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EARLY ASSESSMENT OF WIND TURBINE LAYOUT IN SUMMIT WIND PROJECT

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Altamont Winds LLC ("AW") requested my assessment of its proposed wind turbine layout as part of its Summit Wind project. The Summit Wind project would replace about 400 KCS56-100 KW wind turbines with about 30 2.1 MW modern wind turbines. I visited the proposed wind turbine sites several times during January through April 2014, each additional time in response to changes made by AW to the project layout, some changes proposed by me to reduce avian hazards. I rated proposed wind turbine addresses for collision hazard, similar to how the Alameda County Scientific Review Committee ("SRC") rated turbines in 2007 through 2009. My ratings differed from the SRC's ratings by not considering collision hazard posed by the status of adjacent wind turbines, because the new turbines will be much farther apart. I also allowed the ratings to vary continuously from 0 (lowest hazard) through 10 (highest hazard). Another difference between my ratings and those of the SRC was that I was more knowledgeable about golden eagle collision risk than I was in 2007 to 2009, as I have since developed predictive models of collision risk, I have validated the models to some extent, and I have since spent many hours observing golden eagle flights in the Altamont Pass Wind Resource Area ("APWRA") as part of directed research to develop improved predictive models.

I am confident that the Summit Wind project will reduce the average number of golden eagle fatalities per year in the APWRA. Only one wind turbine will operate in Summit Wind for every 21 turbines that operated between the 1980s until now. Furthermore, the new wind turbines will shift the rotor–swept areas to higher off the ground, from a range of 9.3 to 33.4 m above ground among the old 100-KW wind turbines with an 18 m rotor diameter on 18.3 m and 24.4 m towers to a range of 41.5 m to 138.5 m above ground among the new wind turbines with a 97 m rotor diameter on 90 m towers. The greater height above ground should reduce collision rates. Also, repowering will provide the opportunity to more carefully site the turbines. Given the experience of the repowered Buena Vista Wind Energy Project and the Vasco Winds Energy Project, there is no reason to expect that Summit Wind will cause the same level or increased golden eagle fatalities. However, repowering cannot prevent all golden eagle fatalities, as the project area is heavily used by golden eagles.

The Summit Wind project area happens to be used intensively by golden eagles for foraging and social interactions. Golden eagles of all age groups fly in this area. Given the level of golden eagle activity in the project area, it should be expected that golden eagles will collide with the new wind turbines in Summit Wind. A bald eagle was also taken by a KCS56-100 turbine nearby the proposed turbine address 25, so there will be some potential for taking additional bald eagles, as well. However, the collision rate in the new project should be lower than it has been since the 1980s, and I believe that I can help minimize the collision rate to the degree possible by helping to site the wind turbines where golden eagles less often fly or less often perform behaviors suspected to associate with collisions.

During my first two visits to the project site, I found some wind turbines were planned where the topography would deflect winds, such as within ridge saddles and at the apices of concave slope features declining to the southwest or northwest (the prevailing wind directions). Deflected (or funneled) winds can destabilize golden eagle flights, and the loss of flight control can contribute to wind turbine collisions. Ridge saddles are also often used as passage points by golden eagles crossing ridges or ridge crests. I recommended that all wind turbines in ridge saddles be relocated, and that wind turbines at the apices of concave slope features declining southwest or northwest be shifted away from the aspect of the slope that faces the deflected winds, if possible.

Some wind turbines were also planned for breaks in slope. I recommended that these turbines be relocated because golden eagles often target breaks in slope for crossing ridge features. Related to breaks in slope as a hazard, I also examined proposed wind turbine sites for likely changes to the local topography that will be caused by grading for access roads and turbine pads. The grading can create breaks in slope, which would be best minimized or avoided by AW. In Table 1, I noted where I thought the grading could create collision hazards.

My recommendations on the initial turbine sites were communicated to AW by telephone because AW often had engineers either in the field or at the planning table making adjustments while I was on site. AW was responsive to my earlier recommendations, having since relocated wind turbines that I initially rated 9, 9.5, and 10. My current recommendations go to the turbine sites as they were planned on 24 March and 8 April 2014 (Table 1). I am certain that this more recent layout would be safer to golden eagles than would have been the layout prior to my site visits and AW's decisions to relocate turbines. However, two of the new sites could take disproportionate numbers of eagles, and those would be 32 and 33.

In Table 1, I also cautioned against sites where the SRC rated old-generation wind turbines high for collision hazard. An example was turbine 19 (as of 24 March 2014), where the SRC rated all of the old turbines on that knoll 8.5 out of 10. In my opinion, a modern wind turbine on that knoll will present less of a hazard to golden eagles than did the earlier wind turbines, but AW will still have to be concerned about how the SRC will react to a wind turbine proposed at this site.

Some of the proposed wind turbine sites were difficult for me to predict golden eagle collision rates. Turbine 19, again, was a good example of a topographic setting that left me wondering what the impact might be. Other examples were turbines 1, 2, 3, 8, and 18. Turbines 8 and 19 were planned for the peaks of knolls, which are where I would normally recommend turbines, but these knolls are lower than the larger ridge structures to the west. Golden eagles crossing the ridges from the west will have had to achieve a minimum altitude to clear the ridge structures, and the subsequent flight paths could put them at the same altitude as the rotor planes of these turbines unless the eagles decide to ascend or descend prior to reaching the turbines. Turbines 1 and 18 are near the intersections of ridge features with larger topographic features just to the north. I suspect that eagles might cross the ridges at these intersections, but I am unsure about the levels of collision risk at these locations. Turbines 2 and 3 are low on the slope, which I normally would recommend against, but these turbines are low on the eastern slope of a large hill. I am unsure about the collision risk posed by these turbines.

Where I am less confident in my risk assessments, the pending collision hazard models might help. My GIS analyst and I are nearly ready to develop map-based collision risk models based on the directed behavior surveys being performed across the APWRA, including at multiple behavior stations located within the Summit Wind project area. We have finished measuring slope attributes in 25 million analytical grid cells overlayed on a digital elevation model of the APWRA, although there are two additional measurements that we agreed should be made. It is possible that we will have a model prepared within the next one to two months. The model will support the locations where my ratings of collision hazard were relatively low, and it will add confidence to hazard predictions applied to other wind turbines.

Where I saw opportunities for safer siting, I made recommendations in Table 1. Another approach to reducing collision hazard would be to use a larger wind turbine so that fewer sites need to be used.

I need to caution that my assessment was focused on golden eagle collision hazards. I made a few notes about potential hazards to red-tailed hawks, but I really did focus on golden eagles.

Bat fatalities could also emerge as an issue, especially around the larger hills at turbine addresses 1 through 4, and Alt30. On the other hand, the old-generation wind turbines might already be taking bats at rates that are similar to rates that would be noticed on the larger pads and access roads of modern wind turbines. More research is needed on bat impacts at old and new wind turbines.

In summary, turbines 17, 32, and 33 will probably be implicated with disproportionate numbers of eagle fatalities due to the terrain settings in which they would be installed. I cannot recommend these sites. Turbine 18 could also be a problem for the same reason, but I remain unsure about it. Turbine Alt28 also poses high collision hazard based on topography, although eagle activity has not been as intense here as at the other turbines already mentioned in this paragraph.

Table 1. Early assessment of proposed wind turbine locations in the Summit Wind project, including hazard ratings and recommendations and comments on the proposed locations. I worked with several site plans as the project layout evolved, but the addresses below refer specifically to the layout of 7 April 2014, which is attached as an Exhibit below.

Address	Rating	Recommendation/Comment
1	7	Within slight break in slope/d/saddle. Move south 20 m.
2	7	Low on slope on east side of large hill
3	8	Knoll by often-used saddle. Move E-SE to max 30 m.
4	5	Gently declining ridgeline. Minimize cut in slope due grading.
5	7.5	Will cut slope of narrow ridge in between saddle (east) and NW concave slope (west). Move upslope 40 to 60 m.
6	7	Near major saddle, though on local crest
7	8	Catches southwest winds
8	7.5	Lower terrain; heavy eagle traffic through here.
9	7.5	Knoll between saddles at apices of concave slopes. Move to 4343 or 4340
10	5	Knoll, but low terrain
11	7	Low terrain near trees; likely problem for red-tailed hawks
12	8	N side of heavily used saddle. Move N to middle of peak.
13	8.5	N side of saddle. Intense eagle activity. Move N to peak.
14	7	Peak, but intense eagle activity here
15	7	Peak, but intense eagle activity here
16	6.5	Local ridge crest, but near major saddle.
17	9.5	Next to saddle that is intensely used by eagles.
18	7	Low terrain near break in slope
19	8.5	Peak downwind of major saddle. Intense traffic through here. All turbines removed from hill were rated 8.5 by SRC.
20	4	No issue.
Alt 20	7.5	Local peak within complex saddles. Move south to knoll.
21	6.5	Local peak between two saddles
22	4	No issue.
23	6.5	Slight grade; will cut into south side of slope
24	5	No issue.
25	5	No issue.
26	6	On peak, but near saddle. Move 20 m south.
Alt 27	8.5	Saddle. Move north to local ridge crest.
Alt 28	9	Break in slope. Move to bench nearer Vasco Rd.
Alt 29	7.5	Near break in slope. Move 10 m north to old pad.
Alt 30	8.5	Apex of SW concave slope and near rock formations and trees.
27	7	Peak, but intense eagle activity here
31	7	Peak, but intense eagle activity here
32	9.5	Low on declining east-west ridge, immediately west of north-south saddle crossing. Intense eagle use observed here.
33	9	Just west of saddle atop SW slope. Intense eagle traffic here.

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EXHIBIT 1: Site Plan