

ARTICLE

WIND POWER COMPANY COMPLIANCE WITH MITIGATION PLANS IN THE ALTAMONT PASS WIND RESOURCE AREA

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I. INTRODUCTION	230
II. MITIGATION RECOMMENDATIONS BY INDEPENDENT SCIENTISTS	233
A. Orloff and Flannery (1992)	233
B. Smallwood and Thelander (2004, 2005)	235
C. Smallwood and Spiegel (2005a)	238
D. Smallwood and Spiegel (2005a) on Repowering	242
III. MITIGATION PLANS	243
A. Windfarm Five Year Review Conditions (1993)	243
B. Altamont Avian Plan (Richard Curry Assocs. 1997)	246
C. Repowering EIR (Alameda County 1998)	250
D. Conditional Use Permit for Diablo Winds Repowering (2003)	255
E. Buena Vista Wind Energy Project	257
1. Proposed Installation (Certified EIR)	259
2. Mitigation Measures in Biological Resources Chapter.	261
3. Avian Collision Monitoring Plan Referenced in EIR	264
4. California Attorney General Settlement Agreement.	265
F. Renewal of CUPs in 2003 for Old-generation Wind Turbines ...	269
G. Alameda County Permit Conditions of September 2005	270
H. Settlement Agreement of November 2006	274
IV. CONCLUSIONS	282

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I. INTRODUCTION

Wind power generation is developing rapidly worldwide. As a source of renewable energy, wind power is viewed by many as an attractive alternative to fossil fuels and as a source of energy that can help reduce atmospheric carbon dioxide emissions. At sites with suitable winds, substrates, and transmission infrastructure, secondary environmental barriers to wind power generation include aesthetic viewshed and biological impacts. The most widely recognized biological impacts are bird and bat collisions with wind turbine blades. Other biological impacts include bird and bat electrocutions on the power collection system; collisions with guy-wires used to support meteorological towers; habitat loss caused by construction of access roads and tower pads; and habitat loss caused by wind turbine avoidance behaviors.¹

On the other hand, secondary environmental barriers present problems only if wind power generation is restricted by policy decisions to limit the impact of wind energy projects. These policy decisions usually rely on past experience with operational wind power projects and are sometimes spawned by public concern over past projects. California's Altamont Pass Wind Resource Area ("APWRA") in Alameda and Contra Costa Counties represents an often cited example of the potential concerns inhibiting large-scale public acceptance and political support of wind energy. While critics often express fears that proposed wind power projects might repeat the APWRA experience in which large numbers of birds were killed, proponents of wind energy characterize the APWRA as an isolated example of adverse biological impacts. Therefore, it is instructive to examine the measures taken to reduce bird mortality caused by energy-generating wind turbines at the APWRA and to determine whether the mitigation plans implemented at the APWRA have resulted in restricted power generation. The objective of this paper is to review the various mitigation plans proposed or required in the APWRA in order to: (1) identify trends in compliance (or noncompliance); (2) assess the potential effectiveness of such measures; and (3) suggest how mitigation plans might be formulated to more effectively minimize or reduce biological impacts.

The APWRA is permitted for up to 580 megawatts ("MW") of rated capacity, including more than 5,000 old-generation wind turbines ranging in rated capacity from 40 to 400 kilowatts ("KW") each, as well as two repowered projects with thirty-one Vestas V47 660-KW turbines and thirty-eight Mitsubishi 1 MW turbines. The repowered projects replaced several hundred older turbines from 2004 to 2006.² The APWRA

1. See S. ORLOFF & A. FLANNERY, CAL. ENERGY COMM'N, WIND TURBINE EFFECTS ON AVIAN ACTIVITY, HABITAT USE, AND MORTALITY IN ALTAMONT PASS AND SOLANO COUNTY WIND RESOURCE AREAS ix (1992).

2. K. S. SMALLWOOD & L. NEHER, CAL. ENERGY COMM'N, REPOWERING THE APWRA:

generates only a fraction of its rated capacity but has killed thousands of birds belonging to at least seventy-four different species, as well as at least three species of bats. Of the seventy-four bird species affected, sixty-eight are protected by the Migratory Bird Treaty Act; one by the Bald and Golden Eagle Protection Act; and eighteen by the California Fish and Game Code.³ One species is listed as endangered under the federal Endangered Species Act; three are listed as threatened or endangered under the California Endangered Species Act; fifteen are listed as California Species of Concern; and four are listed as California Fully Protected.⁴

The APWRA represents a particularly useful focus for this paper because it has been in operation since the 1980s and has generated most of the publicly-funded and independent scientific research on bird collisions with wind turbines in the United States. The California Energy Commission (“CEC”) funded the initial investigations that identified the bird collision problem in the APWRA.⁵ The CEC then funded additional projects, including a large-scale study of bird collisions and bird utilization in the APWRA from 1989 to 1991;⁶ part of a long-term study of Golden Eagles in the area;⁷ a large-scale bird collision and behavior study from 2001 to 2003;⁸ and subsequent studies and assessments performed by this author and his colleagues.⁹ The National Renewable Energy Laboratory

FORECASTING AND MINIMIZING AVIAN MORTALITY WITHOUT SIGNIFICANT LOSS OF POWER GENERATION 1 (2004), available at <http://www.energy.ca.gov/2005publications/CEC-500-2005-005/CEC-500-2005-005.PDF>.

3. See Bald and Golden Eagle Protection Act, 16 U.S.C. §§ 668–668d (2000); Migratory Bird Treaty Act, 16 U.S.C. §§ 703–15 (2000 & Supp. 2004); CAL. FISH & GAME CODE § 3503.5 (West 2007) (regarding birds of prey); K. S. SMALLWOOD & C. G. THELANDER, NAT’L RENEWABLE ENERGY LAB., BIRD MORTALITY AT THE ALTAMONT PASS WIND RESOURCE AREA, MARCH 1998–SEPTEMBER 2001 29 (2005) [hereinafter BIRD MORTALITY AT THE APWRA], available at <http://www.nrel.gov/docs/fy05osti/36973.pdf>.

4. Endangered Species Act 16 U.S.C. §§ 1531–44 (2000 & Supp. 2004); California Endangered Species Act, CAL. FISH & GAME CODE §§ 2050–97 (West 2006); see BIRD MORTALITY AT THE APWRA, *supra* note 3, at 29.

5. See generally J. ESTEP, CAL. ENERGY COMM’N, AVIAN MORTALITY AT LARGE WIND ENERGY FACILITIES IN CALIFORNIA: IDENTIFICATION OF A PROBLEM 4–6 (1989) (documenting avian collision and electrocution incidents at wind energy facilities in California).

6. See generally ORLOFF & FLANNERY, *supra* note 1, at ix (evaluating the extent and significance of the impact of wind turbines on birds in the APWRA).

7. See generally W. GRAINGER HUNT, CAL. ENERGY COMM’N, GOLDEN EAGLES IN A PERILOUS LANDSCAPE: PREDICTING THE EFFECTS OF MITIGATION FOR WIND TURBINE BLADE-STRIKE MORTALITY (2002), available at http://www.energy.ca.gov/reports/2002-11-04_500-02-043F.PDF (reporting on a long-term study of golden eagles in the Diablo Mountains of west-central California).

8. See generally K. S. SMALLWOOD & C. G. THELANDER, CAL. ENERGY COMM’N, DEVELOPING METHODS TO REDUCE BIRD MORTALITY IN THE ALTAMONT PASS WIND RESOURCE AREA 8 (2004) [hereinafter DEVELOPING METHODS TO REDUCE BIRD MORTALITY IN THE APWRA], available at http://www.energy.ca.gov/reports/500-04-052/2004-08-09_500-04-052.PDF (reporting on a four-year research effort on bird mortality in the APWRA).

9. See K. S. SMALLWOOD & L. SPIEGEL, CAL. ENERGY COMM’N, ASSESSMENT TO SUPPORT AN ADAPTIVE MANAGEMENT PLAN FOR THE APWRA (2005) [hereinafter ASSESSMENT TO SUPPORT AN ADAPTIVE MANAGEMENT PLAN], available at <http://www.biologicaldiversity.org/swcbd/programs/bdes/altamont/CEC-assessment-mitigation-plan.pdf>; K. S. SMALLWOOD & L. SPIEGEL, CAL. ENERGY

(“NREL”) also funded a large-scale study of bird collisions and behaviors in the APWRA from 1998 to 2001,¹⁰ as well as earlier research on the Golden Eagle population.¹¹ In the meantime, wind power companies hired their own consultants to perform studies.¹² Through such public and private research efforts, much has been learned about bird collisions with wind turbines in the APWRA. The review of mitigation plans presented in this Article should also reveal the degree to which scientific knowledge has contributed to reducing bird mortality.

Researchers of APWRA bird collisions have recommended various mitigation plans, often repeating specific measures. After Orloff and Flannery (1992) recommended some of the earliest measures, Richard Curry Associates (1997) presented a mitigation plan that the wind power companies (“the Companies”) operating in the APWRA agreed to implement.¹³ In 2003, Smallwood and Thelander provided the Companies

COMM’N, COMBINING BIOLOGY-BASED AND POLICY-BASED TIERS OF PRIORITY FOR DETERMINING WIND TURBINE RELOCATION/SHUTDOWN TO REDUCE BIRD FATALITIES IN THE APWRA (2005) [hereinafter COMBINING BIOLOGY-BASED AND POLICY-BASED TIERS], available at http://designwithccp.net/alt/alt_doc/third_cec_assessment_of_mitigation_plan_060105.rtf; K. S. SMALLWOOD & L. SPIEGEL, CAL. ENERGY COMM’N, PARTIAL RE-ASSESSMENT OF AN ADAPTIVE MANAGEMENT PLAN FOR THE APWRA (2005) [hereinafter PARTIAL RE-ASSESSMENT OF AN ADAPTIVE MANAGEMENT PLAN], available at http://www.altamontsrc.org/alt_doc/cec_032505_partial_re_assessment_of_an_amp_for_apwra_acctg_for_turbine_size.pdf; K. S. SMALLWOOD & L. NEHER, CAL. ENERGY COMM’N, REPOWERING THE APWRA: FORECASTING AND MINIMIZING AVIAN MORTALITY WITHOUT SIGNIFICANT LOSS OF POWER GENERATION (2004), available at <http://www.energy.ca.gov/2005publications/CEC-500-2005-005/CEC-500-2005-005.PDF>.

10. See generally BIRD MORTALITY AT THE APWRA, *supra* note 3 (researching the causal relationships between wind turbines and bird mortality in the APWRA).

11. See generally PREDATORY BIRD RESEARCH GROUP, UNIVERSITY OF CALIFORNIA, A POPULATION STUDY OF GOLDEN EAGLES IN THE ALTAMONT PASS WIND RESOURCE AREA: POPULATION TREND ANALYSIS 1994–1997 iv (1999), available at <http://www.nrel.gov/docs/fy99osti/26092.pdf> (providing a detailed discussion of the data and findings of a four year study of the golden eagle population in the APWRA).

12. See, e.g., Judd A. Howell, *Bird Mortality at Rotor Swept Area Equivalents, Altamont Pass and Montezuma Hills, California*, 33 TRANSACTIONS OF THE W. SECTION OF THE WILDLIFE SOC’Y 24, 29 (1997); JUDD A. HOWELL & JOSEPH E. DIDONATO, U.S. WINDPOWER, INC., ASSESSMENT OF AVIAN USE AND MORTALITY RELATED TO WIND TURBINE OPERATIONS, ALTAMONT PASS, ALAMEDA AND CONTRA COSTA COUNTIES, CALIFORNIA, SEPTEMBER 1988 THROUGH AUGUST 1989 4 (1991); PAUL KERLINGER & RICHARD CURRY, ALTAMONT OWNERSHIP CONSORTIUM, ANALYSIS OF GOLDEN EAGLE AND RED-TAILED HAWK FATALITIES ON ALTAMONT OWNERSHIP CONSORTIUM PROPERTY WITHIN THE ALTAMONT WIND RESOURCE AREA (AWRA) (1997) (unpublished report) [hereinafter ANALYSIS OF GOLDEN EAGLE AND RED-TAILED HAWK FATALITIES]; PAUL KERLINGER & RICHARD CURRY, ALTAMONT INFRASTRUCTURE CO., THE RELATIONSHIP OF GOLDEN EAGLE (*AQUILA CHRYSAETOS*) AND RED-TAILED HAWK (*BUTEO JAMAICENSIS*) COLLISION FATALITIES IN THE ALTAMONT PASS WIND RESOURCE AREA OF CALIFORNIA TO GROUND SQUIRREL MANAGEMENT PRACTICES: 1989–2002 (2003); WEST, INC., WILDLIFE MONITORING AT ALTAMONT PASS, WINTER 05–EARLY FALL 06: PRELIMINARY DRAFT RESULTS ii (2006), available at http://www.altamontsrc.org/alt_doc/apwra_prel_mon_rpt.pdf.

13. See RICHARD CURRY ASSOCS., ALTAMONT AVIAN PLAN: STATUS REPORT TO THE U.S. FISH AND WILDLIFE SERVICE BY THE CONSORTIUM OF ALTAMONT OWNERS 3 (1997) [hereinafter ALTAMONT AVIAN PLAN], available at http://www.altamontsrc.org/alt_doc/r45_altamont_avian_plan_report_dec_1997_w_appendices.pdf.

and regulatory agencies with a list of mitigation recommendations in advance of their 2004 report.¹⁴ Representing the CEC, Smallwood and Spiegel also provided the Altamont Working Group with three additional assessments of measures and recommendations in 2005.¹⁵

The remainder of this paper will review proposed and required mitigation plans to reduce bird mortality in the APWRA, starting with suggestions from independent scientific researchers. Additionally, this paper will note whether the measures were implemented and will discuss their overall effectiveness. These notes are based on the author's personal involvement with the stakeholder groups, his time in the field, and his involvement in multiple research and planning efforts.¹⁶ The following review lists the recommended and required mitigation measures in the outline format in which they were originally presented. For those plans lacking an alpha-numeric listing of specific measures, individual measures are bulleted. The original wording is used as much as practical but is sometimes modified for brevity while attempting to maintain the meaning and intent of the original text. Each set of recommended or required mitigation measures is followed by a discussion of the outcome, which details the known results of the measures implemented as well as their likely effectiveness within the context of currently known bird collision mechanisms.

II. MITIGATION RECOMMENDATIONS BY INDEPENDENT SCIENTISTS

A. Orloff and Flannery (1992)

Researchers have suggested various means to reduce mortality in the APWRA since 1992. For instance, Orloff and Flannery (1992) originally recommended that the following experimental measures be applied to those wind turbines documented as having killed disproportionately more raptors as compared to other bird species:

14. See generally DEVELOPING METHODS TO REDUCE BIRD MORTALITY IN THE APWRA, *supra* note 8.

15. ASSESSMENT TO SUPPORT AN ADAPTIVE MANAGEMENT PLAN, *supra* note 9, at 1–2.

16. After performing research in the Altamont Pass Wind Resource Area from 1999 to 2003, in 2005 Smallwood worked for G3 Energy and enXco to prepare their second Environmental Impact Report (“EIR”) for the Buena Vista Wind Energy project, for which Smallwood recommended mitigation measures. Later that year, he consulted with the California Office of the Attorney General while it negotiated a settlement with the owners of Buena Vista Wind Energy project (which had become Babcock & Brown) for a mitigation plan to replace the plan previously certified but not fully implemented by the Contra Costa County Board of Supervisors. Smallwood was nominated to the Alameda County Scientific Review Committee to guide the County's 2005 mitigation plan and monitoring, and from 2004 to the present, he has performed research under contract with the CEC's Public Interest Energy Research program on the APWRA bird mortality issues. His knowledge of what has been done in the APWRA is based on eye-witness observations, countless personal communications with knowledgeable individuals, and both published and unpublished documents.

- Paint blades of the last three turbines in the row either yellow or in a spiral pattern to increase blade visibility to raptors and birds;¹⁷
- Exclude cattle from a 77 meter radius area around turbines to discourage near-turbine habitation by ground squirrels, which might attract raptors and hence distract them from the turbines while diving to attack squirrels;¹⁸
- If the above measures prove ineffective, install sound devices to disorient raptors with either intermittent emissions, or emissions triggered by remote detection of an approaching raptor to prevent habitation;¹⁹
- Search 200 of the turbines immediately following storms or fog inundation to determine if weather contributes to fatalities;²⁰
- Install video cameras to record collisions;²¹
- Perform Geographic Information System (“GIS”)²² analysis of fatality data to identify topographic associations with mortality;²³
- Obtain wind turbine attributes from wind power companies to test for patterns between fatalities, rotor speed, and blade configuration;²⁴ and
- Obtain data on turbine operation time from wind power companies to test for any links between fatalities and the percentage of time each turbine operated.²⁵

Orloff and Flannery also suggested off-site compensation in the form of purchasing conservation easements or fee title commensurate with the loss of life, followed by habitat enhancements to increase the habitat’s carrying capacity.²⁶ They felt this measure was necessary because it would

17. ORLOFF & FLANNERY, *supra* note 1, at 5-5.

18. *Id.* Orloff and Flannery also recommended against using poison to control ground squirrels for fear of secondary poisoning of raptors. *Id.*

19. *Id.* at 5-6.

20. *Id.*

21. *Id.* at 5-7.

22. “GIS is a computer software program, similar to a relational database management system, that can manage, maintain, and manipulate spatially-referenced data.” ORLOFF & FLANNERY, *supra* note 1, at 5-7.

23. *Id.*

24. *Id.* at 5-8.

25. *Id.* at 5-8.

26. *Id.* at 5-8 to 5-9.

be many years before effective mitigation would be available to reduce raptor mortality.²⁷ Finally, Orloff and Flannery suggested donating funds annually to local rehabilitation centers to support their efforts to rehabilitate injured birds.²⁸

Outcome.—Fifteen years after Orloff and Flannery’s recommendations, only the video camera installation has been implemented—and only incompletely at that.²⁹ Kennetech Windpower, Inc. (“Kennetech”) hired a group of ornithologists, who installed video cameras to detect bird collisions with turbines during the mid-1990s; however, Kennetech abandoned the effort after it filed for bankruptcy.³⁰ There is no published record regarding whether the cameras recorded any collisions.³¹

Other measures such as painting the turbine blades, excluding cattle, and installing sound devices might have reduced raptor mortality, but unfortunately, the true positive impact of these measures, if any, remain unknown. Off-site compensation alone would not have reduced mortality, but such efforts may have protected and increased the extent of habitat elsewhere. The post-storm turbine search, video camera installations, GIS analysis, and other pattern and collision-linking analyses set forth above are investigatory measures and, therefore, would not have directly reduced raptor mortality. Instead, they would have vastly improved existing knowledge of raptor collisions and, perhaps, knowledge concerning how to reduce such collisions, as well. If the Companies had supplied Orloff and Flannery with turbine output data, and if they had supplied Smallwood and Thelander with these data in later studies as requested, subsequent analyses of fatality associations with measured predictor variables would have been much clearer.

B. Smallwood and Thelander (2004, 2005)

After four years of research funded by NREL and CEC, Smallwood and Thelander recommended replacing the old-generation wind turbines with modern turbines, a process referred to as “repowering.”³² Doing so would create the opportunity to carefully site the turbines in safer locations in the future and would place the lowest reach of the blades above the flight patterns of certain raptor species found to be highly susceptible to turbine

27. ORLOFF & FLANNERY, *supra* note 1, at 5-9.

28. *Id.*

29. Richard C. Curry & Paul Kerlinger, *Avian Mitigation Plan: Kenetech Model Wind Turbines, Altamont Pass WRA, California*, NATIONAL AVIAN-WIND POWER PLANNING MEETING III 20 (1998), available at http://www.nationalwind.org/publications/wildlife/avian98/04-Curry_Kerlinger-Altamont.pdf.

30. *Id.* at 19.

31. *Id.* at 20.

32. DEVELOPING METHODS TO REDUCE BIRD MORTALITY IN THE APWRA, *supra* note 8, at 4.

collisions.³³ Smallwood and Thelander recommended that certain measures be implemented experimentally because of their potentially high cost and uncertain effectiveness.³⁴ In the event that regulators or the Companies decided not to repower the APWRA, Smallwood and Thelander recommended the following mitigation measures, which will also appear in some mitigation plans reviewed later:

Priority Group 1:

- Cease the rodent control program, because the program actually increased the mortality among some species, did not affect the mortality of others, and jeopardized certain endangered species relying on the rodents being controlled;³⁵
- Acquire conservation easements off-site;³⁶
- Replace the Wildlife Reporting and Response System (“WRRS”)³⁷ monitoring approach with a more scientifically defensible monitoring method;³⁸
- Experimentally install flight diverters at end-row turbines;³⁹
- Experimentally paint blades using the Hodos scheme, which uses a highly reflective paint and involves a pattern of one black blade and two white blades;⁴⁰
- Remove broken and non-operating wind turbines;⁴¹
- Relocate selected, highly dangerous wind turbines;⁴²
- Install wind turbine designs beneficial to the APWRA bird fatality issue;⁴³ and
- Retrofit power poles to American Powerline Interaction

33. *Id.* at 308.

34. *Id.* at 348.

35. *Id.* at 334.

36. *Id.* at 347.

37. WRRS is a system that “relies on volunteer reporting of bird carcasses discovered by turbine workers during routine but unsystematic maintenance or repair services, and is therefore not a scientific sampling program.” DEVELOPING METHODS TO REDUCE BIRD MORTALITY IN THE APWRA, *supra* note 8, at 333.

38. *Id.*

39. *Id.* at 344.

40. *Id.* at 345. *See generally* W. HODOS, MINIMIZATION OF MOTION SMEAR: REDUCING AVIAN COLLISIONS WITH WIND TURBINES 18 (2003), available at <http://www.nrel.gov/wind/pdfs/33249.pdf>.

41. DEVELOPING METHODS TO REDUCE BIRD MORTALITY IN THE APWRA, *supra* note 8, at 345.

42. *Id.* at 346.

43. *Id.*

Committee (“APLIC”) standards to prevent electrocutions.⁴⁴

Priority Group 2:

- Reduce the vertical and lateral edge in slope cuts and nearby roads, because these disturb soils and attract fossorial mammals which select such land conditions when constructing burrows;⁴⁵
- Move rock piles away from wind turbines, because they attract raptors expecting to find potential prey living in the rocks;⁴⁶
- Experimentally exclude cattle from wind turbines to determine whether the resulting stature of taller vegetation discourages raptor foraging near wind turbines, and whether the raptor food-base in cattle dung is relocated farther from the turbines;⁴⁷
- Retrofit tower pads to prevent under-burrowing by small mammals;⁴⁸
- Experimentally install accelerometers to learn when to shut down wind turbines;⁴⁹ and
- Implement the means to effectively monitor the power output of wind turbines.⁵⁰

Outcome.—Nearly 10% of the APWRA’s permitted capacity was repowered between 2004 and 2006, though there are no plans to repower most of the remaining 580 MW of permitted capacity. The Companies purportedly ceased participation in the rodent control program, but such claims have not been verified. One company painted the blades of forty-two turbines in the recommended pattern but did not utilize the reflective paint recommended by Hodos. At least some power poles were retrofitted to reduce electrocution risk to raptors, but the total number of poles that meet the APLIC standards remains unknown. Other than these limited and questionable implementations of the recommended measures, none of the remaining measures were implemented.

44. *Id.* at 347. See generally EDISON ELEC. INST., AVIAN POWER LINE INTERACTION COMM., SUGGESTED PRACTICES FOR RAPTOR PROTECTION ON POWER LINES: THE STATE OF THE ART IN 1996 (1996).

45. DEVELOPING METHODS TO REDUCE BIRD MORTALITY IN THE APWRA, *supra* note 8, at 335.

46. *Id.*

47. *Id.* at 336.

48. *Id.* at 339.

49. *Id.* at 346.

50. DEVELOPING METHODS TO REDUCE BIRD MORTALITY IN THE APWRA, *supra* note 8, at 347.

Smallwood and Thelander (2004) estimated that their recommended measures could reduce raptor mortality by 20% to 40% if implemented universally, rather than experimentally.⁵¹ Smallwood and Spiegel (2005a) were more optimistic, estimating that a select assortment of these measures, combined with a winter shutdown of turbines, could reduce raptor mortality by 50% while an aggressive implementation of these measures could reduce mortality by 85%.⁵²

C. Smallwood and Spiegel (2005a)

The Altamont Working Group met between 2004 and 2005 to debate mitigation needs and the potential effectiveness of proposed measures. The meeting resulted in a series of proposed adaptive management plans prepared by the Companies' consultant, WEST, Inc. Smallwood and Spiegel responded with assessments concerning the effectiveness of the Companies' proposed plans.⁵³ The WEST, Inc. plans were largely adopted by Alameda County on September 22, 2005.⁵⁴ The following list summarizes mitigation measures recommended by Smallwood and Spiegel to achieve the goal of 50% mortality reduction within three years, based upon the estimates set forth by Smallwood and Thelander (2004):

Immediate Implementation

- Selectively relocate or shutdown certain operating turbines;⁵⁵
- Shut down wind turbines during the winter;⁵⁶
- Cease the rodent control program;⁵⁷
- Retrofit electric distribution poles to APLIC standards;⁵⁸
- Move artificial rock piles down the slopes and at a distance of at least 200 meters away from the wind turbines;⁵⁹

51. *Id.* at 354.

52. ASSESSMENT TO SUPPORT AN ADAPTIVE MANAGEMENT PLAN, *supra* note 9, at 3, 9.

53. *Id.* at 1; *see* WEST, INC., *supra* note 12, at ii.

54. *See infra* Part III.G.

55. ASSESSMENT TO SUPPORT AN ADAPTIVE MANAGEMENT PLAN, *supra* note 9, at 3–9. Wind turbines were classified into tiers of priority for shutdown, using three rating systems summarized in three reports. These ratings relied on factors associated with the collision-caused fatalities of four focal raptor species: Golden Eagle, Red-tailed Hawk, American Kestrel, and Burrowing Owl. Smallwood and Spiegel (2005c) recommended that turbines in Tiers 1, 2, and 3 be shut down or relocated.

56. *Id.* at 9–11. Initially suggested by the Companies, Smallwood and Spiegel recommended that all of the turbines be shut down from November 1st to February 28th because power generation was relatively low during this period while raptor mortality was relatively high.

57. *Id.* at 11.

58. *Id.*

59. *Id.*

2008]

WIND POWER COMPANY COMPLIANCE

239

- Retrofit the tower pads so that they cannot be under-burrowed by rodents and rabbits;⁶⁰
- Move turbine or tower parts and equipment away from wind turbines;⁶¹
- Remove derelict wind turbines;⁶²
- Remove superfluous meteorological towers;⁶³
- Establish a system for implementation of off-site compensatory mitigation measures;⁶⁴ and
- Perform scientific monitoring of fatalities, behaviors, and relative abundance.⁶⁵

If a 50% reduction in mortality has not been achieved within three years, the following measures must be implemented:

Contingency Measures

- Shift raptor foraging away from turbines by managing grazing activities, thereby reducing visual exposure of prey to raptors out to 50 meters from the wind turbines;⁶⁶
- Install flight diverters at end-row turbines, using a design upon which raptors cannot perch;⁶⁷ and
- Utilize the Hodos blade painting scheme on 25% of new turbines in repowering projects.⁶⁸

Outcome.—Table 1 summarizes Smallwood and Spiegel’s estimates concerning the effectiveness of each proposed measure and whether it was implemented. The implementation of some of these measures will be discussed in greater detail in the reviews of monitoring plans to follow. The wind turbines classified into Tiers 1, 2, and 3 operated until the summer of 2007, and some continue to operate. During the winters of 2005–2006 and 2006–2007, most of the Companies experimented with a

60. ASSESSMENT TO SUPPORT AN ADAPTIVE MANAGEMENT PLAN, *supra* note 9, at 12.

61. *Id.* Equipment and parts are piled near some wind turbines throughout the APWRA, and the piles harbor rabbits and ground squirrels, which in turn attract large raptors.

62. *Id.*

63. *Id.*

64. *Id.* at 13–15. Estimated or predicted mortality levels could be used to assess a per-kilowatt hour fee to be paid into an interest-bearing account for the purpose of conserving raptor habitat elsewhere.

65. ASSESSMENT TO SUPPORT AN ADAPTIVE MANAGEMENT PLAN, *supra* note 9, at 16.

66. *Id.*

67. *Id.*

68. *Id.* at 17.

half-winter shutdown but not a full-winter shutdown.⁶⁹ Two small repowering projects were installed, but other than the decision of one company to install a single end-row flight diverter in late 2007, no evidence exists to verify that the wind power companies actually implemented the other measures recommended by Smallwood and Spiegel.

Mitigation Measure	GOEA	RTHA	MAKE	BUOW	Implemented?
Relocation of select turbines	H	H	H	H	No
Seasonal shutdown	H	H	H	H	Partially
Cease rodent control	M	M	L	M	Yes*
Retrofit distribution poles	L	M	L	L	Yes*
Move rock piles	U	M	L	M	No
Retrofit tower pads	M	M	L	L	No
Move parts & equipment	M	M	L	H	No
Remove derelict turbines	U	M	M	L	No
Remove superfluous meteorological towers	L	L	L	M	Unknown
Off-site compensation	M	M	M	M	No
Monitoring plan	H	H	H	H	Yes
Grazing management	M	M	M	H	No
Blade painting	U	U	U	U	No
Bird flight diverters	H	M	U	H	No
Repowering	H	H	H	H	Partially

Table 1: Summary of estimated effectiveness of recommended mitigation measures directed at old-generation wind turbines, and whether the measures were implemented since the 2005 assessments, where GOEA = golden eagle, RTHA = red-tailed hawk, AMKE = American kestrel, BUOW = burrowing owl, H = high effect, M = medium effect, L = low effect, and U = unknown.⁷⁰ These assessments are estimates, and only a few can be estimated quantitatively.

With regard to the combined impact of permanently shutting down selected APWRA turbines and shutting down the remainder of the turbines during the winter, the likely effectiveness of these measures was expressed as the estimated annual fatalities in the APWRA, F_{C} , and was calculated as:

69. For a description of the Companies' shutdown experiments, see *infra* Part III.E-F, H.

70. ASSESSMENT TO SUPPORT AN ADAPTIVE MANAGEMENT PLAN, *supra* note 9, at 18. It has not been independently verified that the Companies have implemented the measure.

Equation 1⁷¹

$$F_{-C} = ((F_{4074} - F_C) \div F_{4074}) \times F_{APWRA} ,$$

where the fatalities documented at the shutdown turbines, F_C , were subtracted from those among the 4,074 turbines that were searched, F_{4074} , and F_{APWRA} was the estimated annual number of fatalities with no wind turbine shutdowns (Smallwood and Thelander (2004)). The annual number of fatalities remaining after permanent and winter-time shutdowns, $F_{-C, -w}$, was calculated as:

Equation 2⁷²

$$F_{-C, -w} = F_{-C} - \left(F_{-C} \times p \times \frac{O_w}{E_w} \right),$$

where p was the proportion of the year that the turbines were shutdown—0.146 for one-half of the winter and 0.292 for the entire winter—and O_w and E_w were the observed and chi-square expected number of birds killed during winter. The percentage reduction of fatalities predicted by shutting down select turbines permanently and all others during a portion of the winter was calculated as:

Equation 3⁷³

$$\text{Percent fatality reduction} = (F_{APWRA} - F_{-C, -w}) \div F_{APWRA} \times 100\% .$$

For this exercise, the annual fatalities were those composing the upper end of the uncertainty range reported in Smallwood and Thelander (2004). This approach did not factor in the relative abundance of birds. The resulting point estimates are summarized in Table 2.

Raptor mortality might be reduced by about 54% by permanently shutting down turbines in Tiers 1, 2, and 3 and shutting down the remainder of the turbines during the entire winter. These shutdowns would sacrifice

71. This equation accounts for the expected reduction in raptor fatality if chosen turbines are permanently shut down. Accordingly, if there are no fatalities recorded at the now shut down turbines ($F_C = 0$), the estimated annual fatalities will be unaffected by the permanent shut down of the selected turbines. At the other extreme, if all the fatalities of the 4,074 turbines searched were recorded at the shut down turbines ($F_{4074} = F_C$), then the annual raptor fatality would be reduced to zero as a result of the permanent shut down.

72. This Equation accounts for the additional reduction in raptor fatality if certain turbines are shut down during the winter time.

73. This equation translates the estimated number of the reduction in raptor fatality ($F_{-C, -w}$) into an annual percentage reduction.

about 17% of the rated capacity of the APWRA. Besides repowering, these selective and seasonal shutdowns are probably the most effective mitigation measures that could be taken to reduce bird mortality in the APWRA.

Raptor Species and Power Output	% Reduction due to Wind Turbine Shutdowns of Tiers:							
	1	1 & 2	1-3	1-4	1-2	1-3	1-2	1-3
					Half winter		Full winter	
Golden eagle	8	19	39	50	28	48	41	57
Red-tailed hawk	4	14	28	39	29	42	47	56
American kestrel	14	18	30	42	32	47	53	63
Burrowing owl	0	9	9	23	22	25	39	41
All Raptors	7	15	27	38	29	41	45	54
All Birds	3	8	15	27	22	30	37	44
MW rated capacity	1	3	7	13	8	9	16	17

Table 2: Estimated mortality reductions due to permanent shutdowns of turbines in tiers of collision risk and winter-time shutdown of the remaining turbines.⁷⁴

D. Smallwood and Spiegel (2005a) on Repowering

For repowering projects, Smallwood and Spiegel (2005) recommended the following measures:

- “Shut down and lock the blades of wind turbines during the winter and late fall months;
- Avoid placing wind turbines near the bottoms of ravines or valleys;
- Avoid placing wind turbines on slopes exposed to the prevailing winds, and favor slopes that tend to be leeward to the prevailing winds;
- Avoid placing turbines on steep slopes;
- Avoid placing turbines in ridge saddles;
- Use tower heights and rotor diameters that minimally maintain a distance of 29 [meters] between the ground and the lowest reach of the rotor plane;
- Deploy turbines with the Hodos et al. painting scheme unless and until field research determines it is ineffective;

74. The author uses equations 1, 2, and 3 above to estimate fatality reduction percentages that will result from half-winter or full-winter shut down of turbines in Tiers 1 through 4.

2008]

WIND POWER COMPANY COMPLIANCE

243

- Cluster the turbines as much as is practical, and avoid isolating turbines;
- Do not pile rocks near turbines, and do not store turbine parts, towers, or equipment near turbines;
- Install tower pads less likely to be sought by burrowing animals for cover, and spread gravel around the pad out to 5 feet to deter small mammals;
- Do not perform rodent control within the project area;
- Minimize vertical and lateral edge in the construction of the tower laydown area;
- Underground all electric distribution lines;
- If meteorological towers are necessary, use towers that do not require guy wires for support; . . .
- Require removal of non-operating or derelict turbines, as well as their towers within 30 days they cease operating (except, of course, intentional seasonal shutdowns) [and]
- A working group should be established to review the monitoring plan, the monitoring results, and periodically review the adaptive management plan.⁷⁵

Outcome.—Rather than summarizing the level of implementation of these measures here, the details will be discussed later under the reviews of the Diablo Winds and Buena Vista repowering projects.⁷⁶

III. MITIGATION PLANS

A. *Windfarm Five Year Review Conditions (1993)*

Apparently responding to Orloff and Flannery's recommendations, the Windfarm Five Year Review Conditions of 1993 ("the Five Year Review") provided the earliest evidence of mitigation planning to reduce bird mortality.⁷⁷ The stated intent was to modify previously imposed conditions or to add new conditions eliminating raptor collisions with wind turbines.⁷⁸ The Five Year Review envisioned a Tri-County Mitigation Compliance Monitoring Program led by Alameda County that might include such

75. ASSESSMENT TO SUPPORT AN ADAPTIVE MANAGEMENT PLAN, *supra* note 9, at 17.

76. *See infra* Part III.D–E.

77. *See* ALAMEDA COUNTY, WINDFARM FIVE YEAR REVIEW CONDITIONS 1–10 (1993) [hereinafter WINDFARM FIVE YEAR REVIEW].

78. *Id.* at 1.

measures as painting wind turbine blades, fitting specific turbines with noise-emitting devices, installing perimeter fencing, amending reporting standards affected by the wind farm company's permit, or other measures.⁷⁹ The review stated that "[a]ny condition modified or added shall be of the same force and effect as if originally imposed."⁸⁰ The Five Year Review called for the following measures:

"3.To mitigate avian injury and mortality due to collisions, the wind developer shall participate in the Tri-County's Mitigation Compliance Monitoring Program which includes, but may not be limited to filing wildlife injury reports as necessary and submitting fees to hire a consultant that will prepare a permanent compliance monitoring program to oversee compliance with existing and proposed mitigation measures, [Environmental Impact Report ("EIR")] and General Plan as stated below.

In the event of avian injury or mortality in or around the windfarm site:

- a) The wind developer shall be responsible for filing a wildlife injury report with the U.S. Fish and Wildlife Service and Zoning Administrator within 3 days of discovery. The wind developer shall file the report in the form outline in Exhibit B.
- b) In the case of an injury, the wind developer shall also be responsible for contacting one of the following organizations within 3 hours to provide immediate veterinary care for the injured animal within 24 hours of discovery:
 - i) The Department of Fish and Game, Region 3;
 - ii) Five Mile Creek Raptor Center; or
 - iii) Nearest qualified wildlife rehab center or specialist as approved by the U.S Fish and Wildlife Service.

The compliance monitoring fee shall be computed based on the number of wind turbines built and operated by each developer. The fee computation and use of the fees shall be as follows:

- a) (number of turbines) x (\$30 per turbine per year for one year) = (\$ developer's proportional contribution to the Compliance Monitoring Program)
- b) At the option of the County (*based on a recommendation from the Avian Windfarm Advisory Committee*), the County may collect an additional fee (up to \$30 per turbine) to complete the Tri-County's Mitigation Compliance Monitoring Program Study. The combined fee shall not exceed \$60 per turbine.

79. *Id.*

80. *Id.*

2008]

WIND POWER COMPANY COMPLIANCE

245

- c) Use of the fees by the County shall be limited to the following:
- i) Hiring consultants to prepare a permanent windfarm Mitigation Compliance Monitoring Program, EIR and General Plan update;
 - ii) Funding the remaining portion of the Tri-County study on 'Wind Turbine Effects on Avian Activity, Habitat Use and Mortality'. This amount shall not exceed \$10,000; and
 - iii) Reimbursement of the actual costs for county administration of the Tri-County Mitigation Monitoring Program Study.
- d) Funds which are collected shall be deposited in an interest-bearing account that will be established for the purpose stated above;
- e) If the fees in subsection (a) are imposed as of the effective date of this action, the total yearly fee shall be paid in accordance with the following schedule: 40% of the total fee due 3 months from the effective date of this action; 30% of the total fee due 6 months from the effective date of this action; and 30% (the remaining balance) of the total fee due 9 months from the effective date of this action.
- f) Upon completion of the study creating the permanent compliance monitoring program, where the actual amount of the study differs from the estimate used to compute the funds deposited by the wind developer, the computation shall be adjusted subject to paragraph b) above and additional funds deposited, or refunded to the wind developer according to their pro-rata share of the remaining deposit or balance due. The wind developer shall be allowed 6 months to deposit any additional fees with the County. The County shall be allowed 45 days after the study and related EIR are accepted by the Board of Supervisors to refund any fees up to collected under this condition.

Failure to act in compliance with this condition will be construed as a violation of Zoning and enforcement proceedings shall commence as provided for by Section 8-90.3 of the Zoning Ordinance.”⁸¹

Additionally, the Five Year Review requires that electrocution shall be mitigated by retrofitting electric distribution poles.⁸²

81. WINDFARM FIVE YEAR REVIEW, *supra* note 77, at 1-3.

82. *Id.* at 4-5. Retrofits will be made to poles with riser elements, top transformers, capacitor banks, and metering sets by insulating all jumper wires with a minimum 5 KV rating; covering all exposed terminals with wildlife boots or equivalent approved by Zoning Administrator; using nonconductive material for all straight combination arms on riser poles (aluminum type material

Outcome.—Fatality reports were generated and provided to the U.S. Fish and Wildlife Service (“USFWS”), but it is not verified whether the reports reached the Zoning Administrator or that the reports were timely submitted. As of 2004, all injured birds were being taken to Lindsay Wildlife Hospital, where nearly all were euthanized.⁸³ Of the fifty-two raptors delivered to the Hospital during 2004–2006, forty-nine were euthanized; one died on its own; and the fate of two is unascertained.⁸⁴ It remains unknown whether the General Plan was updated or whether the fee was paid. There is no evidence that the Companies established a Technical Advisory Committee (“TAC”) or that they developed a Mitigation Compliance Monitoring Program. No EIR was prepared for the operation of the old-generation wind turbines. The injury reports, the fee, the compliance monitoring program, and the EIR each would have reduced raptor mortality only if effective remedial actions were taken in response.

The NREL and CEC research team observed that some electric distribution poles were retrofitted between 1998 and 2003, but despite such efforts, some of the poles remained unsafe. In 2007, at least two companies were actively retrofitting riser poles as the result of a 2006 settlement agreement with various Audubon and environmental groups.⁸⁵ Adequate pole retrofits would have prevented most electrocutions. Orloff and Flannery attributed the cause of death of 8% of the raptors to electrocution.⁸⁶ A decade later, Smallwood and Thelander identified electrocution as a contributing cause of only nine out of 688 (approximately 1.3%) of avian deaths, suggesting progress in reducing electrocutions.⁸⁷ It is unknown whether the Companies submitted a verification letter to the Zoning Administrator regarding pole retrofits.

B. Altamont Avian Plan (Richard Curry Assocs. 1997)

In December 1997, the Consortium of Altamont Owners (“the Consortium”) submitted a status report to the USFWS concerning their May 1997 plan to reduce avian fatalities attributable to collisions with wind

prohibited); and bonding of pole-top devices on nonconductive arms using insulated wire. Poles with electrocution history shall be modified on case by case basis within thirty days from electrocution event. New overhead power lines shall be installed to standards equal or exceeding those just described. New lines shall comply with PG&E standard #061149 Raptor-Protected Primary Construction Wood Pole Distribution Lines. Within forty-five days from the effective date of the Zoning Administrator’s action, the wind developer shall submit a letter confirming the overhead electrical lines were modified as required on January 16, 1991, or the permit shall be in violation of zoning and enforcement proceedings shall commence. *Id.*

83. E-mail from Joan Stewart, Altamont Infrastructure Co., Fla. Power & Light Co., to Gina Bartlett, Alameda County SRC (Mar. 23, 2007) (on file with author).

84. *Id.*

85. For a detailed discussion of the settlement agreement, see *infra* Part III.H.

86. ORLOFF & FLANNERY, *supra* note 1, at x, 3-44.

87. BIRD MORTALITY AT THE APWRA, *supra* note 3, at 56.

turbines (“Altamont Avian Plan”).⁸⁸ The Consortium was comprised of ESI Bay Area, Inc.; WPP87, L.P.; ENIVEST, Inc.; Mountain Energy; Energy Investors Fund; and Kennetech Windpower, Inc.⁸⁹ While a new owner acquired Kennetech just before the Coalition issued its findings, the status report stated that the new owner would assume responsibility for plan implementation as part of its purchase agreement.⁹⁰ The Altamont Avian Plan included the following observations and strategies:

- WRRS continued unabated with monthly reports to USFWS of fatalities discovered by wind turbine maintenance personnel;⁹¹
- By the date of the Altamont Avian Plan, 131 of the 165 designated poles had been retrofitted, and by year’s end 157 riser poles and eight dip poles should be retrofitted for raptor safety;⁹²
- WRRS data was used to complete the first quantitative analysis of Golden Eagle and Red-tailed Hawk fatalities in the wind farm to identify risky turbines and topographic situations;⁹³
- By early Spring 1998, install telephone poles in the immediate vicinity of twenty-eight turbines suspected of causing flight-related fatalities in order to alert birds of additional obstacles to fly around, thereby creating buffers between flying birds and turbines; also install perch guards on end-row turbines, as well as alternative perches if perching is common in the area;⁹⁴
- Starting April 1999, paint blades of KCS56-100 turbines

88. ALTAMONT AVIAN PLAN, *supra* note 13, at 3.

89. *Id.*

90. *Id.*

91. *Id.* at 4.

92. *Id.* at 4–5. Dip poles are those located on either side of underground distribution lines. *Id.* at 5. Retrofits were to consist of replacing five KV jumper wires with fifteen KV insulated wire, insulating all underground cables of fused cut-out risers so that concentric ground wires are not exposed, insulating metal T-end sections on the fiberglass cross-arms of fused cut-out risers, correcting any potential pathway from terminal connections, grounding, bonding wires or ineffective boots, reorienting fused cut-outs to increase the distance between components, and removing some of the existing PVC perch deterrents on fiberglass T-mounts of fused cut-out risers and the main cross-arm of switched risers. *Id.*

93. ALTAMONT AVIAN PLAN, *supra* note 13, at 5.

94. *Id.* at 5–6 (citing ANALYSIS OF GOLDEN EAGLE AND RED-TAILED HAWK FATALITIES, *supra* note 12). According to Kerlinger and Curry, APWRA turbines located at the ends of rows, the edges of gaps in rows, or located in topographical dips or notches accounted for 68% of Golden Eagle deaths as well as 60% of Red-tailed Hawk deaths in WRRS. Kerlinger and Curry concluded many of the fatalities were flight related. ANALYSIS OF GOLDEN EAGLE AND RED-TAILED HAWK FATALITIES, *supra* note 12.

according to the results of research conducted at Boise State University;⁹⁵

- By March 1998, install four types of perch guards on 152 wind turbines/towers, including a polyester mesh that will cover the turbine platform like a shroud; a one-half inch galvanized wire hardware cloth positioned to prevent perching on lattice tower cross-members four and five; a galvanized four-by-four inch wire mesh, eighteen to twenty-four inches wide, affixed six inches above cross member three; and an electrical wire strung nine inches above cross-member three to shock birds attempting to perch on the tower;⁹⁶
- Conduct pre-treatment behavioral observations in November and December of 1997, amounting to sixty hours per site (180 total hours);⁹⁷
- Conduct post-treatment behavioral observations in January and February of 1998, amounting to sixty hours per site (180 total hours);⁹⁸
- Encourage as many owners as possible to participate in the Alameda County ground squirrel control program for five or more years to ensure consistency in application and conformance with the County permit and California Department of Fish and Game (“CDFG”) guidelines, and assist with the removal of killed squirrels remaining above-ground (squirrels poisoned by diphacinone—an anticoagulant—often die in their burrows);⁹⁹ and
- Implement the overall plan in five years, and employ adaptive management to modify the program as needed.¹⁰⁰

Outcome.—The following elements of the Altamont Avian Plan have been implemented: (1) submission of WRRS reports to the USFWS; (2) retrofitting of power poles;¹⁰¹ (3) analysis of WRRS data; (4) a limited installation of perch guards on towers; (5) pre and post-treatment observations of raptor flights (though there has been no report of post-

95. ALTAMONT AVIAN PLAN, *supra* note 13, at 7.

96. *Id.* at 7–10.

97. *Id.* at 10.

98. *Id.*

99. *Id.* at 12–13.

100. ALTAMONT AVIAN PLAN, *supra* note 13, at 14.

101. The riser poles were supposed to have been retrofitted in January 1991, and by 1993, enforcement action was threatened if the poles were not retrofitted. FIVE YEAR REVIEW, *supra* note 77, at 5.

treatment observations or flight patterns);¹⁰² and (6) a ground squirrel control program. However, these elements are unlikely to reduce raptor mortality significantly. The WRRS reports would decrease raptor mortality only if the analysis led to effective remedial actions. In this case, the analysis was not peer-reviewed or otherwise circulated among interested scientists. Further, there is little evidence of subsequent remedial action other than a rather limited installation of wire mesh perch guards around certain cross-members and turbine catwalks. In 2002–2003, the CEC researchers noted 185 of 2,363 towers examined were fitted with wire mesh, but Smallwood and Thelander found no reduction of mortality at these turbines.¹⁰³ Raptors appear to perch on turbines while they are not operating; therefore, perch guards on functional turbines are unlikely to reduce mortality.

The ground squirrel control program began in 1997, but in 2002, the USFWS and CDFG insisted that it be terminated because the public did not review the program pursuant to California Environmental Quality Act (“CEQA”). After learning of the program, the regulatory agencies expressed concern over the program’s impacts on threatened, endangered, and other sensitive species that rely upon ground squirrel burrows.¹⁰⁴ The agencies were also concerned with secondary poisoning of raptors and the potential for raptor habitat loss in the event that the program succeeded in eradicating ground squirrels from the APWRA. Smallwood and Thelander (2004) found that, for a minority of species, the program may have slightly reduced mortality, but for most, it had no positive effect. In fact, for several species, the program may have increased mortality.

The flight deterrent element of the Altamont Avian Plan was not implemented, as no telephone poles were installed during the NREL and CEC studies. Smallwood and Thelander (2004) proposed a similar flight deterrent measure that likely would have reduced raptor mortality. However, the strategy of providing alternative perches located away from the turbines would have produced relatively insignificant results. After all, raptors already have literally thousands of perches from which to choose in the APWRA, and many raptors choose to perch on the ground. While two alternative perches were installed in the APWRA, Smallwood witnessed only one instance of a raptor actually utilizing an alternative perch in 2007.

102. See generally PAUL KERLINGER & RICHARD CURRY, ALTAMONT INFRASTRUCTURE CO., ANALYSIS OF FLIGHT PATTERNS AND PATHWAYS OF GOLDEN EAGLES AND RED-TAILED HAWKS IN RELATION TO WIND TURBINES AND TOPOGRAPHY IN THE ALTAMONT PASS WIND RESOURCE AREA (AWRA) OF CALIFORNIA 2 (1999) (researching the flight patterns of raptors within the wind plant).

103. DEVELOPING METHODS TO REDUCE BIRD MORTALITY IN THE APWRA, *supra* note 8, at 339–40.

104. Such endangered or sensitive species include the San Joaquin Kit Fox, the California Red-legged Frog, the California Tiger Salamander, and the Burrowing Owl.

C. Repowering EIR (Alameda County 1998)

In 1998, Alameda County certified its EIR for repowering the APWRA.¹⁰⁵ This EIR covered both Alameda and Contra Costa Counties, although Alameda County served as the lead agency. The County revoked the permits after three years due to Company inaction toward repowering. Regardless, later project applicants regarded the 1998 Repowering EIR as a programmatic EIR and tiered into it. The Repowering EIR provided for the following measures:

Limitation on Development

- Because no data exist to indicate how turbine size, rotor diameter, or rotor-swept areas influence wind turbine-caused bird mortality, it appears wind turbines simply act to obstruct raptor movements. Therefore, the average replacement ratio of six old turbines for every new turbine will reduce mortality.¹⁰⁶

Design Standards

- **Maximum Rotation Speed.** Because collision risk increases with the maximum rotation speed of turbine,¹⁰⁷ replacing old turbines operating at 50 to 72 revolutions per minute (“rpm”) with new turbines operating at 20 to 28 rpm will reduce mortality. The maximum rpm of new turbines shall not exceed 35 rpm.¹⁰⁸
- **Tubular Towers.** To prevent perching, all new turbines must have tubular towers with no perchable surfaces or appendages.¹⁰⁹
- **Interior Tower Access.** To prevent perching, no new turbines will have ladders mounted outside towers.¹¹⁰
- **Perch-Proof Nacelles.** To prevent perching, all new turbines will have nacelles with no appendages, edges, or ancillary features that can provide perching.¹¹¹

105. See ALAMEDA COUNTY, REPOWERING A PORTION OF THE ALTAMONT WIND RESOURCE AREA: FINAL ENVIRONMENTAL IMPACT REPORT (1998) [hereinafter 1998 EIR].

106. *Id.* at 13–14.

107. See generally V.A. Tucker, *A Mathematical Model of Bird Collisions with Wind Turbine Rotors*, 118 J. SOLAR ENERGY ENG'G 253 (1996) (describing a model for predicting avian collisions with wind turbine blades), available at http://www.altamontsrc.org/alt_doc/vance_tucker_rsa_published_papers.pdf.

108. 1998 EIR, *supra* note 105, at 14.

109. *Id.* at 14–15.

110. *Id.* at 15.

111. *Id.*

- **Guy Wires.** No new turbines will be supported by guy wires, though guy wires will be permitted to support meteorological towers.¹¹²
- **Electrical Lines.** Power lines will be located underground where feasible. All new low voltage lines (480–690 volts (“V”)) and medium voltage lines less than 1000 feet in length will be located underground. All aboveground wires will be greater or equal to 4/0 in size in order to improve visibility.¹¹³
- **Utility Poles.** Upgrade existing utility poles to reduce electrocutions.¹¹⁴ All new poles shall incorporate the specifications for existing poles and will also comply with PG&E Standard #061149, Raptor-Protected Primary Construction of Wood Pole Distribution Lines. Riser poles will not have cut-outs, and jumper leads must be oriented vertically to discourage raptors from perching on them.¹¹⁵

Siting Standards

- Turbines will not be sited on slopes greater than 25%, unless approved by the TAC.¹¹⁶
- No turbines will be within a dip or notch if the cross-axis of the ridge is less than 300 feet wide and the slope along the cross-axis has a gradient of less than 25%.¹¹⁷
- No turbines will be in a dip or notch if it converges with a draw or canyon.¹¹⁸

112. *Id.*

113. 1998 EIR, *supra* note 105, at 15–16.

114. *Id.* at 16–18. Upgrades include sufficient insulation to all jumper wires, wildlife boots or other insulating materials will cover any exposed terminals, insulated wire will be used in bonding pole-top devices mounted on nonconductive arms, and grounded exposed brackets will be located twenty-four vertical or forty-eight lateral inches from energized devices. Additionally, all underground cables of fused cut-out risers will be insulated so concentric ground wires are not exposed, metal T-end sections on fiberglass cross-arms of fused cut-out risers will be insulated, corrections to potential pathway form terminal connections, grounding, bonding wires, or ineffective wildlife boots, and reorient fused cut-outs to increase inter-component distances. Lastly, upgrading will also include installation of perch deterrents where necessary, and where fatalities continue, removal of perch deterrents and increase insulation.

115. *Id.* at 17–18.

116. *Id.* at 20.

117. Dip expresses the depression or saddle along the linear axis of a ridge whose lowest point is twenty-five feet or greater below the highest adjacent point along the linear axis of the ridge within 150 feet. The side slopes of a dip are a 17% or greater gradient, where the horizontal of the slope angle is six times greater than the vertical component. Notch describes the depression or saddle along the linear axis of a ridgeline with a side slope gradient of 25%. *Id.* at 19–20.

118. 1998 EIR, *supra* note 105, at 19. Draw depicts the depression or saddle along linear axis of ridge with a side slope gradient of 33%. Canyon describes the depression or saddle along linear axis of

- No turbines will be in the dip or notch that is in line with another dip or notch on a parallel ridge in the direction of wind currents.¹¹⁹
- At dips or notches, turbines will not be within a space of 200 feet on either side of the dip or notch in order to maintain 400 or more feet between tower locations.¹²⁰

Monitoring

- **Short-term Monitoring.** Perform two years of pre- and post-project bird use and mortality surveys. For projects that cannot provide two years of pre-construction use surveys, an appropriately selected reference site will be assigned for general performance of evaluations regarding relative changes in bird behavior, mortality, and risk due to repowering.¹²¹
- **Raptor Use Surveys.** Perform raptor use surveys during sessions lasting at least one hour at each observation point throughout the project area, three times per season for two years (twenty-four sessions per observation point). In order to account for observer bias, surveyors must practice estimating heights and distances of turbines, power poles, and rotors each month. Observers will record counts of all ground squirrels and rabbits visible within 360 degrees.¹²²
- **Raptor Mortality Surveys.** Perform raptor mortality surveys within sixty-two meters of the wind turbines, three times per season for two years (twenty-four surveys per turbine). Long-term monitoring shall consist of reporting all fatalities to WRRS, as well as searcher detection and scavenger removal trials used to adjust mortality estimates derived from long-term monitoring. Perform a blind test of the WRRS system a minimum of once every five years during the permit period.¹²³
- **Monitoring Schedule.** Short-term monitoring of raptor use and mortality must commence immediately following installation and operation of the new turbines. Long-term monitoring must also commence immediately, and extend

ridge with a side slope gradient of 50%.

119. *Id.* at 20.

120. *Id.*

121. *Id.* at 21.

122. *Id.* at 22.

123. 1998 EIR, *supra* note 105, at 23.

throughout the permit period.¹²⁴

- **Monitoring Reports.** Annual monitoring reports will be submitted to the County, the USFWS, and the CDFG, summarizing raptor use surveys, raptor mortality surveys, environmental factors affecting results, and including a description of any remedial actions taken.¹²⁵

Assessment of Avian Mortality

- Alameda and Contra Costa Counties will form an avian TAC, consisting of avian and planning experts with no more than two representatives each from Alameda and Contra Costa County Planning Departments, USFWS, CDFG, and individual wind plant operators. The TAC will meet at least annually, will assign causes of death to bird carcasses, and will advise the Counties on the need for remedial measures.¹²⁶

Remedial Measures

- Wind turbines determined to cause a disproportionate number of fatalities shall prompt a remedial response. Though the list is not exclusive, such remedial measures may consist of one of the following:
 - (1) Installation of structures or devices around turbines to avert avian impacts;
 - (2) Retrofitting turbines with markings, devices or other measures to avert collisions;
 - (3) Enhancing off-site nesting locations to promote raptor reproduction; or
 - (4) Removing non-project turbines identified as disproportionately responsible for fatalities.¹²⁷

Refinement of Standards

- Siting and design standards would be adjusted in the future based on continuing fatalities, the success or failure of remedial actions, and new research findings.¹²⁸

Outcome.—To date, the measures set forth by the 1998 Repowering EIR apply only to the Diablo Winds and Buena Vista repowering

124. *Id.* at 25.

125. *Id.*

126. *Id.* at 26.

127. *Id.* at 27.

128. 1998 EIR, *supra* note 105, at 27.

projects.¹²⁹

While most of these measures would likely effect a reduction in avian mortality, the replacement of old-generation turbines with modern turbines would probably produce the most significant results. Indeed, installation of modern turbines might reduce raptor fatalities more than any other measure considered in the context of the APWRA. However, the likely success of this strategy would not be attributable to the reasons provided in the EIR. The lack of data reflecting a statistical relationship does not necessarily mean that the relationship does not exist, as claimed in the EIR. Most birds killed by wind turbines appear to be struck by blades, rather than the birds flying into stationary portions of the turbine. Thus, the most important positive changes introduced by repowering consist of: (1) the increased height of the lowest reach of turbine blades from the ground; (2) an overall shift of much of the rotor-swept area above the height domain in which some bird species frequently fly; and (3) opportunities to site new turbines in safer locations or in locations where birds fly less frequently.

Most of the EIR design standards rely upon empirically unsupported notions of collision mechanisms. Further, the new standard for turbine operating speed relies upon Tucker's (1996) mathematical model of collision risk for birds flying through the rotor zone, which unrealistically omits considerations related to the rpm's influence on the frequency of bird flights through the rotor zone.¹³⁰ Wind turbines operating at a lower rpm may be more dangerous to raptors if raptors fly through their rotor zones more often. Significantly, the empirical evidence from the APWRA indicates that bird fatalities increased with increasing turbine size, which is generally associated with lower rpm.¹³¹ Design standards concerned with perching on turbines and towers inevitably assume that perching is a necessary precursor to collisions, though most researchers in the APWRA believe flight behaviors are the primary contributors to collisions.¹³² Guy wires also offer little explanation for the rate of avian collisions because few of the APWRA's old-generation wind turbines were even supported by guy wires, and it is doubtful that guy wires come close to killing as many birds as do the blades of wind turbines. With regard to underground wiring, such design standards would certainly reduce electrocutions,

129. For a discussion of EIR measures implemented at the Diablo Winds and Buena Vista projects, see *infra* Part III.D–E.

130. See generally V.A. Tucker, *Using a Collision Model to Design Safer Wind Turbine Rotors for Birds*, 118 J. SOLAR ENERGY ENG'G 263 (1996) (suggesting that, under Tucker's mathematical collision model, redesigned turbine motors could achieve a 90% reduction in avian mortality), available at http://www.altamontsrc.org/alt_doc/vance_tucker_rsa_published_papers.pdf.

131. DEVELOPING METHODS TO REDUCE BIRD MORTALITY IN THE APWRA, *supra* note 8, at 212–13.

132. See HOWELL & DIDONATO, *supra* note 12; ANALYSIS OF GOLDEN EAGLE AND RED-TAILED HAWK FATALITIES, *supra* note 12; DEVELOPING METHODS TO REDUCE BIRD MORTALITY IN THE APWRA, *supra* note 8, at 246–332.

though death by electrocution accounts for only 1% to 9% of APWRA fatalities.

Turbine siting standards would reduce mortality by minimizing the number of new wind turbines in lower terrains—such as valleys, ravines, and ridge saddles—where raptor species perform many of their flights. Fatality monitoring for use by a TAC would also likely result in reduced mortality when coupled with enforcement of remedial actions. The design and siting standards were refined based on such monitoring results.

D. Conditional Use Permit for Diablo Winds Repowering (2003)

On September 25, 2003, Alameda County produced a pre-hearing analysis of the environmental review required for the proposed repowering of the Diablo Winds project, replacing one hundred sixty-nine 150 KW and 250 KW FloWind vertical axis turbines with either forty-five 660 KW Vesta Wind Systems horizontal axis turbines or forty-five 800 KW NEG-Micon turbines.¹³³ The County concluded that Diablo Winds did not differ from the repowering projects proposed in the 1998 Repowering EIR.¹³⁴ The County also found that there were no submissions of new important information regarding significant environmental impacts or feasible mitigation measures associated with the project as previously approved.¹³⁵ Though it had previously revoked conditional use permits (“CUP”) issued for other projects also covered by the 1998 Repowering EIR, the County concluded the Diablo Winds repowering project warranted no additional CEQA review. Thus, the 1998 EIR covered the Diablo Winds project, and the project was subject to the EIR mitigation-monitoring program.¹³⁶ Despite concluding that no additional CEQA review was warranted, the County required the following conditions before issuing the Diablo Winds CUP:

- The Permittee shall comply with all of the applicable terms of the 1998 Repowering EIR;¹³⁷
- The Permittee will cooperate with the County to resolve avian

133. EAST COUNTY BD. OF ZONING ADJUSTMENTS, ALAMEDA COUNTY PLANNING DEP’T, Res. No. Z-03-117 (2003).

134. *Id.* at 1 (noting that “[t]he project is located in a land use area that serves as habitat to common, rare, threatened and endangered species, including avian species that have been subject to mortality due to collision with wind turbines and electrocution along power lines. The project includes all feasible measures to address this impact, as specified in the Repowering Program, Biological Resources Management Plan, and EIR”); *see also* 1998 EIR, *supra* note 105.

135. One month earlier at a meeting for resource agencies and representatives of APWRA companies, the Companies informed Smallwood and Thelander that there were no plans to repower the APWRA. Briefs on the researchers’ results and preliminary recommendations regarding mitigation were provided to the Companies.

136. EAST COUNTY BD. OF ZONING ADJUSTMENTS, *supra* note 133.

137. *Id.* at 11.

issues and mitigate avian impacts through the TAC process described in the 1998 Repowering EIR;¹³⁸

- The Permittee will implement both the short and long-term fatality monitoring programs described in the 1998 Repowering EIR;¹³⁹
- The Permittee shall facilitate and otherwise participate in research studies recommended by the TAC or in other studies recommended by the County for the area covered by the Permittee's project;¹⁴⁰ and
- If the TAC process determines a turbine is killing disproportionately more birds than other turbines, Permittee shall comply with remedial action initiated by the County for that specific turbine in accordance with the 1998 Repowering EIR.¹⁴¹

Permit Compliance.—Implementation of the siting standards has not been verified. The TAC was not constituted or activated; therefore, there was no TAC available to identify which turbines killed disproportionate numbers of raptors.¹⁴² Unpublished data from the first two years of monitoring indicate that just two of the turbines accounted for approximately half of the overall bird deaths attributed to the entire project. Thus, the TAC would have had the opportunity to reduce mortality had it been formed. No remedial measures were implemented, and there were no refinements to design or siting standards. Furthermore, monitoring was not performed to the 1998 Repowering EIR standards. The Permittee conducted no pre-construction behavior or fatality surveys; performed no bias tests on the behavior surveys; and altered the post-construction behavior surveys by using thirty minute sessions instead of sixty minute sessions. The agencies did not receive monthly monitoring reports, and the WRRS was not supplemented by scavenger removal trials, searcher detection trials, or blind tests.

The pre-hearing analysis warned that, if the Permittee violates “one or more applicable federal laws or regulations, the County will make a finding that the project in question is out of compliance with the permit and will require that the subject turbine(s) be removed or relocated.”¹⁴³ The project has arguably been out of compliance with the Migratory Bird Treaty Act¹⁴⁴

138. *Id.*

139. *Id.*

140. *Id.*

141. EAST COUNTY BD. OF ZONING ADJUSTMENTS, *supra* note 133, at 11.

142. E-mail from Chris Bazar, Alameda County Planning Dir., to author, (May 23, 2007, 02:36:56 PST) (on file with author).

143. EAST COUNTY BD. OF ZONING ADJUSTMENTS, *supra* note 133, at 11.

144. *See* 16 U.S.C. §§ 703–712.

and the Bald and Golden Eagle Protection Act,¹⁴⁵ as well as with multiple County permit conditions. Though the County has not taken any responsive action, raptor mortality has, nevertheless, declined since the removal of the old-generation wind turbines, as predicted by Smallwood and Thelander (2004).¹⁴⁶ Based on unpublished data, Smallwood estimated that, by replacing old-generation turbines with modern turbines, raptor mortality reduced by 70%, although Red-tailed Hawk mortality increased nearly three-fold.¹⁴⁷

E. Buena Vista Wind Energy Project

In the Spring of 2005, an EIR was released for public comment regarding the second proposed repowering project in the APWRA: the Buena Vista Wind Energy Project.¹⁴⁸ Smallwood provided expert comments in response to the Buena Vista EIR.¹⁴⁹ According to Smallwood, the EIR inadequately informed the public of the project's likely impacts. It did not rely upon any of the research results produced from 1998 to 2003 concerning APWRA bird collisions and entirely omitted Grainger Hunt's research and reports on Golden Eagles.¹⁵⁰ The EIR inaccurately described the area's wildlife and concluded that threatened or endangered species simply do not use the project site. The EIR also proposed inadequate mitigation measures.¹⁵¹ The appropriateness of tiering the EIR from the 1998 Repowering EIR was questioned because the CUPs of the latter had been withdrawn due to inaction and because the information in the 1998 EIR was outdated.

The Buena Vista EIR stated that bird fatalities would be avoided through a set of wind turbine design standards, including: (1) slower rotational speed of the blades (compared to the blades of the turbines being replaced); (2) a neutral, nonreflective color treatment of the blades; (3) no use of guy wires to support tall structures; (4) use of tubular towers with additional features intended to prevent perching on the towers; and (5)

145. See 16 U.S.C. §§ 668–668d.

146. K. SHAWN SMALLWOOD, ALTAMONT WORKING GROUP, BIOLOGICAL EFFECTS OF REPOWERING A PORTION OF THE ALTAMONT PASS WIND RESOURCE AREA, CAL.: THE DIABLO WINDS ENERGY PROJECT 1–2 (2006), available at http://www.altamontsrc.org/alt_doc/r34_biological_effects_diablo_winds_smallwood_07_2006.pdf.

147. *Id.*

148. See LAMPHIER-GREGORY ET AL., COUNTY OF CONTRA COSTA CMTY. DEV. DEP'T, ENVIRONMENTAL IMPACT REPORT FOR THE BUENA VISTA WIND ENERGY PROJECT (2004), available at <http://www.co.contra-costa.ca.us/department/cd/current/BuenaVistaDEIR>.

149. See Letter from author to David Brockbank, Contra Costa County Cmty. Dev. Dep't (July 5, 2004), in LAMPHIER-GREGORY ET AL., *supra* note 148, at Appendix D [hereinafter Smallwood Comment Letter].

150. Smallwood Comment Letter, *supra* note 149, at 7–9.

151. *Id.* at 11; see also LAMPHIER-GREGORY ET AL., *supra* note 148, at 2–14 (setting forth recommended mitigation measures).

relocation of power lines underground to prevent electrocutions.¹⁵² Smallwood's comment letter, based upon research conclusions regarding the APWRA, pointed out how only one of the above standards would reduce bird mortality.¹⁵³ Specifically, Smallwood noted that, while relocating power lines underground can reduce fatalities, far fewer birds die from electrocution than the overall number of birds killed by wind turbine blades.¹⁵⁴

Smallwood's comment letter proposed mitigation measures to reduce avian mortality.¹⁵⁵ After the comment period, the applicant withdrew the EIR and began preparing a new EIR. In order to foster careful repowering in the APWRA, which constituted the highest priority recommendation by Smallwood and Thelander (2004), Smallwood joined the EIR preparation team. The team also included the applicants' consultants and an attorney. Though the team's decisions often resulted in compromises, the direct avian impacts were supported by undeniable data, and the resulting mitigation measures were more comprehensive and carefully formulated than other wind project review documents. Even so, the mitigation measures were described vaguely, enabling the lead agency to conclude that measures were implemented even when they had not been implemented as intended. Ultimately, Smallwood was not provided final drafts of the EIR or the monitoring plan and, therefore, was unaware of any last minute changes to the documents. Regardless, he shares responsibility for deficiencies in the EIR.

After a few months, the Contra Costa County Board of Supervisors certified the final EIR. However, the California Office of the Attorney General ("California AG") obtained the project's final site plan and learned that it deviated considerably from the project described in the EIR. Therefore, the California AG intervened and hired Smallwood as a consultant during subsequent settlement negotiations with Babcock & Brown Renewable Holdings, Inc. ("Babcock & Brown"), who had purchased the project from G3 Energy and enXco.¹⁵⁶ While Smallwood possessed no decision-making authority with regard to the terms of the settlement agreement, he again shares responsibility for any deficiencies in the agreement. Since the time at which the settlement was finalized, Smallwood has witnessed the project's construction and operations while performing another research assignment across the street from the project. Additionally, Babcock & Brown and Contra Costa County considered whether the Alameda County Scientific Review Committee ("SRC")

152. Smallwood Comment Letter, *supra* note 149, at 12–13.

153. *Id.* at 13.

154. *Id.*

155. *Id.* at 14.

156. For more information regarding the terms of the California AG settlement agreement, see *infra* Part III.E.4.

should serve as the TAC for the Buena Vista project, and as a member of the SRC, Smallwood remained up-to-date on certain aspects of the project's mitigation measures until mid-2007, when Contra Costa County decided not to use the SRC as its TAC.

The proposed measures for mitigating biological impacts at the Buena Vista project were somewhat scattered throughout the EIR, which included an early chapter proposing installation standards to reduce impacts and a dedicated chapter on biological resources promising specific measures for impacts to biological resources. Additionally, though the fatality monitoring plan was central to the proposed mitigation measures, it appeared in a separate document. Below are the proposed measures to mitigate biological impacts for the Buena Vista Wind Energy Project, including those of the California AG's settlement agreement.

1. Proposed Installation (Certified EIR).

The Project Description Chapter of the EIR applies the following measures:

- The existing 6.6 acres of existing tower pads will be reclaimed to native vegetation after removal of 179 existing turbines;¹⁵⁷
- Approximately 5.7 acres previously used for access roads will also be reclaimed for native vegetation;¹⁵⁸
- The northern two turbines in the "C" string will be placed atop sixty-five meter towers to reduce collision risk at these locations low in the canyon;¹⁵⁹
- Seven turbines composing the "P" string will be placed upon forty-five meter towers, and the majority of the remaining turbines will be mounted upon fifty-five meter towers;¹⁶⁰
- No turbines will be sited on any slope with a gradient greater than 25%;¹⁶¹
- Except for the two northern-most turbines in the "C" string, no turbines will be sited within a dip or notch where the cross axis of the ridge is less than 300 feet wide and the slope gradient along the cross axis is 25% or greater;¹⁶²

157. LAMPHIER-GREGORY ET AL, *supra* note 148, at 3-41.

158. *Id.*

159. *Id.* at 3-42.

160. *Id.*

161. *Id.* at 3-45.

162. LAMPHIER-GREGORY ET AL, *supra* note 148, at 3-45, 3-46.

- “No turbines are proposed in a dip or notch that is in line with another dip or notch on a parallel ridge in the direction of the wind currents;”¹⁶³
- No turbines are proposed at dips or notches within 200 feet on either side of the lowest point of another dip or notch, maintaining a space of at least 400 feet between such tower locations;¹⁶⁴
- The remaining ten years of the lease agreement will be relinquished for 90% of the 2,500 acre project site, freeing up the property owner to sell conservation easements on this acreage;¹⁶⁵
- Two of three existing meteorological towers will be replaced without guy wire support, and the third will be removed;¹⁶⁶
- New roads will be constructed along 1.25 miles to reach new strings of turbines;¹⁶⁷
- The Applicant will contribute \$500 per MW of installed nameplate capacity, up to a maximum of \$20,750 per year, to a conservation fund;
- If, after three years of monitoring, the combined focal raptor mortality estimates exceed EIR predictions, then the applicant will increase the annual conservation payment to a maximum of \$1000 per MW;
- The Applicant recommends the TAC make recommendations to the County regarding use of these funds for conservation of off-site habitat for raptors and grassland birds, and for other monitoring and research purposes; and
- The Applicant proposes that up to 50% of the annual conservation fund be used to cover the costs of monitoring and research performed after the initial three-year monitoring effort.

Actual Installation.—It has not been verified that the old tower pads and access roads were restored to native grassland, but the resident

163. *Id.* at 3-46.

164. *Id.*

165. *See id.* at 3-19 (noting that “[a]t the request of the underlying property owner, the Project applicant has agreed to an early cancellation of its lease agreements. This early cancellation will enable the underlying property owner to consider the sale of this property, or the sale of conservation easements, as permanent open space”).

166. *Id.* at 3-47.

167. LAMPHIER-GREGORY ET AL., *supra* note 148, at 3-47.

vegetation probably grew back where erosion did not impede growth. The new roads were wide, and grading appeared to extend beyond the roads. Thus, it is questionable whether the project achieved a net gain of native vegetation. These measures would not have reduced raptor mortality but, of course, could have benefited special-status terrestrial species of wildlife.

The northern two turbines were mounted on fifty-five meter towers instead of sixty-five meter towers. The two turbines of the “V” string were mounted on forty-five meter towers instead of fifty-five meter towers. These deviations from the plan will likely increase mortality. However, the Applicant probably achieved the siting standards, which will likely serve to reduce mortality in comparison to the replaced turbines.

As of December 2007, nearly one year after operations began, fatality monitoring had not begun, and the TAC had not been established.¹⁶⁸ Therefore, no monitoring results are compiled to compare mortality estimates of the new project to the previous project. This deviation from the plan threatens the effectiveness of multiple key EIR elements, which depend heavily upon the results of fatality monitoring.

The status of the other measures, such as the change in the land lease agreement and payment into the conservation fund, remains unknown at this time. A mitigation-monitoring plan was not formulated, and there was no requirement to notify anyone whether these mitigation measures were actually implemented.

2. Mitigation Measures in Biological Resources Chapter.

The Biological Resources Chapter of the EIR outlines several mitigation measures to minimize impacts to special vegetation complexes and special-status terrestrial species. The measures presented in this Article, however, are restricted to those directed toward minimizing or reducing avian impacts:

- **Measure 8-7a: Cease Rodent Control Program.** “The Project Developer shall not participate in the rodent control programs on leased lands and will discourage landowners from using poisoning for rodent control in the vicinity of the project. Recent studies suggest moderate levels (intermittent) of rodent control may increase raptor fatalities, and secondary impacts to terrestrial wildlife from rodent control are a concern. The landowner with the largest number of turbines (Sousa) has agreed not to use poisoning as a means of rodent control.”¹⁶⁹
- **Measure 8-7b: Rock Piles.** “Construction of foundations

168. The County Board of Supervisors approved the formation of the TAC in June, and in July 2007, Contra Costa County issued its request for proposals to monitor fatalities at Buena Vista.

169. LAMPHIER-GREGORY ET AL., *supra* note 148, at 8-54.

will use rocks created during the excavation process rather than leaving the rock piles near turbines.”¹⁷⁰

- **Measure 8-7c: Gravel Turbine Base.** “Place gravel at least five feet around each tower foundation to discourage small mammals from burrowing near turbine bases.”¹⁷¹
- **Measure 8-7d: Increase Ground to Rotor Clearance.** “Turbine tower heights should be at least fifty-five meters in height at sites where the [Federal Aviation Administration] will allow that height, and sixty-five meters at the two higher risk turbines at the north end of the ‘C’ String. The taller tower heights would increase the ground to rotor clearance and likely reduce raptor mortality, especially for Red-tailed hawks, Golden eagles, American kestrels, and Burrowing owls.”¹⁷²
- **Measure 8-7e: Ridge Crest Sites.** “Wherever feasible, turbines should not be sited on or immediately adjacent to upwind side of ridge crest. Raptor use has been shown in general to be higher on the prevailing upwind side of ridges at the Foote Creek Rim Wind Project in Wyoming (Strickland 2001), and turbines sited away from the rim edge may have contributed to low raptor fatality rates. This recommendation has not been specifically tested in the APWRA, but has been used in micro-siting turbines at the other sites, including the Stateline Wind Project in Oregon and Washington.”¹⁷³
- **Measure 8-7f: Un-Guyed Permanent Meteorological Towers.** “Studies at the Foote Creek Rim Wind Project concluded that guyed meteorological towers may kill more passerines per structure than turbines. Two new diagonal lattice or monopole structures will be constructed on site for monitoring meteorological data and guy wires shall not support these structures.”¹⁷⁴
- **Measure 8-7g: Minimize Vertical and Lateral Edge.** “Turbine construction shall minimize cutting into hill slopes in an attempt at achieve smooth rounded terrain rather than sudden berm or cuts to potentially reduce prey abundance.”¹⁷⁵

170. *Id.*

171. *Id.*

172. *Id.*

173. *Id.* at 8-55.

174. LAMPHIER-GREGORY ET AL., *supra* note 148, at 8-55.

175. *Id.*

- **Measure 8-7h: Review Final Site Plan.** “Prior to obtaining a grading or building permit, the Project applicant should submit a final site plan for review and approval by the County Zoning Administrator demonstrating compliance with the standards described in this document.”¹⁷⁶
- **Measure 8-7i: Monitoring Program.** “A scientifically defensible monitoring program shall be implemented to estimate the avian fatality rates from the new turbines, and important covariates such as prey base and avian use.
 - (a) Standardized fatality monitoring and avian use and behavior studies shall be conducted for a minimum of three years.
 - (b) A technical advisory committee should be formed to oversee the program, and propose additional mitigation and/or additional monitoring depending on the results of the monitoring program.
 - (c) Should additional mitigation be necessary, potential measures may include off-site mitigation.”¹⁷⁷
- **Measure 8-8: Indirect Avian Impacts.** “The presence of wind turbines may alter the landscape so that wildlife habitat use patterns are altered, thereby displacing wildlife from the Project Area.”¹⁷⁸
- **Measure 8-9a (concerning Bat Collisions): Monitoring Program.** To estimate bat mortality from new turbines, scientifically defensible monitoring will be implemented.¹⁷⁹
- **Measure 8-9b (concerning Bat Collisions): Technical Advisory Committee.** The TAC will evaluate monitoring results, and if bat mortality is determined to be significant, the TAC can recommend additional bat monitoring or mitigation measures such as contributing to bat conservation (e.g., Bat Conservation International).¹⁸⁰

Outcome.—A mitigation monitoring plan was not formulated, and

176. *Id.*

177. *Id.*; see also WALLACE ERICKSON & K. SHAWN SMALLWOOD, CONTRA COSTA COUNTY, CAL., AVIAN AND BAT MITIGATION MONITORING PROGRAM FOR THE BUENA VISTA WIND ENERGY PROJECT (2004), reprinted in LAMPHER-GREGORY ET AL., *supra* note 148, at Exhibit E (setting forth a monitoring program for the Buena Vista project).

178. LAMPHER-GREGORY ET AL., *supra* note 148, at 8-56, 8-57. Habitat displacement of birds due to the presence of the new, large wind turbines were deemed less than significant. Mitigation was found to be unnecessary.

179. *Id.* at 8-59.

180. *Id.*

there was no notification requirement by which to determine whether any of the measures were implemented. It has not been verified that the rodent control program has terminated, as required under Measure 8-7a. Measure 8-8 did not actually present any measure at all, and the reason for not mitigating indirect avian impacts was unfounded. Further, the project owners piled rocks near the wind turbines, in defiance of Measure 8-7b, and they ignored Measure 8-7d by using fifty-five meter towers where they were supposed to use sixty-five meter towers and using forty-five meter towers to support two turbines that were supposed to be supported by fifty-five meter towers. Nearly all turbines were installed either on or upwind of ridgelines and ridge crests in direct violation of Measure 8-7e. In some cases, careful grading minimized lateral and vertical edges, while in others the cuts into the hill produced the kind of dramatic edges that are attractive to burrowing rodents, contrary to Measure 8-7g. As of December 2007, eleven months after project operations began, no fatality monitoring had begun, in spite of Measure 8-7, and the TAC was not yet established, in direct defiance of Measure 8-9.

3. Avian Collision Monitoring Plan Referenced in EIR.

The avian collision-monitoring plan proved to be a pivotal element of other key mitigation measures in the EIR as well as the California AG's subsequent settlement agreement with the project's owners. The plan calls for the following measures:

- **Technical Advisory Committee.** The TAC will evaluate each fatality found during monitoring and will decide the cause of death; whether the death can be attributed to a particular turbine; and whether any patterns of fatalities are discernable.¹⁸¹
- **Avian Use and Behavior Surveys.** Avian abundance and behavior surveys will be performed during thirty-minute observation sessions twice per month for two years at six stations, and observer bias will be quantified and adjustments made.¹⁸²
- **Prey Base Mapping.** Ground squirrel and pocket gopher burrow systems will be mapped within 300 feet of wind turbines and in two reference areas using GPS.¹⁸³
- **Avian and Bat Fatality Study.** Avian and bat fatality monitoring will be performed monthly for three years within seventy-five meters of every turbine, and the first search will

181. ERICKSON & SMALLWOOD, *supra* note 177, at 4.

182. *Id.* at 5-6.

183. *Id.* at 7.

commence within thirty days after the turbines become operational.¹⁸⁴

- **Searcher Efficiency Trials.** Searcher efficiency trials will begin with the commencement of turbine operations. The trials will use roughly 160 trial carcasses per year, which will be placed within the fatality search areas but spread over eight trial periods within a year.¹⁸⁵
- **Disposition of Data.** Annual monitoring reports will be submitted to the County, the USFWS, and the CDFG, and a monthly summary of all raptor fatalities will be submitted to Contra Costa County.¹⁸⁶

Outcome.—As of December, 2007, the TAC had not convened. Additionally, no avian use and behavior surveys had commenced, nor had any rodent burrow mapping, fatality monitoring, or searcher efficiency trials. Therefore, the agencies have received no data regarding fatality monitoring.

4. California Attorney General Settlement Agreement.

As previously mentioned, the California AG learned shortly after Contra Costa County certified the Buena Vista EIR that the final site plan for the project was quite different from the specifications provided under the EIR. In order to address concerns regarding any deviations from the EIR, the California AG entered into a settlement agreement (“the Agreement”) in May of 2006 to achieve mitigation of avian mortality at both the Buena Vista wind farm, which is operated by Babcock & Brown, and the nearby Tres Vaqueros wind farm.¹⁸⁷ The terms of the Agreement are set forth below:

- **Term 1.** Buena Vista LLC (“BV LLC”) will shut down all 179 existing (old-generation) wind turbines at the Buena Vista site. All electrical lines will be moved underground, with the exception of the interconnect line out of the substation that connects the project with a 230 KV transmission line and the existing PG&E transmission line. Turbines will be sited in compliance with a layout map attached to the settlement agreement and on the side of the ridge line facing the wind where practical and commercially

184. *Id.* at 7–8.

185. *Id.* at 10.

186. ERICKSON & SMALLWOOD, *supra* note 177, at 14.

187. *See* Cal. Attorney Gen. Settlement Agreement for Avian Mitigation (May 10, 2006) [hereinafter Agreement for Avian Mitigation]. Babcock & Brown affiliates Buena Vista Energy, LLC and Tres Vaqueros Wind Farms, LLC were also named as parties to the settlement agreement.

feasible.¹⁸⁸

- **Term 2.** If not consistent with the Buena Vista CUP conditions and other County conditions, “BV LLC confirms and concurs that the TAC identified in the permit shall be constituted of independent experts.”¹⁸⁹ BV LLC may give recommendations regarding the overall makeup of the TAC membership. The monitor shall have scientific expertise and shall be independent and impartial. All monitoring plan data will be available to the TAC and to the County for public distribution.¹⁹⁰
- **Term 3.** The adaptive management program of the final EIR and the monitoring plan, as modified by this Agreement, shall be mandatory. The monitoring plan now requires carcass searches to be conducted at each turbine twice every month. Long-term monitoring after the conclusion of the initial monitoring effort will be required but may be reduced to once every three years for the next fifteen years. BV LLC will provide site access to CDFG upon reasonable request and consistent with operational and safety requirements.¹⁹¹
- **Term 4.** If the project achieves less than a 35% average annual reduction in focal raptor mortality, as compared to the base case of fifty-four focal raptors per year as determined by the three-year monitoring program, BV LLC shall conduct winter season (November 15th through February 28th) shutdowns of particular turbines that may be found to contribute disproportionately to focal raptor fatalities up to a maximum of 10% of BV’s installed capacity. The shutdown plan shall be approved by both the TAC and the County.¹⁹²
- **Term 5.** If the project fails to reduce focal raptor mortality, as compared to the base case of fifty-four focal raptors per year as determined by the three-year monitoring program, BV LLC agrees to a full winter season (November 15th through February 28th) shutdown. If the additional monitoring shows that winter shutdowns do not materially reduce avian mortality, the shutdown will no longer be required, but BV LLC will work to figure out other ways to reduce avian

188. *Id.* at 2.

189. *Id.*

190. *Id.*

191. *Id.*

192. Agreement for Avian Mitigation, *supra* note 187, at 3.

mortality.¹⁹³

- **Term 6.** If adaptive management actions are taken pursuant to the Buena Vista use permit or this Agreement, the initial monitoring plan shall extend another three years at which point those actions will be evaluated to determine the effectiveness of the adaptive management actions, assuming that this obligation does not conflict with permit requirements.¹⁹⁴
- **Term 8.** “Tres Vaqueros Wind Farms LLC (or such other Babcock & Brown affiliates) agrees that if the Buena Vista Project is unable to achieve a 50% average annual reduction in focal raptor mortality as compared to the current base case of fifty four focal raptors per year at the Buena Vista site as determined by the three year monitoring program for Buena Vista, it will begin to decommission the existing wind turbines at the Tres Vaqueros site by September 1, 2012. Completion of decommissioning shall proceed without unreasonable delay.”¹⁹⁵
- **Term 9.** “If Tres Vaqueros Wind Farms LLC (or such other Babcock & Brown affiliates) has not begun repowering at the Tres Vaqueros site by September 1, 2011, it shall begin to decommission the existing wind turbines at the Tres Vaqueros site by September 1, 2012.”¹⁹⁶
- **Term 10.** If Tres Vaqueros Wind Farms LLC (or such other Babcock & Brown affiliates) obtains the right to operate the Tres Vaqueros project, it agrees to pay a mitigation fee of \$1000 per MW per year until the existing turbines are removed, and after December 2008, to a full winter shutdown of the existing turbines (November 15th through February 28th) until the existing turbines are removed. If studies in the APWRA establish winter shutdowns are ineffective, the Parties will reconsider the requirements of this Term. The mitigation fees shall be paid to the Contra Costa County avian conservation fund and shall not be used for monitoring costs.¹⁹⁷
- **Term 12.** “Tres Vaqueros Wind Farms LLC agrees to evaluate using one or more vertical axis wind turbine as part

193. *Id.*

194. *Id.*

195. *Id.*

196. *Id.*

197. Agreement for Avian Mitigation, *supra* note 187, at 4.

of repowering the Tres Vaqueros site, if repowering of that site proceeds.”¹⁹⁸

- **Term 13.** BV LLC agrees to contribute \$350,000 to a fund to be administered by CDFG for mitigation efforts to benefit raptor and raptor habitat in the greater area encompassed by and surrounding the APWRA. The AG will ensure CDFG consults with Babcock & Brown on the expenditure of such funds. The Parties intend for the funds to be spent, or for projects receiving the funds to be identified, within three years of the effective date of this agreement. BV LLC shall pay \$175,000 within thirty days of the effective date of this Agreement and \$175,000 within one year of the effective date of this Agreement.¹⁹⁹
- **Term 14.** If Babcock & Brown obtains rights to the Tres Vaqueros project, Tres Vaqueros Wind Farms LLC (“TV LLC”) agrees to contribute \$350,000 to a fund to be administered by CDFG for mitigation efforts for the benefit of raptors and raptor habitat in the greater area encompassed by and surrounding the APWRA. The AG will ensure that CDFG consults with Babcock & Brown in conjunction with expenditure of such funds. The Parties intend for the funds to be spent, or for projects receiving the funds to be identified, within three years of the effective date of this agreement. TV LLC shall pay \$175,000 within thirty days of the date that Babcock & Brown obtains the rights to the project and \$175,000 within one year.²⁰⁰
- **Term 15.** “BV LLC will pay \$10,000 to the AG for costs, due within 30 days of the Effective Date of this Agreement.”²⁰¹

Outcome.—Parts of Term 1 and all of Terms 13 and 15 were implemented. The Companies replaced the old-generation turbines and installed the electrical lines underground as agreed. According to the California AG, payments totaling \$350,000 were made to the National Fish and Wildlife Foundation, the Environmental Fund, and the Altamont Pass Sub-account for habitat and incident-specific restoration. Additionally, the Companies provided contributions of \$10,000 to the AG’s office as compensation for the AG’s negotiation costs. Compliance with the above measures should reduce mortality and provide a source of compensation for

198. *Id.*

199. *Id.*

200. *Id.*

201. *Id.*

a small portion of the fatalities that cannot be avoided, so long as the funds are expended effectively.

On the other hand, other potentially effective measures were not implemented. Based on observations of most of the turbines from various nearby vantage points, the majority of the wind turbines were sited on the prevailing windward aspects of the ridgelines and ridge crests instead of being sited on the leeward aspects. As of December 2007, eleven months after wind turbine operations commenced, fatality monitoring had not begun. Therefore, the Companies did not fulfill their obligation under Term 2. As a direct result, the Companies also could not come into compliance with Terms 3, 4, 5, or 6, because decisions about whether and how to implement adaptive management measures necessarily depend upon the results of fatality monitoring.

The effectiveness of Terms 8 and 9 are also questionable because the Tres Vaqueros wind farm permit will expire in 2012. It is unclear whether the California AG knew about the termination of the Tres Vaqueros permit at the time of the settlement negotiations. While the nearby Nordtank and KCS56-100 turbines operate, the Tres Vaqueros wind turbines often do not, and thus, the owners of Tres Vaqueros might not seek to renew the permit after 2012. Additionally, the impact of Term 10 remains in doubt, as it remains unknown whether TV LLC will obtain rights to operate the Tres Vaqueros project. The effectiveness of Term 12 is also questionable because it is voluntary, and it is unknown how one would determine whether or not TV LLC considered using a vertical axis turbine. Further, Term 12 would only reduce bird mortality if a vertical axis turbine with external housing is installed in place of a conventional horizontal axis wind turbine.

F. Renewal of CUPs in 2003 for Old-generation Wind Turbines

After twenty-year CUPs expired for several of the Companies, the East Bay Board of Zoning Adjustments renewed all of the CUPs for indefinite periods.²⁰² Californians for Renewable Energy (“CARE”) unsuccessfully appealed this decision to the Alameda County Board of Supervisors. CARE and the Golden Gate Audubon Society (“GGAS”) subsequently filed petitions for writ of mandate in the Alameda Superior Court, pursuant to CEQA. The Court merged the petitions and stayed the proceedings to allow the Petitioners and the County time to participate with the Altamont Working Group in the hopes of reaching a mutually satisfactory solution.²⁰³ The 2003 CUPs included the following provisions:

- **Condition 10: Working Group.** The Permittee and the

202. See ALAMEDA COUNTY CMTY. DEV. AGENCY, PRE-HEARING ANALYSIS ON ALTAMONT PASS WIND RESOURCE AREA CONDITIONAL USE PERMIT RENEWALS (2003).

203. See discussion on the Altamont Working Group *infra* Part III.G.

County will cooperate to resolve operational issues and mitigating circumstances through the process of a Working Group established by the Alameda County Planning Director.²⁰⁴

- **Condition 11: Avian Research Studies.** The Permittee shall provide access to wind facility lands subject to the CUP and will participate by consulting in research protocols recommended by the County Planning Director.²⁰⁵
- **Condition 12: Color Treatment.** Experimental blade color treatments may be reviewed and approved by the County Planning Director upon Permittee's request.²⁰⁶
- **Condition 13: Avian Injury or Fatality.** The Permittee is responsible for filing a monthly avian injury report with the USFWS and with the Alameda County Planning Director for resulting injury or avian fatality. Within three hours of discovering the injury of a protected bird, the Permittee will be required to contact either Region Three of the CDFG or the nearest qualified wildlife rehabilitation center or specialist approved by the USFWS in order to obtain immediate veterinary care for the injured bird.²⁰⁷

Permit Compliance.—The 2003 permit conditions would not have reduced mortality unless the Altamont Working Group was able to agree on effective mitigation measures, which the Companies would then agree to implement. The Altamont Working Group met for nearly one year, but group members could not agree on a plan. The County disbanded the group several months before the Board of Supervisors approved new permit conditions. These conditions were largely from the adaptive management plan proposed by the Companies during the Altamont Working Group process. Critics including environmental groups and resource and regulatory agencies, other than Alameda County, opposed the Companies' adaptive management plan. Aside from the formation of the Altamont Working Group, no actions were taken and no studies were performed during the period that these conditions were in effect. Conditions 11 through 13 were merely repeated from past mitigation plans, which had failed to reduce avian mortality.

G. Alameda County Permit Conditions of September 2005

Pursuant to Condition 10 of the renewed CUPs, Alameda County

204. ALAMEDA COUNTY CMTY. DEV. AGENCY, *supra* note 202, at Attachment B.

205. *Id.*

206. *Id.*

207. *Id.*

created an Altamont Working Group in 2003, although the group did not begin meeting until Summer 2004.²⁰⁸ Originally, the Altamont Working Group was viewed suspiciously. The resource agencies did not attend the earliest meetings and, instead, held their own interagency meetings. In the meantime, environmental groups boycotted the Altamont Working Group meetings and hosted their own meetings. The interagency meetings generated several ideas pertaining to mitigation—most notably a formula for an appropriate and consistent off-site compensation fee. However, the agencies realized that this idea would not advance without discussing it with other parties, and in Fall 2004, agency representatives, along with environmental groups, began attending the Altamont Working Group meetings.

The Altamont Working Group met for roughly one year. The wind companies directed their consulting firm, WEST, Inc., to produce a series of “adaptive management plans.” The Altamont Working Group asked Smallwood and Linda Spiegel of the CEC to provide technical assessments of various proposed mitigation measures for the adaptive management plans. Based largely on the final plan produced by WEST, Inc. in February 2005, the Alameda County Board of Supervisors approved the following permit conditions for the continued operation of old-generation wind turbines in the APWRA:

- The SRC will be convened by October 31, 2005;²⁰⁹
- The SRC will confirm that Tier 1 turbines were shutdown by October 31, 2005;²¹⁰
- By November 30, 2005, Permittee shall provide a schedule for implementing on-site strategies to reduce avian mortality as identified by CEC-sponsored research, including the following;²¹¹
 - Retrofit all electric distribution poles to APLIC standards within 180 days of permit approval;
 - Remove derelict and nonoperating turbines, though towers may remain at the ends of rows if deemed beneficial as flight diverters by the SRC. 50% of the turbines will be removed within 180 days of permit approval and 100% of the turbines will be removed within one year;

208. *See id.*

209. BD. OF SUPERVISORS OF THE COUNTY OF ALAMEDA, Res. R-2005-453, Exhibit G-2: AVIAN WILDLIFE PROTECTION PROGRAM & SCHEDULE 1 (2005), available at http://www.altamontsrc.org/alt_doc/alt_settlement/s10_exhibit_g_2_for_non_settlement_companies.pdf.

210. *Id.*

211. *Id.* at 1–2.

- Relocate all artificial rock piles from turbines within 180 days of approval by the USFWS;
- Implement other on-site management measures suggested by CEC research and approved by the Planning Director within 180 days of permit approval. Such measures may include: (1) use of preventative measures to stop under-burrowing by small mammals; (2) cessation of rodent control activities; (3) use of the Hodos scheme to paint turbine blades; (4) use of designs and siting to discourage raptor use; (5) elimination of vertical and lateral edges; (6) replacement of reinforced/guyed turbines and meteorological towers; (7) restriction of grazing near turbines on a seasonal basis; (8) installation of accelerometers; and (9) installation of improved turbine monitoring equipment;
- A winter-time shutdown experiment will be completed by February 28, 2006;²¹²
- A report regarding the results of the first year winter-time shutdown will be provided to the SRC by the Permittee on May 31, 2006;²¹³
- The Permittee will provide a report to the Planning Director regarding the progress toward repowering 10% of the Permittee's turbines by March 31, 2006, with follow-up letters by March 31, 2007 and March 31, 2008;²¹⁴
- The SRC will recommend to the Planning Director potential strategies for conservation of critical wildlife habitat by September 22, 2006;²¹⁵ and
- With SRC input, the County shall have completed a draft scope of work for an EIR by March 31, 2007.²¹⁶

All but one of the Companies agreed to extend the permit conditions across the entire APWRA, including in Contra Costa County. Northwind Energy, however, refused to cooperate with the permit conditions and disallowed fatality and utilization monitoring at their turbines.

Permit Compliance.—Over fourteen months, the Companies had not

212. *Id.* at 2.

213. *Id.*

214. BD. OF SUPERVISORS OF THE COUNTY OF ALAMEDA, *supra* note 209, at 2.

215. *Id.* at 2.

216. *Id.* at 3.

complied with most of the permit conditions and failed to meet a majority of the deadlines. The SRC was not even formed until September of 2006, eleven months later than intended. No schedule was provided for the implementation of on-site strategies to reduce raptor mortality. The majority of the wind turbines in Tiers 1 and 2 were not shut down, even by April 3–5, 2007, and derelict towers and turbines were not removed. Between April 3–5, 2007, Smallwood observed just as many derelict towers as had been recorded during 1998–2003.²¹⁷ The artificial rock piles had not been moved; no tower platforms were retrofitted to reduce under-burrowing by fossorial mammals; no turbines were moved to increase their concentration; and no earth was moved around the turbines to reduce vertical or lateral edges. Accelerometers were not installed; guyed towers were not removed; cattle were not restricted from grazing where turbines operate; and improved turbine monitoring equipment was not installed. Finally, the Planning Director did not receive any letters reporting progress toward repowering 10% of the Permittee's total number of turbines by the end of the fourth year, and the SRC did not receive a scope of work for the EIR. Most of these measures, had they been implemented, would have considerably reduced raptor mortality.

The Companies partially complied with a few measures. In Fall 2006, the Companies told the SRC that the power poles had been retrofitted to APLIC standards, but the job remained incomplete as of April 2007. The County had not verified that the APLIC standards were met. Without consulting the SRC, one Permittee painted the blades of forty-two 100 KW turbines, utilizing the correct painting design but not utilizing the correct paint. The half-winter shutdown experiment was implemented, but the turbine blades were not locked into place. Thus, even the "shutdown" turbines continued to kill several birds. Furthermore, the average fatality search interval was nearly as long as the two-month treatment period in the experiment, which produced inconclusive results because many of the fatalities could not be attributed to one of the two treatment periods. The SRC never addressed the onsite and off-site strategies to conserve critical wildlife habitat. Further, the SRC will not address any such conservation strategies because the settlement agreement took this task away from the SRC and, instead, assigned it to CDFG's NCCP.²¹⁸ The winter shutdown could have significantly reduced raptor mortality, but it will remain insignificant so long as it is treated merely as an experiment and as long as birds are lured into inhabiting the areas near shutdown turbines only to encounter the same turbine blades once they restart.

The Companies may have complied with two permit conditions.

217. Smallwood based his impressions upon personal observations of 3,146 turbines visible from public roadways and other vantage points.

218. For a summary of the key provisions of the Audubon settlement agreement, see *infra* Part III.H.

While the claim is currently unverified, the Companies have suggested that they withdrew from the rodent control program. The Companies also complied with the condition seeking that derelict lattice towers remain in place at the ends of turbine rows to serve as flight deterrents. However, Smallwood had warned against leaving derelict towers at the ends of rows because doing so might unintentionally increase raptor mortality due to inter-specific and intra-specific encounters between flying raptors and raptors perched on the end-row derelict towers. Smallwood's warning was ignored, and raptor mortality during 2005–2006 increased in comparison with the mortality rates of previous years.

H. Settlement Agreement of November 2006

On November 6, 2006, a settlement agreement (“Audubon Agreement”) was reached between a coalition of Audubon and environmental groups, a team of wind power companies, and the Alameda County Board of Supervisors.²¹⁹ The Alameda County Board of Supervisors adopted the Audubon Agreement on January 11, 2007, which included the terms set forth below:

- **Term 3: Reduction in Raptor Mortality.**²²⁰ The Companies shall reduce annual raptor mortality by 50% within three years of the effective date of this Agreement.
 - (a) The baseline for determining the overall reduction in raptor mortality is 1300. The raptor species that shall be evaluated to determine the reduction in raptor mortality are Golden Eagle, Burrowing Owl, American Kestrel, and Red-tailed Hawk. The reduction in raptor mortality shall be ascertained using field monitoring data collected in accordance with the CUPs and scaling factors for searcher efficiency and scavenging as approved by the SRC. If the above-referenced scaling factors exceed 2.5, the Parties, in consultation with the SRC and any other individuals or entities agreeable to the Parties, shall meet and confer to re-determine a mutually acceptable baseline for

219. Settlement Agreement, Golden Gate Audubon Society v. County of Alameda, No. RG05239790 (2007) [hereinafter Audubon Settlement], available at [http://www.altamontsrc.org/alt_doc/alt_settlement/s1_board_approved_settlement_agreement\(55464923_1\).pdf](http://www.altamontsrc.org/alt_doc/alt_settlement/s1_board_approved_settlement_agreement(55464923_1).pdf); see also Settlement Framework, GGAS, No. RG05239790, available at http://www.altamontsrc.org/alt_doc/alt_settlement/s9_11_06_06_final_settlement_framework_executed.pdf. Parties to the settlement included the GGAS; Ohlone Audubon Society; Mount Diablo Audubon Society; Santa Clara Valley Audubon Society; Marin Audubon Society; CARE; ESI Bay Area GP, Inc.; ESI Altamont Acquisitions, Inc., on behalf of Green Ridge Power, LLC; ESI Tehachapi Acquisitions, on behalf of Altamont Power, LLC; enXco, Inc.; and SeaWest Power Resources, LLC. Altamont Wind, Inc., however, declined to settle, and their 920 wind turbines continue to operate under the September 22, 2005 Alameda County permit conditions.

220. Audubon Settlement, *supra* note 219, at 2–3.

2008]

WIND POWER COMPANY COMPLIANCE

275

determining raptor mortality and/or percentage reduction in raptor mortality that triggers adaptive management measures as specified in 3(c) of this Agreement.

- (b) The Companies, Audubon, and County, in consultation with the SRC, shall meet and confer at least annually to determine if mutually acceptable mid-course corrections in measures to reduce raptor mortality are appropriate after the SRC evaluates the prior year's monitoring data. Agreed-upon midcourse corrections shall be forwarded to the County for consideration if the measures require permit modifications.
- (c) Adaptive management measures will be implemented if raptor mortality is not reduced by 50% by November 1, 2009.
 - (i) The SRC will prioritize the measures, and after analyzing field monitoring data will evaluate measures that have not reduced raptor mortality at the expense of energy production. The SRC shall use its best efforts to prioritize management efforts by June 1, 2009.
 - (ii) By August 1, 2009, the Companies and Audubon will propose an adaptive management plan to the SRC and the County for review if the SRC projects less than a 50% reduction in raptor mortality by November 1, 2009. This plan will be designed to reduce raptor mortality by 50% with the least impact on energy production, and may eliminate or reduce seasonal shutdowns. The SRC shall act on the adaptive management plan by November 1, 2009.
 - (iii) Nothing in this Agreement shall preclude the Companies from implementing other measures, such as rodent trapping, reasonably designed to reduce raptor mortality by 50%, provided that the measures are not outside the CUP's terms.

- **Term 4: Seasonal Shutdown.**²²¹ The Companies shall cease operations for approximately half of the nonrepowered operating turbines between November 1, 2007 and December 31, 2007 and the remaining half of the nonrepowered operating turbines between January 1, 2008 and February 28, 2008.
- **Term 5: Turbine Removal or Relocation.**²²²
 - (a) The Companies shall shut down Tier 1 and 2 turbines within thirty days of this Agreement or, in the event an alternative list of turbines is presented to the SRC, as specified in Term 5(a)(ii), within fifteen days of SRC approval of such list, whichever is later.
 - (i) Tier 1 and 2 turbines are those 155 turbines identified as such in Smallwood and Spiegel (2005), and as therein allocated per each Company and per each Company's individual projects.
 - (ii) Any time after the execution of this Agreement, each Company may submit to Audubon and the SRC a list and description of high-risk turbines already shut down and ask for credit against this Tier 1 and 2 shutdown requirement. The SRC will grant credit for such turbines reasonably determined on a scientific and technical basis to be high risk, provided that such turbines were shut down on or after May 2002. This evaluation will be unprejudiced by turbines unlisted as Tier 1 or 2.
 - (b) The Companies shall shut down Tier 3 turbines or turbines identified pursuant to Term 5(b)(ii) by October 31, 2008.
 - (i) Tier 3 includes 152 or fewer turbines, and no more for each Company's individual project than the number allocated in Smallwood and Spiegel (2005).

221. *Id.* at 3.

222. *Id.* at 3-4; *see also* Settlement Framework, *supra* note 219, at 1-2.

2008]

WIND POWER COMPANY COMPLIANCE

277

- (ii) By July 1, 2007, each Company may present to the SRC an alternative list of turbines for shutdown and ask for credit against this Tier 3 shutdown requirement. Applicable turbines may include previously removed turbines that were among those considered in Smallwood and Spiegel (2005), provided such turbines were non-derelict when removed. The SRC shall select for shutdown, on a scientific and technical basis, the highest risk turbines of those presented by each Company (Tier 3 list vs. proposed alternatives).
- (c) The Companies shall remove each turbine subject to a shutdown requirement as specified in this Agreement unless the SRC, on a scientific and technical basis, approves of its continued existence (e.g., end-row turbine that serves as a flight diverter) or renewed operation (e.g., middle of a string with low risk). Any turbine subject to shutdown may be relocated to any non-Tier 1, 2, or 3 existing turbine site, provided that it is relocated in accordance with certain criteria specified in the Settlement Framework.²²³
- **Term 6: Blade Painting Study.**²²⁴ The Companies may participate in a SRC-approved study to determine whether blade painting reduces raptor mortality. Up to 450 turbines may be painted, and a corresponding number used as controls. Turbines shall be painted by December 31, 2007, or as soon thereafter as reasonably possible, depending on when the SRC approves the study.
 - (a) The Companies shall present a proposed before and after control impact (“BACI”) study design to the SRC for review and approval.
 - (b) The SRC shall either approve the BACI design within thirty days of submission, or respond within thirty days with changes necessary for approval, so that the BACI study can be incorporated into the monitoring program as soon as possible.
 - (c) Turbines with painted blades or those turbines used as

223. Audubon Settlement, *supra* note 219, at 1, at 4; Settlement Framework, *supra* note 219, at 5.

224. Audubon Settlement, *supra* note 219, at 4-5.

controls shall be exempted from all permanent and seasonal shutdown requirements for the study period.

- (d) Initial blade painting allocations subject to the further provisions of Term 6(e) below are up to:
- (i) 285 ESI turbines, plus 285 control group turbines;
 - (ii) 108 enXco turbines, plus 108 control group turbines; and
 - (iii) fifty-seven SeaWest turbines, plus fifty-seven control group turbines.
- (e) One Company can assume by mutual agreement all or part of another Company's initial blade-painting allocation. The final allocations of turbines beyond the allocations stated in Term 6(d), and up to 450 painted turbines, shall be by agreement of the Companies and subject to a SRC-approved BACI design.

• **Term 7: Natural Communities Conservation Plan**
("NCCP").²²⁵

- (a) The Parties intend to develop a NCCP pursuant to Section 2801 et seq. of the California Fish and Game Code to address the long-term operation of APWRA wind turbines and conservation of affected species of concern along with their natural communities. The NCCP or similar agreement shall only apply to the operation, construction, maintenance, and repowering of wind turbines and shall not apply to land use development, farming, ranching, or other agricultural activities, except with property owner consent.
- (b) The County will sponsor the NCCP, and the Companies shall fund it.
- (c) The NCCP may lead to modified CUP terms. The Parties acknowledge that future repowering of the APWRA, which is central to the current CUPs, will also factor into adaptive management measures as provided for in Term 3 of this agreement and/or in the development of the NCCP. The repowering and shutdown provisions in the CUPs have been amended to delete those provisions no longer effective for the Companies because the adaptive management plan and NCCP are expected to supersede those

225. *Id.* at 5-6.

provisions. Future repowering requirements will be governed by the adaptive management plan or NCCP approved by the County and CDFG. If no agreements to modifying documents are made, the existing CUP conditions relating to repowering will not remain in effect, but the Parties agree that the County may amend the permits in light of then current conditions to address repowering obligations.

- (d) The Parties have prepared and executed a draft Planning Agreement for developing a NCCP. Notwithstanding the foregoing, the terms of this Agreement and the CUPs, as modified by this Agreement, shall remain in full force and effect if the Parties or CDFG do not agree to a NCCP or similar agreement.

Outcome to date.—On May 8, 2007, the Alameda County Board of Supervisors approved one year of funding for the fatality and utilization monitoring and directed staff to seek funding from public sources for the remaining eighteen months of the monitoring period.²²⁶ The parties to the Audubon Agreement informed the SRC that the Companies are no longer required to remove derelict turbines and towers nor are they required to move artificial rock piles, per SRC recommendation and 2005 permit conditions.²²⁷ The majority of Tier 1 and 2 turbines operated until the fall and winter seasons of 2007. The Companies have not committed to implementing any additional mitigation measures other than the half-winter turbine shutdown, which would be performed without locking the blades in place.

The Companies still have not acted on some of the terms, perhaps because the language of the Audubon Agreement gives them the latitude to delay action. For example, Term 5(c) could allow the Companies to indefinitely postpone shutting down Tier 1, 2, and 3 turbines by simply continuing to request credits for turbines reportedly shut down or moved in the past.²²⁸ Indeed, one party to the Audubon Agreement, Green Ridge Power (“FPLE”), requested such credits and, thereby, avoided its obligation under the agreement to shut down Tier 1 and 2 turbines while the SRC deliberated on the matter for seven months. The SRC finally voted 4-to-1 to grant the credits on the condition that nine Tier 1 turbines

226. See ALTAMONT PASS WIND RESOURCE AREA SCIENTIFIC REVIEW COMM., NOTES: CONFERENCE CALL 1 (2007), available at http://www.altamontsrc.org/alt_doc/p31_src_meeting_notes_5_8_07_final.pdf.

227. Settling Parties Response to Follow-Up to Feb. 5 SRC Meeting, GGAS, No. RG05239790, available at http://www.altamontsrc.org/alt_doc/alt_settlement/s13_questions_for_dettling_parties_response.pdf.

228. See Audubon Settlement, *supra* note 219, at 3–4.

be shutdown immediately.²²⁹ The removal of Tier 1 and 2 turbines could have reduced raptor mortality about 15%.²³⁰

Similarly, the SRC has not received a proposed study plan for blade painting, as required under Term 6.²³¹ Indeed, Altamont Wind, Inc. (“AWI”) informed the SRC in April 2007 that they purchased the patent on the Hodos painting scheme. AWI claimed that other Companies could not implement blade-painting experiments without first obtaining AWI approval, which has not been granted.

Several of the terms will not reduce mortality, including Term 3; the portion of Term 6 addressing blade painting; and Term 7. Term 3 specifies a 50% reduction target, but the parties to the Audubon Agreement provided no quantitative assessment by which to determine whether or how their mitigation plan can reduce mortality by 50%. By fixing baseline mortality, capping the adjustment factor, and limiting the post-settlement mortality estimation to four species, the Audubon Agreement set the stage for determining mortality based upon potentially inconsistent assumptions and methods, perhaps even crediting the Companies with levels of mortality reduction not actually achieved. The baseline estimate of 1,300 raptor deaths encompassed all raptor species, not only the four target species.²³² The baseline estimate was also calculated using an adjustment factor of 3.15,²³³ a factor larger than the 2.5 factor imposed by the parties to the Audubon Agreement as an upper value for use on the post-settlement estimate.²³⁴ Thus, if raptor mortality truly does not change post-settlement but the SRC proceeds to apply Term 3 as written, the calculation would yield a misleading mortality reduction figure of 31%, rather than 0%.

Term 3(b) also will not substantially reduce avian mortality. The

229. See ALTAMONT SCIENTIFIC REVIEW COMM., ALTAMONT SRC DECISION ON FPLE CREDIT FOR REMOVING HIGH RISK TURBINES 2 (2007), available at http://www.altamontsrc.org/alt_doc/p40_src_on_fple_credits.pdf (indicating that the FLPE credit issue was approved by the SRC); see also ALTAMONT SCIENTIFIC REVIEW COMM., MEETING SUMMARY 7–9 (2007), available at http://www.altamontsrc.org/alt_doc/p28_src_meeting_summary_apr_2007_final__v5_31_07.pdf.

230. See Table 2, *supra* note 74.

231. Smallwood’s Replies to the Parties’ Response to Queries from the SRC and Comments from the California Office of the Attorney General at 3, 5, GGAS, No. RG05239790 (Mar. 3, 2007), available at http://www.altamontsrc.org/alt_doc/alt_settlement/s16_smallwoods_replies_to_parties_response_3_9_07.pdf.

232. See Audubon Settlement, *supra* note 219, at 2; see also DEVELOPING METHODS TO REDUCE BIRD MORTALITY IN THE APWRA, *supra* note 8, at 3 (noting that “between 881 and 1,300 raptors are killed annually in the APWRA”). The four target species included Golden Eagle, Red-tailed Hawk, Burrowing Owl, and American Kestrel.

233. The adjustment factor was the multiplier against mortality originally calculated from the number of carcasses found and attributed to wind turbine collision. The multiplier is derived from the numbers of carcasses not found due to searcher error and scavenger removal. See Alameda County Scientific Review Committee Replies to the Parties’ Responses to Its Queries and to Comments from the California Office of the Attorney General at 3–5, GGAS, No. RG05239790 (Apr. 3, 2007), available at http://www.altamontsrc.org/alt_doc/alt_settlement/s20_src_replies_to_parties_answers_04_03_07.pdf.

234. Audubon Settlement, *supra* note 219, at 2.

SRC's role was previously to evaluate data and recommend mitigation measures. Thus, Term 3(b) only slightly modified this process by enabling the parties to the Audubon Agreement to decide upon measures before the SRC recommends them. However, Term 3(c) also changes the SRC's role in a manner that will not achieve mortality reduction during the three year period overseen by the SRC. Should raptor mortality not be reduced by 50% by November 1, 2009, the Companies' presentation of an adaptive management plan to the SRC will be pointless, in that the CDFG will assume the SRC's traditional role of formulating mitigation measures as the NCCP comes into existence. Finally, the Alameda County Board of Supervisors resolution of 2005 already authorized the SRC to recommend blade painting.²³⁵ Thus, Term 6 only added the specific numbers of turbines that the Companies might be willing to devote for purposes of experimenting with blade painting.

Pursuant to Term 7, the utility of a NCCP as a tool to help achieve the 50% mortality reduction through repowering or other means remains unclear. The process to develop and approve an NCCP is likely beyond the timeframe for mortality reduction required under the Audubon Agreement. Also, it is unprecedented for a NCCP to cover one group of species in the "community" and ignore the rest—in this case, the nonvolant special-status species such as California Red-legged Frogs and California Tiger Salamanders. It remains unclear whether California can issue take-permits for species protected by federal and international laws. Finally, no evidence has surfaced to suggest that CDFG will be funded to develop the NCCP or that CDFG has agreed to pursue this NCCP.

Certain statements in the Audubon Agreement pose the potential to reverse the benefits of the Alameda County CUPs, as established in 2005. Term 4 retracts the County's previous commitment to increasing the duration of the winter-time shutdowns of older model turbines in 2007–2008.²³⁶ While this abrupt shift might increase raptor mortality relative to the 2005 Alameda County permit conditions, Term 4 could potentially reduce raptor mortality by 14% if implemented as written. However, Term 6(c) exempts up to 900 turbines used in the blade painting experiment from winter-time and permanent shutdowns, again increasing raptor mortality relative to the 2005 Alameda County permit conditions.²³⁷ The Term 6(c) exemption could also confound studies designed by the monitoring team and the SRC to measure the effectiveness of various mitigation measures, including a winter-time shutdown. Thus, the Audubon Agreement sacrificed substantial mortality reductions in exchange for blade painting experimentation, the effects of which remain highly uncertain.

235. BD. OF SUPERVISORS OF THE COUNTY OF ALAMEDA, *supra* note 209, at 2.

236. *See generally* Audubon Settlement, *supra* note 219, at 3 (listing duration for winter shutdowns).

237. *See* Audubon Settlement, *supra* note 219, at 5.

Though Term 5(b) concerning the shutdown of Tier 3 turbines is not yet due for implementation, the measure might reduce Golden Eagle mortality by approximately 20% and further reduce overall raptor mortality by 12%.²³⁸ While this progress might have been offset by allowing the Companies to take credits for previously shutting down turbines pursuant to Term 5(b)(ii), the credit request deadline specified under the Audubon Agreement has now passed.²³⁹

IV. CONCLUSIONS

Multiple mitigation plans have been recommended or required since the early 1990s, but such measures were seldom implemented. Similarly, scientific recommendations seeking to improve understanding of the causal factors behind avian-turbine collisions have been ignored or rejected, such as the deployment of technology to remotely detect collisions and the provision of turbine power output data to researchers. In hindsight, if the wind power Companies had implemented these measures upon their initial endorsement in 1992, significant new knowledge regarding mortality prevention may have been generated, such that thousands of raptor deaths in the APWRA may have been avoided, as well as deaths in the other wind farms that have cropped up throughout the world since that time. By the end of the Smallwood and Thelander study of the APWRA, the notion should have been undeniable that conventional fatality and utilization monitoring, while very important, remains unsatisfactory for purposes of understanding the magnitude of biological impacts and causal factors of wind turbine collisions.

For years, researchers analyzed mortality estimates that were typically expressed as the number of fatalities per-turbine per-year.²⁴⁰ However, the rapid increase in the size of the turbines ended the usefulness of this metric.²⁴¹ A 2.5 MW turbine is twenty-five times the size of a 100 KW turbine. Thus, comparing mortality on a per-turbine basis no longer makes any logical sense.²⁴² More recently, investigators have compared mortality expressed as the number of fatalities per-MW of rated capacity per-year, but this metric does not account for the variation in actual power output or for unique attributes, such as turbine activity among specific turbine models, sites, and seasons. The only mortality metric that will enable

238. See Table 2, *supra* note 74.

239. The deadline for such credit requests expired on July 1, 2007. Audubon Settlement, *supra* note 219, at 4.

240. BIRD MORTALITY AT THE APWRA, *supra* note 3, at 28–29, 37.

241. See generally CAL. INST. FOR ENERGY AND ENVIRONMENT, CAL. ENERGY COMM'N, AVIAN WIND STATISTICAL PEER REVIEW PROJECT 49 (2006), available at <http://www.energy.ca.gov/2006publications/CEC-500-2006-114/CEC-500-2006-114.PDF>.

242. *Id.* (noting that “[i]t is senseless to compare fatalities per turbine per year when the turbines can vary from 40 kW to 2.5 MW”).

investigators to accurately gauge wind turbine impacts with any hope of understanding the underlying collision mechanisms is the number of fatalities per-kilowatt hour (“KWh”) since the last fatality search, where KWh is the actual power output of the turbine²⁴³ Researchers began requesting APWRA power output data in 1992, but the requested data was not received until Babcock & Brown released data for a few dozen turbines in 2007.

Similarly, much could have been learned by installing technology to remotely detect collisions. In the APWRA, scavengers remove small-bodied bird carcasses quickly, and research budgets have never been adequate to search the turbines with sufficient frequency to be able to find more than just a small fraction of the carcasses deposited by the APWRA wind turbines. As a result, the error term associated with scavenger removal is very large, producing imprecise mortality estimates.²⁴⁴ If the wind power Companies had installed technology with which to detect avian-turbine collisions, as recommended by researchers since 1992, the avian collision issue would, in all likelihood, be much better understood and the measures necessary to reduce avian mortality much more effective.

The host counties and the Companies are both repeating the missed opportunities of the early 1990s. The Diablo Winds and Buena Vista repowering projects were allowed to operate without TACs, though TACs are required in order to obtain a permit. As a result, independent scientists were not in place to interpret the Diablo Winds fatality and utilization monitoring data. Similarly, the Buena Vista project is now operating without any fatality or utilization monitoring, both of which are needed in order to support other mitigation measures and are key to learning whether repowering the APWRA should be expedited. Meanwhile, the Companies have not provided the Alameda County SRC or other independent scientists with any meaningful power output data from individual turbines located within the APWRA, and therefore, the mortality metric remains crude.

The settlement agreement for the continued operation of old-generation wind turbines constituted yet another missed opportunity to learn about bird collisions. The Agreement did not require remote detection of avian-turbine collisions or the provision of power output data to the SRC. Rather, the Agreement required continued fatality monitoring, but both the Companies and the County have not committed to funding this monitoring effort through the period of the Agreement. Even if the funding was committed, it remains doubtful that the methods being employed will

243. *Id.* (indicating that “[w]e believe a superior metric will be fatalities per kWh”); see also K. Shawn Smallwood & Carl Thelander, *Bird Mortality in the Altamont Pass Wind Resource Area, California*, 71 J. WILDLIFE MGMT. 215 (2008), available at <http://www.bioone.org/archive/0022-541X/72/1/pdf/i0022-541X-72-1-215.pdf>.

244. See BIRD MORTALITY AT THE APWRA, *supra* note 3, at 39 (discussing methods by which to calculate mortality estimates while taking into consideration the likelihood of scavenger removal).

achieve adequate precision in the mortality estimates. Furthermore, the Agreement empowered the parties to negotiate with what should be strictly scientific findings of the SRC, and in some cases, the Agreement took the unusual step of arriving at certain scientific conclusions in advance of SRC deliberations.

To reduce avian mortality in the APWRA, however, it will take more than scientific understanding. The Companies need to take substantial remedial actions. According to the evidence, fatality monitors are finding more turbine-killed raptors per fatality search with each subsequent monitoring effort, and despite this unfortunate increase in mortality, the only compensatory measure attempted to date has been a payment of \$350,000 by the owners of the Buena Vista Wind Energy project into a conservation fund.²⁴⁵ The mortality trend demonstrated by Figure 1 will not change unless significant remedial actions are finally implemented in the APWRA.

The history of noncompliance with APWRA permit conditions suggests that nothing will change unless the permit conditions are enforced. As the permitting agency, Alameda County is principally responsible for enforcing these permits. The USFWS, CDFG, and the California AG also share a measure of responsibility for enforcing state, federal, and international wildlife protection laws. Enforcement actions pursued by any of these agencies would likely reverse the mortality trend shown in Figure 1.

The APWRA experience suggests that mitigation plans for this and other wind farms will be incomplete without adequate funds dedicated to mitigation compliance. Mitigation plans can be rather complicated to develop and coordinate among multiple agencies, some of which may in fact be unaware that they are named recipients of preconstruction survey reports or compensatory mitigation fees. It is unlikely that any member of the public will attempt to track compliance with such a potentially complicated suite of permit conditions involving varying action deadlines, action thresholds, and agencies such as USFWS, the state wildlife agency, a specific lead agency, and others. Furthermore, given the history of noncompliance in the APWRA, a mitigation plan for wind turbine-caused fatalities ought to include a performance bond before it can be taken seriously. The performance bond should be a significant amount and should be carefully tied to specific mortality thresholds assessed by

245. The studies selected for this comparison were those involving fatality searches at turbines selected from throughout the APWRA. Reasons for the increase in avian fatalities could be attributed to a combination of any of the following factors: (1) researchers may have used different methods, though it is unclear whether methods differed enough to matter; (2) raptors might be accumulating in the APWRA as they are forced out of other habitat areas destroyed by human activities; and (3) changes in the APWRA might have increased collision risk, such as converting from lattice to tubular towers; commencing ground squirrel control in 1997; and deploying derelict lattice towers at ends of turbine rows after 2003.

scientific monitoring.

Beyond the 580 MW cap on rated capacity imposed by the Counties, biological impacts have not served as environmental barriers to wind power generation in the APWRA. No wind turbines have been red-tagged for permit violations, and no companies have been fined or put out of business. However, by raising public concerns, documented biological impacts have served as “soft” environmental barriers to new wind power development elsewhere. The public will likely grow even more concerned if current mortality levels continue in the APWRA or if similar mortality levels are experienced at other wind farms. The status and potential future of wind power as a viable, long-term source of renewable energy depends upon whether the industry commits to supporting research into the underlying causes of bird and bat collisions with wind turbines; whether the wind industry commits to implementing effective mitigation measures; and whether the regulatory agencies enforce compliance with operating permits.

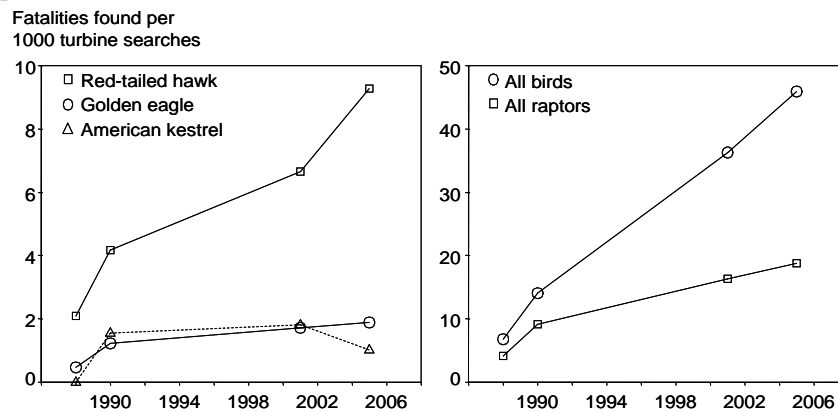


Figure 1. Number of fatalities found per 1000 wind turbine searches among 4 APWRA-wide studies: 1988-89 (Howell and DiDonato 1991), 1989-91 (Orloff and Flannery 1992), 1998-2003 (Cal. energy Comm'n, 2004), and 2005-06 (WEST, Inc. 2006). Data were plotted on the middle year of each study. For raptors, Howell and DiDonato (1991) and Orloff and Flannery (1992) assumed that the turbines were searched once per month, even though actual searches occurred weekly and biweekly in those studies. Raptors typically last longer in the environment. Therefore, monthly searches found nearly as many raptors as weekly or biweekly searches.