinary wind levels would not be detectible above background noise levels to birds more than 82 feet from turbine bases (Dooling 2002).~~ Less mobile or burrowing non-game species would be susceptible to mortality from increased vehicular use at the Echanis Project site.

The Echanis Project would include from 40 to 69 wind turbines arrayed in multiple strings across the site. Operation of the wind turbines would cause mortality to bird and bat species. Some bat species are vulnerable to mortality from wind turbines because they hunt at altitudes within the rotor-swept area, and either collide with blades or experience barotrauma[5] from flying very close to the blades (Kunz et al. 2007, Baerwald et al. 2008). Tree-dwelling migratory species account for the majority of bat fatalities (75 percent), led by the hoary bat, eastern red bat, and silver-haired bat. Bat fatality at wind developments at five locations in the Pacific Northwest ranged from 0.7 to 3.4 bats per turbine per year and is an order of magnitude lower than bat fatalities recorded in the eastern United States (Arnett et al. 2008). Based upon the fatality range for Pacific Northwest wind developments, the 40 to 69 turbines at the Echanis Project site would cause from 28 to 235 bat deaths per year. Based upon bats found within the Project Area, hoary bats and silver-haired bats would most likely comprise the majority of the bat fatalities on-site. Two other bat species present within the Project Area have been found during post-construction mortality studies at other wind developments in the United States, big brown bat and little brown bat. However, they have comprised a small proportion (less than or equal to 10 percent) of total bat mortality at other wind developments in the Pacific Northwest (Arnett et al. 2008).

Raptor species vary in their susceptibility to collisions with wind turbines, but red-tailed hawks, American kestrels, and golden eagles are the species most commonly found during post-construction mortality studies in areas where these raptor species are present (NWCC 2001). Although raptor use in an area is not strongly correlated with raptor mortality from wind developments, species that are more susceptible to collision with turbines generally have higher mortality in areas where they are more abundant (Orloff and Flannery 1992, Kerlinger et al. 2005).

Raptor use, a metric developed for comparison across pre-construction surveys at proposed wind developments, was monitored at eight points immediately west of the Project Area. Use was the greatest in summer and the least in the winter, and compared with 36 other pre-construction use estimates in the midwest and west, was categorically low to moderate (Derby et al. 2008). In a review of raptor mortality at 13 wind developments in the Columbia Plateau Ecoregion, raptor mortality varied from 0.00 to 0.32 (mean of 0.12) raptors per turbine per year (NWC 2010c). Three of the 13 sites had no raptor mortality.

Based upon these findings, raptor mortality at the Echanis Project site could vary from 0 to 22 raptors per year from collision with wind turbines. Monitoring at one point on the east edge of the Echanis Project yielded numerous fall migratory observations of raptors that were using the cliff-wall updraft to conserve energy during their long flights south. <u>However, turbines would be located at least 500 feet from the cliff-top edge which would reduce the potential for collisions with ridge-soaring raptors. This turbine set-back from cliff and rim edges has been supported by the USFWS in Project discussions regarding the ABPP/ECP, as a means to minimize collisions by ridge-soaring raptors with wind turbines. Curtailment and direct mitigation measures have been developed for this Project in conjunction with the USFWS and would be implemented as a component of the ABPP/ECP during conditions shown to produce kidding or soaring conditions over the site. This is further discussed in the Special Status Species and Mitigation sections below.</u>

Waterfowl and shorebirds would be affected only minimally by the Echanis Project because of the lack of suitable habitat at the Echanis Project site, and the presence of extensive open water and wetlands away from the Echanis Project site at the MNWR. Sites where waterfowl and shorebirds have had notable mortality are located in flat agricultural areas in Minnesota and Wisconsin (NWCC 2001). Given that surveys of the

[5] Barotrauma occurs near rapidly spinning rotors where the air pressure is decreased substantially, causing fatal lung tissue damage.

Echanis Project site and the area immediately west of the Echanis Project yielded very few observations of waterfowl or shorebirds (NWC 2007, 2010c), the potential for collision would be very low. The northern edge of the main access road to the Echanis Project site would pass through some lower elevation areas where waterfowl or shorebirds would be more likely to be present, but road improvement in this area would cause only a negligible (<1 percent) amount of habitat loss for these species. Additional vehicle use associated with operation and maintenance of the Echanis Project could cause an undetectable increase in vehicular-related mortality.

Passerines comprise the majority of bird mortality at wind developments outside of California, ranging from 67 to 91 percent of the total number of documented fatalities, with a mean of 78 percent (NWCC 2001)[6]. Although migrant species comprise the majority of bird fatalities, the absence of large overnight bird kills at wind development sites indicates that most fatalities are not occurring during migrations (NWCC 2001), although further research is on-going (Kunz et al. 2007). At 13 wind developments within the Columbia Plateau Ecoregion with similar habitat types to the proposed Project, fatality of all birds varied from 0.6 to 10.0 (mean of 3.68) deaths per turbine per year (NWC 2010c). Extrapolated to the Echanis Project site, the fatality estimate would be from 24 to 690 avian deaths per year, of which 19 to 538 would be passerine species (based upon the 78 percent average). Of the 13 studies, only two sites had bird fatalities greater than 5.0 birds per turbine per year. The native species most vulnerable to collision, based upon the percent composition of birds found during mortality studies, were horned lark (32 percent), golden-crowned kinglet (6.1 percent), and western meadowlark (3.3 percent). All other species comprised less than three percent of the total (NWC 2010c). Avian and bat mortalities for operating wind projects with habitat types similar to the Echanis Project were compiled as a part of the Project's ABPP, and are provided in Table 3.5-15 below.

Efforts to be as consistent as possible with the requirements of the MBTA would be ensured through implementation of the Project's ABPP/ECP, which is included in Appendix F. Non-golden eagle components of the ABPP/ECP would be implemented under the guidance of the TAC. All components of the ECP would be coordinated with the USFWS via the Project's application for an Eagle Take Permit. Other measures to reduce mortality would be implemented if the avian threshold (2.7 birds per turbine per year for all turbines, or 10 birds for an individual turbine in a single year) was exceeded, or if species-specific thresholds were exceeded. Species-specific thresholds could be developed for special status species and would be overseen by the TAC.

The Applicant would also provide $20,000 prior to construction and $30,000 for the next three years to fund wildlife interaction studies, as guided by the TAC. These studies could include topics such as population-level studies for wildlife impacted by wind energy development in the region, effects of increased recreational use of facility access roads on wildlife, and the ability of perch deterrents to reduce impacts to birds at wind energy projects and transmission lines.

The only overhead transmission line common to all alternatives would be a 1.18-mile power collection line between the easternmost turbine string and the Echanis Project substation. To avoid certain types of direct mortality (especially electrocution), the Applicant has agreed to adhere to the APLIC (2006) standards to all transmission line alternatives. The permanent effects of this power collection line upon wildlife would primarily be injury and death to passerine and raptor bird species from collision with the overhead line (USFS 2005). No fatality estimate can be calculated given the dearth of studies and variability of estimates available, but the short length of the line would suggest that only minimal effects would occur to bird species.

[6] Reference to studies outside California are made because the older Altamont, Tehachapi Pass, Montezuma Hills, and San Gorgonio wind developments (in California) have inordinately high avian mortality and are not appropriately comparable to the newer developments.

Table 3.5-15 Avian and Bat Mortalities for Operating Wind Projects with Habitat Types Similar to the Echanis Project

Source	WEF Study Area Location	Dates of Study	Turbines in WEF	Turbine/ Project MW	Avian Mortality per Turbine per Year	Bats Mortality per Turbine per Year
Young et al. 2006	Combine Hills, OR	02/04–02/05	41	Mitsubishi MWT-1000A / 41 MW	2.56	1.88
Johnson et al. 2003	Klondike, OR	02/02–02/03	16	Enron 1.5 MW / 24 MW	1.42	1.16
NWC and WEST 2007	Klondike II, OR	2006	50	GE / 75 MW	4.71	0.63
Erickson et al. 2000	Vansycle, OR	01/99–12/99	38	Vestas 660 kW / 24.9 MW	0.63	0.74
Erickson et al. 2004	Stateline, OR/WA	01/02–12/03	454	Vestas 660 kW / 299.64 MW	1.93	1.12
Kronner et al. 2008	Big Horn, WA	2006–2007	133	GE / 199.5 MW	3.81	2.86
Young et al. 2007	Hopkins Ridge, WA	01/06–12/06	83	Vestas / 150 MW	2.21	1.13
Erickson et al. 2003	Nine Canyon, WA	09/02–08/03	37	Bonus 1.3 MW / 48.1 MW	3.59	3.21
Erickson et al. 2008	Wild Horse, WA	01/08–12/08	127	V80 / 229 MW	2.79	0.71
TRC 2008	Judith Gap, MT	Fall 06–Spring 07	90	GE 1.5 SLE / 135 MW	4.52	13.40
Young et al. 2003	Foote Creek Rim, WY	11/98–06/02	69	600 kilowatt (kW) / 41.4 MW	1.50	1.34
Average:					2.70	2.56

Source: Echanis 2011.

BIG GAME

The Project would not likely cause direct adverse impacts to individual big game animals and big game populations. Recent big game monitoring associated with the Elkhorn Wind Project in Oregon showed shifts in mule deer winter range distribution, where deer were farther from turbine strings (Hagen 2011b). Compared to pre-construction use, counts of mule deer during post-construction surveys was reduced in the first seven distance bands evaluated, 0 to 1,640 feet (0 to 500 meters), out of 9,842 to 11,483 feet (3,000 to 3,500 meters). This shift in distribution is consistent with deer response to natural gas development in Wyoming (Sawyer et al. 2009). Actual numbers of mule deer counted within the Elkhorn Wind Project survey area decreased from 1,560 counted in three flights in 2004 to 2005, to 1,170 counted in four flights in 2008 to 2009 (BLM 2010).

Increased activity along roads is associated with the displacement of big game species (Rowland et al. 2005, Forman and Alexander 1998 in BLM 2010). Johnson et al. (2000) found that differing traffic levels have different impacts on deer and elk habitat use. After a literature review of linear route effects on wildlife, Gaines et al. (2003) reported that as traffic volumes increased, the mean distance elk moved away from roads increased (Gaines et al. 2003 in BLM 2010). Table 3.5-16 displays the mean distance elk moved away from roads.

the site per during each work day. Traffic volume on Project roads would therefore be minor. This level of use would not likely have a negative influence on lek persistence, although the use of vehicles on the Echanis Project site would lead to an increased chance of direct mortality from collisions (up to one per year during construction and maintenance activities).

The *Sage-Grouse Strategy* (Hagen 2011a) and accompanying rules are implemented by the ODFW. The BLM recognizes the ODFW *Sage-Grouse Strategy* habitat categorization map and considers the recommendations for disturbances contained in that document, such as Project-related roads, power collection line, and turbines, and would implement the *Sage-Grouse Strategy* to the extent possible. The mitigation framework for the core area approach outlined in the *Sage-Grouse Strategy* is outlined in a document titled *Implementing Habitat Mitigation for Greater Sage-Grouse Under the Core Area Approach* ("*Mitigation Framework*"; Hagen 2011b). The effect of the presence of turbines in late brood rearing habitat is not certain at this time. The presence of roads would not necessarily reduce greater sage-grouse use, but the timing and amount of road use would determine the extent that greater sage-grouse and other wildlife would avoid the road. Application of the *Mitigation Framework* to the proposed Project is discussed under Mitigation in this section. Figure 3.5-5 shows the *Sage-Grouse Strategy* habitat categorization in the Project Area. The Applicant has committed to implement a greater sage-grouse mitigation plan consistent with the four phases of the *Mitigation Framework*, which are: assessment, mitigation site identification, conservation project identification, and creation and implementation of a monitoring and management plan. This is further discussed in the Mitigation section below.

SPECIAL STATUS RAPTORS

Special status raptor species include bald eagle, golden eagle, northern goshawk, ferruginous hawk, and western burrowing owl. No suitable burrowing owl habitat exists at the Echanis Project site or the main access road, and no northern goshawks or ferruginous hawks were observed during field surveys. Northern goshawks prefer forested areas and aspen stands that are larger and more densely spaced than found at the Echanis Project, and so they generally would not be present except during spring or fall migrations. Ferruginous hawks are associated with rolling grassland and sagebrush habitats without the steep slopes or juniper forests present at the Echanis Project, so they generally would not be present except during migrations. One bald eagle was observed in the fall during its southern migration over the Echanis Project site. Because the bald eagles' preference for sites is near water, bald eagles would generally occur only as migrants at the Echanis Project site. Bald eagle winter roost areas are not present at the Echanis Project site. Recently, there has been at least one confirmed bald eagle mortality at a wind energy project in North America (Pearce 2010). ~~No bald eagle has been documented as a fatality from wind turbine collision at any site in the United States.~~ Golden eagles were present at both the Echanis Project site and immediately west of the Echanis Project site, but were observed over canyons and away from the ridges where turbines are proposed (NWC 2010c). ~~Golden eagles have been killed at other wind developments, although the incidences of fatalities are very low.~~ No nests for any special status raptor species were found within 2 miles of the Echanis Project site.

Given the potential for a lethal collision of a golden eagle, since they were present in surveys at the Project site and immediately west of the site, with the proposed transmission line or wind development components, a Programmatic BGEPA permit would be required to provide operational protection for the Project.

Direct effects to golden eagles would result from disturbance and mortality. Actions that resulted in disturbance from the development of the Echanis Project would include the effects of construction of the turbines and associated infrastructure. The nearest active golden eagle nest in 2010 was 2.5 miles from the Project Area footprint, and not in line of sight of the Project Area. Potential direct effects could include the disturbance of foraging birds by the spinning turbines. Wildlife surveys did not reveal much, if any, foraging activities by golden eagles within the footprint of the Echanis site, thus this type of disturbance is expected to be minimal but would be considered under the BGEPA as "take" (see the discussion in the ABPP/ECP).

Indirect disturbances to golden eagles from the construction and operation of the proposed Project could include an increase or decrease in the golden eagle prey base throughout the Project Area. Changes in vegetation from construction, operation, and maintenance of the Project could decrease the prey populations that are dependent upon such vegetation. Removal and management of vegetation in and around the Project site, as described in the proposed Project Revegetation Plan (Appendix F), could lead to decreased vegetation canopy height and cover for golden eagle prey. Therefore, indirect effects arising from the construction and operation of the Project could indirectly result in golden eagle mortality from an increase in prey and foraging opportunities throughout the Project Area, drawing golden eagles into the area and increasing the opportunity for collisions. Maintenance activities, including the use of Project roads, could also increase the opportunity for collisions of golden eagles with maintenance or construction vehicles and, additionally, indirectly present a risk for golden eagle mortality to those individuals attracted to the road kill if it was not removed.

Alternatively, the same factors might reduce the use of the area by golden eagles, resulting in a decrease in mortality as a result of indirect effects from construction and operation of the Project. As above, effects might result from a decrease in prey base and reduced foraging over the Project Area. Disturbances resulting from the Project from visual obstructions, physical flight obstructions, and noise could decrease the use of the Project Area by golden eagles.

Per Draft Eagle Conservation Guidelines, "Danger Zone Factors," were addressed for the Echanis site as a part of the ECP. The danger zone factors are provided below in bold typeface, with an analysis of the situation at the Echanis site immediately following.

1. Topographic features conducive to slope soaring

a. On or bordering the top of a slope oriented perpendicular to the prevailing wind direction. The entire land mass upon which the Echanis Project is proposed is a gently-sloped fault block that rises from northwest to southeast. Though turbine orientation would be perpendicular to the prevailing wind direction (which is westerly), the slopes to the west of all turbines are gradual, and do not create consistent updrafts that would attract or concentrate eagles.

b. Near (within 164 feet [50 meters]) of a ridge-crest or cliff edge. Though some turbines were originally sited near the eastern rim, all were moved back from that cliff edge because of wildlife concerns.

2. Topographic features that create potential flight corridors

a. In a saddle or low point on a ridge line. Two saddles exist within the Echanis Project, but no turbines are sited in proximity to them.

b. Near a riparian corridor, at a forest or wetland edge, or near shorelines of large water bodies that eagles are reluctant to traverse. This feature does not apply to the Project Area.

3. Proximate to potential foraging sites

a. Near perennial or ephemeral water sources that support a robust fishery or harbor concentrations of waterfowl. These features are not found on the Project Area.

b. Near a prairie dog (Cynomys spp.) colony or area of high ground squirrel density. Belding's ground-squirrel (Urocitellus beldingi) colonies exist in the draws between turbine strings at East Ridge and West Ridge Projects, but turbines are sited far from these concentrations of potential prey. The Echanis Project is apparently at too great an elevation for any concentrations of this, the only colonial rodent species in the region.

c. Near cover likely to support rabbits or hares. Jackrabbits are abundant in the lower elevations to the east and north of the Echanis Project, and likely represent the dominant prey of golden eagles in the area. The Project Area itself, however, does not provide cover for rabbits or hares.

d. Near concentrations of livestock where carcasses and neonatal stock occur. Cattle are not moved to the Project Area until summer, well after calving is complete.

e. Near sources of carrion. No.

f. Near game dumps or landfills. No.

4. Near likely perch structures or roost sites. Naturally-occurring perches are not found in proximity to the proposed turbines.

5. In an area where eagles may frequently engage in territorial interactions

a. At about one-half of the mean project-area inter-nest distance (based on Stage 2 surveys) from an eagle nest site. Golden eagle territories, far from saturating the Project Area, are few and far between. The only meaningful inter-nest distance would be derived from the two nearest nests, and one-half that distance would be approximately 2 miles. Although a few turbines are sited within 2 miles of the nearest nest, they are in a different direction than the next-nearest nest and, thus, away from the areas where territorial interactions would occur.

Several of the concerns raised and discussed during the workshops conducted between the USFWS, ODFW, and BLM during completion of the ECP are addressed below:

- The USFWS expressed concerns about the ability of birds to pass through a "picket fence" of turbines, arrayed perpendicular to the prevailing west winds. The Applicant provided the USFWS detailed calculations and illustrations demonstrating the anticipated "rotor swept area" calculations and the resultant conditions across the site. The information used to calculate the rotor swept area is shown in Figure 3.5-6 below. The results show that the distance between rotor swept areas is approximately 176 meters. An analysis of these data showed that the site presents a low to moderate risk to eagles (See ABPP/ECP in Appendix F).
- The USFWS also expressed concerns about proximity to treed areas, in particular groves of aspen in lower elevation areas near the site. The Applicant provided maps delineating the buffer areas of 328 feet (100 meters) or more on nearly every turbine location.
- The USFWS expressed concerns about seasonal (fall) east winds that might create soaring or "kiting" conditions over the Project Area, prompting migrating raptors to possibly collide with turbines. The Applicant provided the USFWS with three years of data from on site meteorological measuring equipment that measured vertical wind patterns. Those data indicated that the types of conditions that might prompt such behavior occurs infrequently. Further discussions about the phenomenon led to the view that even in circumstances of east winds in fall and early winter months, during raptor migrations, there was nothing about the terrain where turbines would be located to suggest that eagles would be more likely to fly over the Project than over the valley to the east.

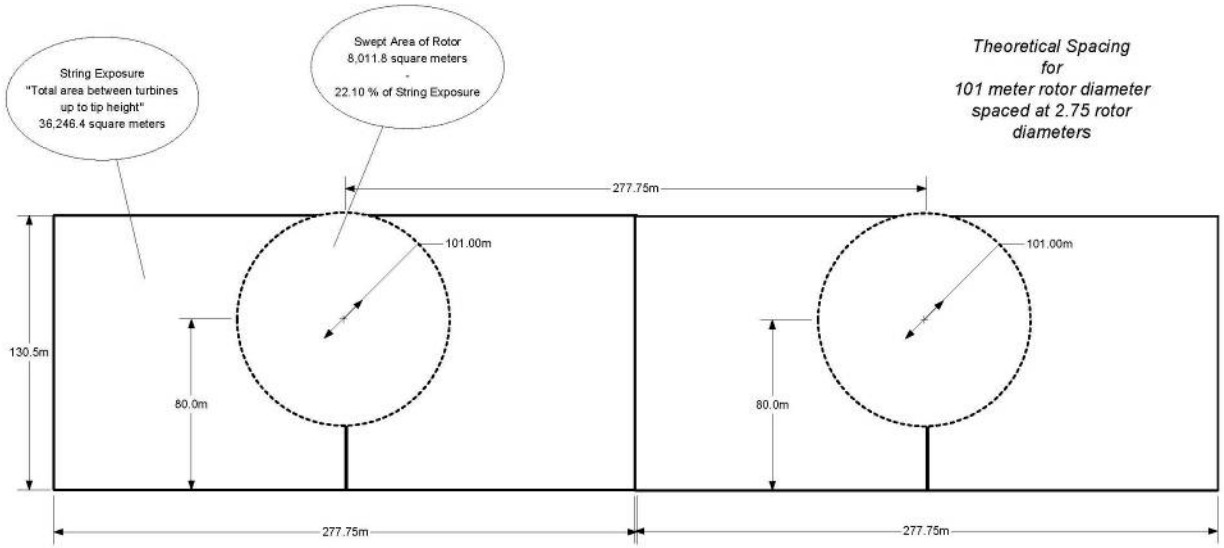

Figure 3.5-6. Calculation of Rotor Swept Area

Estimates were made for the degree of risk to golden eagles at several geographic scales, and considering the direct, indirect, and cumulative effects of the Echanis Project. As part of the process for the determining risk to golden eagles, the Applicant used data collected from the wildlife surveys (see Appendix E) and estimated mean use of the site by eagles. These data were compared to other mean raptor use at other wind turbine locations that also have post-construction mortality data (Table 3.5-18). A comparison of estimates of mean use versus post-construction mortality at these sites resulted in the following linear relationship, $y = 0.1267x + 0.001$ ($R^2 = 0.875$). When this linear relationship was used as a predictor of annual golden eagle mortality at the proposed Echanis Project, the result was 1.7 golden eagles per year (0.016/MW/year x 105MW). When taking into account the uncertainty included in this estimate, this translates into about 0 to 3 golden eagles per year (Echanis 2011).

A majority of the wind projects listed in Table 3.5-18 were constructed on wheat fields and are likely not directly comparable to projects built on native habitat. However, these data provide the best available information when comparing golden eagle mean use and post-construction mortality.

Eagle management by the USFWS is considered adaptive and mediated through the permit process. Take permits have a five-year life. At the end of five years, data accumulated over the previous five years, including eagle nest site occupancy, success, and productivity; eagle site use; and eagle mortality information, is evaluated relative to avoidance, minimization, monitoring, and compensatory mitigation carried out as conditions of the permit. If these measures are considered adequate to result in the USFWS management goal of no-net loss of eagles, either through disturbance or mortality, then it is likely that the permit would be re-issued with the same permit conditions as before. If analyses showed that existing permit conditions were inadequate to result in the USFWS management goal of no-net loss, then permit conditions would be modified to achieve that management goal. This adaptive process ensures that mitigations agreed to in the ABPP/ECP, and included as conditions on the permit, are effective in achieving the USFWS goal of no-net loss of eagles. At the end of the life of the Echanis Project, the turbines would no longer be operational and would be removed, so no raptor mortality would occur as a result of the retired turbines.

Table 3.5-18 Estimates of Raptor Use and Post-Construction Mortality at Various U.S. Wind Turbine Locations

Wind Project	Raptors Use (#/20-min point count)	Raptors Mortality (#/MW/yr)	Source
Combine Hills, OR	0.60	0	Young et al. 2005
Condon, OR	0.37	0.02	Fishman Ecological Services 2003
Elkhorn, OR	0.27	0.02	USFWS data, date unknown
Klondike I, OR	0.47	0	Johnson et al. 2003a
Klondike II, OR	0.47	0.11	NWC and WEST 2007
Leaning Juniper, OR	0.52	0.06	Kronner et al. 2007
Vansycle, OR	0.41	0	Erickson, date unknown
Stateline, WA/OR	0.41	0.09	Erickson et al. 2004
Bighorn I, WA	0.90	0.15	Kronner et al. 2008
Hopkins Ridge, WA	0.64	0.14	Young et al. 2007
Nine Canyon, WA	0.26	0.05	Erickson et al. 2003
Wild Horse, WA	0.40	0.09	Erickson, date unknown
Diablo Winds, CA	3.50	0.39	(reference unknown)
High Winds, CA	2.90	0.43	(reference unknown)

Source: Echanis 2011

PASSERINE AND WOODPECKERS

Six special status passerine and woodpecker species could occur on the Echanis Project site or the main access road Yellow-breasted chat, willow flycatcher, olive-sided flycatcher, black rosy finch, Lewis' woodpecker, and white-headed woodpecker. Each species would spend the majority of their time within the vegetative canopy of forested areas and at flight levels below the rotor-swept area. Therefore, there would be a low likelihood that these species would be affected by collisions with the turbines at the Echanis Project site. Because of their higher rate of occurrence at the Project site during the spring or fall migrations, these species could be at a greater risk of collision with turbines at these times due to higher migration flight patterns.

MOUNTAIN QUAIL

Wind developments are not known to have been constructed in quail habitat, so no records of mortality exist. However, other gamebird species fatalities have been found at wind developments, so it is possible that the Echanis Project could cause a low level of mortality for this species, from collisions with turbines. Quail flights are generally low and predominantly would be below the level of the rotor-swept area. Increased collisions with vehicles from maintenance and other operational traffic could occur, although it would be undetectable.

NORTHERN SAGEBRUSH LIZARD

Northern sagebrush lizard would be susceptible to crushing by vehicles from maintenance operations where access roads traversed suitable sagebrush habitat occupied by the lizard. Elevated levels of vehicle use during maintenance activities would cause an undetectable increase in mortality.

TEMPORARY EFFECTS

FISH RESOURCES

The main access road to the Echanis Project site would cross three creeks (Kiger, Booners, and Mud Creeks) where temporary effects of culvert installation and road widening would cause sediment to enter the creeks