Summit Repower Siting Process - Update to August 23, 2016 and November 10, 2016 reports.

June 29, 2017

Introduction

This document addresses the siting work outstanding as of the November 10th, 2016 siting report, and the November 18th, 2016 and December 20th, 2016 meetings of the Alameda County Wind Repowering / Avian Protection Technical Advisory Committee (AC WR/AP TAC).

Turbine siting work remaining after the November 18th TAC meeting:

- Completion of Dr. Smallwood's avian risk analysis and any adjustment of turbines to reduce potential avian risk.
- Update of shadow flicker, noise, and blade throw studies for the final selected turbine model.
- Confirmation of microwave path avoidance and National Telecommunication and Information Administration (NTIA) clearance.
- Confirmation of turbine setback distances by a California licensed land surveyor.

Avian Risk Analysis

In 2014, Dr. Shawn Smallwood was hired to provide a turbine siting analysis for the project. Dr. Smallwood's report is attached (*Smallwood 081114 Avian report*).

In October, 2016, Dr. Smallwood was contracted by Altamont Winds LLC to complete his avian siting analysis. His report was completed November 8th, 2016 with a December 12th, 2016 addendum. The report and addendum are attached (*Siting Wind Turbines to Minimize Raptor Collisions at Summit Winds Repowering Project, Altamont Pass Wind Resource Area*; and *Report Addendum: Collision Hazard Model Performance*).

Table 11 of the November 8th report, *Micro-siting recommendations directed to Summit Winds turbine layout*, lists turbine sites which overlap hazard classes 3 or 4, and suggests moves and concerns for each turbine site:

Table 11. *Micro-siting recommendations directed to Summit Winds wind turbine layout, where GOEA = golden eagle, RTHA = red-tailed hawk, AMKE = American kestrel, and BUOW = burrowing owl.*

Site	Overlaps hazard class 3 or 4				Suggested move/Concern
	GOEA	RTHA	AMKE	BUOW	
1	No	Yes	No	No	Move 20 to 25 m south
2	No	Yes	Yes	No	None
3	Near	No	No	Near	None
4	No	No	No	Yes	None
5	Yes	Yes	Yes	No	No local move possible; Steep declining slope
6	Yes	Yes	No	No	Too close to saddle
7	Yes	No	Near	No	None
8	Yes	Yes	Yes	No	No local move possible; Depressed knoll near trees heavily used by eagles
9	Yes	No	Yes	No	Knoll between 3 saddles leaving no local moves
10	Yes	Near	Yes	No	Local move likely infeasible
11	No	No	No	No	None
12	No	Near	Near	No	None
13	Yes	Yes	No	No	Move NNW away from saddle
14	No	No	No	No	None
15	No	No	Yes	No	None
16	No	Yes	Yes	No	None
17	No	Yes	Near	No	Move NNW across small saddle; Too close to intensively traversed large saddle
18	No	No	Near	No	Met tower site would be safer, farther from saddle
19	No	No	Near	No	None, but should prevent upwind berm due to grading
20	No	No	No	No	None
21	No	Yes	No	No	None
22	No	Yes	Yes	No	None
27	Near	Yes	Near	No	None
28	Yes	Yes	Yes	No	No better local option; entire ridgeline risky for both eagles and red-tailed hawks
31	Yes	Yes	Yes	No	Intensively used low terrain with no safe local option
32	Yes	Yes	Yes	No	Move 40 m WNW away from saddle; intensively used ridge
33	Yes	Yes	Yes	No	None; Intensively used area
Yes:	11	15	12	1	

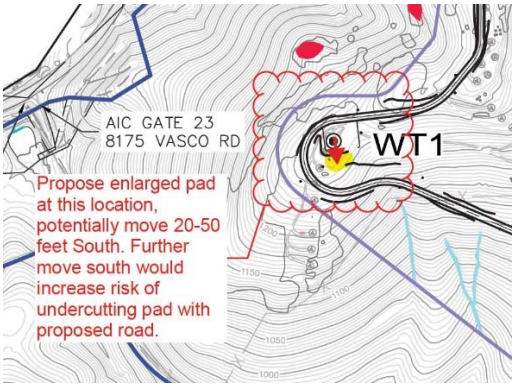
Of the 27 turbine sites; Dr. Smallwood lists no comments or concerns for 13 sites, warns against proposed grading creating an upwind berm at 1 site, lists 8 sites where no move is feasible due to terrain constraints, and suggests making moves to 5 turbine sites in an effort to reduce avian risk.

DK Consulting, the civil engineers for the project, worked to move the 5 turbine locations as close to Dr. Smallwood suggestions as practical considering engineering, setbacks and other design parameters. The 5 sites and resulting moves are shown below:

Turbine site 1:

Dr. Smallwood's suggestion: "Move 20 to 25 meters south."

DK Consulting attempted to move turbine 1 south as recommended. They were only able to move the turbine approximately 50 feet (15.2 meters) south as moving it further would increase the risk of undercutting the proposed pad with the proposed road. See DK Consulting's notes regarding turbine 1 below:

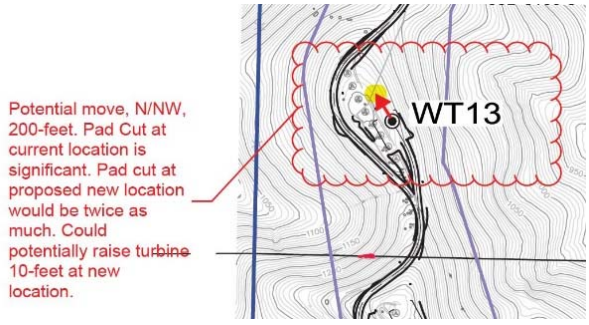


For the full drawing with notes prepared by DK Consulting, see attached, *DK Consulting – Turbine Moves per Shawn Smallwood.* For the final turbine move locations, see attached, *Turbine Road Base Map–1544 (Smallwood Recommended Turbine Moves)*.

Turbine site 13:

Dr. Smallwood's suggestion: "Move NNW away from saddle."

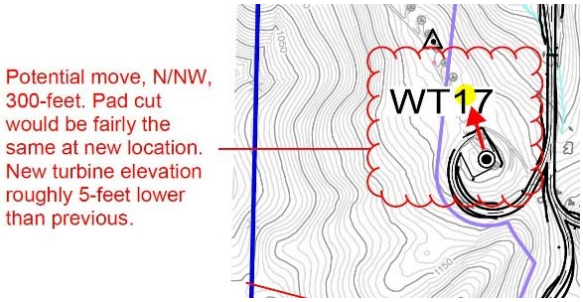
DK Consulting determined that turbine 13 could be moved NNW approximately 200 feet but would require an excavation of twice as large.



Turbine site 17:

Dr. Smallwood's suggestion: "Move NNW across small saddle; too close to intensively traversed large saddle."

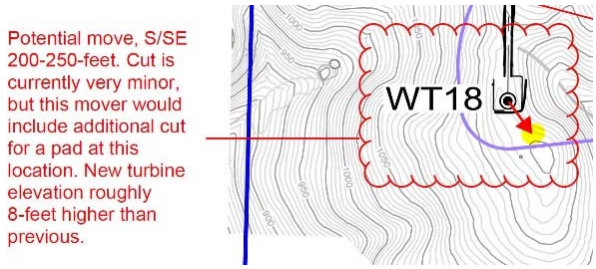
DK Consulting was able to move turbine 17 NNW 300 feet across the small saddle and away from the large saddle.



Turbine site 18:

Dr. Smallwood's suggestion: "Met tower site would be safer, farther from saddle."

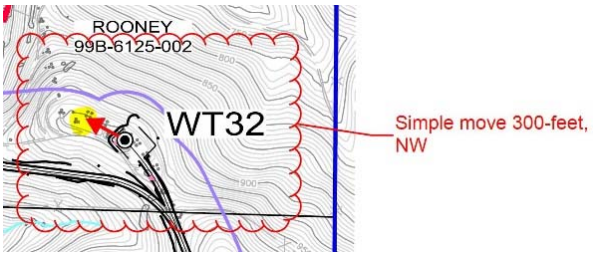
DK Consulting moved turbine 17 SSE approximately 200 feet towards the Met tower location and away from the large saddle. The "dot" is the Met tower.



Turbine site 32:

Dr. Smallwood's suggestion: "Move 40 meters WNW away from saddle; intensely used ridge."

DK Consulting moved turbine 32 approximately 300 feet northwest.



Blade throw, Shadow flicker, and Sound analysis

Blade throw, Shadow flicker, and sound studies have been updated for both the GE 116 2.3-2.5 MW and Vestas V110 2.0-2.2 MW turbines. The Vestas turbine will have a hub height of 95 meters and a rotor diameter of 110 meters. The GE turbine will have a hub height of 90 meters and a rotor diameter of 116 meters. One of these will be the final turbine for the project. Both turbines were studied because final negotiations with the turbine manufactures may not be complete by the TAC meeting.

The studies were done using the 27 CUP approved turbine locations, with the five turbine locations moved by DK Consulting as suggested by Dr. Smallwood, and an alternate location for turbine 20 (Alt20) due to a setback issue with a PG&E ROW uncovered during the boundary survey. The study also modeled the turbines at the proposed elevations as designed by DK Consulting and shown in the grading plans submitted for approval with the Alameda Public Works Agency.

Blade Throw

Epsilon Associates completed a blade throw analysis on April 25, 2017. The purpose of the analysis is to assess potential blade throw distances using common assumptions and determine if, in the rare event a blade is dislodged from a turbine, it could collide with a sensitive receptor (e.g. residence), or passing vehicle, transmission line, or adjacent parcel. The analysis included the Vestas turbine with a 110 meter rotor and a 95 meter hub height, and the GE turbine with a 116 meter rotor and a 90 meter hub height. The analysis included the CUP approved turbine locations along with the alternate locations for the five proposed turbine moves suggested by Dr. Smallwood. Also included is an alternate location for turbine 20 due to a setback issue with a vacant PG&E ROW. The analysis also used the proposed turbine elevations as designed by DK Consulting.

For the Vestas turbines, calculating the maximum throw distance for release of entire blade at the maximum rotor speed, accounting for the maximum elevation drop at each location, conservatively neglecting air resistance, results in a maximum distance (depending on local terrain) between 141 and 163 meters (163 meters = 534.77 feet).

For the GE turbines, calculating the maximum throw distance for release of an entire blade at the maximum rotor speed, accounting for the maximum elevation drop at each location, while conservatively neglecting air resistance, results in a maximum distance (depending on local terrain) between 146 and 173 meters (173 meters = 567.58 feet).

Based on a review of the aerial photography, the maximum blade throw distances will not extend to the traveled roadways in the vicinity of the Project (Altamont Pass Road, Interstate 580, Vasco Road, publicly-accessible sections of Dyer Road and Goecken Road). Similarly, transmission lines in the project area are also beyond maximum blade throw distances for both turbine models, based on available data. Finally, the maximum blade throw distances predicted for each turbine do not extend to the 27 specific residential receptor locations.

See the attached, *Altamont Wind (Summit) – Blade Throw Analysis*.

Shadow Flicker

CH2M Hill, the environmental consultant for the project, completed a shadow flicker analysis for the project on April 13, 2017.

The shadow flicker modeling results represent the greatest predicted shadow flicker exposure from the GE and Vestas turbine models. Consistent with standard industry practice, the number of predicted hours and minutes of flickering on the day with the maximum amount of flickering has **not** been adjusted to take cloud cover into account, providing a worst-case prediction. The predicted number of hours and minutes of solar flicker on an annual basis have been adjusted to reflect cloud cover conditions, providing a more realistic (although still overstated) estimate of potential shadow flicker exposure. None of the 27 receptors are located in the areas of heaviest shadow flicker exposure, and only one (receptor B) is located in an area with more than 30 hours of predicted shadow flickering per year (in the zone with 35.00 to 44.99 hours of predicted annual flicker). Receptor B is the only receptor located in an area where the Alameda County standard for maximum annual shadow flicker exposure of over 30 hours per year has the potential to be exceeded. The total predicted annual shadow flicker at this receptor would be 37 hours and 51 minutes per year. This receptor is located on land under lease from Altamont Winds and is considered a participant of the Project. There are four receptors (receptors A, B, J and T), located in an area where the Alameda County standard for maximum daily shadow flicker exposure of over 30 minutes per day has the potential to be exceeded. Receptors A, B, and T are participants of the project. Receptor J is a non-participant living on Dyer road. Shadow flicker at receptor J can potentially exceed the county ordinance threshold by 1 minute per day. This exceedance can be resolved through a change in the turbine location, height, or through curtailment during time of shadow flicker. Other acceptable resolution can be through mitigation with receptor J's owner, resulting in a waiver.

See attached, *Summit Wind Repower Project Shadow Flicker Analysis*.

Sound

CH2M Hill completed a predicted sound level analysis for the project on April 7, 2017. The turbines modeled were the GE 116 2.3-2.5 MW and Vestas V110 2.0-2.2 MW.

The analysis showed that none of the receptors would experience sound levels exceeding the county ordinance threshold.

See attached, *Summit Wind Repower Project Predicted Sound Levels*.

Microwave Path Avoidance and NTIA Clearance

Microwave Path Avoidance

Comsearch completed a microwave path study on April 14, 2017. The study included the Vestas turbine with a 110 meter rotor and a 95 meter hub height, and the GE turbine with a 116 meter rotor and a 90 meter hub height. The analysis included the CUP approved turbine locations along with the alternate locations for the five proposed turbine moves made by DK

Consulting as suggested by Dr. Smallwood. Also included is an alternate location for turbine 20 (Alt20). The analysis also used the proposed turbine elevations as designed by DK Consulting.

A two-dimensional comparison of the turbine locations with microwave paths through the project site showed one turbine, turbine 21, as possibly intersecting the Fresnel Zone of one microwave path.

Figure 4: Potential Obstruction Cases

The possible obstruction caused by turbine 21 was further examined by Comsearch from a cross sectional perspective. A cross sectional analysis calculates the precise height and width of 100% of the first Fresnel Zone at the turbine location based on the antenna heights of the two link endpoints and the earth curvature bulge at the specific turbine location. The cross sectional analysis incorporated both the Vestas and GE rotor diameters and tower heights.

The cross sectional analysis uses these values to calculate the clearance between the blades and the microwave Fresnel Zone. The results of the cross sectional calculations can be seen in Table 4 below. It shows positive values indicating clearance of the Fresnel zone for both turbine dimensions.

Microwave Link ID	Fresnel Zone Width at Turbine Location (m)	Microwave Centerline Height at Turbine Location (m)	Turbine ID	Hub Height (m)	Blade Length (m)	Cross Sectional Clearance (m)
36	7.92	51.42	21	90	58	7.44
36	7.92	51.42	21	95	55	13.19

Table 4: Cross Sectional Analysis Results

Conclusion:

The study identified 43 microwave paths intersecting the Summit Wind Repower Project area. The Fresnel Zone for these microwave paths were calculated and mapped. One turbine, Turbine 21, was found to intersect the two dimensional Fresnel Zone of path 36. Based on the cross sectional analysis, it was determined that the blades are higher than the beam path and

should clear the Fresnel Zone. Therefore, no turbines will cause obstruction to the microwave system in the area.

See attached, *Wind Power GeoPlanner™, Microwave Study, Summit Wind Repower Project*

NTIA Clearance

The National Telecommunications Information Administration (NTIA) reviewed the plans for the project and provided a letter response on June 8th, 2017. The letter reported one agency, Western Area Power Administration of the Department of Energy, as having potential issues with turbine placement in the project area.

On June 9th, the coordinates for all 27 CUP approved turbine locations, including the alternate locations for the five proposed turbine moves suggested by Dr. Smallwood and the alternate location for turbine 20 (Alt20), were sent to WAPA for review.

The results from WAPA are pending and any changes to the turbine locations required to satisfy WAPA will be reported to the TAC.

See attached, *Summit Wind Project: Alameda & Contra Costa Counties,* CA, National Telecommunications and information Administration, Dated June 8th, 2017.

Confirmation of Setback Distances

DK Consulting, a California licensed engineering and surveying consultant, performed the civil engineering and design of the project. They also performed land surveying work including topographic and boundary surveys. With these surveys, they were able to accurately measure the distances from the CUP approved and alternate turbine locations to property lines, roads, dwellings, hiking trails, and transmission lines to compare setback distances from the turbines.

Two turbines are under consideration for the project: The Vestas V110 turbine with a 110 meter rotor diameter a 95 meter tower height, with a Total Turbine Height (TTH) of 150 meters or 492.12 feet; and The GE 116 turbine with a 116 meter rotor diameter and a 90 meter tower height, with a TTH of 148 meters or 485.56 feet.

In the setback analysis shown below, the Vestas turbine with a greater total turbine height was used where the setback was based on TTH (492.12 feet), and the GE turbine with a larger rotor diameter was used where the setback was based on RL (380.57 feet). Where any setback distance resulted in a distance less than the worst-case predicted blade throw distance by Epsilon Associates (GE at 567.58 feet), the blade throw distance was used as the setback distance.

One setback violation occurs due to the distance between Turbine 11 and Dyer road. The Alternative minimum incorporating difference in elevation results in a distance of 684 feet to gate 12 at the end of Dyer road; while the measured distance is 558.41 feet. Applying the worse-case blade throw distance of 568 feet extends beyond the measured distance by 9.59 feet.

With CDA and TAC approval, the worse-case blade throw distance can be used as the setback and Turbine 11 moved 10 feet away from Dyer Road satisfying the setback requirement.

Turbine 20, as measured by DK Consulting, is 121.57 feet from a vacant PG&E ROW. The alternate location for 20 (Alt20) meets all the setback requirements, creates no shadow flicker, sound, or possible blade throw impacts.

For DK Consulting measurements, see attached, *DK Consulting – Turbine Setback Measurements.*

Setback used shown in Red.

Turbine	General Setback Category	General Setback (x TTH or RL)	Elevation Difference (feet)	Elevation Difference (%)	Elevation Adjusted Setback (feet)	Alternate Minimum Setback (feet)	Blade Throw (GE Turbine = 568 feet)	DK Consulting Measured (feet)
Alt 1	Property Wind CUP	1.1 RL	270	27%	552		568	1092.90
Alt 1	Vasco Road	2.5 TTH (1.25 Alt Min)	390	39%	1422	807		1092.90+
2	Property Wind CUP	1.1 RL	0	0%	419		568	1143.68
3	Recreational Area/Property	1.25 TTH	170	17%	699			1802.63
4	Recreational Area/Property	1.25 TTH	110	11%	670			1202.91
5	Property Wind CUP	1.1 RL	210	21%	522		568	947.46
6	Property Wind CUP	1.1 RL	300	30%	566		568	2062.95
7	Property Wind CUP	1.1 RL	200	20%	517		568	1988.25
8	Property No CUP	1.25 TTH	220	22%	723			1289.77
9	Well within all Setbacks							
10	Property No CUP	1.25 TTH	230	23%	728			1803.89
10	Dwelling (Project participant)	3.0 TTH (1.5 Alt Min)	230	23%	1590	851		1498.99
11	Dwelling (Project Participant)	3.0 TTH (1.5 Alt Min)	100	10%	1526	787		843.71
11	Property No CUP	1.25 TTH	120	12%	674			714.33
11	Dyer Road	2.5 TTH (1.25 Alt Min)	140	14%	1300	684	568	558.41
12	LARPD Trail	2.5 TTH	230	23%	1344			1465.70 +/-
12	LARPD Recreational Area	1.25 TTH	230	23%	729			1356.09
12	Transmission (Dyer Substation)	2.0 TTH (1.0 Alt Min)	110	11%	1039	547	568	742.32
Alt 13	LARPD Trail	2.5 TTH	450	45%	1452			1693.12 +/1
Alt 13	LARPD Recreational Area	1.25 TTH (1.0 Alt Min)	150	15%	689	566	568	649.23
14	LARPD Trail	2.5 TTH	350	35%	1403			1882.94 +/-
14	LARPD Recreational Area	1.25 TTH	140	14%	684			893.55
15	LARPD Trail	2.5 TTH	230	23%	1344			2960.93 +/-
15	LARPD Recreational Area	1.25 TTH	220	22%	723			1367.23
16	LARPD Trail	2.5 TTH	330	33%	1393			2399.05 +/-
16	LARPD Recreational Area	1.25 TTH	80	8%	655			1408.29
Alt 17	LARPD Trail	2.5 TTH	240	24%	1349			1403.46 +/-

Alt 17	LARPD Recreational Area	1.25 TTH	200	20%	714			1063.99
Alt 18	Transmission Line	2.0 TTH (1.0 Alt Min)	40	4%	1004	512	568	914.97
Alt 18	LARPD Recreational Area	1.25 TTH	220	22%	723			1316.43
19	Transmission Line	2.0 TTH	340	34%	1152			1618.56
Alt 20	Transmission Line	2.0 TTH (1.0 Alt Min)	70	7%	1019	527	568	883.30
21	Property No CUP	1.25 TTH	320	32%	773			1406.39
21	Dwelling (Project Participant)	3.0 TTH	490	49%	1718			2396.89
22	Dwelling (Project Participant)	3.0 TTH	400	40%	1673			2039.93
22	Property No CUP	1.25 TTH	190	19%	709			1315.37
22	Altamont Pass Road	2.5 TTH	490	49%	1472			1925.16 +/-
27	Property No CUP	1.25 TTH	60	6%	645			1122.64
28	Property No CUP	1.25 TTH	110	11%	670			792.95
28	LARPD Recreational Area	1.25 TTH	-180	-18%	527		568	905.25
31	Property Wind CUP	1.1 RL	70	7%	453		568	2272.19
Alt 32	Property Wind CUP	1.1 RL	160	16%	498		568	1210.29
33	Property Wind CUP	1.1 RL	100	10%	508		568	977.65
33	Property No CUP	1.25 TTH	80	8%	655			1587.01

Adopted Alameda County Turbine Setback Requirements

Affected Land Use or Corridor	General Setback	Setback Adjustment for Turbine Elevation Above or Below Affected Use[a]	Alternative Minimum[b]
Adjacent parcel with approved wind energy CUP[c]	1.1 times rotor length ***(159 feet x 1.1=175 feet for the Project)***	1% TTH added or subtracted per 10ft. of turbine elevation, respectively, above or below affected parcel	50% of general setback
Adjacent parcel without approved wind energy CUP	1.25 times TTH ***(454 feet x 1.25=568 feet for the Project)***	1% TTH per 10ft. above or below affected parcel	1.1 times rotor length
Adjacent dwelling unit	3 times TTH ***(454 feet x 3.0=1,362 feet for the Project)***	1% TTH per 10ft. above or below affected unit	50% of general or elevation differential setback
Public road (including I-580), trail, commercial or residential zoning	2.5 times TTH ***(454 feet x 2.5=1,135 feet for the Project)***	1% TTH per 10ft. above or below affected right-of-way	50% of general setback with report by qualified professional, approved by Planning Director
Recreation area or property	1.25 times TTH ***(454 feet x 1.25=568 feet for the Project)***	1% TTH per 10ft. above or below affected property	TTH
Transmission line[d]	2 times TTH ***(454 feet x 2.0=908 feet for the Project)***	1% TTH per 10ft. above or below path of conductor line at ground level	50% of general setback with report by qualified professional, approved by Planning Director

Notes:
TTH = total turbine height: the height to the top of the rotor at 12:00 position. Setback distance to be measured horizontally from center of tower at ground level.
[a] The General Setback based on TTH will be increased or reduced, respectively, based on whole 10-ft. increments in the ground elevation of the turbine above or below an affected parcel, dwelling unit, road right of-way, or transmission corridor conductor line. Any portion of a 10-ft increment in ground elevation will be disregarded (or rounded down to the nearest 10-ft interval).
[b] *Alternative Minimum* refers to a reduced setback standard, including any adjustment for elevation, allowed with a notarized agreement or an easement on the affected property, subject to approval of the Planning Director.
[c] No setback from parcel lines is required within the same wind energy CUP boundary. Knowledge of proposed wind energy CUPs on adjacent parcels to be based on best available information at the time of the subject application.
[d] Measured from the center of the conductor line nearest the turbine.

Attached References

Summit Repower Siting Process, Altamont Winds LLC, August 23, 2016.

Summit Repower Siting Process – Update to August 23, 2016 Report, Altamont Winds LLC, November 10, 2016.

Smallwood 081114 Avian report, Prepared by Shawn Smallwood, August 11, 2014.

Siting Wind Turbines to Minimize Raptor Collisions at Summit Winds Repowering Project, Altamont Pass Wind Resource Area; and *Report Addendum: Collision Hazard Model Performance*). Prepared by Dr. Shawn Smallwood, November 8, 2016.

Smallwood Siting Report Addendum 12-12-16

Turbine Road Base Map–1544 (Smallwood Recommended Turbine Moves), Prepared by DK Consulting, June 21, 2017.

DK Consulting – Turbine Moves per Shawn Smallwood, Prepared March 2, 2017.

Altamont Wind (Summit) – Blade Throw Analysis, Prepared by Epsilon Associates, April 25, 2017.

Summit Wind Repower Project Shadow Flicker Analysis, Prepared by CH2M Hill, April 13, 2017.

Summit Wind Repower Project Predicted Sound Levels, Prepared by CH2M Hill, April 7, 2017.

Wind Power GeoPlanner™, Microwave Study, Summit Wind Repower Project, Prepared by Comsearch, April 14, 2017.

Summit Wind Project: Alameda & Contra Costa Counties, CA, National Telecommunications and information Administration, Dated June 8th, 2017.

DK Consulting – Turbine Setback Measurements, Prepared by DK Consulting, January 31, 2017.