APPENDIX A

2010 Settlement Agreement

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AGREEMENT TO REPOWER TURBINES AT THE ALTAMONT PASS WIND RESOURCES AREA

THIS AGREEMENT (the "Agreement") is entered into as of this 3rd day of December 2010, by and between **Golden Gate Audubon Society, Ohlone Audubon Society, Mount Diablo Audubon Society, Santa Clara Valley Audubon Society, and Marin Audubon Society** (collectively "Audubon"); and **CAlifornians for Renewable Energy** ("CARE"); and **Green Ridge Power LLC, Windpower Partners 1990, L.P., Windpower Partners 1991, L.P., Windpower Partners 1991-2, L.P., and Windpower Partners 1992, L.P.** (collectively, "NextEra Wind"), and the **People of the State of California, ex rel Attorney General** ("AG"). Audubon, CARE, NextEra Wind and the AG are referred to individually as a "Party" and collectively as the "Parties."

RECITALS

This Agreement is made with respect to the following recitals of fact:

A. On September 22, 2005, the Alameda County Board of Supervisors approved conditional use permits ("CUPs") for the operation of existing wind turbines by NextEra Wind and other wind power companies (the "Wind Power Companies") at the Altamont Pass Wind Resources Area ("APWRA").

B. On or about October 2005 Audubon and CARE petitioned the Alameda County Superior Court for a writ of mandate to set aside the CUPs.

C. In January 2007, Audubon, CARE, Alameda County and the Wind Power Companies entered into a settlement agreement ("2007 Settlement Agreement"). On January 11, 2007, Alameda County modified the CUPs for the Wind Power Companies to be consistent with the 2007 Settlement Agreement.

D. The 2007 Settlement Agreement requires the Wind Power Companies to reduce raptor mortality by 50% and to implement adaptive management measures if a 50% reduction in mortality is not achieved. The 2007 Settlement Agreement also contemplates the development of a Natural Communities Conservation Plan ("NCCP")/Habitat Conservation Plan ("HCP") or similar agreement to address the long-term operation of wind turbines at the APWRA.

E. The Parties believe repowering old generation Kenetech 56-100 and KVS 33 turbines ("Old Generation Turbines") to be the most effective measure to reduce mortality at the APWRA.

TERMS AND CONDITIONS

NOW THEREFORE, in consideration of the mutual promises and covenants contained in this Agreement, the Parties agree as follows:

1. Relationship to 2007 Settlement Agreement

The Parties agree that ESI Energy, LLC, ESI Bay Area GP, Inc., ESI Tehachapi Acquisitions, Inc., and ESI Altamont Acquisitions, and their respective affiliates (collectively, the "NextEra Settlers") and NextEra Wind will have satisfied their obligations under the 2007 Settlement Agreement to reduce raptor mortality by 50% provided NextEra Wind is in compliance with this Agreement.

2. Repowering Schedule

NextEra Wind (or, hereinafter, any new entities formed for repowering purposes) will repower the Old Generation Turbines it currently owns and operates in the APWRA, as the APWRA is currently delineated in Alameda and Contra Costa Counties, as soon as commercially reasonable as defined below, in not more than three phases, each phase representing up to approximately 80 MW, in accordance with the terms of this Agreement. In order to repower existing Old Generation Turbines for Phases 2 and 3 as specified below, NextEra Wind may need to exchange certain Old Generation Turbines for a similar number of Old Generation Turbines that, as of the effective date of this Agreement, are under the control of another wind turbine operator in the APWRA. In the event NextEra Wind acquires additional turbines after the effective date of this Agreement, other than those Old Generation Turbines that may be acquired pursuant to an exchange to facilitate repowering of Phases 2 and 3, NextEra Wind shall repower such turbines in accordance with Section 2.4 below.

2.1 Phase 1

Phase 1 will be based in Contra Costa County. Phase 1 will be described in the Environmental Impact Report ("EIR") Contra Costa County is preparing for the Vasco Winds project. NextEra Wind will repower Phase I promptly after all necessary local, state and/or federal entitlements, permits, certifications or similar approvals (collectively referred to as "Approvals") are obtained. If Approvals are obtained by February 28, 2011, NextEra Wind will repower Phase 1 by December 31, 2011, unless there are circumstances beyond NextEra Wind's control as provided in Section 3.

Regardless of whether Approvals are obtained by February 28, 2011, NextEra Wind will continue to use all commercially reasonable efforts to repower the Phase 1 turbines by December 31, 2012.

2.2 Phase 2

Phase 2 will be based in Alameda County. Phase 2 will be described in a programmatic EIR that Alameda County prepares for repowering the Alameda portion of the APWRA or a project specific EIR to address NextEra Wind's proposed project. NextEra Wind will repower Phase 2 promptly after all Approvals are obtained. If Approvals are obtained by September 30, 2011, NextEra Wind will repower Phase 2 by December 31, 2012, barring unforeseen delays. If Approvals are obtained by September 30, 2012, NextEra Wind will repower Phase 2 by December 31, 2013, unless there are circumstances beyond NextEra Wind's control as provided in Section 3. Completion of Phase 1 shall not be a prerequisite for initiation of Phase 2.

Regardless of whether Approvals are obtained by September 30, 2012, NextEra Wind agrees it will continue to use all commercially reasonable efforts to repower the Phase 2 turbines by December 31, 2014.

2.3 Phase 3

Phase 3 will be based in Alameda County. Phase 3 may be described in a focused EIR that tiers off of Alameda County's programmatic EIR. NextEra Wind will repower Phase 3 promptly after all Approvals are obtained. If Approvals for Phase 2 are obtained by September 30, 2011 and Approvals for Phase 3 are obtained by September 30, 2012, NextEra Wind will repower Phase 3 by December 31, 2013, barring unforeseen delays. If Approvals for Phase 2 are obtained by September 30, 2012 and Approvals for Phase 3 are obtained by September 30, 2013, NextEra Wind will repower Phase 3 by December 31, 2014, unless there are circumstances beyond NextEra Wind's control as provided in Section 3. Notwithstanding the foregoing, NextEra Wind may repower Phases 2 and 3 simultaneously.

Regardless of whether Approvals are obtained by September 30, 2013, NextEra Wind agrees it will continue to use all commercially reasonable efforts to repower the Phase 3 turbines by September 30, 2015.

2.4 Subsequently acquired turbines

If, after the effective date of this Agreement, NextEra Wind (or any entities formed for such purposes relative to this subsection) acquires non-repowered turbines (including but not limited to Kenetech 56-100 and KVS-33 turbines) from current owners or operators in the APWRA, NextEra Wind will use commercially reasonable efforts to coordinate repowering of such turbines with the repowering schedule outlined above. Notwithstanding the foregoing, NextEra Wind shall shutdown such subsequently acquired turbines no later than one (1) year after the commercial operation date ("COD") for Phase 3 or the date of their acquisition, whichever is later. NextEra Wind shall use commercially reasonable efforts to remove all subsequently acquired turbines within three (3) months and in no event more than six (6) months after their shutdown. Prior to repowering, such turbines shall be subject to the 2007 Settlement Agreement. Notwithstanding the foregoing, Old Generation Turbines acquired pursuant to the exchange outlined in Section 2 shall be repowered pursuant to the schedule for Phases 2 and 3.

3. Commercially Reasonable Efforts; Meet and Confer Requirements

For each phase of repowering, NextEra Wind shall exercise all reasonable and good faith efforts and use all reasonable due diligence to enter into a power purchase agreement under commercially reasonable terms, and to obtain all necessary Approvals to satisfy the requirements of that power purchase agreement in order to meet the repowering schedules specified in Sections 2.1 through 2.4 herein. Provided NextEra Wind exercises all reasonable and good faith efforts and uses all reasonable due diligence, NextEra Wind shall not be deemed in violation of this Agreement for failing to repower in accordance with the schedules specified in Sections 2.1 through 2.4 herein. Notwithstanding the foregoing, NextEra Wind shall shut down all Old Generation Turbines it owns and operates no later than November 1, 2015 and shall remove any and all such turbines within the APRWA no later than March 15, 2016 except as provided for in

section 2.4. Notwithstanding any provision in this Agreement to the contrary, NextEra Wind shall have no liability to any of the Parties for failure to repower in accordance with its obligations under this Agreement so long as NextEra Wind satisfies its shut down and removal obligations as described in the preceding sentence.

The Parties recognize that, despite the use of commercially reasonable efforts, NextEra Wind may not be able to meet one or more of the repowering schedules specified in Sections 2.1 through 2.4, due to circumstances that are beyond its control, such as unavailability of turbines, or inability to obtain Approvals or commercially reasonable power purchase agreements despite NextEra Wind's reasonable, good faith efforts and the exercise of all reasonable due diligence. If NextEra Wind cannot meet any or all of the repowering schedules specified in Sections 2.1 through 2.4 due to circumstances beyond its control, NextEra Wind shall notify the other Parties to this Agreement in writing within thirty (30) days after NextEra Wind reasonably determines that it will be unable to do so. NextEra Wind shall propose a place within Alameda County, and possible dates and times for the Parties to meet and confer within thirty (30) days after NextEra Wind provides such written notification, unless the Parties agree in writing to an alternative time frame to meet and confer. Ten (10) days prior to the agreed upon date and time for the meet and confer meeting of the Parties, NextEra Wind shall provide written support for why one or more of the repowering schedules in Section 2 cannot be met and shall provide a proposed new schedule for repowering. Any new schedule proposed by NextEra Wind and/or agreed to by the Parties does not alter NextEra Wind's obligation to shut down all Old Generation Turbines it owns or operates within the APWRA by November 1, 2015 and remove such turbines within the APWRA by March 15, 2016 and to shut down all subsequently acquired turbines as provided for in Section 2.4.

If the Parties are unable to reach agreement on a new repowering schedule, NextEra Wind shall operate any remaining non-repowered turbines according to the Avian Wildlife Protection Program and Schedule in NextEra Wind's Conditional Use Permits adopted on January 11, 2007 (Exhibit G-1) by the Alameda County Board of Supervisors, including any requirements to remove High Risk Turbines (hazardous turbines ranked 7.0 and above) and Unproductive Turbines and other requirements described in any County-approved adaptive management plan. Notwithstanding the foregoing, NextEra Wind may apply to the Alameda County Scientific Review Committee ("SRC") for credit for removal of any High Risk Turbines due to repowering already achieved and/or removal of turbines that have been or will be required pursuant to this Agreement that are in excess of what would otherwise be required pursuant to the Avian Wildlife Protection Program and Schedule, as amended by any County-approved adaptive management plan.

4. Siting of Repowered Turbines

NextEra Wind shall site repowered turbines within each of the three phases of repowering described in Sections 2.1 through 2.3 based on the best scientific and commercial data, including studies that rely on methods in peer-reviewed scientific journals, which are available at the time the draft NextEra Wind is circulated for public and agency review and comment for each applicable phase of repowering. The Parties agree that siting of repowered turbines shall be based on field data that confirm the behavior, utilization and distribution patterns of affected avian and bat species prior to the installation of any new repowered turbines, as well as based on

appropriate computer models that predict the most dangerous locations for birds and bats based on site geography and topography. The Parties agree that utilizing field data and computer modeling prior to the installation of any new repowered turbines within each phase is essential for ensuring the maximum possible avoidance and reduction of avian and bat mortality from the current old-generation turbines.

The Parties further agree that, in addition to siting of each phase based on pre-construction geographic and topographic surveys and direct observations and modeling of bird and bat utilization and behavior at the site, siting of Phase 2 and each subsequent phase also shall be based on post-construction monitoring data from each applicable earlier phase (fatality and bird and bat utilization and behavior monitoring), as well as on monitoring data, reports and studies from other repowering projects. The post-construction monitoring data shall be used to evaluate the validity of the previous pre-construction siting evaluations and to update and improve the siting evaluations for each subsequent repowering phase.

4.1 Phase 1 siting

Phase 1 turbines will be sited by incorporating the analysis included in Smallwood and Neher, *Siting Repowered Turbines to Minimize Raptor Collisions at Vasco Winds*, 03 June 2010 ("Vasco Winds Siting Report"), which evaluates a digital elevation model (DEM) and raptor use and behavior data to develop geographical and topographical map-based predictive models of where raptors more often fly and perform specific hazardous behaviors such that location of repowered turbines in these areas would create the greatest risk to raptors.

4.2 Phases 2 and 3 and subsequently acquired turbines siting

Phases 2 and 3 and subsequently acquired turbines will be sited by incorporating (when scientifically and technically applicable) the Vasco Winds Siting Report, as well as post-construction monitoring data of each applicable earlier Phase, and pre-construction geographical and topographical map-based predictive models based on raptor use and behavior studies in the APWRA, and any additional studies published in peer-reviewed scientific journals that are in existence at the time the draft EIR for the particular repowering phase is circulated for agency and public review and comment.

The Parties shall meet and confer to discuss the siting for each repowering phase prior to NextEra Wind submitting the siting plan for the final array of turbines for each repowering phase to Alameda County for environmental review. NextEra Wind shall notify the other Parties to this Agreement in writing, proposing a place within Alameda County and possible dates for the Parties to meet and confer within twenty (20) days after NextEra Wind provides such written notification, unless the Parties agree in writing to an alternative time frame to meet and confer. Ten (10) days prior to the agreed upon date and time for the meet and confer meeting, NextEra Wind shall provide the other Parties to this Agreement a siting plan and written explanation of the siting of the proposed turbines. The written explanation shall include a justification for the deviation(s), if any, from any map-based predictive models as described above. Additionally, the consultant who prepared the map-based predictive models shall make a technical presentation during the meet and confer meeting. The Parties agree to work in good faith to resolve any disagreement they may have over the proposed siting plan. In the event the Parties are unable to

resolve their differences, the AG and/or Audubon and/or CARE may submit comments to the SRC explaining their concerns.

NextEra Wind agrees to consult with the SRC during preparation of the EIRs for Phases 2 and 3 in accordance with the terms of the Conditional Use Permits. The Parties agree that the SRC may assist in the technical evaluation of the scope and content of the EIRs to be prepared for Phases 2 and 3, respectively. The Parties agree that the SRC must be given adequate opportunity to review and comment on the draft EIRs for Phases 2 and 3.

5. Monitoring and Further Management Measures

5.1 Post-construction monitoring

Each phase of repowered turbines will be subject to three years of post-construction monitoring unless additional monitoring is required pursuant to Section 5.2 below. Post-construction monitoring shall begin no later than three (3) months after the COD for each phase. Post-construction monitoring shall include collecting field data on behavior, utilization and distribution patterns of affected avian and bat species in addition to fatalities. In addition, each phase of repowering shall be subject to two years of further monitoring commencing on the tenth anniversary of its COD. NextEra Wind also agrees to provide access to qualified third parties to conduct any additional monitoring after the initial three year monitoring period has expired and before the additional two year monitoring period has commenced, and after the additional two year monitoring period has expired, provided that such additional monitoring utilizes scientifically valid monitoring protocols that yield results which are reasonably comparable to other efforts to monitor NextEra Wind's repowered turbines. The initial three year monitoring period and the subsequent two year monitoring period together shall constitute the post-construction monitoring period.

NextEra Wind agrees to implement monitoring of all repowered turbines for fatalities pursuant to an enforceable monitoring program established in consultation with the Contra Costa County Technical Advisory Committee ("TAC") established pursuant to Contra Costa County's Vasco Winds EIR or the SRC, as applicable. The monitoring shall use red-tailed hawks, golden eagles, American kestrels and burrowing owls ("Focal Raptor Species") and bats as benchmarks for evaluating the effectiveness of the overall NextEra Wind repowering effort pursuant to Section 2 herein and to inform and update siting analyses for each subsequent phase of the overall repowering effort and for any other future repowering efforts. NextEra Wind also will conduct bird and bat utilization and behavior studies, in consultation with the TAC or the SRC, for each phase of repowering in order to inform and update siting analyses for each subsequent phase of the overall NextEra Wind repowering effort and for any other future repowering efforts. NextEra Wind also shall monitor each repowered turbine at least once per month for the duration of the post-construction monitoring period for fatalities of the four focal raptor species, bats and all other bird species, as recommended by the TAC and the SRC, as appropriate. Finally, NextEra Wind shall monitor a subset (30%) of the repowered turbines at least twice per month for the duration of the post-construction monitoring period for each phase of repowering for fatalities, bird and bat utilization and/or behavior, in consultation with the TAC or the SRC, as appropriate.

Post-construction monitoring shall be conducted by a reputable consultant with applicable experience ("Monitor"). NextEra Wind shall select the Monitor from the following list: Insignia Environmental, Ventus Environmental Solutions, CH2M Hill, or another Monitor recommended by the SRC or TAC or agreed to by the Parties. Post-construction monitoring shall not exceed $300,000 annually per phase, including the production of monitoring reports, as adjusted for inflation.

The Monitor shall prepare interim, annual monitoring reports within three months of completing each year of post-construction monitoring, and shall prepare a final three year Monitoring Report within six months of completing three years of post-construction monitoring for each phase of repowering and a final two year Monitoring Report within six months of completing two years of post-construction monitoring. All monitoring reports shall report adjusted and unadjusted annual fatalities for the Focal Raptor Species, bats and all other bird species on a per-turbine and per megawatt basis. The monitoring reports shall also summarize the results of the bird and bat behavior and use studies for the preceding one or three years, as applicable. The Monitor shall supplement the final three year Monitoring Report for each repowering phase with subsequent monitoring data collected in accordance with this Agreement.

5.2 Fatality reduction measures

The SRC or TAC, as applicable, shall review the final three year Monitoring Report for each repowering phase to evaluate whether any repowered turbines are causing significantly disproportionate Focal Raptor and/or bat fatalities relative to other turbines included within that particular phase of repowering. If one or more turbines are causing significantly disproportionate Focal Raptor or bat fatalities, then the SRC or TAC, as applicable, in consultation with the Parties, may recommend to the Planning Director of the applicable county additional focused monitoring and/or management measures designed to reduce the fatalities attributable to those turbines; provided, however, that such measures shall not include relocation or permanent shutdown of any repowered turbine. NextEra Wind, in its sole discretion, shall determine whether to implement the recommended management measures and/or conduct the additional focused monitoring. Notwithstanding the foregoing, the Parties acknowledge that fatality reduction or other measures may be required pursuant to applicable law including but not limited to the federal Endangered Species Act (16 U.S.C §§ 1530 *et seq.),* Bald and Golden Eagle Protection Act (16 U.S.C. §§ 668-668d), Migratory Bird Treaty Act (16 U.S.C. §§ 703-712) or the California Endangered Species Act (California Fish and Game Code, §§ 2050, *et seq.*).

5.3 Obligations regarding existing turbines

NextEra Wind's obligations under Avian Wildlife Protection Program and Schedule in NextEra Wind's Conditional Use Permits adopted on January 11, 2007 (Exhibit G-1) to monitor existing non-repowered Old Generation and other turbines and implement winter seasonal shutdown shall continue until such turbines are removed.

5.4 Monitoring reports

All monitoring reports, including all raw monitoring data upon which the reports are based, shall be made available to members of the TAC, the SRC and the public as promptly as possible, but in any event no later than thirty (30) days after the report is produced.

5.5 Relationship to NCCP/HCP

If NextEra Wind participates in an approved Natural Communities Conservation Plan/Habitat Conservation Plan (NCCP/HCP) for the APWRA, the provisions of Section 5 of this Agreement shall be replaced by the monitoring and adaptive management requirements of the NCCP/HCP. If NextEra Wind participates in an NCCP/HCP that is ultimately approved by the federal and state wildlife agencies, such plan also shall supersede Section 6 of this Agreement, provided the NCCP/HCP contains measures to fully compensate for any ongoing fatalities of, and to provide an overall net conservation benefit for the Focal Raptor Species and other covered species, including bats.

6. Mitigation Fee for Ongoing Harm to Focal Raptor Fatalities

To compensate for ongoing fatalities of the bird and bat species identified in the monitoring reports required by Section 5.4, NextEra Wind agrees to pay a mitigation fee of $10,500 per megawatt of installed capacity for each phase of repowering (including subsequently acquired turbines). The fee shall be paid in three annual installments with the first payment due no later than three months of the COD for each phase. NextEra Wind shall notify the Parties in writing of the COD for each phase within 14 days of the COD. 50% of the total fees for each phase shall be paid to the California Energy Commission's Public Integrated Energy Research Program ("PIER") for scientific research on the effects of wind turbines on birds and bats at the APWRA; and 50% of the total fees shall be paid to a fund to be administered by the East Bay Regional Park District ("EBRPD"), the Livermore Area Regional Park District ("LARPD"), or any other entity identified in the NCCP/HCP conservation plan, or a combination of those entities for conservation efforts for the benefit of those bird and bat species and their habitat in the greater area encompassed by and surrounding the APWRA. Notwithstanding the foregoing, before providing funding to the recipient(s), the Parties shall meet with the recipient(s) in an effort to negotiate a Memorandum of Understanding ("MOU") ensuring that the funds will be used consistent with this Agreement. If no such MOU can be reached, the Parties will meet and determine how to reallocate the funds for the benefit of those bird and bat species and their habitat in the greater area encompassed by and surrounding the APWRA.

7. CEQA Process and Permitting

7.1 Comments

Provided NextEra Wind is in compliance with all material aspects of this Agreement as described in Section 10, the AG, Audubon and CARE shall not oppose or challenge the certification of any EIR or any entitlements for any repowering phase. Notwithstanding the foregoing, the AG, Audubon and CARE may submit comments on the adequacy of the environmental documentation for each phase of repowering. Prior to submitting any comments,

the AG, Audubon and/or CARE shall first meet and confer with NextEra Wind and make a good faith effort to resolve any concerns.

7.2 Relationship to mitigation measures

The Parties agree that mitigation required pursuant to this Agreement shall count towards any compensatory mitigation requirements imposed pursuant to CEQA and other local, state or federal Approvals.

7.3 Incorporation of provisions of Agreement into EIRs for repowering

While recognizing that final decisions regarding permit conditions and environmental documents are within the purview of the applicable permitting agencies, the Parties agree to use their best efforts to ensure that the provisions of this Agreement, including but not limited to siting and monitoring of repowered turbines, mortality reduction measures, and mitigation funds for unavoidable ongoing avian fatalities, will be incorporated as conditions of approval for local government permits approved for each phase of the overall NextEra Wind repowering effort, and as mitigation and monitoring measures in the final EIRs certified by Contra Costa and Alameda Counties for each phase of the overall NextEra Wind repowering effort, and any adaptive management plan approved by Alameda County.

8. Covenants Not to Sue

The AG, Audubon and CARE hereby release any and all existing and future claims against NextEra Wind (including any new entities formed for repowering or other purposes stated herein) and the NextEra Settlers, with respect to any and all avian and bat mortality at the APWRA for existing and repowered turbines. If, for any reason, this Agreement or any portion thereof is terminated or otherwise deemed invalid, the release of existing and future claims by the AG, Audubon and CARE will continue to apply to any phase of repowering for which Approvals have been obtained.

9. Successors, Assigns and Affiliates

This Agreement shall be binding upon the successors, assigns and affiliates of the Parties.

10. Enforcement

The Parties shall make all reasonable efforts to resolve their disputes and disagreements regarding the meaning of "compliance with" and/or "implementation of" this Agreement informally and in good faith prior to seeking any judicial relief to enforce the terms of this Agreement. If any Party has a dispute concerning the meaning of "compliance with" and/or "implementation of" this Agreement, that Party shall send a written notice to all other Parties that specifies the nature of the dispute and requests resolution of the dispute.

Upon receipt of such written notification, the Party receiving such notice shall either send the other Parties written notice within seven (7) days of receipt that it intends to cure and shall cure the alleged deficiency within sixty (60) days; or, if the Party receiving the notice is unable to cure the alleged deficiency or disputes the alleged deficiency, that Party receiving such notice

shall provide written notice to this effect to all Parties within seven (7) days of receipt of the notification.

If the Party receiving the notice disputes the alleged deficiency, the Parties shall initiate informal negotiations to resolve the dispute. Such period of informal negotiations shall not extend beyond sixty (60) days from the date on which the Party receiving the notice requests such negotiations, unless the Parties agree otherwise in writing. If the alleged violation is not remedied or the Parties fail to reach an agreement during the 60-day informal negotiation period, the noticing Party may seek judicial relief to enforce the terms of this Agreement in superior court.

11. Obligation to Terminate Existing Financing

Certain assets of NextEra Wind at the APWRA, including the existing Old Generation turbines, are subject to an existing financing agreement. NextEra Wind is in the process of terminating that financing agreement with respect to the existing APWRA NextEra Wind assets and has received lender approval to do so on or about December 1, 2010. Because the termination of the existing financing agreement must be completed, and the mortgage on the existing turbines and other assets satisfied, before NextEra Wind commits to decommissioning the existing turbines, this Agreement, which provides for such decommissioning, cannot become binding until the mortgage on the applicable NextEra Wind APWRA assets is satisfied. NextEra Wind characterizes the financing change as ministerial in light of the lender approval. In the very unlikely event that the financing change has not occurred by January 1, 2011, this Agreement is null and void, and NextEra Wind shall be subject to all obligations of the Avian Wildlife Protection Program and Schedule in NextEra Wind's Conditional Use Permits adopted on January 11, 2007 (Exhibit G-1), as amended by the County-approved adaptive management plan. NextEra Wind will notify the Parties to this Agreement when such satisfaction has occurred, or whether it will not occur, promptly, within 7 days after such an event becomes known to NextEra Wind. If such satisfaction has not occurred by January 1, 2011, the Parties agree to meet and confer within thirty days and use their best efforts to reach a new agreement for repowering that addresses the financing change issue.

12. No Admission of Wrongdoing

This Agreement is the result of a compromise with respect to the disputes between the Parties. In no event shall this Agreement be deemed an admission of wrongdoing or liability of any kind by any Party.

13. Amendments

Unless expressly permitted by this Agreement, no supplement, modification or amendment of any term, provision or condition of this Agreement (including this section) shall be binding or enforceable unless evidenced in a writing executed by all of the Parties to this Agreement.

14. Applicable Law

This Agreement shall be governed exclusively by and construed and enforced exclusively in accordance with and subject to the law of the state of California without regard to its choice of

law provisions, except in the event of bankruptcy by any Party, in which event the laws of the United States shall also apply, where appropriate.

15. Authority to Enter into Agreement

The Parties here represent and warrant that they have reviewed this Agreement with their respective attorneys, and that they have authority to enter into and sign this Agreement on their behalf.

16. Counterparts

This Agreement may be executed in counterparts, each of which shall be deemed an original, and each of which shall constitute together one and the same instrument. The counterparts will be binding on each of the Parties, even though the various Parties may have executed separate counterparts.

Dated: December 3, 2010 GREEN RIDGE POWER LLC

BY: _____

ITS: President

TJ Tuscai
President

Dated: December 3, 2010 WINDPOWER PARTNERS 1990, LP

BY: ESI BAY AREA GP, INC

ITS: General Partner

BY: _____

ITS: President

TJ Tuscai
President

Dated: December 3, 2010

WINDPOWER PARTNERS 1991, L.P.

BY: ESI BAY AREA GP, INC

ITS: General Partner

BY: _____

ITS: President

TJ Tuscai
President

Dated: December 3, 2010

WINDPOWER PARTNERS 1991-2, L.P.

BY: ESI BAY AREA GP, INC

ITS: General Partner

BY: _____

ITS: President

TJ Tuscai
President

Dated: December 3, 2010

WINDPOWER PARTNERS 1992, L.P.

BY: ESI BAY AREA GP, INC

ITS: General Partner

BY: _____

ITS: President

TJ Tuscai
President

Dated: December 3, 2010

GOLDEN GATE AUDUBON SOCIETY,
OHLONE AUDUBON SOCIETY,
MOUNT DIABLO AUDUBON SOCIETY,
SANTA CLARA VALLEY AUDUBON SOCIETY and
MARIN AUDUBON SOCIETY

Name: Bill Yeates, Kenyon Yeates LLP
Title: Attorney representing
Golden Gate, Ohlone, Mount Diablo, Santa Clara Valley, and Marin Audubon Societies.

Dated: December __, 2010

CALIFORNIANS FOR RENEWABLE ENERGY

Name: Michael E. Boyd
Title: President of the Board of Directors

Dated: December __, 2010

PEOPLE OF THE STATE OF CALIFORNIA
EX REL. ATTORNEY GENERAL

Name: Ken Alex
Title: Senior Assistant Attorney General

Dated: December ___, 2010

GOLDEN GATE AUDUBON SOCIETY,
OHLONE AUDUBON SOCIETY,
MOUNT DIABLO AUDUBON SOCIETY,
SANTA CLARA VALLEY AUDUBON SOCIETY and
MARIN AUDUBON SOCIETY

_____

Name: Bill Yeates, Kenyon Yeates LLP
Title: Attorney representing
Golden Gate, Ohlone, Mount Diablo, Santa Clara Valley, and Marin Audubon Societies.

Dated: December __, 2010

CALIFORNIANS FOR RENEWABLE ENERGY

Michael E. Boyd

_____

Name: Michael E. Boyd
Title: President of the Board of Directors

Dated: December __, 2010

PEOPLE OF THE STATE OF CALIFORNIA
EX REL. ATTORNEY GENERAL

_____

Name: Ken Alex
Title: Senior Assistant Attorney General

Dated: December ___, 2010

GOLDEN GATE AUDUBON SOCIETY,
OHLONE AUDUBON SOCIETY,
MOUNT DIABLO AUDUBON SOCIETY,
SANTA CLARA VALLEY AUDUBON SOCIETY and
MARIN AUDUBON SOCIETY

_____

Name: Bill Yeates, Kenyon Yeates LLP
Title: Attorney representing
Golden Gate, Ohlone, Mount Diablo, Santa Clara Valley, and Marin Audubon Societies.

Dated: December __, 2010

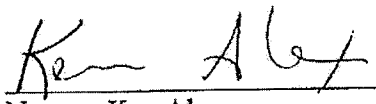
CALIFORNIANS FOR RENEWABLE ENERGY

_____

Name: Michael E. Boyd
Title: President of the Board of Directors

Dated: December 3__, 2010

PEOPLE OF THE STATE OF CALIFORNIA
EX REL. ATTORNEY GENERAL



Name: Ken Alex
Title: Senior Assistant Attorney General

APPENDIX B

Smallwood & Neher: Siting Repowered Wind Turbines to Minimize Raptor Collisions at Vasco Winds

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Siting Repowered Wind Turbines to Minimize Raptor Collisions at Vasco Winds

K. Shawn Smallwood and Lee Neher

18 February 2011

NextEra is considering repowering its old-generation wind turbines in the Vasco Winds project with modern wind turbines, either with GE xle 1.5 MW turbines or Siemens 2.3 MW turbines. Repowering should reduce raptor fatalities caused by the wind turbines while also increasing the amount of renewable energy generated by the project (Smallwood and Karas 2009). Raptor fatalities can be further reduced by carefully siting the new wind turbines to minimize the frequencies at which raptors of various species encounter the wind turbines while flying. In this study we extended simple Fuzzy Logic (FL) models of raptor activity in the Vasco Caves Regional Preserve to the adjacent Vasco Winds project site.

The Fuzzy Logic approach is a rule-based system useful with noisy data or with zero-dominated data sets, and is applied to events occurring within classes that are assumed to have graduated rather than sharp boundaries. The rules consist of assigning likelihood values of an event occurring. Likelihood values can range 0 to 1 for each predictor variable, depending on how far a value of the predictor variable differs from the mean where the event has been recorded. The magnitude of each deviation from the mean is assessed by the analyst based on error levels, data distribution, and the analyst's knowledge of the system. In our case, the events were of birds flying over terrain characterized by suites of slope conditions.

Bird observations in Vasco Caves Regional Preserve generally followed guidelines recommended by Gauthreaux (1996), Anderson et al. (1999), U.S. Fish and Wildlife Service (2003), and the California Energy Commission and California Department of Fish and Game (CEC & CDFG 2007). However, interpretation of flight patterns from bird observations can be confounded by relationships between bird detection rates and (1) distance of the bird from the observer, and (2) the airspace visible from each observation station. For most species, detection rates should be expected to decrease with increasing distance from the observer and with decreasing visible airspace within the maximum survey radius due to obstructing hills and slopes. These effects on detection rates need to be quantified and removed by appropriately weighting bird observations for how far away the birds were located from the observer when recorded.

We used newly available Light Detection and Ranging (LIDAR) data to construct a digital elevation model (DEM) of the Vasco Caves study area and of the Vasco Winds project area. The DEM had a 2-foot grid cell resolution, so the study area and project area DEMs included millions of grid cells. We developed map-based predictive models of where raptors more often fly and perform specific hazardous behaviors, and we extended these models to the proposed Vasco Winds repowering project area to assist an effort to carefully site new wind turbines at locations intended to cause the least harm to wildlife while also serving the power generation objectives of the project owner.

Study Area

The Vasco Winds project site occurs in the Contra Costa County portion of the Altamont Pass Wind Resource Area (APWRA). The APWRA encompasses about 165 km^2 (16,500 ha) of ridges and hills generally extending northwest to southeast in eastern Alameda and southeastern Contra Costa Counties, California. Located in the Inner Coast Range geomorphic province and bordering the Central Valley province. Elevations range 78 m to 470 m above mean sea level. Slopes are covered mostly by non-native, annual grasses, which grow mostly during January through March and are dead or dormant by June. Cattle grazers hold most of the land, leasing out wind energy rights to wind power companies. Wind turbines in the APWRA are arranged in rows of 2 to 62 turbines, typically along ridge crests (i.e., peaks of the ridge features) and ridgelines extending down toward ephemeral streams. Wind turbine rows also occupy slopes, valleys, and hill peaks, and all operate in winds from any direction, although most winds originate from the southwest or northwest. Old-generation wind turbine models are listed in Smallwood and Thelander (2008).

The proposed repowering project site for Vasco Winds is located within the northern portion of the APWRA, where elevations range 70 m to 300 m. The site is about 10 km southwest of Byron. The land encompassed by Vasco Winds lies between Los Vaqueros Road and Los Vaqueros Reservoir to the west and Vasco Caves Regional Preserve to the east and north. A second portion of the project area is located on the east side of Vasco Road, just south of the Buena Vista Wind Energy project site. The terrain at Vasco Winds is similar to the terrain in Vasco Caves Regional Preserve, where we developed species-specific models of activity areas for golden eagle, red-tailed hawk, American kestrel, and burrowing owl.

METHODS

Utilization data

Raptor flights.—Within Vasco Caves Regional Preserve, B. Karas, H. Snively, and S. Smallwood collected bird utilization data from 15 observation stations weekly from June 2006 through September 2007, totaling 774 1-hour sessions (Smallwood et al. 2009b). Birds were recorded out to 600 m from each station. Birds recorded during these sessions were also mapped onto hand-held, hard-copy maps depicting aerial images of the area under observation and including prominent features and blue lines highlighting ridge crests. Observers wrote symbols onto the maps where they estimated raptors and corvids were located at one-minute intervals, totaling 7,699 recorded observations. Mapped locations were then digitized as point features in ArcMap GIS layered onto a DEM.

Bird attribute data were recorded into digital audio recorders and later transcribed to electronic spreadsheets. Attributes included species, number of individuals, flight behavior if flying, perch structure if perching, and height above ground. We also recorded interactions with other birds, and the number of minutes into the session. At the start of each session and at 15-min intervals we recorded temperature, wind speed, and wind direction.

Burrowing owls.—Within Vasco Caves Regional Preserve, J. Barclay and L. Harmon searched for burrowing owls and their nest burrows from 33 observation points in 2006 and 39 points in 2007, using 10 x 40 binoculars and a 25 x 60 spotting scope from both inside and outside an automobile. They performed 15 surveys (54 hours) from 24 May to 2 August 2006, and 11 surveys (44 hours) from 3 April to 27 June 2007. In both years, 11 surveys were initiated during morning, generally spanning 08:00 hours to 13:00 hours. Nest burrows had a breeding pair in attendance during repeat surveys. To represent nest productivity, the maximum number of emergent juveniles between 2 and 4 weeks old was recorded. Burrowing owl burrows were characterized as point features in ArcMap GIS and layered onto our DEM of the study area. The analytical grid for the burrowing owl burrow model development consisted of 582,068 grid cells.

Digital Elevation Model

We utilized two separate digital elevation model (DEM) grids for this project. The majority of geoprocessing tasks were performed using a 10 foot cell size DEM obtained from Contra Costa County. This data set was produced using LIDAR data and ARC TIN software by Mapcon Mapping Inc. during 2007-2008. We also obtained 2 foot contour interval vector GIS data from Contra Costa County and produced by the same contractor. We then created a 2 foot DEM from the contours using ESRI software. The 2 foot DEM was used for slope and aspect modeling.

All derived parameters were calculated for the entire Vasco Caves study area, plus an aggregated 2,000 foot buffer around 15 bird observation points, to ensure that all bird observations would be covered. The aggregated 609-m buffer served as our mask (limit) for analyzing previously collected bird data against the higher resolution DEM. The 609-m radius was converted to a 2,000 foot radius and an additional 200 feet was added to buffer modeling data for geoprocessing.

Within the Vasco Caves Regional Preserve, we limited (masked) statistical analyses to data within the areas searched for raptors. The resulting analytical grid was composed of 908,297 10x10-foot cells, each cell assigned a unique membership number. The analytical grid was used to develop and test predictive models, which were later projected across the Vasco Winds project area.

Slope Attributes

The same geoprocessing steps were used to characterize slope attributes as reported in Smallwood and Neher (2004, 2009) and Smallwood et al. (2009a,c), but this time we refined some steps to differentiate grid cells between ridge-like (convex) and valley-like (concave) tendencies. We used the Curvature function in the Spatial Analysis extension of ArcGIS 9.2 to calculate the curvature of a surface at each cell centroid. A positive curvature indicated the surface was upwardly convex at that cell, a negative curvature indicated the surface was upwardly concave, and a value of zero indicated the cell surface was flat. The curvature data (-51 to 38) were classified using the Natural Breaks (Jenks) function with 3 classes of curvature – convex, concave and mid-range. The break values were visually adjusted to minimize the size of the mid-range class. We used a series of geoprocessing steps called ‘expand,’ ‘shrink,’ and ‘region group,’ as well as ‘majority filter tools’ to enhance the primary slope curvature trend of a

location. The result was a surface almost exclusively defined as either convex or concave (Figure 1). The convex surface areas consisted primarily of ridge crests and peaks, hereafter referred to as ridges, and the concave surface areas consisted primarily of valleys, ravines, ridge saddles and basins, hereafter referred to as valleys.

Line features representing the estimated average centers of ridge crests and valley bottoms (Figure 2) were derived from the following steps. ESRI's Flow direction function was used to create a flow direction from each cell to its steepest down slope neighbor, and then the Flow accumulation function was used to create a grid of accumulated flow through each cell by accumulating the weight of all cells flowing into each down slope cell. A valley started where 50 upslope cells had contributed to it in the Flow accumulation function, and a ridge started where 55 cells contributed to it. The flow direction and flow accumulation functions were applied to the ridges by multiplying the DEM by -2 to reverse the flow. Line features that represented ridges and valley bottoms were derived from ESRI's gridline and thin functions, which feed a line through the centers of the cells composing the valley or ridge. Thinning put the line through the centers of groups of cells $\geq$40 in the case of valleys.

The two foot slope analysis grid was used to create polygons with a relatively gentle slope. A Standard Deviation classification was used to identify areas with < 7.4 % slope. These areas were then converted to polygons and intersected with the ridge/valley lines to determine polygons associated with either ridge or valley descriptions. The borders of these polygons were converted to lines and combined with the ridge/valley line datasets, respectively, and polygons in valley features were termed *valley polygons* and polygons on ridge tops were termed *ridge polygons* (Figure 2).

Horizontal distances (m) were then measured between each DEM grid cell and the nearest valley bottom boundary (in the valley line combined data set) and the nearest ridge top boundary or ridgeline (in the ridgeline combined data set), referred to as *distance to valley* and *distance to ridge*, respectively. These distances were measured from the DEM grid cell to the closest grid cell of a valley bottom or ridgeline, respectively, not including vertical differences in position. The *total slope distance* was the sum of *distance to valley* and *distance to ridge*, and expressed the size of the slope. The DEM grid cell's position in the slope was also expressed as the ratio of *distance to valley* and *distance to ridge*, referred to as the *distance ratio*. This expression of the grid cell's position on the slope removed the size of the slope as a factor.

The vertical differences between each DEM grid cell and the nearest valley bottom boundary and nearest ridge top boundary or ridgeline were referred to as *elevation difference*, and this measure also expressed the size of the slope. In addition to the trend in slope grade at each DEM grid cell, the *gross slope* was measured as the ratio of *elevation difference* and *total slope distance*. The DEM grid cell's position on the slope was also expressed as the ratio of the elevation differences between the grid cell and the nearest valley and between the grid cell and the nearest ridge, referred to as *elevation ratio*. Additionally, we measured the grid cell's position on the slope as the average of the percentage distance and the percentage elevation to the ridge top. This mean percentage was named *percent up slope*, and provided a more robust expression of the grid cell's position on the slope (Figure 3).

Percent up slope did not distinguish a grid cell's position between slopes on large hills versus medium or small-sized hills, so we expressed the local topographic influence of the feature where each cell was located, where *hill size* was the elevation difference between the nearest valley bottom polygon and nearest prominent ridge top polygon (Figure 4).

Each DEM grid cell was classified by *aspect* according to whether it faced north, northeast, east, southeast, south, southwest, west, northwest, or if it was on flat terrain. Each grid cell was also categorized as to whether its center on the landscape was windward, leeward or perpendicular to the prevailing southwest and northwest wind directions as recorded during the behavior observation sessions.

Steps to identify saddles, notches, and benches

Because a growing body of evidence has linked disproportionate numbers of raptor fatalities to wind turbines located on aspects of the landscape that are lower than immediately surrounding terrain or that represent sudden changes in elevation, we made a special effort to identify ridge saddles, notches in ridges, and benches of slopes, which are where ridge features emerge from hill slopes that extend above the emerging ridge. These types of locations are where winds often compress by the landscape to create stronger force, and where raptors typically cross hilly terrain or spend more time to forage for prey items. Compared to surrounding terrain, these types of features are often relatively flatter or shallower in slope and sometimes include lower elevations (e.g., saddles). We used geoprocessing steps to provide some objectively to the identification of these features, but we also had to also use judgment because conditions varied widely in how such features were formed and situated.

We used the same procedures as used in the ridge/valley selection. The two foot slope analysis grid was used to create polygons with a relatively gentle slope. A Standard Deviation classification was used to identify areas with < 7.4 % slope. These areas were then converted to polygons. Those polygons not associated with ridge or valley polygons were examined manually. Where these polygons were visually associated with saddle and or step features, they were identified as polygons representing saddles, notches, or benches. We also examined maps depicting contours of the variable *percent up slope*, because these contours readily revealed sudden breaks in slope typical of saddles, notches, and benches, which we also represented with polygons.

Visible and Hidden Volumes of Surveyed Airspace

At each 10x10 foot grid cell within the Vasco Caves study area, we extruded volumes of airspace upward at 10-foot increments to a 460-foot (140.2 m) ceiling above the observer at each observation station, and each cube of airspace was classified whether it was visible or hidden from each observation station by line of sight. Cubic volumes of air space were each 1000 feet^3 (28.31 m^3). Visible versus hidden volumes of airspace were summed within 20 equidistant radial bands extending laterally from each observation station, each band 100 feet (30.48 m) farther from the last and the outer survey boundary 2000 feet (609 m) from the observer.

We summed the first observations of raptors recorded during utilization surveys, and converted the sums to detection rates. The most basic detection rate was number of observations per hour (each session was an hour). We also calculated a detection rate as the number of observations per hour per km^3 of visible airspace within each sequentially larger outer survey boundary, where boundaries were increased in 100-foot radial increments. The detection rates calculated within sequentially larger boundaries were spatially correlated because the numbers of birds within inner radial bands contributed cumulatively to those counted in outer radial bands. To remove the effect of this spatial correlation, we also calculated a detection rate as the number of observations per hour per km^3 of visible airspace within each sequential, 100-foot radial band extending from the observer, for which the numbers of observations closer to the observer did not contribute to the numbers observed within each specific band, i.e., the counts within each radial band were independent rather than cumulative. In either case, we compared detection rates to distance intervals from the observer and fit regression models to the patterns in the data.

Species-specific detection rates (first observations/km^3/hour) were predicted for all grid cells within the masked study area, based on their distances from observation stations within 609 m. Each predicted detection rate was divided by the maximum possible – the rate estimated within 100 feet of the observation station. Thus, each grid cell was assigned a proportional weighting of detection likelihood relative to the nearest radial band to the observer. These proportions were summed when a grid cell was within 609 m of >1 observation station, e.g., a grid cell with a detection weighting (D) of 0.18 from station 9 and a weighting of 0.07 from station 13 would be given a summed weighting of 0.25. Grid cells were further weighted (W) by the relative number of observation sessions per station (S) where the number of sessions at a station was divided by the maximum number achieved among all the stations:

$$W_i = \frac{\sum D_i}{D_{MAX}} \times \frac{S_i}{S_{MAX}} \quad ,$$

where the *i*th grid cell could range in weightings from 0 to 1.

Associations between bird utilization and slope attributes

We characterized the location of each raptor by aspect, slope, rate of change in slope, direction of change in slope, and elevation. These variables were also used to generate raster layers of the study area, one raster expressing the aspect of the corresponding slope (hereafter referred to as *aspect*), and the other expressing whether the landscape feature was tending toward convex versus concave orientation. These features were defined using geoprocessing.

Log_{10} and natural log transformations were used to better fit normal distributions, and then chi-square tests for association and principal components analysis (PCA) were used to further understand how the variables related to raptor locations and to each other. To minimize the effects of confounding, no more than one predictor variable was selected from each principle component for any model developed to classify grid cells according to whether they associated with raptor locations.

We used fuzzy logic (FL) modeling (Tanaka 1997, Kainz 2004) to predict the likelihood each grid cell would be used by golden eagle, red-tailed hawk, American kestrel, and burrowing owl. FL likelihood surfaces were first created by each selected predictor variable. For each predictor variable, we calculated the mean, standard deviation, and standard error among the grid cells where each targeted bird species was observed during standard observation sessions. These statistics formed the basis from which we assigned FL membership to grid cells. Depending on the pattern in the data, we assigned FL membership values of 1 whenever the value of the predictor variable was within a certain prescribed distance in value from the mean, oftentimes within 1 SD, but sometimes within 1 or 2 SE. FL membership values of 1 expressed our confidence that grid cells with the corresponding value range for the predictor variable are likely to be visited by the target species. FL membership values of 0 were assigned to grid cells that were far from the mean value, usually defined by prescribed distances from the mean such as >2 SD from the mean. FL membership values of 0 expressed our confidence that grid cells with the corresponding value range for the predictor variable are unlikely to be visited by the target species. All other grid cells were assigned FL membership values according to the following formulae, assuming that the likelihood of occurrence of each species will grade gradually rather than abruptly across grid cells that vary in value of the predictor variable (Y):

$$0.5 \times (1 - \cos(\pi \times (Y - V_c) \div (V_f - V_c))) \text{ below the mean}$$
$$0.5 \times (1 + \cos(\pi \times (Y - V_c) \div (V_f - V_c))) \text{ above the mean,}$$

where V_c represented the variance term (SD or SE) closer to the mean and V_f represented the variance term farther from the mean.

FL likelihood values were then summed across predictor variables contributing to a species-specific model, and natural breaks were used to divide the summed values into 4 classes: 1 represented the suite of grid cells including fewer bird observations other than expected, 2 represented the suite of grid cells including about equal or slightly greater than equal bird observations other than expected, 3 represented the suite of grid cells including more bird observations other than expected, and 4 represented the suite of grid cells including substantially more bird observations other than expected. The performance of each model was assessed by the magnitude of the ratio of the observed number to the expected number of observations occurring within the suite of conditions specified by each FL surface class, where consideration was also given to fewer numbers of predictor variables and smaller portions of the study area contributing to the ratios in surface classes 2, 3, and 4. FL surface models were later projected across the Vasco Winds project area. We also extended our mapping of special landscape features to the Vasco Winds project area.

RESULTS

Bird detection rates

The volume of airspace that was visible from the observation station decreased with increasing distance from the observer within the Vasco Caves Regional Preserve study area (Figure 5). To account for the variation in visible airspace among stations, we calculated avian utilization rates as the number of birds/hr/km^3 of visible airspace within a 140 m ceiling. These utilization rates

also decreased with increasing distance from the observer, so we estimated detection functions to quantify and to later remove the effect from model development (Table 1).

Table 1. First detections/hr/km^3 of visible airspace within radial bands regressed on number of 30.75-m radial bands from the observer, where a and b represented the intercept and slope of regression models, r^2 was the coefficient of determination, SE was standard error, and P was the probability of committing a Type I error in hypothesis-testing.

		Model parameters				
Species/Group	**Model**	**a**	**b**	**r^2**	**SE**	**P**
Golden eagle	Inverse	0.3842	10.5260	0.88	0.91	0.001
Red-tailed hawk	Power	86.3666	-0.7585	0.91	0.20	0.001
Turkey vulture	Power	65.3069	-0.9403	0.88	0.29	0.001
Northern harrier	Logarithmic	10.4761	-3.6200	0.87	1.19	0.001
Prairie falcon	Inverse	-1.1380	16.9745	0.96	0.83	0.001
American kestrel	Inverse	-1.6516	54.0601	0.95	2.84	0.001
Burrowing owl	None					
Raptors	Power	295.2248	-0.9994	0.96	0.18	0.001
Common raven	Power	369.0675	-1.1663	0.91	0.31	0.001

Topographic associations

The variable *percent up slope*, strongly influenced the locations of burrowing owl burrows, golden eagle flight locations, and red-tailed hawk and American kestrel hovering and kiting locations (Figures 6 and 7). Whereas golden eagle flights did not relate with *percent up slope* over valley bottoms and lower slopes, they increased in frequency with increasing percent up slope values from halfway up the slopes, peaking at the tops of slopes (Figure 6). Hovering and kiting by red-tailed hawks and American kestrels was most commonly observed high on slopes, though American kestrel hovering/kiting flights peaked between 90% and <100% of the tops of slopes. Burrowing owl nest burrows were most numerous between about 10% and 25% of the way up slopes (Figure 7).

FL models were composed of three to four predictor variables per species (Tables 2-5). Each FL model yielded value ranges from 0 to 1 per predictive variable, which we then weighted and summed as follows:

	Maximum Score Possible
Golden eagle score = 2U + A + 3HP	6
Red-tailed hawk score = 2U + 4A + 2HS + 2HP	10
American kestrel score = 3U + 2A + 3HS	8
Burrowing owl score = 3U + 2EV + ED	6

where U represented *percent up slope*, A represented *aspect*, HP represented grid cells within hazard polygons, HS represented *hill size*, EV represented elevation of nearest *valley polygon*, and ED = *elevation difference*, or the difference in elevation between the nearest ridge crest and nearest valley bottom. Weights were based on the ratio of observed to expected numbers of bird

observations among grid cells with FL membership values of 1. Summed, weighted scores were classified using natural breaks to arrive at 4 FL surface classes per species (Tables 6-9, Figure 8).

Table 2. Golden eagle fuzzy logic membership functions of grid cells belonging to the set of cells with golden eagle observations from 15 stations in Vasco Caves Regional Preserve, where observations were weighted by detection functions derived from distances of grid cells from the observer, visible volume of airspace within the maximum survey radius from each station, number of observation sessions per station, and degree of overlap of observable grid cells from multiple stations.

Value of variable Y for *i*th grid cell	**Basis of membership function**	**Membership function of grid cell belonging to set with bird observations**
Y = Percent up slope		
$86.70 < Y \leq 100$	Within $\bar{x}$ & 1 SD > $\bar{x}$	1
$60.20 < Y < 86.70$	Within 2 SD of $\bar{x}$	$0.5 \times (1 - COS(\pi \times (Y - 60.20) / (86.70 - 60.20)))$
		Undefined
$Y < 60.20$	>2 SD from $\bar{x}$	0
Y = Aspect		
$72.94 < Y < 89.77$ & $268.44 < Y < 285.35$	>1 SD from $\bar{x}$ in both 180˚ hemispheres	1
$32.29 < Y_1 < 72.94$; $230.01 < Y_2 < 268.44$	Within 1 SD & 1 SE < $\bar{x}$ in both 180˚ hemispheres	$0.5 \times (1 - COS(\pi \times (Y - 32.29) / (72.94 - 32.29)))$; $0.5 \times (1 - COS(\pi \times (Y - 230.01) / (268.435 - 230.01)))$
$89.77 < Y_1 < 130.43$; $285.35 < Y_2 < 323.78$	Within 1 SD & 1 SE > $\bar{x}$ in both 180˚ hemispheres	$0.5 \times (1 + COS(\pi \times (Y - 89.77) / (130.43 - 89.77)))$; $0.5 \times (1 + COS(\pi \times (Y - 285.35) / (323.78 - 285.35)))$
$Y < 32.29$ or $Y > 130.43$ $Y < 230.01$ or $Y > 323.78$	Within 2 SE of $\bar{x}$ in both 180-degree hemispheres	0
Y = Hazard polygon		
Y = Within polygon	Not applicable	1

Table 3. Red-tailed hawk fuzzy logic membership functions of grid cells belonging to the set of cells with red-tailed hawk observations from 15 stations in Vasco Caves Regional Preserve, where observations were weighted by detection functions derived from distances of grid cells from the observer, visible volume of airspace within the maximum survey radius from each station, number of observation sessions per station, and degree of overlap of observable grid cells from multiple stations.

Value of variable Y for *i*th grid cell	**Basis of membership function**	**Membership function of grid cell belonging to set with bird observations**
Y = Percent up slope		
73.18 < Y < 102.79	Within 5 SE < $\bar{x}$ & 1 SD > $\bar{x}$	1
43.89 < Y < 73.18	Within 5 SE & 1.5 SD < $\bar{x}$	0.5 × (1 - COS(π × (Y - 43.89) / (73.18 - 43.89)))
102.79 < Y < 114.57	Within 1 SD & 1.5 SD > $\bar{x}$	0.5 × (1 + COS(π × (Y - 102.79) / (114.57 - 102.79)))
Y < 43.89	>1.5 SD from $\bar{x}$	0
Y = Aspect (>100°)		
209.27 < Y < 280.72	Within 10 SE of $\bar{x}$	1
128.80 < Y < 209.27	Within 1.5 SD & 8 SE < $\bar{x}$	0.5 × (1 - COS(π × (Y - 128.80) / (209.27 - 128.80)))
280.72 < Y < 361.20	Within 8 SE & 1.5 SD > $\bar{x}$	0.5 × (1 + COS(π × (Y - 280.72) / (361.20 - 280.72)))
Y < 128.80 or Y > 361.20	>2 SD from $\bar{x}$	0
Y = Hill size		
59.52 < Y < 86.17	Within $\bar{x}$ & 1 SD > $\bar{x}$	1
19.55 < Y < 59.52	Within $\bar{x}$ & 1.5 SD < $\bar{x}$	0.5 × (1 - COS(π × (Y - 19.55) / (59.52 - 19.55)))
86.17 < Y < 99.49	Within 1 & 1.5 SD > $\bar{x}$	0.5 × (1 + COS(π × (Y - 86.17) / (99.49 - 86.17)))
Y < 19.55 or Y > 99.49	>1.5 SD from $\bar{x}$	0
Y = Hazard polygon		
Y = Within polygon	Not applicable	1

Table 4. American kestrel fuzzy logic membership functions of grid cells belonging to the set of cells with American kestrel observations from 15 stations in Vasco Caves Regional Preserve, where observations were weighted by detection functions derived from distances of grid cells from the observer, visible volume of airspace within the maximum survey radius from each station, number of observation sessions per station, and degree of overlap of observable grid cells from multiple stations.

Value of variable Y for *i*th grid cell	**Basis of membership function**	**Membership function of grid cell belonging to set with bird observations**
Y = Percent up slope		
80.86 < Y < 99.04	Within $\bar{x}$ & 10 SE > $\bar{x}$	1
56.13 < Y < 80.86	Within $\bar{x}$ & 1 SD < $\bar{x}$	0.5 × (1 - COS(π × (Y - 56.13) / (80.86 - 56.13)))
99.04 < Y < 100	Within 10 SE > $\bar{x}$ & 100	0.5 × (1 + COS(π × (Y - 99.04) / (100 - 99.04)))
Y < 56.13	>1 SD from $\bar{x}$	0
Y = Aspect		
165.67 < Y < 264.64	Within 8 SE of $\bar{x}$	1
88.96 < Y < 165.67	Within 1.5 SD & 8 SE < $\bar{x}$	0.5 × (1 - COS(π × (Y - 88.96) / (165.67 - 88.96)))
264.64 < Y < 341.35	8 SE to 1.5 SD > $\bar{x}$	0.5 × (1 + COS(π × (Y - 264.64) / (341.35 - 264.64)))
Y < 88.96 or Y > 341.35	>1.5 SD from $\bar{x}$	0
Y = Hill size		
60.30 < Y < 83.16	Within 7 SE of $\bar{x}$	1
38.42 < Y < 60.30	Within 1.5 SD & 7 SE < $\bar{x}$	0.5 × (1 - COS(π × (Y - 38.42) / (60.30 - 38.42)))
83.16 < Y < 105.04	Within 7 SE & 1.5 SD > $\bar{x}$	0.5 × (1 + COS(π × (Y - 83.16) / (105.04 - 83.16)))
Y < 38.42 or Y > 105.04	>1.5 SD from $\bar{x}$	0

Table 5. Burrowing owl fuzzy logic membership functions of grid cells belonging to the set of cells with burrowing owl nest burrows mapped within Vasco Caves Regional Preserve.

Value of variable Y for *i*th grid cell	**Basis of membership function**	**Membership function of grid cell belonging to set with bird observations**
Y = Percent up slope		
5.92 < Y < 31.82	Within - 5 SD & $\bar{x}$	1
2.10 < Y < 5.92	Within 1 SD + 1 SE & 1 SD < $\bar{x}$	0.5 × (1 - COS(π × (Y - 2.10) / (5.92 - 2.10)))
31.82 < Y < 61.53	Within $\bar{x}$ & 1 SD + 1 SE > $\bar{x}$	0.5 × (1 + COS(π × (Y - 31.82) / (61.53 - 31.82)))
Y < 2.10 or Y > 61.523	>1 SD + 1 SE away from $\bar{x}$	0
Y = Elevation of nearest valley bottom polygon		
0 ≤ Y < 135.19	>2 SD > $\bar{x}$	1 Undefined
135.19 < Y < 175.77	Within 2 SD & 2 SE > $\bar{x}$	0.5 × (1 + COS(π × (Y - 135.19) / (175.77 - 135.19)))
Y > 175.77	Within 2 SE > $\bar{x}$	0
Y = Elevation difference		
16.79 < Y < 32.89	Within 4 SE of $\bar{x}$	1
13.93 < Y < 16.79	Within 1 SD & 4 SE < $\bar{x}$	0.5 × (1 - COS(π × (Y - 13.93) / (16.79 - 13.93)))
32.89 < Y < 35.75	Within 4 SE & 1 SD > $\bar{x}$	0.5 × (1 + COS(π × (Y - 32.89) / (35.75 - 32.89)))
Y < 13.93 or Y > 35.75	>1 SD from $\bar{x}$	0

Table 6. Fuzzy logic model of golden eagle flight locations, model performance within the masked study area, and percentage of the project area included in each FL likelihood surface class.

FL likelihood surface class	FL model value range	Sum weighted observations	Masked study area (%)	Observed ÷ expected no. of observations	Project area (%)
1	0-1	343	54.7	0.59	51.0
2	>1-2.1	404	29.2	1.30	32.2
3	>2.1-3	206	10.7	1.80	12.3
4	>3	95	3.7	2.39	4.5

Table 7. Fuzzy logic model of red-tailed hawk hovering and kiting locations, model performance within the masked study area, and percentage of the project area included in each FL likelihood surface class.

FL likelihood surface class	FL model value range	Sum weighted observations	Masked study area (%)	Observed ÷ expected no. of observations	Project area (%)
1	0-4	246	69.3	0.39	59.4
2	>4-6	228	21.2	1.19	24.8
3	>6-7.799	239	8.0	3.31	12.7
4	7.8-10	189	1.6	13.10	3.1

Table 8. Fuzzy logic model of American kestrel hovering and kiting locations, model performance within the masked study area, and percentage of the project area included in each FL likelihood surface class.

FL likelihood surface class	FL model value range	Sum weighted observations	Masked study area (%)	Observed ÷ expected no. of observations	Project area (%)
1	0-4.399	265	77.8	0.36	72.4
2	4.4-5.499	233	12.4	1.97	15.3
3	5.5-7.499	228	7.9	3.02	9.4
4	7.5-8	230	2.0	12.03	2.9

Table 9. Fuzzy logic model of burrowing owl nest burrow locations, model performance within the 543-ha Vasco Caves and Souza parcels that were searched by Albion Environmental in 2006-2007, and percentage of the project area included in each FL likelihood surface class.

FL likelihood surface class	FL model value range	Sum observations	Masked study area (%)	Observed ÷ expected no. of observations	Project area (%)
1	0-3.999	14	79.5	0.38	89.4
2	4-4.999	5	10.8	1.01	8.3
3	5-5.999	13	6.1	4.63	1.9
4	6	14	3.7	8.23	0.5

Predicted Hazard Zones in the Vasco Winds Project Area

The predictive models developed in the masked study area were projected to the Vasco Winds project area, part of which was immediately adjacent to the study area to the west, south, and southeast (Figures 9-16). Comparing percentages between the masked study area and the project area, the distribution of FL likelihood surface classes indicated that the Vasco Winds project area poses greater wind turbine collision hazard levels to golden eagles, red-tailed hawks, and American kestrels than does the Vasco Caves study area (Tables 6-8), but much lower hazard to burrowing owls (Table 9).

Wind Turbine Siting

One of us (Smallwood) met with NextEra five times to compare proposed wind turbine locations to the FL likelihood surface classes depicted in the hazard maps. The first meeting preceded the hazard maps, so Smallwood advised NextEra based on personal knowledge of the ongoing analysis used to generate the hazard maps. The next two meetings involved GIS overlays of turbine locations on the hazard maps, along with required setbacks from roadways and other infrastructure. The final two meetings followed the rearrangement of some turbines to accommodate the loss of access to a portion of the original project area. Throughout these meetings, NextEra relocated turbines according to Smallwood's recommendations after he examined each location for overlap with FL likelihood surface classes representing each focal raptor species.

Smallwood recommended avoiding locations in classes 3 and 4 (orange and red in Figures 9-16; Siemens turbine labels appear in Figure 16). Sometimes he recommended sites close to class 3 for golden eagle if the site maximized distances from class 4 for American kestrel and red-tailed hawk, because the FL model was much stronger for American kestrel and red-tailed hawk and weakest for golden eagle. We were supplied final turbine layouts following the five siting meetings, and Smallwood found most of them to be consistent with his recommendations. The two exceptions are discussed below.

Siemens turbine 7 is planned for the boundary of hazard classes 3 and 4 for both red-tailed hawk and American kestrel. Due to the existing locations of a natural gas line and a microwave beam path, there are no alternative siting options for this turbine. We recommend that this site either be studied more carefully for red-tailed hawk and American kestrel use prior to construction, or additional mitigation measures be considered. Siemens turbine 22 is planned for a golden eagle hazard class 3 (very near class 4), but this was a location we would have selected in the absence of the fuzzy logic models because the site is on the leeward side of the hill with respect to the prevailing direction of the deflection updrafts.

DISCUSSION

We produced simple models of golden eagle flights, red-tailed hawk and American kestrel hovering and kiting, and of burrowing owl nest burrow locations. These models can be used to guide wind turbine siting intended to minimize encounter frequencies between raptors and operating wind turbines, although significant uncertainties in the mechanisms of collisions could reduce the effectiveness of the models. For example, we suspect but we do not know that where golden eagles most often fly corresponds with where they get killed by wind turbines, nor do we know that where red-tailed hawks and American kestrels hover most often is also where they get killed (Smallwood et al. 2009b). We suspect but we do not know that the locations of burrowing owl nest burrows correspond with wind turbine-caused fatalities (Smallwood and Neher 2009, Smallwood et al. 2007, 2009a,c). It may be that rarely performed behaviors cause the majority of wind turbine collisions, and we may not have characterized those rare behaviors. However, until these uncertainties are eliminated, a reasonable first assumption is that our model predictions should correspond with increased hazard of wind turbine collisions should wind turbines be installed where our models predict highest activity levels.

We also note that the repowering project reduces the number of wind turbines on the project area by up to 94%, while also shifting much of the rotor-swept area to greater heights above ground. Many of the flights thought to be hazardous to raptors are performed relatively low to the ground, where more of the rotor-swept areas of the old-generation turbines are located. If the 2.3 MW Siemens turbines are used, the project will also open up considerable turbine-free landscape. Smallwood et al. (2009c) recommended opening up turbine-free habitat space as part of repowering, based on their observations of much greater foraging activity in areas free of wind turbines at Vasco Caves Regional Preserve. Smallwood et al. (2009c) concluded that when given a choice, raptors will more often forage in areas free of wind turbines. The project, as proposed, will enable raptors to choose to forage in significant turbine-free areas in the north-central and western aspects of the project area, as well as in several smaller areas between clusters of wind turbines. This attribute of the study should further reduce raptor fatalities.

Summary

We recommend not locating wind turbines in the hazard polygons on ridge saddles, notches, and benches, or where there are other breaks in the slope of the ridge or hill. We also recommend avoiding the lowest terrain, such as in valley or ravine bottoms. We recommend avoiding areas mapped as FL surface class 4 for any of the target species, and that caution should be exercised within areas mapped as FL surface class 3. Increasing the distances between wind turbines and

FL surface classes 3 and 4 will likely decrease future fatalities of raptors. We found the Vasco Winds final turbine layouts to be consistent with Smallwood's in-person recommendations and with how we intended the FL models to be used, as noted in this report. Siemens no. 7 is the lone turbine that poses moderate to high collision risk for American kestrels and red-tailed hawks.

ACKOWLEDGEMENTS

We thank NextEra for the opportunity to develop map-based guidelines for raptor-safe wind turbine siting. We also thank East Bay Regional Park District and the California Energy Commission's Public Interest Energy Research program for earlier funding of research that prepared us for this project. We thank Jack Barclay, Lindsay Harmon, Brian Karas, and Heather Snively for data collection. We also thank Linda Maples, Sherrity McBane, Leah Neher, and Gina Neher for GIS data entry.

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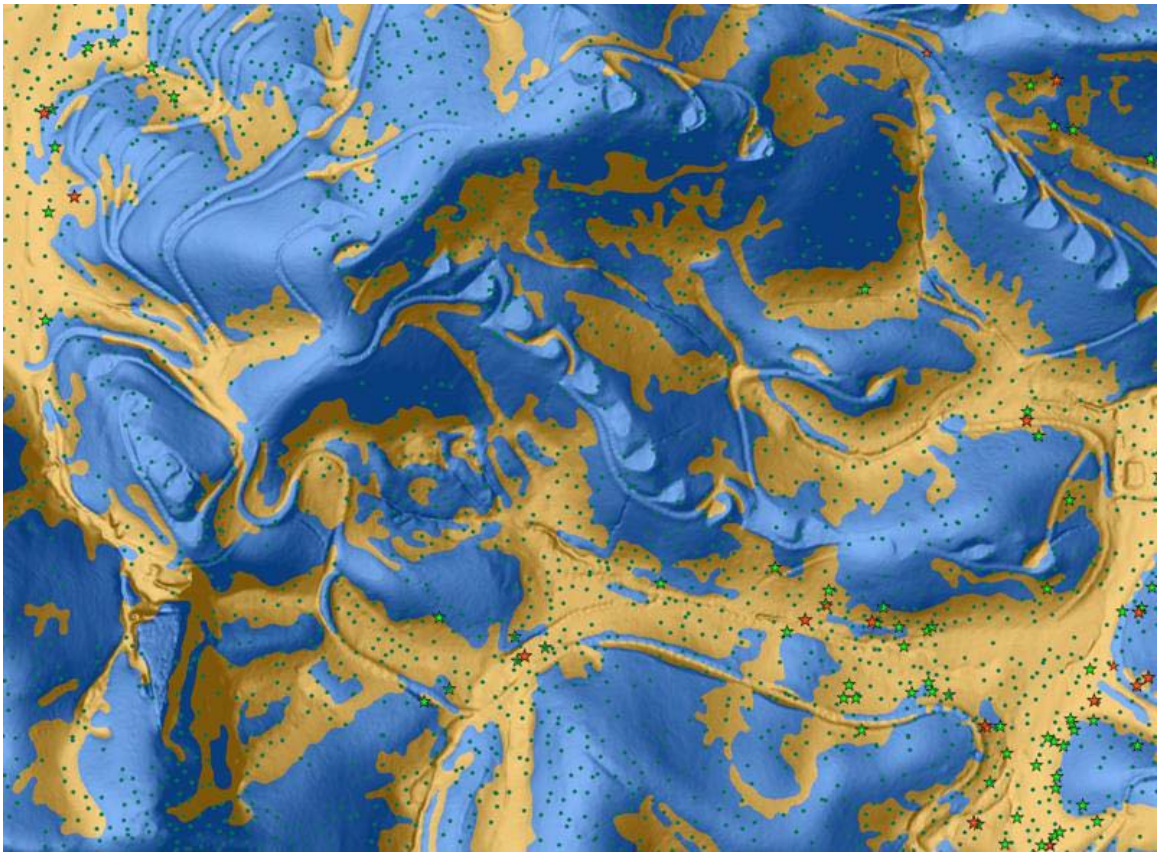

Figure 1. Example representation of differentiation between convex-trending ridge-like features (blue) and concave-trending valley-like features (gold) within the Vasco Caves Regional Preserve study area and overlain by mammal burrows (greed dots) and burrowing owl nest burrows (stars) mapped in 2006-2007. The same geoprocessing methods were applied to the Vasco Winds project area.

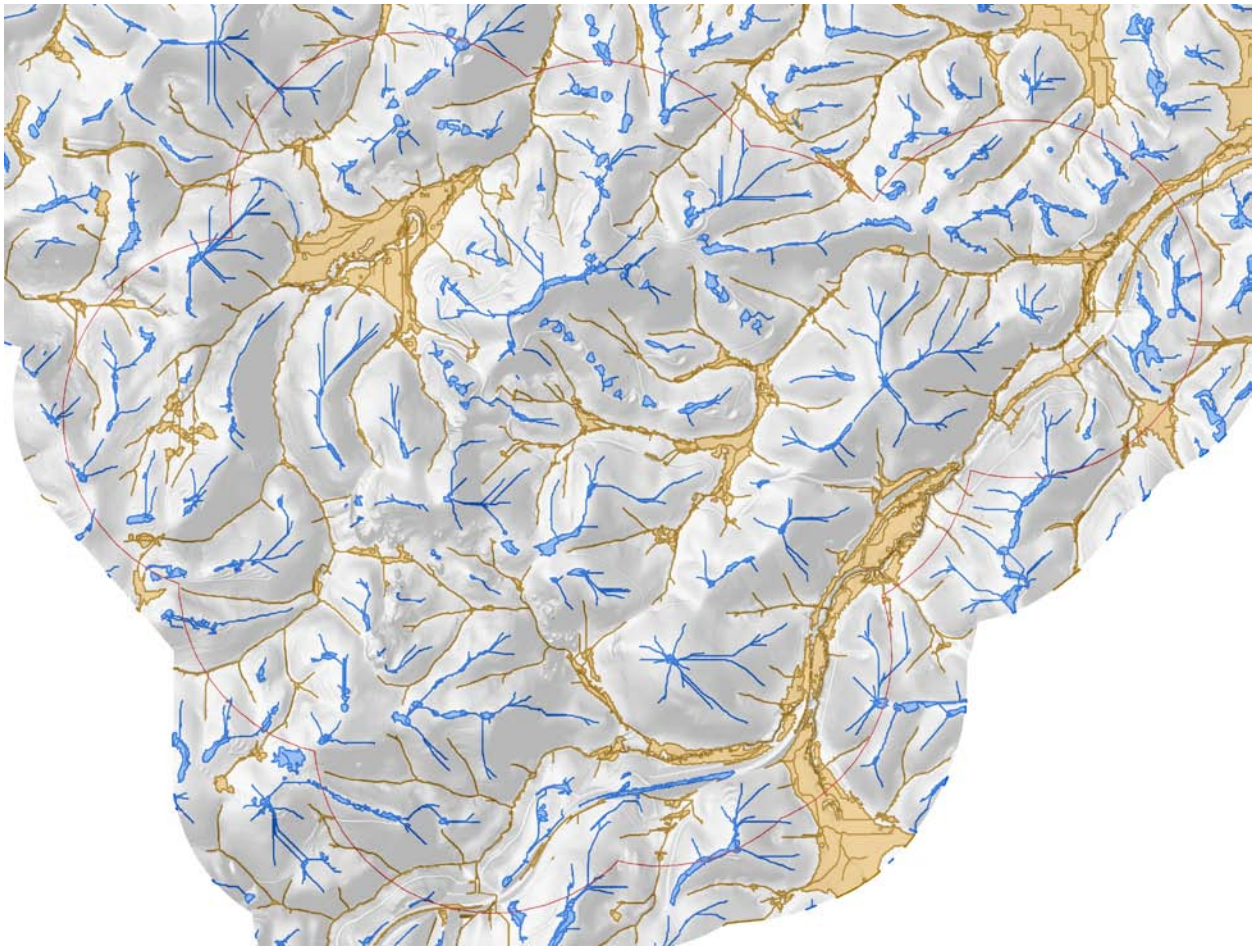

Figure 2. Line features representing ridges and valley bottoms, and significant ridge top and valley bottom polygons, from which revised slope measurements were made in the Vasco Caves Regional Preserve study area. The same methods were applied to the Vasco Winds project area.

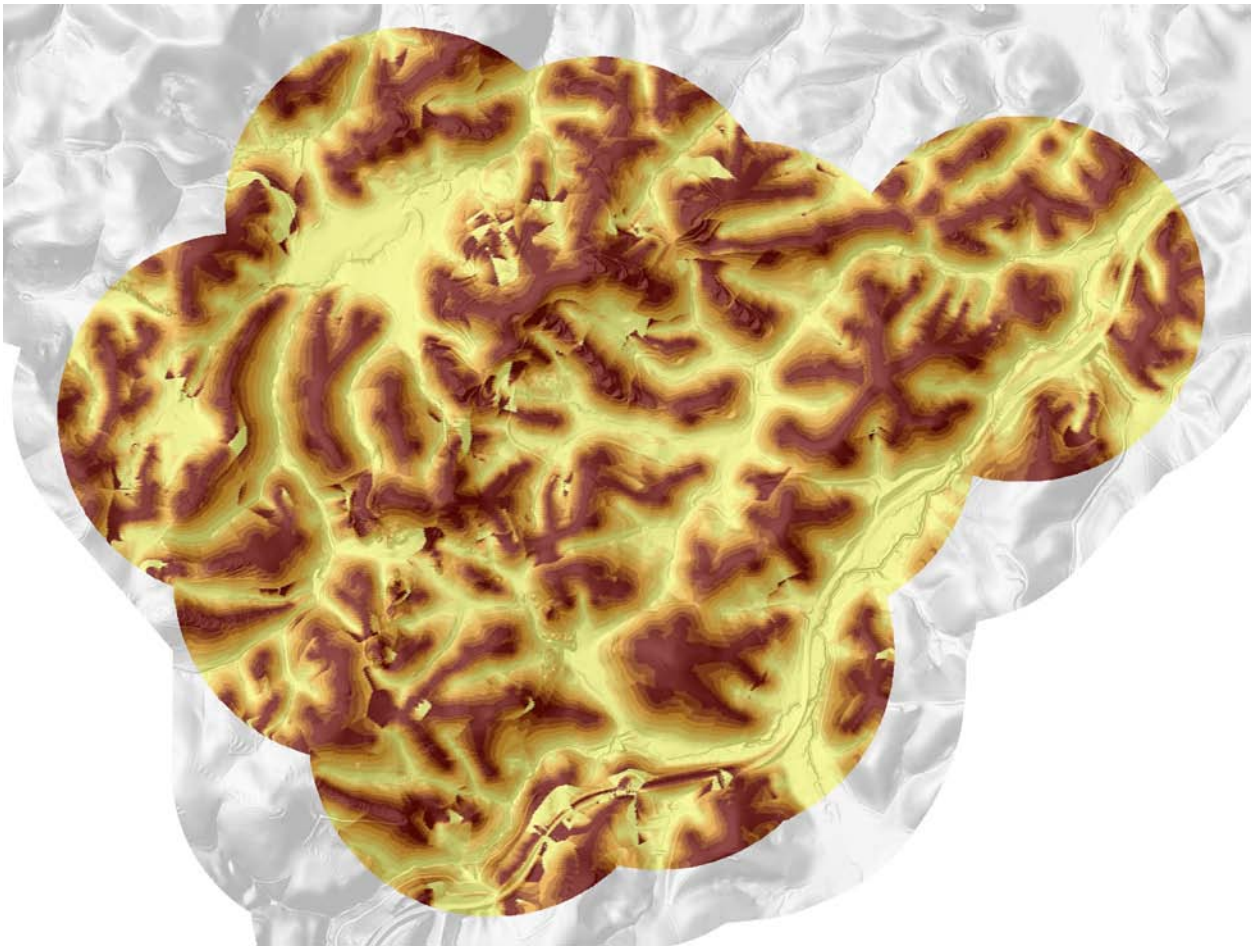

Figure 3. Position on the slope as a percentage of the way from bottom (yellow) to top (maroon) of the slope features in the analytical grid, including all areas surveyed fro birds by Smallwood et al. (2009) in the Vasco Caves Regional Preserve study area. The same methods were applied to the Vasco Winds project area.

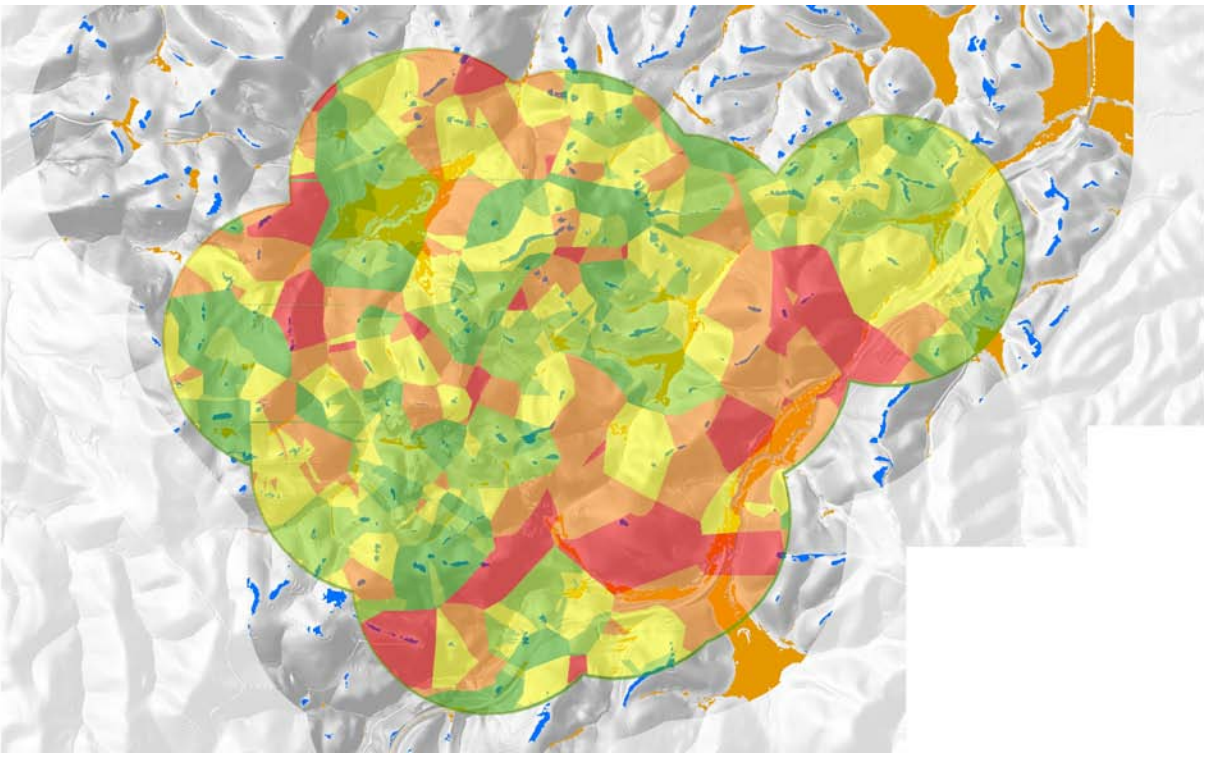

Figure 4. Local topographic influence of the underlying hill slopes in the Vasco Caves Regional Preserve study area, measured as the elevation difference between the nearest valley bottom (gold) and nearest crest of the most prominent hills and ridges in the area (blue), where red denoted largest hills, orange was second to largest, yellow was moderate, light green was second smallest, and dark green was smallest hill features. The same methods were applied to the Vasco Winds project area.

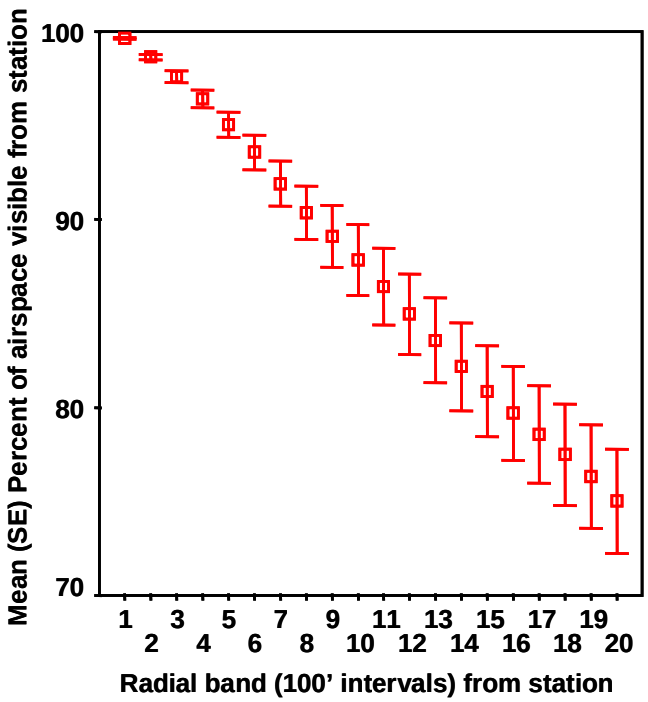

Figure 5. Change in mean percentage of visible volume of airspace within 140-m ceiling and within specific radial bands from the observer (x-axis) among 15 observation stations at Vasco Caves Regional Preserve study area.

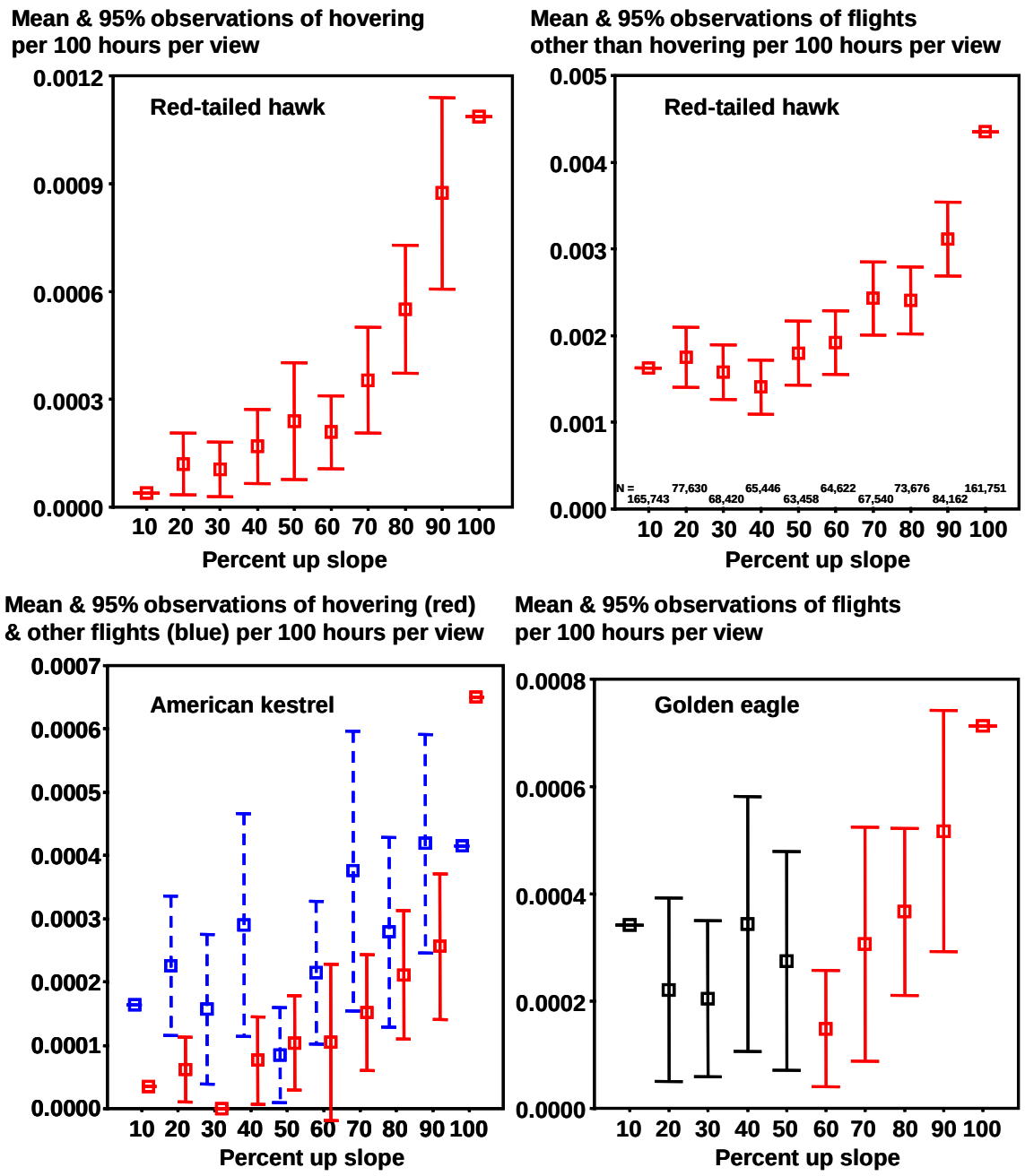

Figure 6. Mean number of red-tailed hawk hovering/kiting flights (top left graph) and all other flights (top right), American kestrel hovering/kiting flights (bottom left, red) and all other flights (bottom left, blue), and golden eagle flights (bottom right) as functions of the grid cell's location as a percentage of the way from the bottom to the top of the slope. Note that mean number of grid cells with golden eagle flights did not grade with slope among grid cells < halfway up the slope (black), whereas it increased with increasingly greater position on the slope among grid cells > halfway up the slope (red).

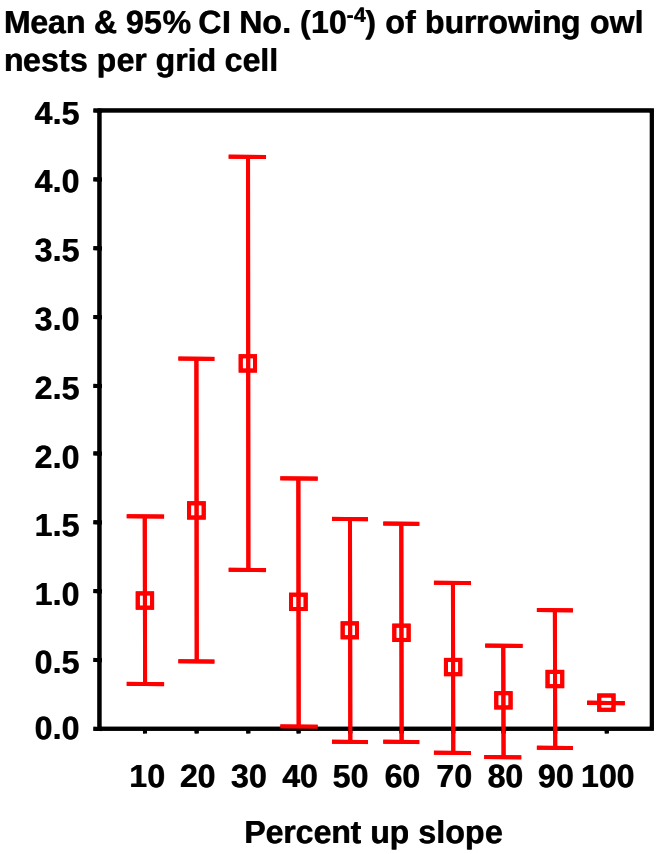

Figure 7. Mean number of grid cells with burrowing owl nest burrows peaked at 20%-30% of the way up the slope.

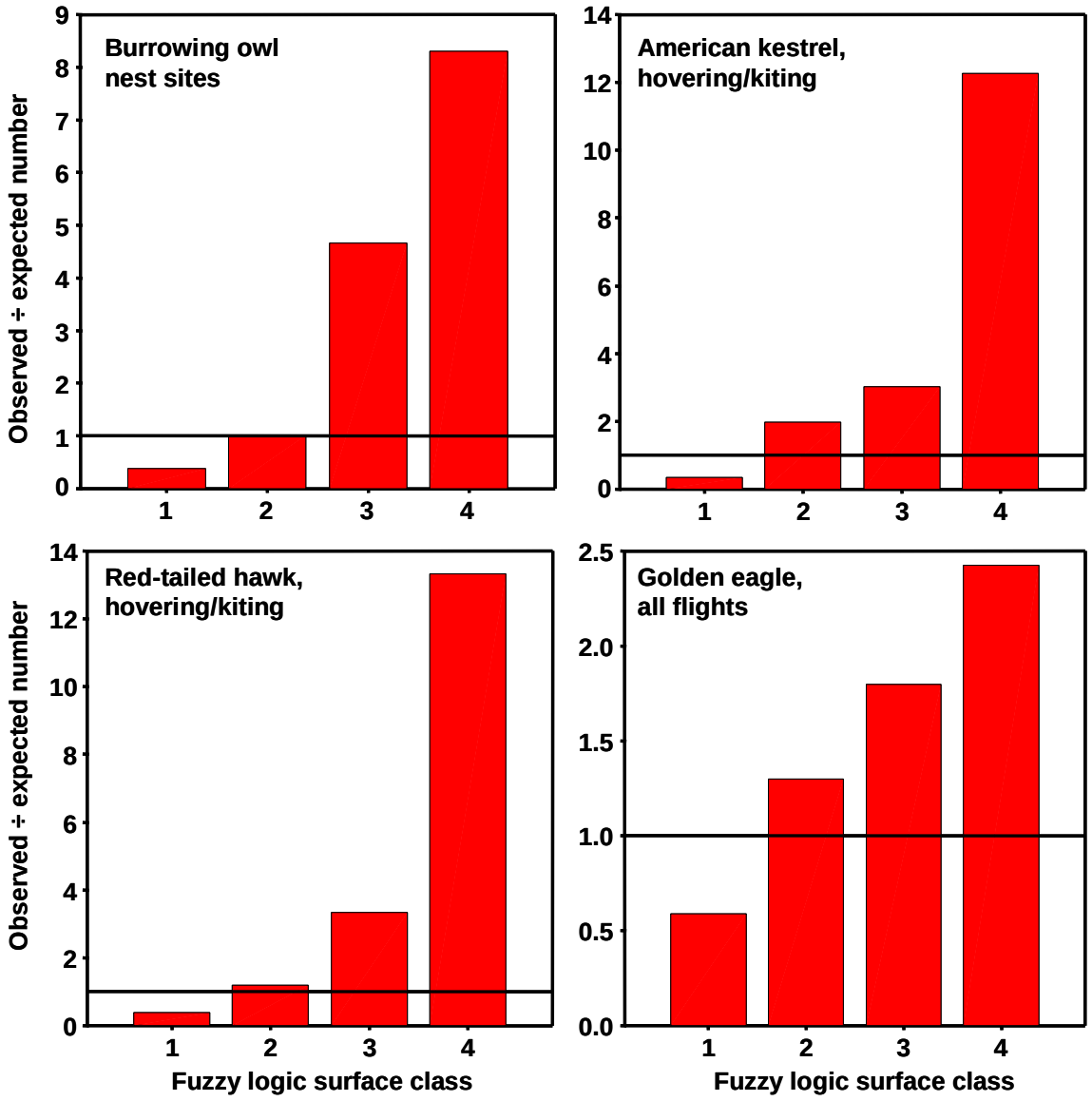

Figure 8. Performance of fuzzy logic models for raptor utilization in the Vasco Caves Regional Preserve study area, including for burrowing owl nest burrow locations (top left graph), American kestrel hovering and kiting flights (top right), red-tailed hawk hovering and kiting flights (bottom left), and all golden eagle flights under the 140-m observation ceiling (bottom right). Horizontal lines at 1.0 represent numbers of observations no greater or lesser other than expected. For example, American kestrel hovering flights in fuzzy logic surface class 4 was 12 times more frequent other than expected.

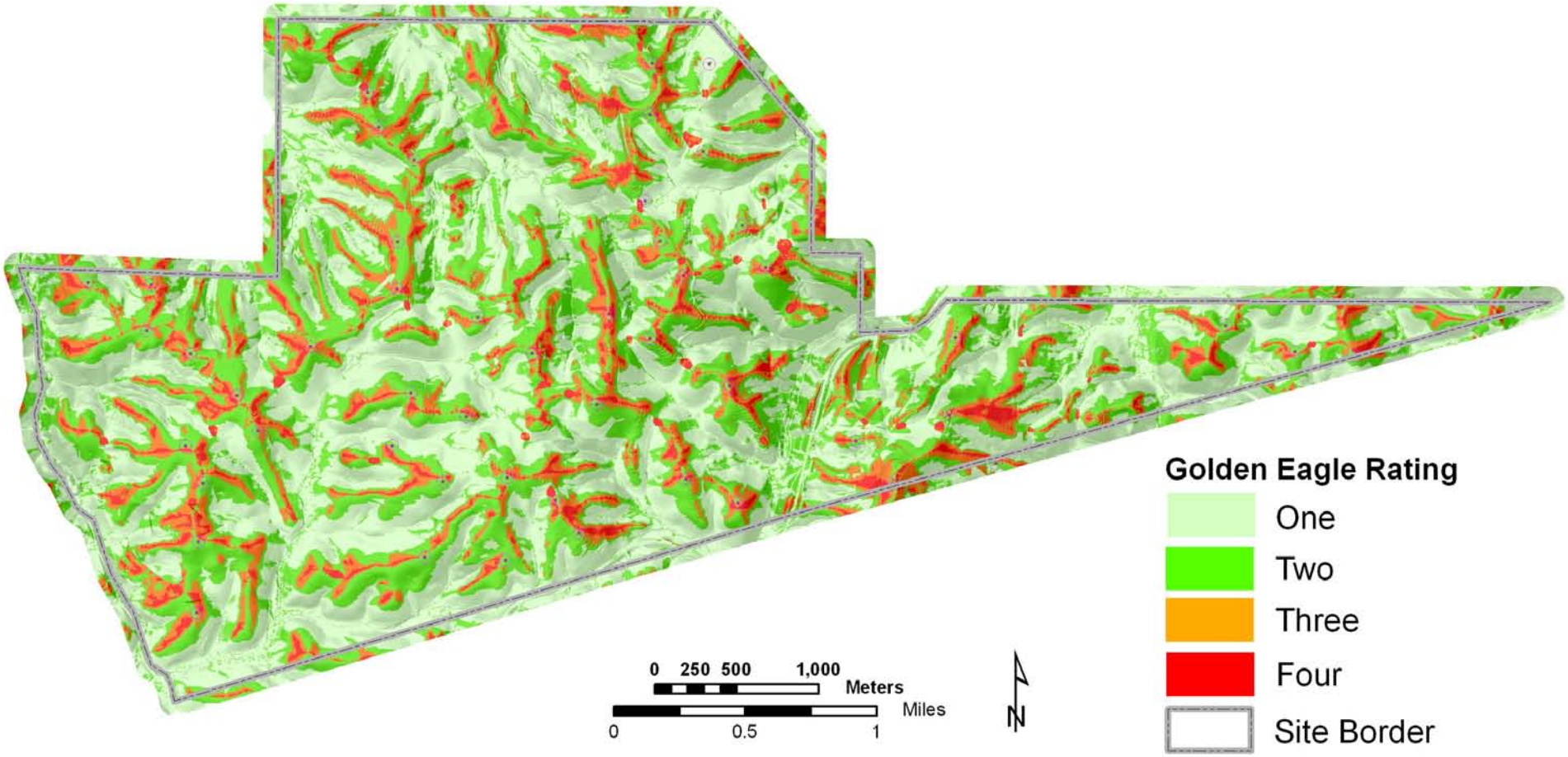

Figure 9. GE xle 1.5 MW wind turbine locations (circles, not to scale) overlaid on a projection of the Fuzzy Logic likelihood surface classes of golden eagle flight locations across Vasco Winds project area, where red corresponds with the highest likelihood of occurrence, orange corresponds with the second highest likelihood, dark green corresponds with the third highest likelihood, and light green corresponds with the least likelihood.

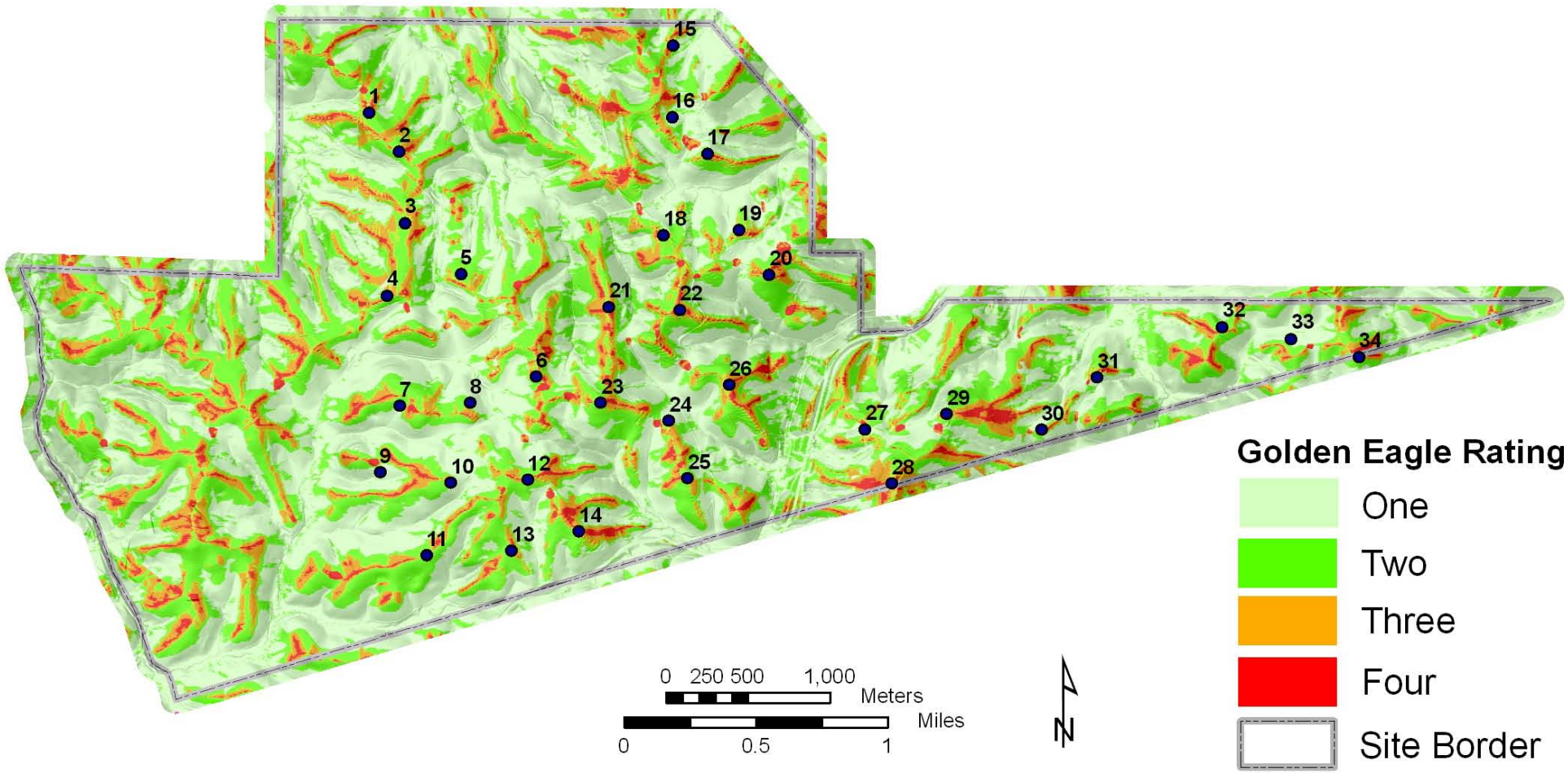

Figure 10. Siemens 2.3 MW wind turbine locations (circles, not to scale) overlaid on a projection of the Fuzzy Logic likelihood surface classes of golden eagle flight locations across Vasco Winds project area, where red corresponds with the highest likelihood of occurrence, orange corresponds with the second highest likelihood, dark green corresponds with the third highest likelihood, and light green corresponds with the least likelihood. The final wind turbine layout was decided on 4 February 2011.

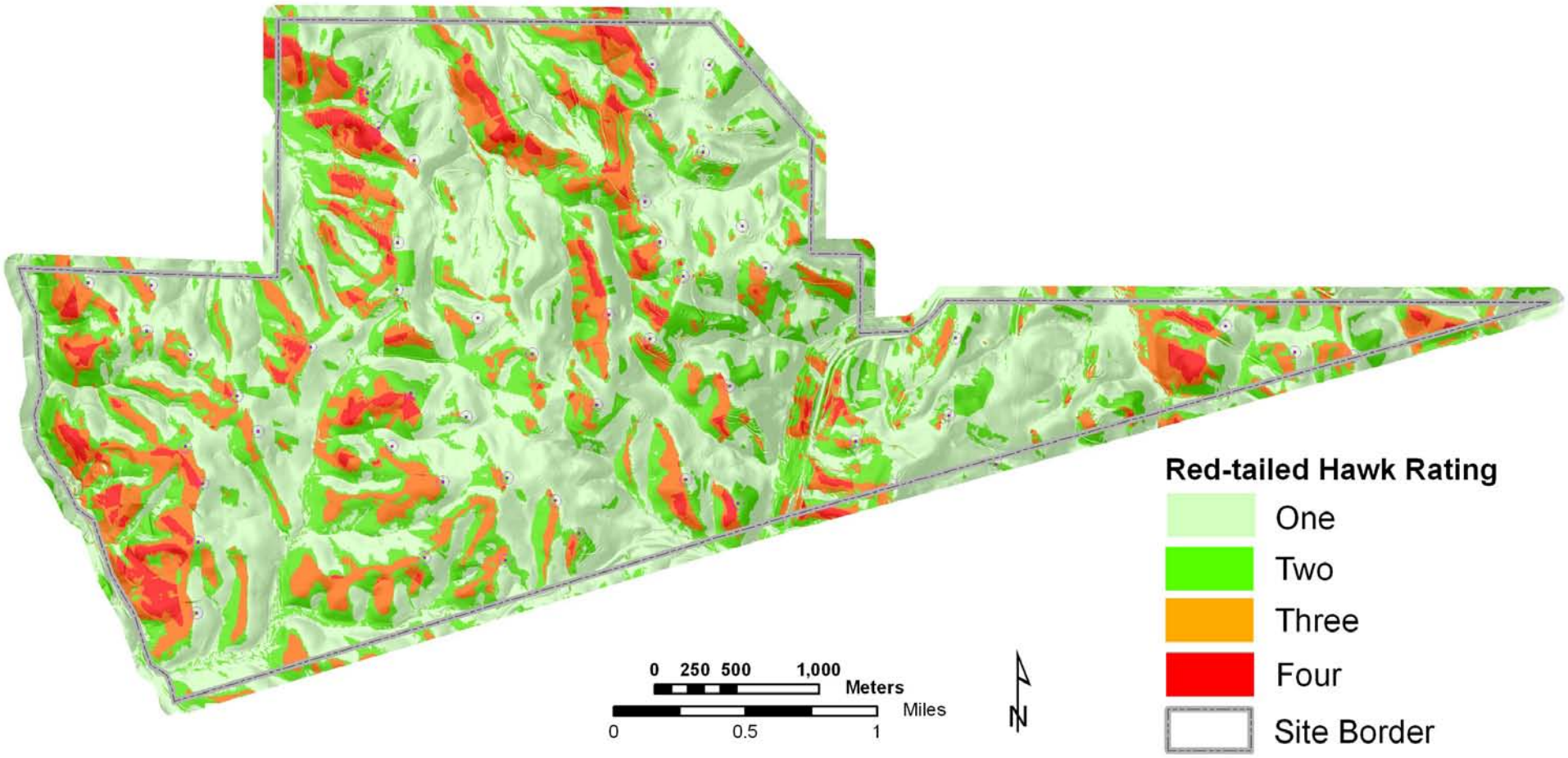

Figure 11. GE xle 1.5 MW wind turbine locations (circles, not to scale) overlaid on a projection of the Fuzzy Logic likelihood surface classes of red-tailed hawk hovering and kiting locations across Vasco Winds project area, where red corresponds with the highest likelihood of occurrence, orange corresponds with the second highest likelihood, dark green corresponds with the third highest likelihood, and light green corresponds with the least likelihood.

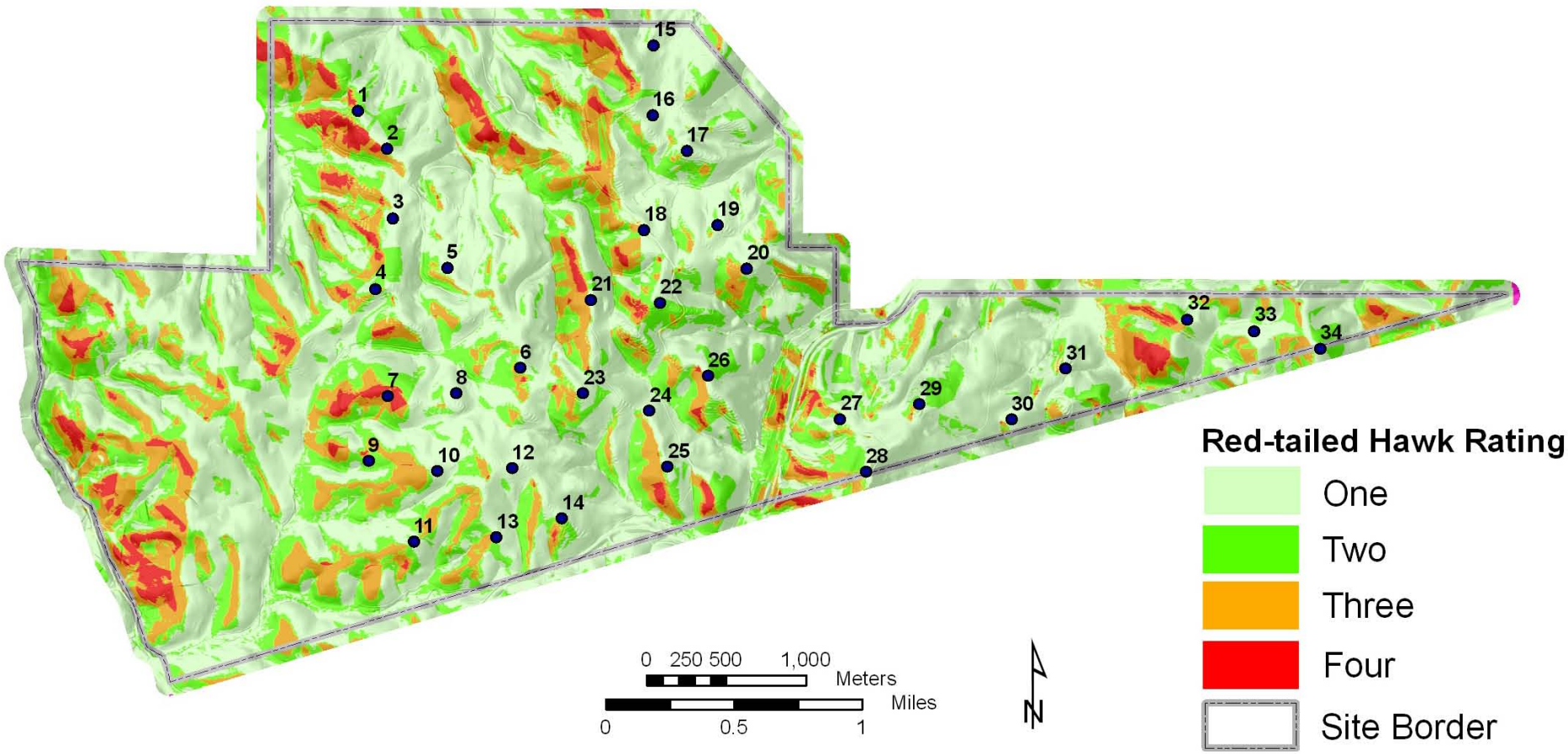

Figure 12. Siemens 2.3 MW wind turbine locations (circles, not to scale) overlaid on a projection of the Fuzzy Logic likelihood surface classes of red-tailed hawk hovering and kiting locations across Vasco Winds project area, where red corresponds with the highest likelihood of occurrence, orange corresponds with the second highest likelihood, dark green corresponds with the third highest likelihood, and light green corresponds with the least likelihood. The final wind turbine layout was decided on 4 February 2011.

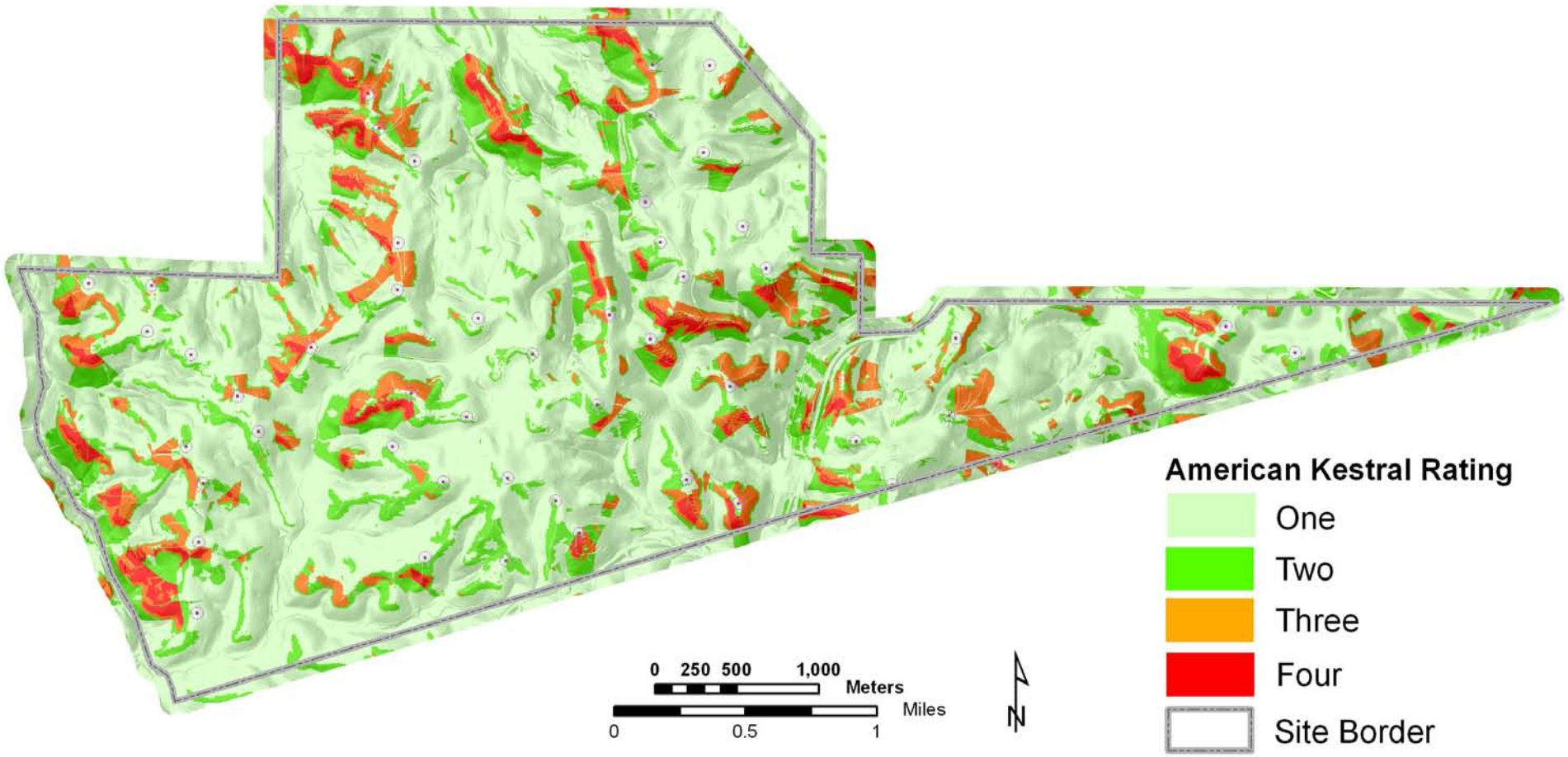

Figure 13. GE xle 1.5 MW wind turbine locations (circles, not to scale) overlaid on a projection of the Fuzzy Logic likelihood surface classes of American kestrel hovering and kiting locations across Vasco Winds project area, where red corresponds with the highest likelihood of occurrence, orange corresponds with the second highest likelihood, dark green corresponds with the third highest likelihood, and light green corresponds with the least likelihood.

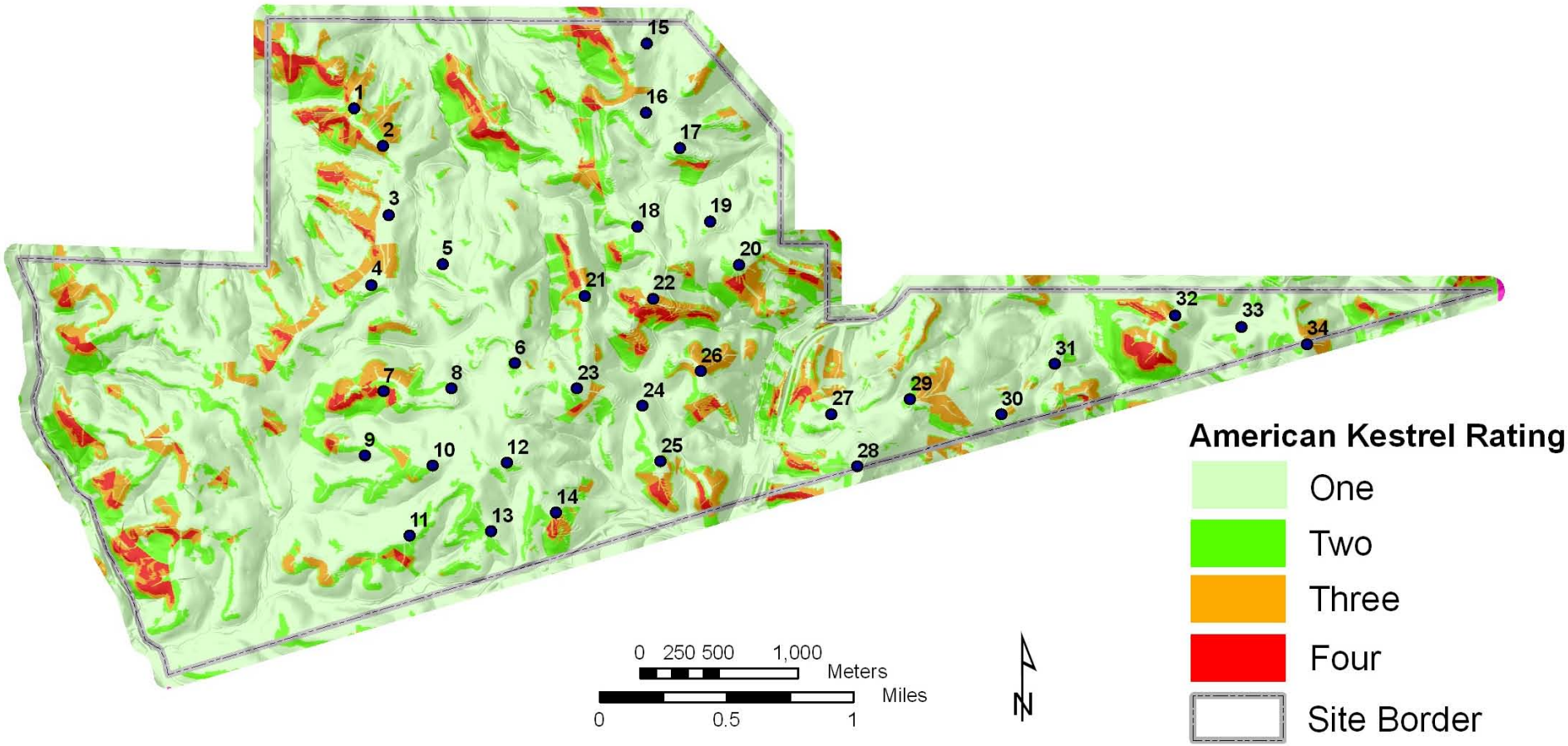

Figure 14. Siemens 2.3 MW wind turbine locations (circles, not to scale) overlaid on a projection of the Fuzzy Logic likelihood surface classes of American kestrel hovering and kiting locations across Vasco Winds project area, where red corresponds with the highest likelihood of occurrence, orange corresponds with the second highest likelihood, dark green corresponds with the third highest likelihood, and light green corresponds with the least likelihood. The final wind turbine layout was decided on 4 February 2011.

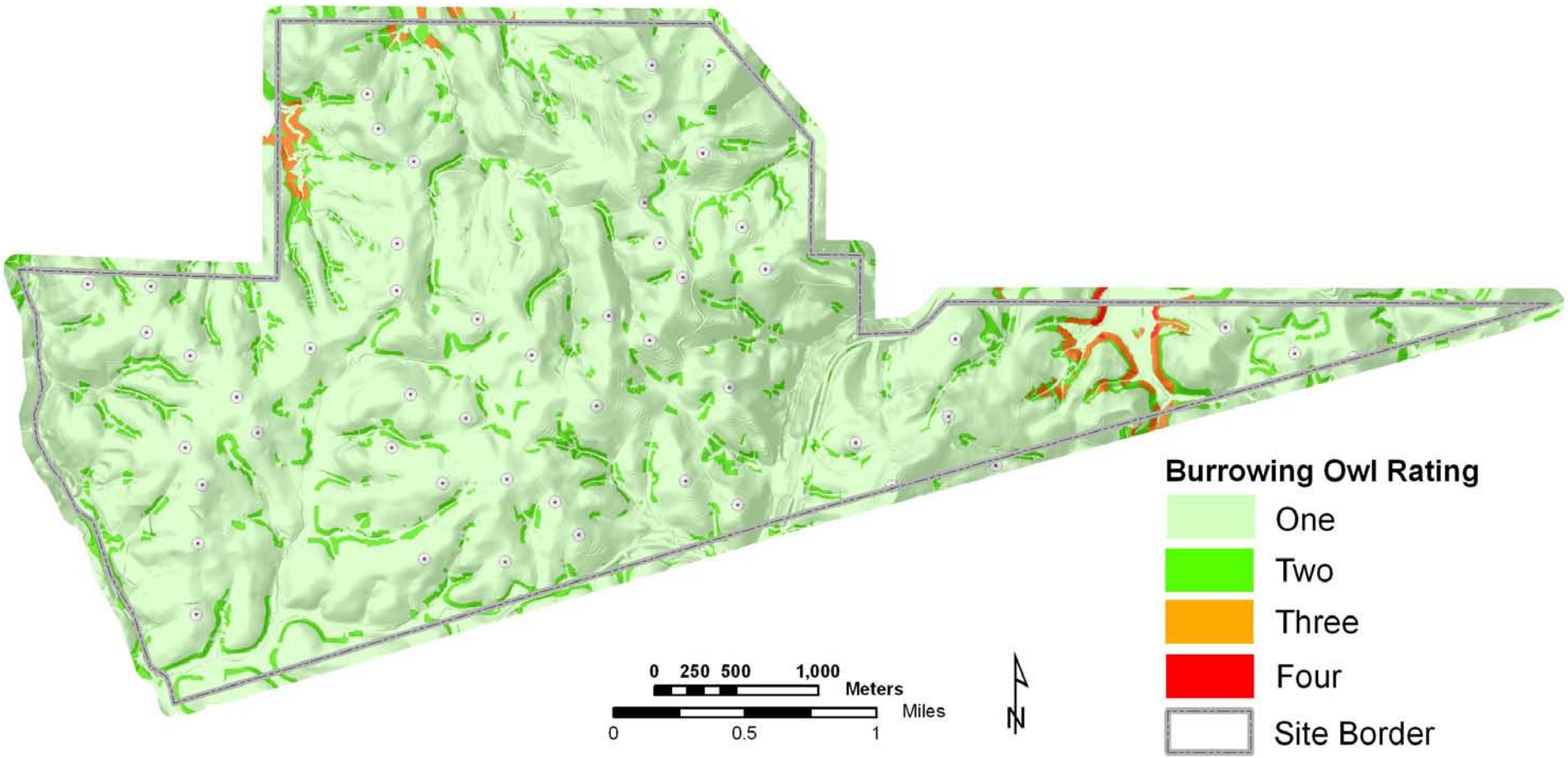

Figure 15. GE xle 1.5 MW wind turbine locations (circles, not to scale) overlaid on a projection of the Fuzzy Logic likelihood surface classes of burrowing owl nest burrow locations across Vasco Winds project area, where red corresponds with the highest likelihood of occurrence, orange corresponds with the second highest likelihood, dark green corresponds with the third highest likelihood, and light green corresponds with the least likelihood.

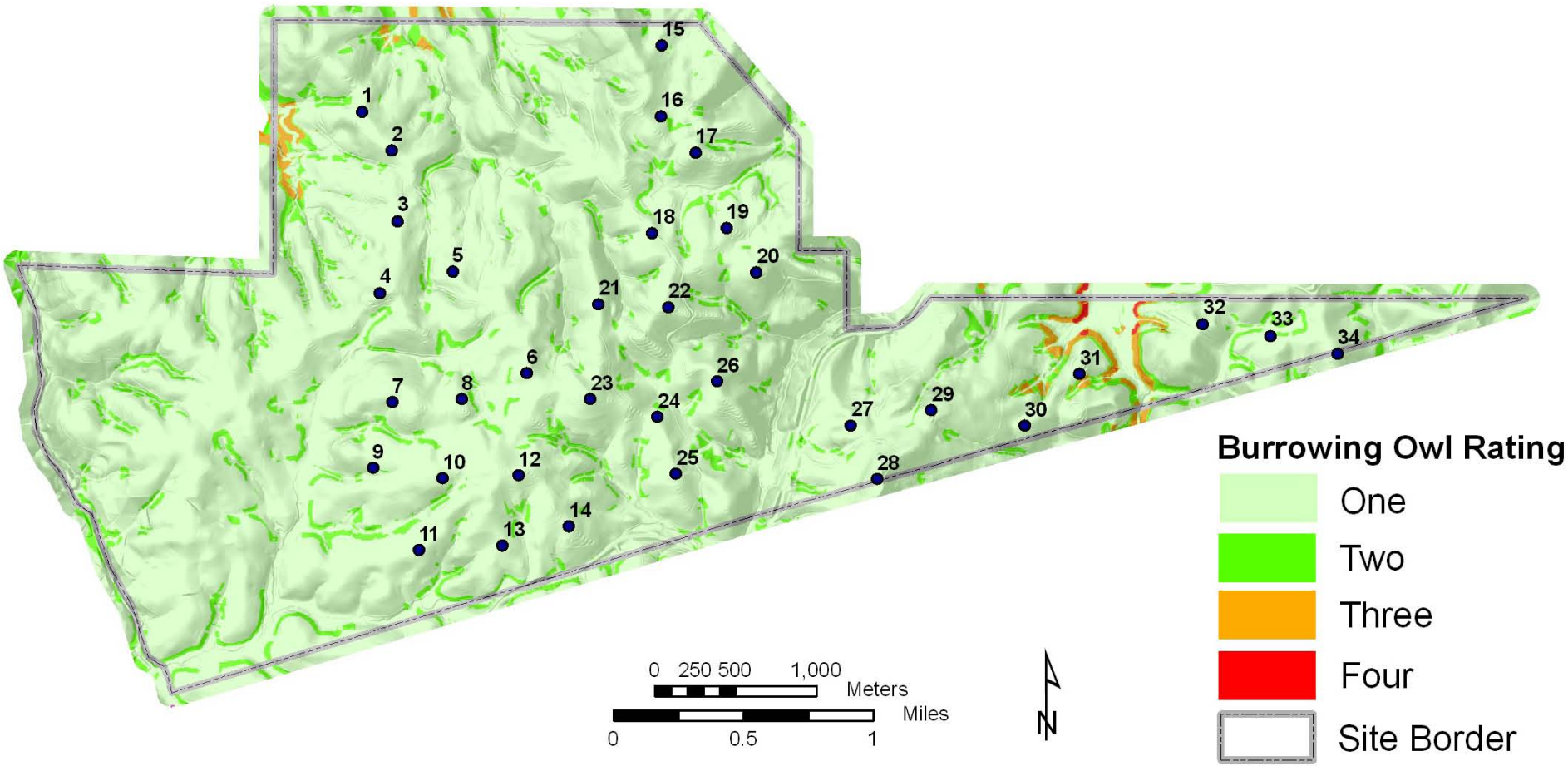

Figure 16. Siemens 2.3 MW wind turbine locations (circles, not to scale) overlaid on a projection of the Fuzzy Logic likelihood surface classes of burrowing owl nest burrow locations across Vasco Winds project area, where red corresponds with the highest likelihood of occurrence, orange corresponds with the second highest likelihood, dark green corresponds with the third highest likelihood, and light green corresponds with the least likelihood. The final wind turbine layout was decided on 4 February 2011.

APPENDIX C

Pandion Systems, Inc.: Altamont Vasco Repower – Acoustic Bat Monitoring Preliminary Findings

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To: Renee Culver, NextEra Energy Resources

From: Pandion Systems, Inc.

Date: 8 October 2010

Subject: Altamont Vasco Repower –Acoustic Bat Monitoring Preliminary Findings

Overview

NextEra Energy Resources is proposing to repower the Vasco Winds Project, an existing wind power project in the northwestern section of the Altamont Pass Wind Resource Area (APWRA). The project area encompasses approximately 4,234 acres. The project's main component is to replace 438 Kenetech KCS - 56 turbines (272 have been previously removed) and 20 Kenetech KVS- 33 turbines with 35 Siemens 2.3 megawatt (MW) turbines (or 50 GE xle 1.5 MW turbines). The overall nameplate capacity (i.e., the maximum amount of power that could be generated if winds blew constantly) would remain approximately the same, although the total amount of energy produced would likely increase. In other words, repowering would entail replacing numerous small, inefficient turbines with fewer large, more efficient turbines. Notable characteristics of the new turbines and the repowering project design are a larger rotor swept area, a much higher ground clearance (minimum blade height), and the elimination of overhead electrical lines.

The project is in the APWRA, a large collection of wind energy facilities owned by several companies that provide electrical power to the California electrical grid. The APWRA is one of the oldest and largest wind generation development areas in the country. Permits have been granted for 5,400 wind turbines with a rated capacity of approximately 580 MW, distributed over 50,000 acres (150 square kilometers) of rolling grassland hills and valleys. Several turbine types are distributed throughout the APWRA, varying in output from approximately 40 kilowatts (kW) to 1MW per turbine. The total number of operating turbines has varied through time from a maximum of approximately 5,400 units in 1998 to approximately 4,200 today.

Pandion Systems, Inc. (Pandion) has conducted preconstruction acoustic bat monitoring at the proposed project area. The work is in accordance with the *California Guidelines for Reducing Impacts to Birds and Bats from Wind Energy Development* for permitting by the California Energy Commission and the California Department of Fish and Game.

Bats and Wind Energy

Based on current knowledge of bat and wind turbine interactions, published fatality reports, and the general ecology of each bat family, risk and likelihood of impact by the Altamont Vasco Winds project varies among species. Recently, the impact of operating wind energy developments on bats has become a concern due to the discovery of bat fatalities at some of these facilities worldwide (North America: Arnett et al. 2008; Comisión Federal de Electricidad 2008, Australia: Hall and Richards 1972, and Europe: Ahlen 2002; Bach and Rahmel 2004; Dürr and Bach 2004; Brinkman 2006). Fatalities of bats are highly variable among wind energy facilities, and among geographic regions. Trends from North America and Germany show a tendency towards higher mortality in migratory species during the fall seasonal period. In the United States and Canada, studies reported a large proportion of these fatalities in tree-roosting species such as the hoary bat (*Lasiurus cinereus*), eastern red bat (*Lasiurus borealis*), western red bat (*Lasiurus blossevillii*), and silver-haired bat (*Lasionycteris noctivagans*) (Arnett et al. 2008). In the south-central United States, Mexican free-tailed bats (*Tadarida brasiliensis*), a migratory species of the family Molossidae, were primarily documented among fatalities. Research to date suggests that bat mortality rates are highest in the eastern United States, followed by the Midwest, and are lowest in the western states (NWCC 2010). Additional systematic research efforts are required to further examine these possible trends, especially those that enhance the predictive value of pre-construction wildlife surveys as they pertain to post-construction mortality levels.

Questions remain as to the mechanism by which bats are killed by wind turbines and to what degree bat populations are affected (Kunz et al. 2007). Current knowledge of the effects of barotraumas (injury resulting from a sudden change in air pressure) suggests that species that are more likely to approach operating wind turbines are most susceptible. Migratory tree bats (*Lasiurus cinereus* [hoary bat], *Lasiurus borealis* [red bat], and *Lasionycteris noctivagans* [silver-haired bat] are among the most commonly reported bat fatalities at wind energy facilities in the United States. The three migratory tree bat species have large geographic ranges and are capable of long-distance migration (up to 2,000 km). These characteristics in combination with behaviors, such as fast, high-altitude flight while foraging and commuting from roosts to foraging grounds, increase risk of collision due to flight in the proximity of the rotor swept zone. Mexican free-tailed bats exhibit migratory behavior and studies in North America have demonstrated that migratory species constitute a disproportionately large percentage of bat fatalities when found at a wind energy site (Arnett et al. 2008). Regardless of migratory activity, molossid species generally forage at high altitudes in open areas (Norberg and Raynor 1987;

McCracken et al. 2008). High risk is associated with these species based on their migratory behavior, heights of activity and reports among fatalities. Although the overall proportion of Mexican free-tailed bats (5.7%) among fatalities in Oklahoma compared to other species has been low (Kunz et al 2007), the majority of studies conducted in North America have been outside the range of Mexican free-tailed bats.

Methods

The proposed Altamont Vasco Repower Wind Project has five ReBAT™ acoustic monitoring arrays that were installed on five meteorological towers (met towers) within the project area (Figure 1). Two different types of met towers were used due to availability within the project area. Two of the met towers that have ReBAT™ systems are temporary met towers that are approximately 60 m tall, while the third temporary met tower is 50 m tall. The two other ReBAT™ systems were installed on permanent met towers approximately 30 m tall. Each of the temporary met towers have two bat monitoring detectors (AR125, Binary Acoustic Technology) installed. The lower detector is positioned at approximately 9 m above ground level, while the upper detector is at approximately 45.5 m above ground level. The upper detector will be capable of detecting bats flying within the rotor swept zone (RSZ) for the proposed repower project. Only one detector was installed on each of the permanent met towers at approximately 30 m.

Bat detectors are contained in aluminum weather proof housings, with a reflector plate positioned at a 45° angle to the opening at the bottom of the housing. Acoustic data collected by the bat detectors have been stored on a custom built computer attached to the met tower approximately 1.5 meters above ground level. Acoustic data has been remotely transmitted back to Pandion's office in Florida through the cellular network. At each tower, the computer has been powered by a series of solar panels and deep cycle batteries located at the base of each met tower. Over the past 3 years, approximately 70 ReBAT™ systems have been installed throughout North America at various proposed wind energy facilities for use in pre-construction bat acoustic monitoring surveys. Additionally, 2 systems have recently been installed on active turbine nacelles to assess relationships between bat activity at the turbine level as it compares to post-construction bat mortality at an active wind energy facility.

The preconstruction bat acoustic monitoring is scheduled for 210 nights. Of these 210 nights a portion was analyzed to species, with more nights analyzed during the priority periods (spring and fall migratory periods) (Table 1). Acoustic recording was set to begin one hour before sunset and end one hour after sunrise nightly.

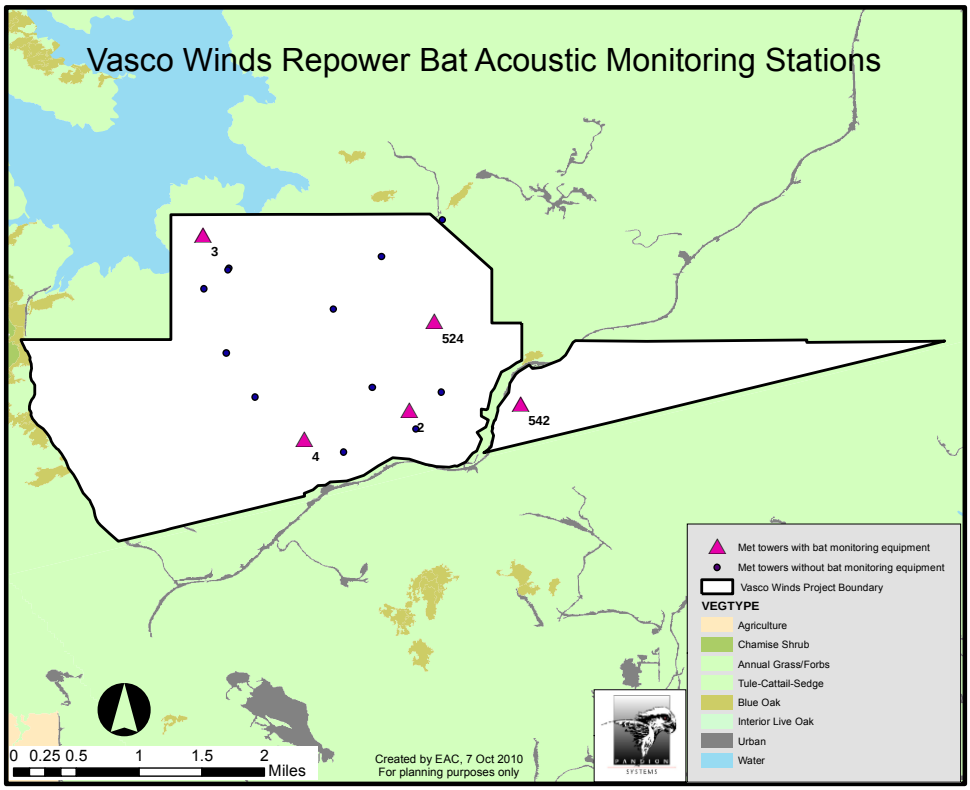

Figure 1. Map of the Vasco Winds project area and meteorological towers containing acoustic bat monitoring equipment

Table 1. Portion of nights analyzed throughout the monitoring period

Season	Number of nights analyzed to species
Spring Migration	30
Summer	10
Fall Migration	30
Winter	10

Preliminary call analysis has provided indices of bat activity levels, spatial and temporal variation of overall bat activity, and species specific activity within the project area.

Preliminary Findings

Cautionary Note: The total number of recorded bat calls provided an index of activity, but does not necessarily constitute the number of bats present because a single bat could potentially have made several calls within a night and over many nights.

There were nights during the monitoring period in which a system was not functional for all or a portion of the night due to operational issues and equipment malfunctions (Table 2).

Table 2. Major technical issues encountered throughout the monitoring season.

Issue	Date of issue detection	Resolution
Upper detector at Met 2 (Alta 5) was discovered by Pandion technician at the base of the met tower. Improper guy wire protection installation is the likely cause of the pulley cable abrasion.	13 July 2010; The absolute date of the detector fall is unknown, but it may be assumed that the detector fell at some point between 23 June 2010 and 13 July 2010.	Tower installation crew lowered the tower and reinstalled the severed pulley cable on 31 July 2010.
Lower detector at Met 2 (Alta 5) was discovered at the base of the tower. Improper guy wire protection installation is the likely cause of the pulley cable abrasion.	20 August 2010; The tower had been previously visited on 26 July 2010, and the lower detector was still attached to the tower	The lower detector was reinstalled on 21 August 2010
Upper detector at Met 2 (Alta 5) was discovered at the base of the met tower. The housing had been reattached to the pulley cable, but had not been raised to the receptacle on the tower at 150 feet.	21 August 2010; From 31 July 2010 through 21 August 2010, Pandion was operating under the assumption that the upper detector housing was positioned on Met 2 at 150 feet, when in reality the housing was on the ground resting against the tower.	The upper detector was raised on 21 August 2010
Lower detector on Met 3 (Alta 4) periodically malfunctioned from 15 July 2010 through 23 August 2010	20 August 2010; Problem had gone undetected as the detector was still collecting noise files	Lower detector was replaced on 23 August 2010

Overall, 465 detector nights of monitoring were considered for this preliminary analysis. The time period reported in this memo includes a portion of nights occurring between 2 May 2010 and 30 September 2009.

Bat activity recorded as a whole at the site was relatively low, with 1166 bat passes recorded from the 5 ReBAT™ systems over 465 analyzed detector nights. This equates to 2.5 average bat passes per detector night for the entire project. Bat activity was similar across ReBAT™ monitoring stations when averaged across the analyzed detector nights on a per station basis (Table 3). Bat activity across the site was approximately three times higher in September than it was in May (the month with the second highest level of activity), and lowest in July (Figure 2). Six bat species and four species complexes were detected from the acoustic data recorded between 2

May 2010 and 30 September 2010 (Table 4). *Tadarida brasiliensis* (Mexican Free-tailed Bat) and *Lasiurus cinereus* (Hoary Bat) were detected most often throughout the monitoring period at 47% and 40%, respectively (Figure 3). Temporal activity patterns for both species were similar with a drastic increase in detected activity during the month of September (Figure 4). Typically, *L. cinereus* and *T. brasiliensis* are thought to fly at greater heights than other bat groups. Given that 80% of all detected bat activity was dominated by these two species, a strong vertical distribution with more calls at the upper detector would be expected, and was observed during the monitoring period (Figure 5).

Table 3. Bat Activity per ReBAT™ Station

NextEra Tower Numbers	ReBAT Numbers	Total Detected Bat Passes	Number of Detector Nights	Average Bat Passes per Detector Night
Met 4	next-alta1	268	120	2.233
Met 542	next-alta2	180	65	2.769
Met 524	next-alta3	159	65	2.446
Met 3	next-alta4	230	115	2
Met 2	next-alta5	329	100	2.611
	Total	**1166**	**465**	**2.5**

Table 4. Species Documented Acoustically at the Project Site

Species Code	Common Name	Scientific Name	Total Pass Count
ANPA_EPFU (Group)	Pallid Bat, Big Brown Bat	*Antrozous pallidus, Eptesicus fuscus*	4
EPFU	Big Brown Bat	*Eptesicus fuscus*	9
EPFU_LANO_TABR (Group)	Big Brown Bat, Silver-haired Bat, Mexican Free-tailed Bat	*Eptesicus fuscus, Lasionycteris noctivagans, Tadarida brasiliensis*	1
LABL	Western Red Bat	*Lasiurus blossevillii*	7
LACI	Hoary Bat	*Lasiurus cinereus*	462
LANO	Silver-haired Bat	*Lasionycteris noctivagans*	12
MYSP50k (Group)	California Myotis, Yuma Myotis	*Myotis californicus, Myotis yumanensis*	15
PAHE	Canyon Bat	*Parastrellus hesperus*	21
TABR	Mexican Free-tailed Bat	*Tadarida brasiliensis*	555
TABR_LANO (Group)	Mexican Free-tailed Bat, Silver-haired Bat	*Tadarida brasiliensis, Lasionycteris noctivagans*	21
UNKN	Unidentified Bat Pass	*NA*	59
Total			**1166**

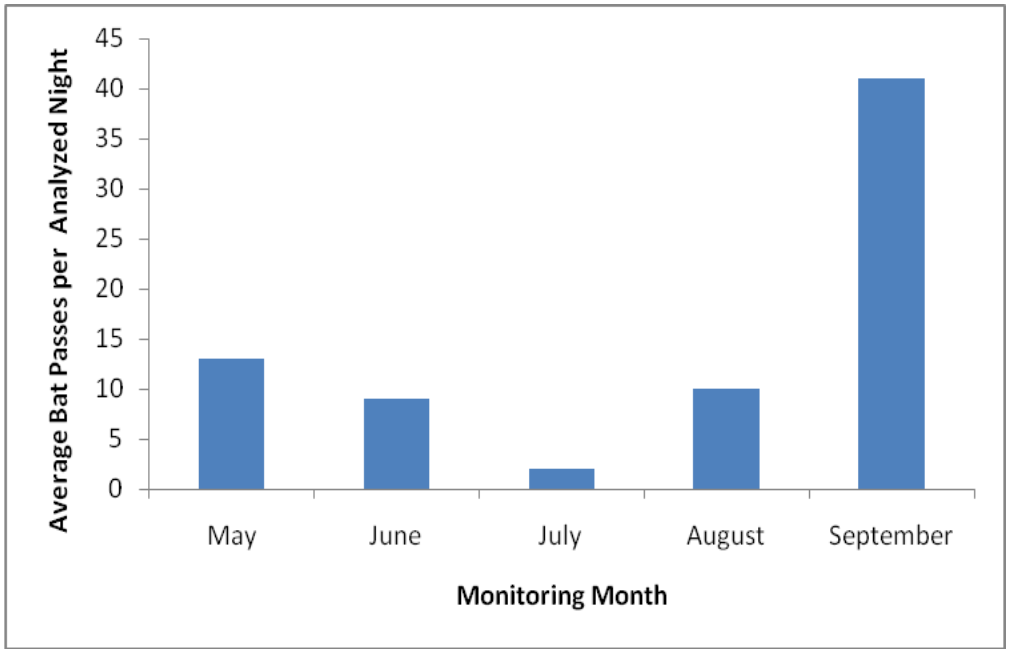

Figure 2. Average Bat Passes per Analyzed Night for the 2010 Monitoring Season. Data from all 5 ReBAT™ systems included, and averaged over number of analyzed nights per month.

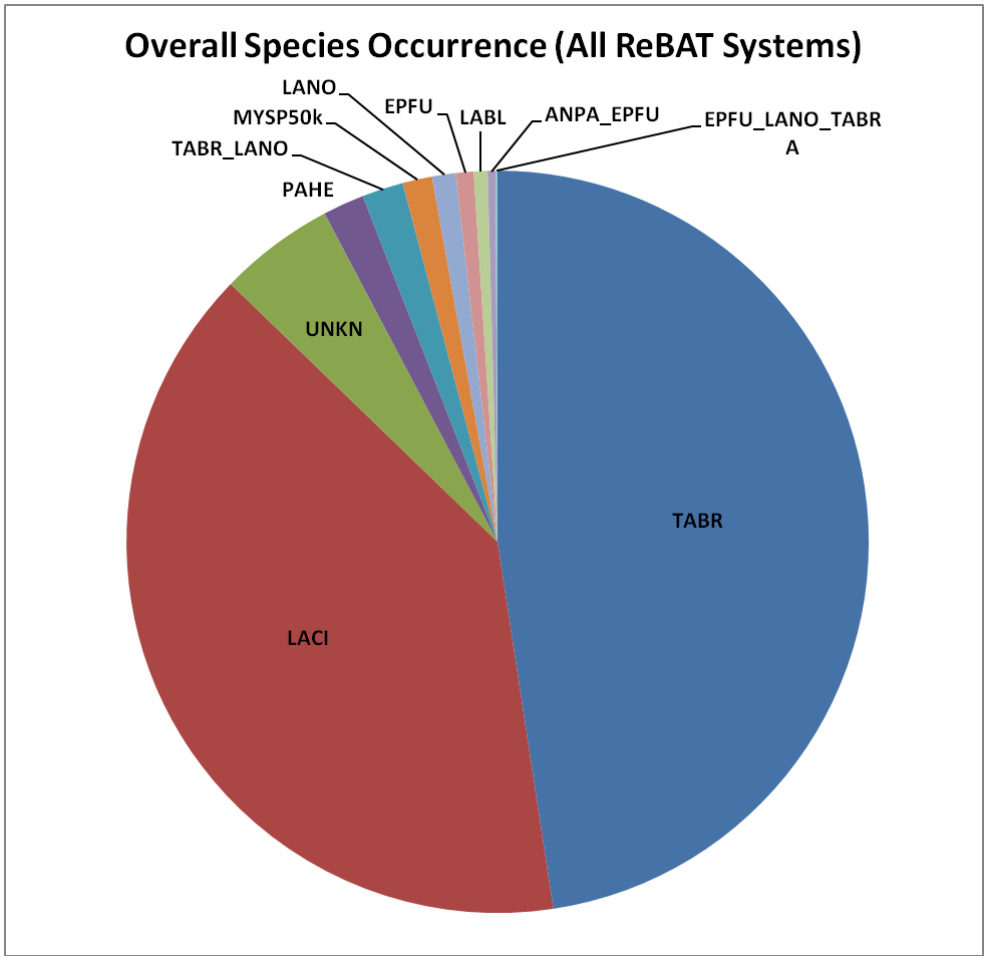

Figure 3. Species Occurrence. Includes all analyzed acoustic data from all systems (2 May 2010 – 30 September 2010). LACI (*Lasiurus cinereus*), TABR (*Tadarida brasiliensis*), EPFU_LANO_TABRA (*Eptesicus fuscus, Lasionycteris noctivagans, Tadarida brasiliensis*), ANPA_EPFU (*Antrozous pallidus, Eptesicus fuscus*), LABL (*Lasiurus blossevellii)*, EPFU (*Eptesicus fuscus*), LANO (*Lasionycteris noctivagans*), MYSP50k (*Myotis californicus, Myotis yumanensis*), TABR_LANO (*Tadarida brasiliensis, Lasionycteris noctivagans*), PAHE (*Parastrellus hesperus*)

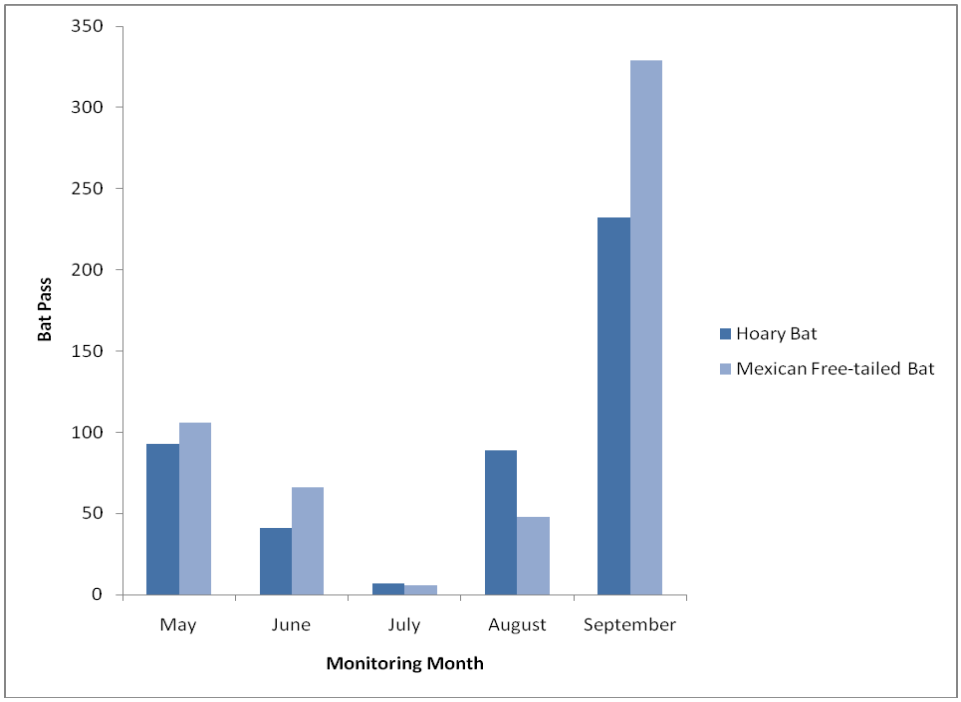

Figure 4. Temporal Variation in Hoary Bat and Mexican Free-tailed Bats Throughout the 2010 Monitoring period. Count of total bat passes from all ReBAT™ systems.

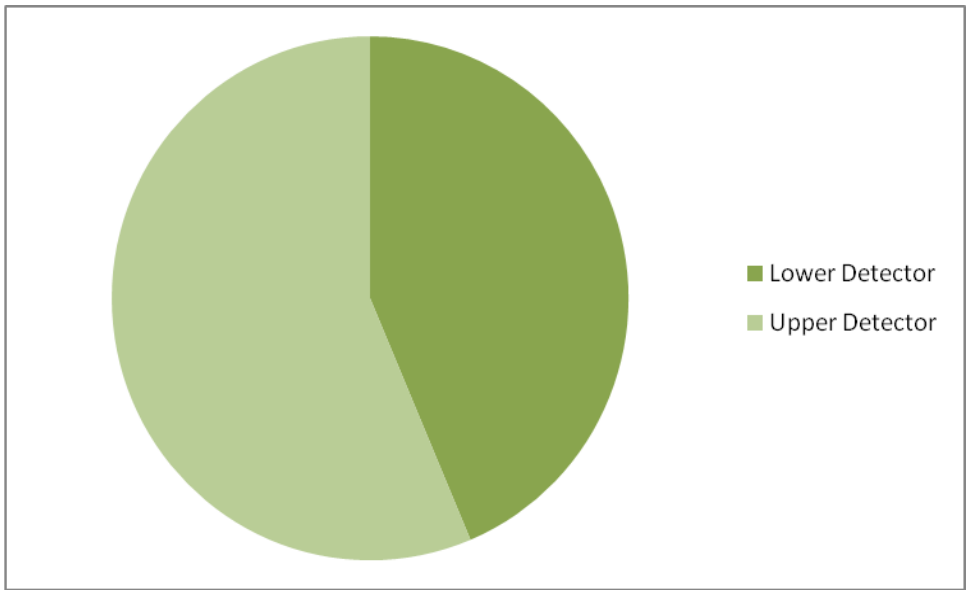

Figure 5. Vertical Distribution of All Detected Species. Data presented are from the three ReBAT™ systems on temporary met towers that have 2 acoustic detectors.

Discussion of Preliminary Results

Overall, bat activity detected within the Vasco Winds Repower project area was relatively low with an average of 2.5 bat passes per detector night reported from preliminary data analysis. Bat activity was lowest during the summer months (June and July), and highest in September, indicating that the project area is not a high use area during the maternity season, but may be important during migratory/transition periods. The two species detected most often during the acoustic monitoring survey were *L. cinereus* (Hoary Bat) of the family Vespertilionidae and *T. brasiliensis* (Mexican Free-tailed Bat) of the Molossidae family. Both species are considered rather common and widespread throughout much of California.

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APPENDIX D

Sycamore Environmental Consultants, Inc.: Botanical Inventory Report for the Vasco Winds Repowering Project

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Botanical Inventory Report
for the
Vasco Winds Repowering Project

Contra Costa and Alameda Counties, CA

Prepared by:

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20 August 2010

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Botanical Inventory Report
for the
Vasco Winds Repowering Project

Contra Costa and Alameda Counties, CA

TABLE OF CONTENTS

I. EXECUTIVE SUMMARY 1

II. INTRODUCTION 1

A. Purpose of Report 1
B. Project Location 1
C. Project Description 7

III. STUDY METHODS 8

A. Literature Search 8
B. Survey Dates and Personnel 8
C. Survey Methods 9
D. Mapping 9
E. Problems Encountered and Limitations That May Influence Results 9

IV. ENVIRONMENTAL SETTING 9

A. Soils 9
B. Weather and Climate Conditions 14
C. Biological Communities 14
1. California Annual Grassland 39
2. Valley Needlegrass Grassland 39
3. *Lupinus albifrons* Alliance (Silver Bush Lupine Scrub) 39
4. Alkali Seep 39
5. Mixed Willow Riparian Woodland 39
6. Bulrush Series 40
7. Seasonal Ponds 40
8. Disturbed Areas 40
D. The Existing Level of Disturbance 40

V. BOTANICAL RESOURCES IN THE BOTANICAL STUDY AREA 41

A. Determination of Special-Status Plants in the Botanical Study Area 41
B. Special-Status Species not in the Project Study Area 42
C. Evaluation of Special-Status Plants 42
D. Evaluation of Special-Status Natural Communities 51
E. Summary of Findings 51

VI. LITERATURE CITED 53

VII. PREPARERS 55

TABLES

Table 1. USGS Quads Evaluated for the Vasco Winds Repowering Project BSA. 8
Table 2. Biological Communities and Other Features in the BSA.....14
Table 3. Special-Status Plants and Natural Communities with the Potential to Occur in the BSA 41

FIGURES

Figure 1. Project Location Map.....3
Figure 2. Aerial Photograph 5
Figure 3. Soils Map 11
Figure 4. Botanical Resources Map 15

APPENDICES

Appendix A. Plant Species Observed
Appendix B. CNDDB Summary Report
Appendix C. USFWS Species Lists
Appendix D. Photographs
Appendix E. Species Evaluated Table

I. EXECUTIVE SUMMARY

Three botanical surveys of the 831.64 ac Vasco Winds Repowering Project botanical study area (BSA) were conducted in 2010. These occurred in March, May, and July. The BSA is located in southeastern Contra Costa and northeast Alameda Counties, CA. The BSA provides suitable habitat for 27 special-status plant species. No federal or state-listed plants were observed in the BSA.

Four special-status plant species were observed in the BSA during the 2010 botanical surveys. A total of approximately 50 individuals of San Joaquin saltbush (*Atriplex joaquiniana*), a CNPS list 1.B2 species, were observed in the southwest portion of the BSA. California androsace (*Androsace elongata* ssp. *acuta*), a CNPS list 4.2 species, were observed in the BSA. Thirty individuals of round-leaved filaree (*California macrophyllum*), a CNPS list 1B.1 species, were observed at one location in the BSA. Approximately 45 individuals of stinkbells (*Fritillaria agrestis*), a CNPS list 4.2 species, were observed at one location in the BSA. No other special-status plant species were observed in the BSA during the botanical surveys.

The California Natural Diversity Database (CNDDB) considers communities with state rarity rankings of S1-S3 to be of "high inventory priority" (DFG 2003, 2007, 2009b). A community with an S3 ranking is considered "rare and threatened" throughout its range by Sawyer et al. (2009). In the BSA, communities identified by CNDDB as a "high inventory priority" include Valley Needlegrass Grassland (14.37 ac; S3) and Alkali Seep (0.40 ac; S2). Mixed Willow Riparian Woodland (3.11ac) and Bulrush Series (4.07 ac) are not listed in DFG (2009b), but are identified as a "high inventory priority" in DFG (2003). No other special-status communities occur in the BSA.

II. INTRODUCTION

A. Purpose of Report

The purpose of this report is to document the results of botanical surveys conducted to identify special-status plants that occur in the BSA. This report was prepared under contract to CH2M Hill, Inc., Sacramento, CA. Contact Ms. Christine Roberts.

B. Project Location

The 831.64 ac BSA consists of 23 mi of 200 ft to 500 ft wide corridors located in southeastern Contra Costa and northeast Alameda counties, CA, approximately 6 mi north of the City of Livermore (Figure 1). The BSA occurs on the Byron Hot Springs USGS topographic quadrangle (Figure 1; T2S, R3E, Sections 4, 5, 32 and, 33; and T2S, R2, unsectionalized portion of the Canada De Los Vaqueros land-grant). Approximately 16.7 mi of BSA corridors are 200 ft wide and the remaining 6.3 mi are 500 ft wide. The BSA is in the San Joaquin Delta (hydrologic unit code 18040003) watershed, and its centroid is 37.7904° north, - 121.7118° west (UTM: Zone 10 S, 613,422 m E, 4,183,391 m N). Figure 2 is an April 2009 aerial photograph of the BSA.

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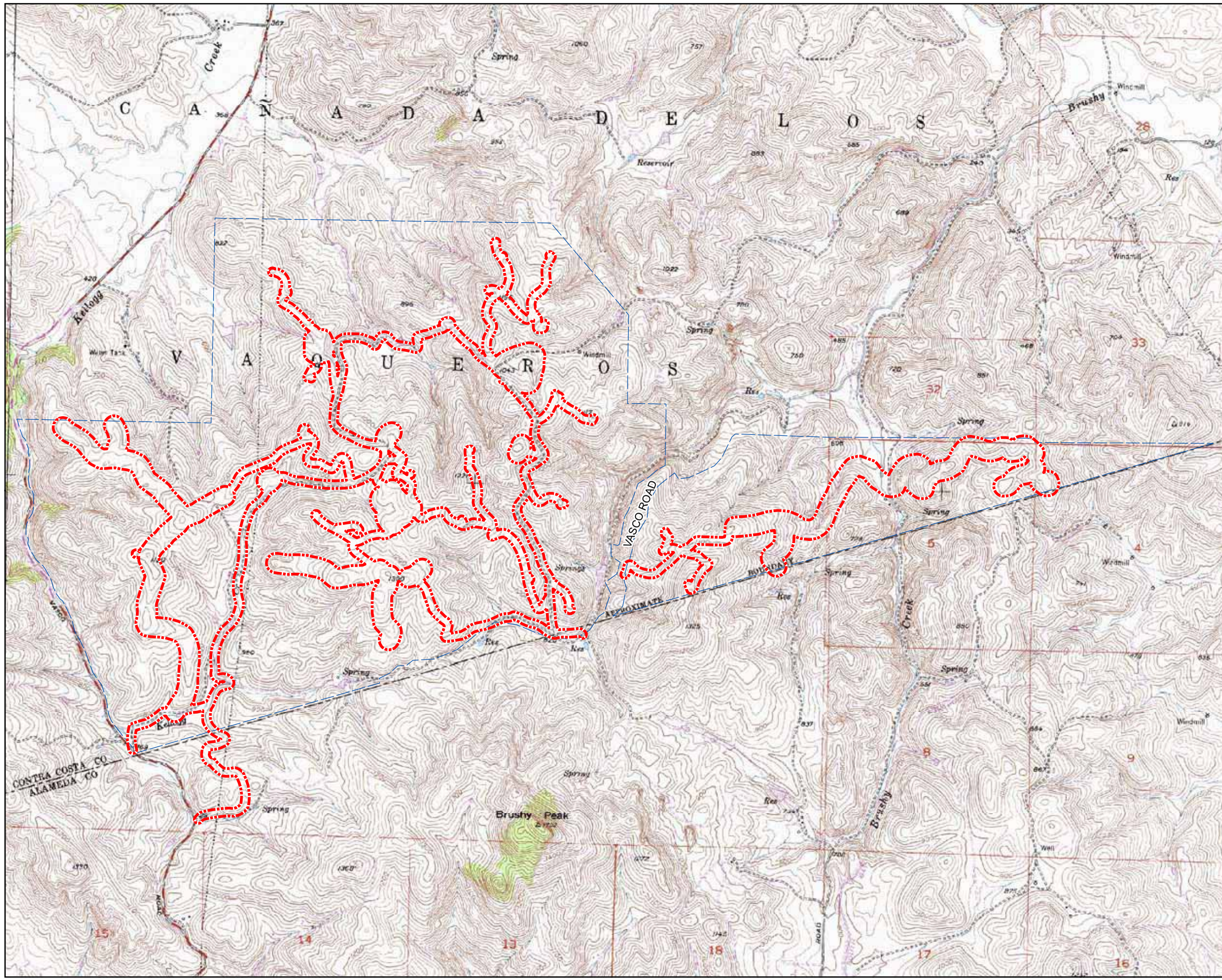

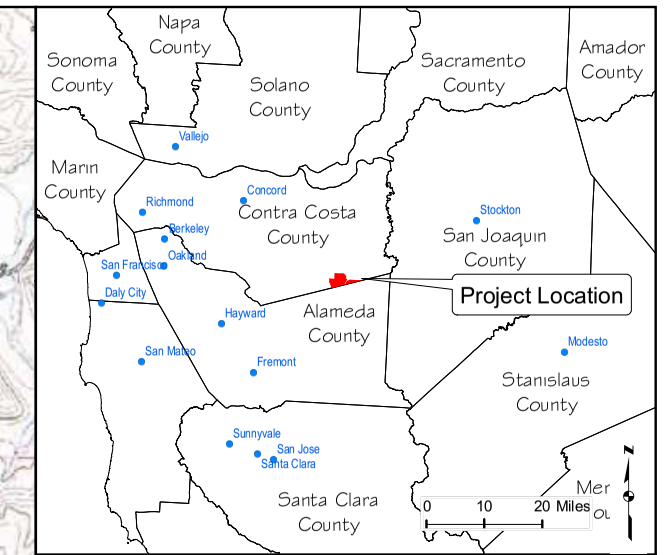

Vasco Winds Repowering Project
Contra Costa County, CA
20 August 2010

Figure 1. Location Map

Botanical Study Area (BSA)
Project Boundary

2,500 1,250 0 2,500 Feet
Scale: 1 inch = 2,500 feet
N

SYCAMORE Environmental Consultants, Inc.

Basemap:
Byron Hot Springs, CA (Rev. 1968)
Mosaicked CA 7.5' x 7.5' 1:24,000
Digital Raster Graphic (DRG) USGS Quad Image
o_se0305.sid
CAL-ATLAS Geospatial Clearinghouse

10013VascoWinds_Fig1LocationMap.mxd

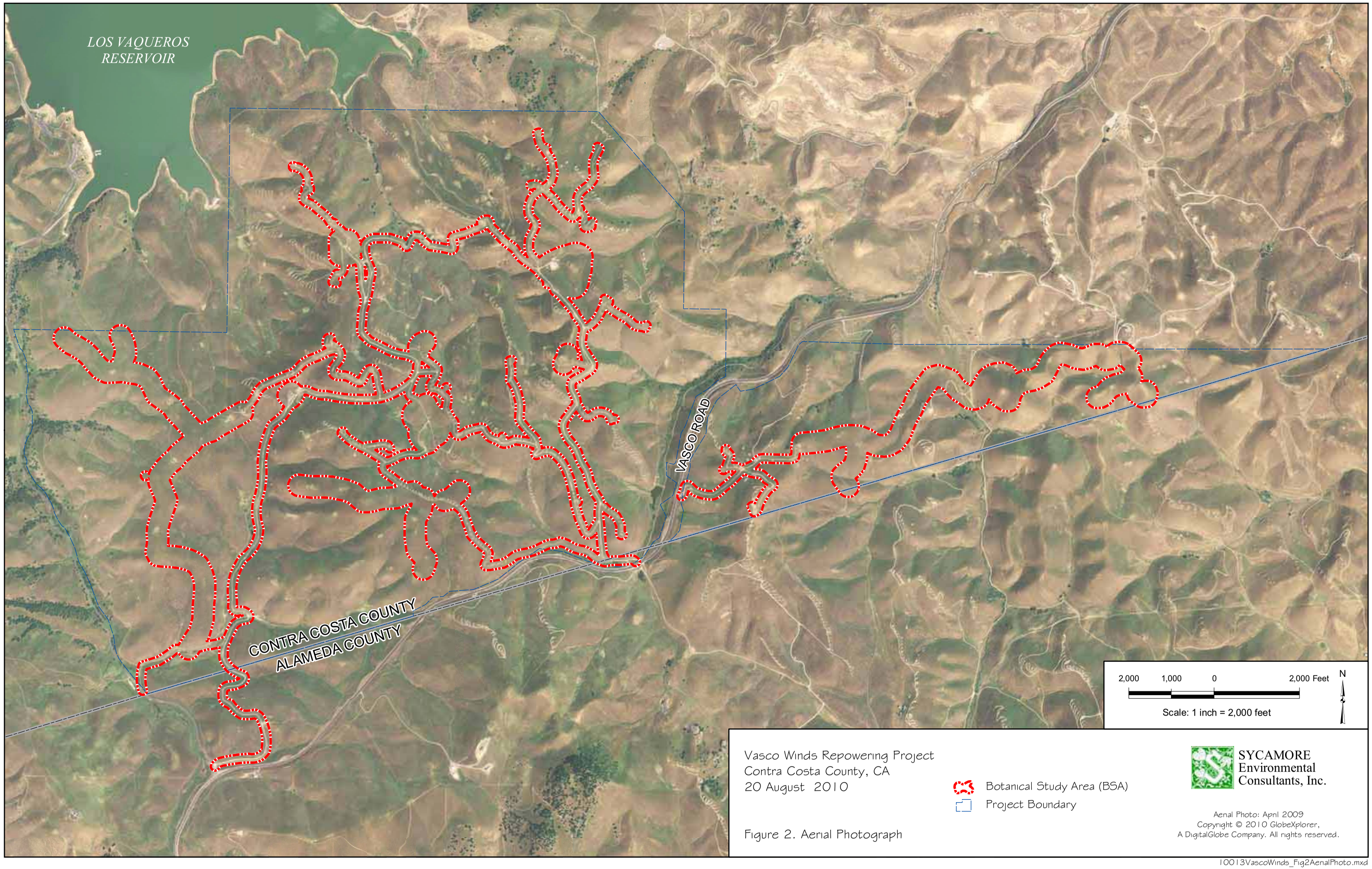

Figure 2. Aerial Photograph

C. Project Description

The following project description was provided by CH2M Hill. Vasco Winds, LLC (Vasco Winds) proposes to implement the Vasco Winds Repowering Project (Project) in southeastern Contra Costa County, CA. The Project site is located within the Altamont Pass Wind Resource Area (APWRA), which is an area designated by the state and by Alameda and Contra Costa counties as a Wind Resource Area because the area maintains winds at a level that supports economically viable wind energy projects. The site of the existing wind farm and the proposed repowering of that site (the Project) is an ideal location for generating electrical power from wind based on the strong predictable wind resource generated at the Project site.

The proposed Project will repower the existing wind farm, Altamont Power, which is a source of renewable energy, by decommissioning and removing 438 existing wind turbines on the existing wind farm site. Following decommissioning, up to 50 new wind turbine generators (WTG) will be installed, representing a net reduction of 381 turbines at the site. The Project will continue transmitting energy from the site to the regional power grid and will maximize renewable energy production by replacing the aging infrastructure with newer, more efficient WTGs. The new WTGs will maintain the same 80-megawatt (MW) nameplate capacity as the existing wind farm that will be decommissioned, but the Project will increase energy production, at a minimum, 150 percent above existing generation because of the efficient and improved design of the new turbines.

Vasco Winds will also remove an additional 286 wind turbine foundations, from which wind turbines have been previously removed.

III. STUDY METHODS

The botanical surveys for this report follow the guidelines set forth by USFWS (1996), DFG (2009a), and California Native Plant Society (CNPS 2001), where applicable. Scientific nomenclature follows Hickman, ed. (1993). Appendix A is a list the species observed.

A. Literature Search

Information on the biology, distribution, taxonomy, legal status, and other aspects of the special-status species was obtained from documents on file in the library of Sycamore Environmental. Standard references used for the biology and taxonomy of plants included Abrams (1923-1960); Hickman, ed. (1993); Munz (1959; 1974); and. On-line references included California Native Plant Society (2010); CalPhotos (2010); and the Consortium of California Herbaria (CCH 2010). References pertaining to biological communities include California Department of Fish and Game (2003, 2007, 2009b); Sawyer and Keeler-Wolf (1995); and Sawyer et al. (2009).

Lists of DFG special-status species reviewed included *Special Vascular Plants, Bryophytes, and Lichens List* (DFG 2010a) and *State and Federally Listed Endangered, Threatened, and Rare Plants of California* (DFG 2010b).

A search of the California Natural Diversity Database (CNDDB, 1 May 2010 version; DFG 2010c) was conducted for the Byron Hot Springs and the eight adjacent USGS quads to determine known records of special-status species in or near the BSA. A CNDDB summary report for the nine quads is in Appendix B. Table 1 lists the USGS quads evaluated.

Table 1. USGS Quads Evaluated for the Vasco Winds Repowering Project BSA.

Antioch South	Brentwood	Woodward Island
Tassajara	**Byron Hot Springs**	Clifton Court Forebay
Livermore	Altamont	Midway

Sycamore Environmental obtained a list from the U.S. Fish and Wildlife Service (USFWS), Sacramento Field Office that identifies federal-listed species that potentially occur in or could be affected by projects on the Byron Hot Springs USGS quad. The list, dated 9 August 2010, is in Appendix C.

B. Survey Dates and Personnel

A total of three surveys were conducted in 2010. Fieldwork for the first survey event was conducted by R. John Little, Ph.D., Adam Forbes, M.S., Charles Hughes, M.S., and Michael Bower, M.S. from 29 March through 1 April 2010. The second survey event was conducted by Mr. Forbes, Mr. Hughes, and Mr. Bower between 19 and 22 May 2010. The third survey was conducted by Mr. Forbes and Mr. Bower between 26 and 28 July 2010. An additional site visit was conducted on 11 August 2010 by Mr. Bower. Approximately 328 person-hours were spent in the field during the three survey events.

C. Survey Methods

Parallel transects were walked by four botanists (first survey), three botanists (second survey), and two botanists (third survey), throughout the entire 831.64 ac BSA to search for special-status plants. Survey coverage in the BSA was 100% during each survey event. The locations of BSA boundaries were determined using GIS boundary data provided by CH2M Hill that had been uploaded onto a Trimble GeoXT GPS unit. All plant species observed were either identified on-site or were collected and identified later. Voucher specimens were collected of most species observed in the BSA. Appendix A lists the species observed. Fieldwork was conducted during March, May, and July to coincide with the evident and identifiable period of special-status species with the potential to occur in the BSA.

D. Mapping

The April 2009 aerial photo in Figures 2 and 4 was downloaded from GlobeXplorer® 2010 and was also used to map the biological communities.

The biological communities were mapped based on field notes and interpretation of the April 2009 aerial photo, at a scale of 1 inch = 350 ft using Sawyer et al. (2009), Sawyer and Keeler-Wolf (1995), and California Department of Fish and Game (2003, 2007, 2009b). The transition from one biological community to another is often subtle and indistinct. In most instances, biological community boundaries represent gradual changes in structurally dominant vegetation, thus, the lines generally do not represent an abrupt change in vegetation on the ground.

E. Problems Encountered and Limitations That May Influence Results

No problems or limitations were encountered that may influence the results.

IV. ENVIRONMENTAL SETTING

The BSA is located north of the City of Livermore in southeast Contra Costa County and northeast Alameda County. Elevation in the BSA ranges from approximately 415 to 1,290 ft above sea level. Topography in the BSA consists of moderate to steep terrain of varying aspect. Land use surrounding the BSA consists of an existing wind farm.

A. Soils

Mapped soil units in the BSA include Altamont clay, 15 to 30 percent slopes, Altamont clay, 9 to 15 percent slopes, Altamont-Fontana complex, 30 to 50 percent slopes, Altamont-Fontana complex, 50 to 75 percent slopes, Capay clay, 0 to 2 percent slopes, Gaviota rocky sandy loam, 40 to 75 percent slopes, eroded, Gaviota sandy loam, 30 to 50 percent slopes, Millsholm loam, 30 to 50 percent slopes, and Rincon clay loam, 0 to 2 percent slopes (NRCS 2010a). The following descriptions are summarized from NRCS (2010b and 1977). Figure 3 is a soils map.

Altamont clay, 9 to 15 percent slopes and Altamont clay, 15 to 30 percent slopes:
The Altamont series consists of deep, well drained soils that formed in material weathered from fine-grained sandstone and shale and occurs on gentle to very steep upland slopes. Average annual precipitation is approximately 17 inches and the mean annual temperature is approximately 59º F. The Altamont series are classified as fine, smectitic, thermic Aridic Haploxererts (NRCS 2010b).

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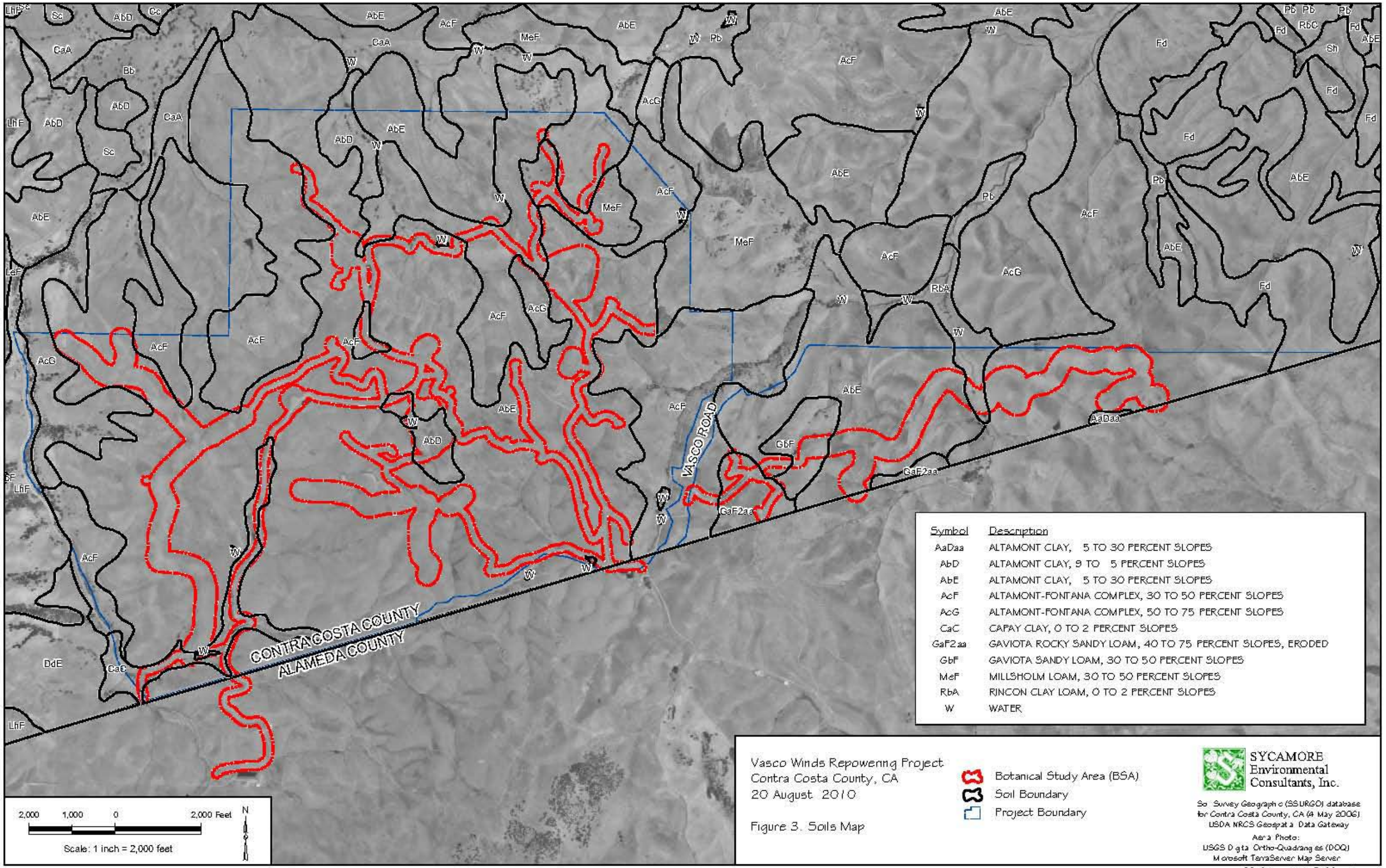

VASCO ROAD
CONTRA COSTA COUNTY
ALAMEDA COUNTY
2,000 1,000 0 2,000 Feet
Scale: 1 inch = 2,000 feet
N
Symbol Description
AaDaa ALTAMONT CLAY, 5 TO 30 PERCENT SLOPES
AbD ALTAMONT CLAY, 9 TO 5 PERCENT SLOPES
AbE ALTAMONT CLAY, 5 TO 30 PERCENT SLOPES
AcF ALTAMONT-FONTANA COMPLEX, 30 TO 50 PERCENT SLOPES
AcG ALTAMONT-FONTANA COMPLEX, 50 TO 75 PERCENT SLOPES
CaC CAPAY CLAY, 0 TO 2 PERCENT SLOPES
GaF2aa GAVIOTA ROCKY SANDY LOAM, 40 TO 75 PERCENT SLOPES, ERODED
GbF GAVIOTA SANDY LOAM, 30 TO 50 PERCENT SLOPES
MeF MILLSHOLM LOAM, 30 TO 50 PERCENT SLOPES
RbA RINCON CLAY LOAM, 0 TO 2 PERCENT SLOPES
W WATER
Vasco Winds Repowering Project
Contra Costa County, CA
20 August 2010
Figure 3. Soils Map
Botanical Study Area (BSA)
Soil Boundary
Project Boundary
SYCAMORE Environmental Consultants, Inc.
Soil Survey Geographic (SSURGO) database for Contra Costa County, CA (4 May 2006) USDA NRCS Geospatial Data Gateway
Aerial Photo: USGS Digital Ortho-Quadrangles (DOQ) Microsoft TerraServer Map Server
00_3VascoWinds_Fig3SoilsMap.mxd

Altamont-Fontana complex, 30 to 50 percent slopes and Altamont-Fontana complex, 50 to 75 percent slopes
The Altamont-Fontana complex consists of 40 to 50% Altamont Clay (see description above) and 30 to 35 % Fontana silty clay loam (NRCS 1977). Fontana silty clay loam consists of deep, well drained soils that formed in residuum weathered from calcareous shale and fine grained sandstone and occurs on hilly, moderately steep to steep uplands. Average annual precipitation is approximately 16 inches and the mean annual temperature is approximately 63º F. The Fontana series are classified as fine-loamy, mixed, superactive, thermic Calcic Haploxerolls (NRCS 2010b).

Capay clay, 0 to 2 percent slopes
The Capay series consists of very deep, moderately well drained soils that formed in moderately fine and fine textured alluvium derived from mostly sandstone and shale and occur on alluvial fans, alluvial flats, interfan basins and basin rims. Average annual precipitation is approximately 15 inches and the mean annual temperature is approximately 61º F. The Capay series are classified as fine, smectitic, thermic Typic Haploxererts (NRCS 2010b)

Gaviota rocky sandy loam, 40 to 75 percent slopes, eroded and Gaviota sandy loam, 30 to 50 percent slopes
The Gaviota series consists of very shallow or shallow, well drained soils that formed in material weathered from hard sandstone or meta-sandstone and occur on hills and mountains. Average annual precipitation is approximately 20 inches and the mean annual temperature is approximately 60º F. The Gaviota series are classified as loamy, mixed, superactive, nonacid, thermic Lithic Xerorthents (NRCS 2010b)

Millsholm loam, 30 to 50 percent slopes
The Millsholm series consists of shallow, well drained soils that formed in material weathered from sandstone, mudstone and shale and occur on hills and mountains. Average annual precipitation is approximately 25 inches and the mean annual temperature is approximately 60º F. The Millsholm series are classified as loamy, mixed, superactive, thermic Lithic Haploxerepts (NRCS 2010b)

Rincon clay loam, 0 to 2 percent slopes
The Rincon series consists of deep, well drained soils that formed in alluvium from sedimentary rocks and occur on old alluvial fans and both stream and marine terraces. Average annual precipitation is approximately 16 inches and the mean annual temperature is approximately 60º F. The Rincon series are classified as fine, smectitic, thermic Mollic Haploxeralfs (NRCS 2010b)

B. Weather and Climate Conditions

The fieldwork for the botanical surveys was conducted from 29 March through 1 April, 19 through 22 May, and 26 through 28 July 2010. The historic (1934-present) average precipitation for the Tracy Carbona gauge from September through March is 8.3 inches (CDWR 2010). From September 2009 through March 2010 the Tracy Carbona gauge received approximately 10.5 inches of rain (CDWR 2010), or approximately 125% of the average accumulated precipitation. Thus, hydrologic conditions were above normal during the botanical surveys.

C. Biological Communities

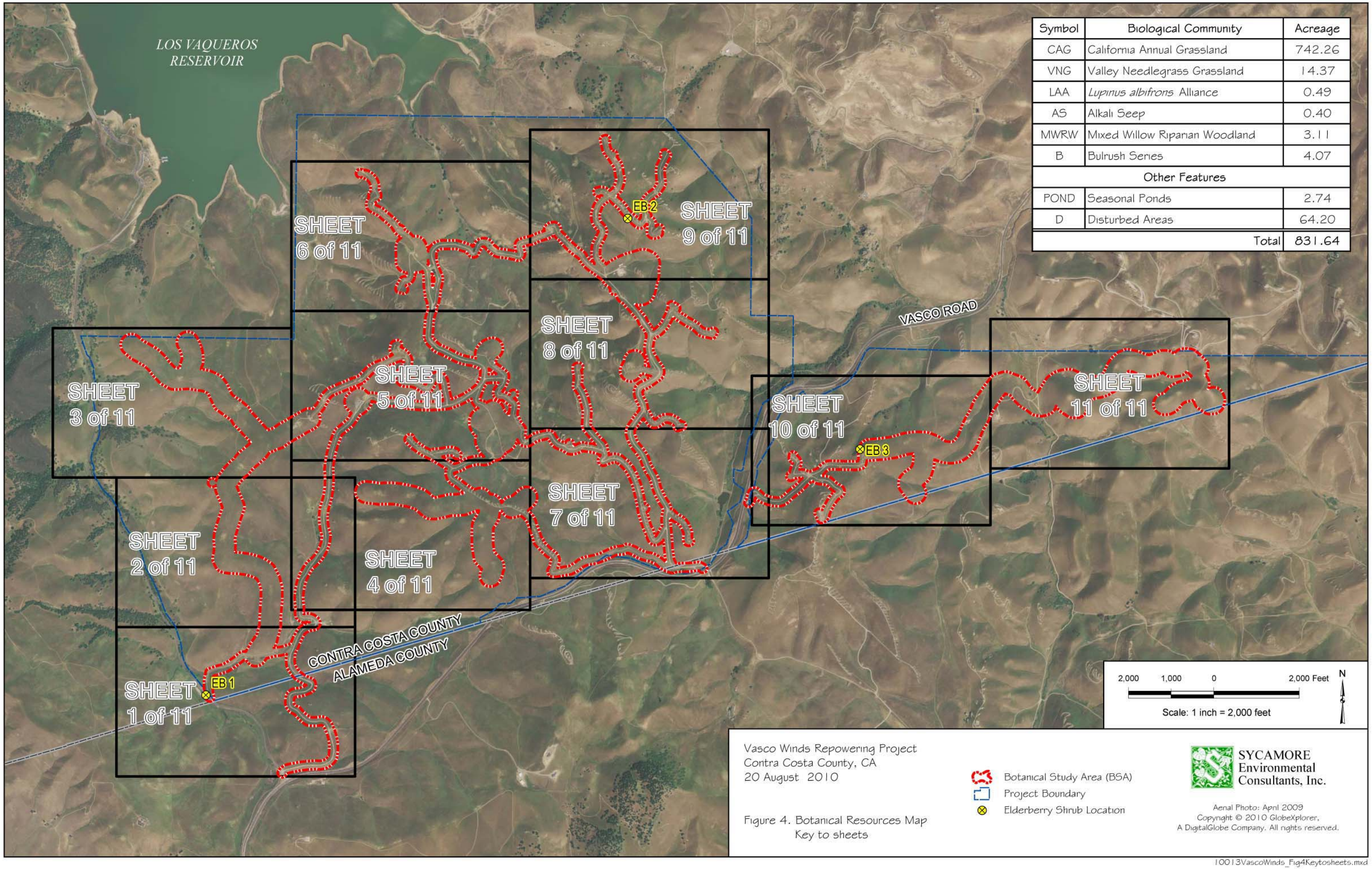
Biological communities are defined by species composition and relative abundance. Biological communities described below correlate where applicable with *A Manual of California Vegetation* (Sawyer and Keeler-Wolf 1995), *A Manual of California Vegetation*, 2nd *Edition* (Sawyer et al. 2009), Holland (1986), and *List of California Vegetation Alliances* (DFG 2003, 2007, and 2009b). Biological communities are mapped in Figure 4 and their acreages are in Table 2. Photographs of the BSA are in Appendix D.

Three elderberry shrubs were observed in the BSA during the botanical surveys (Figure 4; Sheets 1, 9, and 10).

Table 2. Biological Communities and Other Features in the BSA.

Biological Community	**Common Name [6]**	**Global & State Rarity Rank [7]**	**Acreage [8]**
California Annual Grassland [1]	NA	G5 S5	742.26
Valley Needlegrass Grassland [2]	NA	G4 S3	14.37
Lupinus albifrons Alliance [3]	Silver Bush Lupine Scrub	G4 S4	0.49
Alkali Seep [2]	NA	G3 S2	0.40
Mixed Willow Riparian Woodland [4]	NA	--	3.11
Bulrush Series [5]	NA	--	4.07
Other Features			
Seasonal Ponds	NA	NA	2.74
Disturbed Areas	NA	NA	64.20
		Total:	**831.64**

[1] Described in DFG (2007) and Sawyer and Keeler-Wolf (1995).
[2] Described in Holland (1986) and DFG (2003).
[3] Described in DGF (2009b) and Sawyer et. al. (2009).
[4] Described in DFG (2003).
[5] Described in DFG (2003) and Sawyer and Keeler-Wolf (1995).
[6] Common names, where applicable, from DFG (2009b).
[7] Global and State Rarity Rank from DFG (2003, 2007, 2009b, and 2010c).
[8] Acreages were calculated using AutoCAD® functions.



Symbol	Biological Community	Acreage
CAG	California Annual Grassland	742.26
VNG	Valley Needlegrass Grassland	14.37
LAA	*Lupinus albifrons* Alliance	0.49
AS	Alkali Seep	0.40
MWRW	Mixed Willow Riparian Woodland	3.11
B	Bulrush Series	4.07
Other Features		
POND	Seasonal Ponds	2.74
D	Disturbed Areas	64.20
	Total	831.64

SEE SHEET 2 OF 11

PROJECT BOUNDARY
POND
CAG
CAG
CAG
POND
B
CAG
D
CAG
B
CAG
B
CAG
MWRW
CAG
CAG
MWRW
CAG
PROJECT BOUNDARY
EB 1
CAG
CONTRA COSTA COUNTY
ALAMEDA COUNTY
D
CAG
CAG
CAG
CAG
D
CAG
VASCO ROAD

KEY MAP
Not to scale

350 175 0 350 Feet
Scale: 1 inch = 350 feet
N

Vasco Winds Repowering Project
Contra Costa County, CA
20 August 2010

Figure 4. Botanical Resources Map
Sheet 1 of 11

Legend
- Botanical Study Area (BSA)
- Biological Community Boundary
- Project Boundary
- San Joaquin Spearscale (*Atriplex joaquiniana*)
- Elderberry Shrub

Symbol	Biological Community
CAG	California Annual Grassland
MWRW	Mixed Willow Riparian Woodland
B	Bulrush Series
POND	Seasonal Ponds
D	Disturbed Areas

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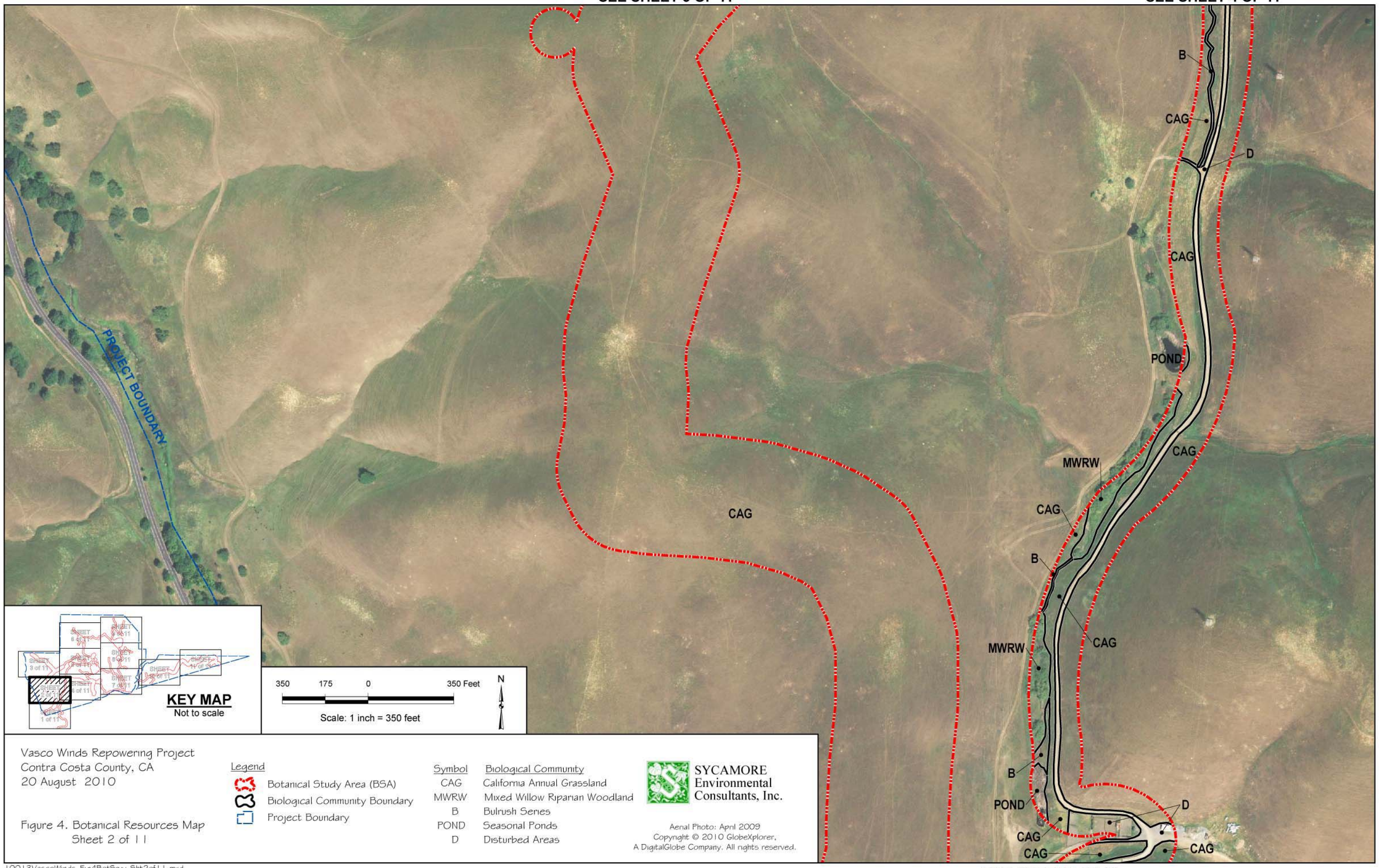
10013NextEra_Fig3BotSrvy_Sht1of11.mxd

SEE SHEET 3 OF 11

SEE SHEET 4 OF 11



Vasco Winds Repowering Project
Contra Costa County, CA
20 August 2010

Figure 4. Botanical Resources Map
Sheet 2 of 11

Legend
- Botanical Study Area (BSA)
- Biological Community Boundary
- Project Boundary

Symbol	Biological Community
CAG	California Annual Grassland
MWRW	Mixed Willow Riparian Woodland
B	Bulrush Series
POND	Seasonal Ponds
D	Disturbed Areas

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10013VascoWinds_Fig4BotSrvy_Sht2of11.mxd

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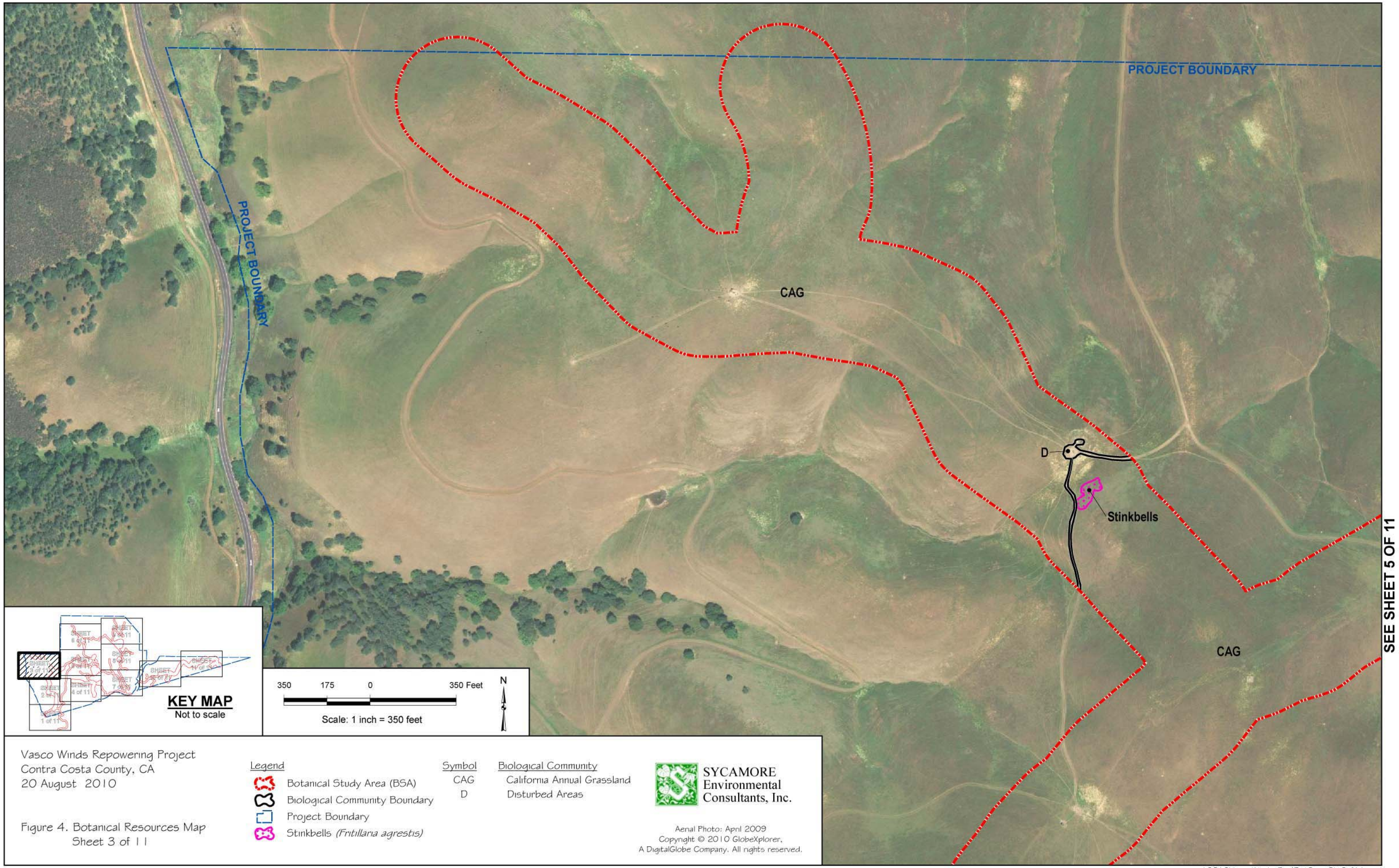
PROJECT BOUNDARY
PROJECT BOUNDARY
CAG
D
Stinkbells
CAG
SEE SHEET 5 OF 11
SEE SHEET 2 OF 11
KEY MAP
Not to scale
350 175 0 350 Feet
Scale: 1 inch = 350 feet
N
Vasco Winds Repowering Project
Contra Costa County, CA
20 August 2010
Figure 4. Botanical Resources Map
Sheet 3 of 11
Legend
Botanical Study Area (BSA)
Biological Community Boundary
Project Boundary
Stinkbells (Fritillaria agrestis)
Symbol
CAG
D
Biological Community
California Annual Grassland
Disturbed Areas
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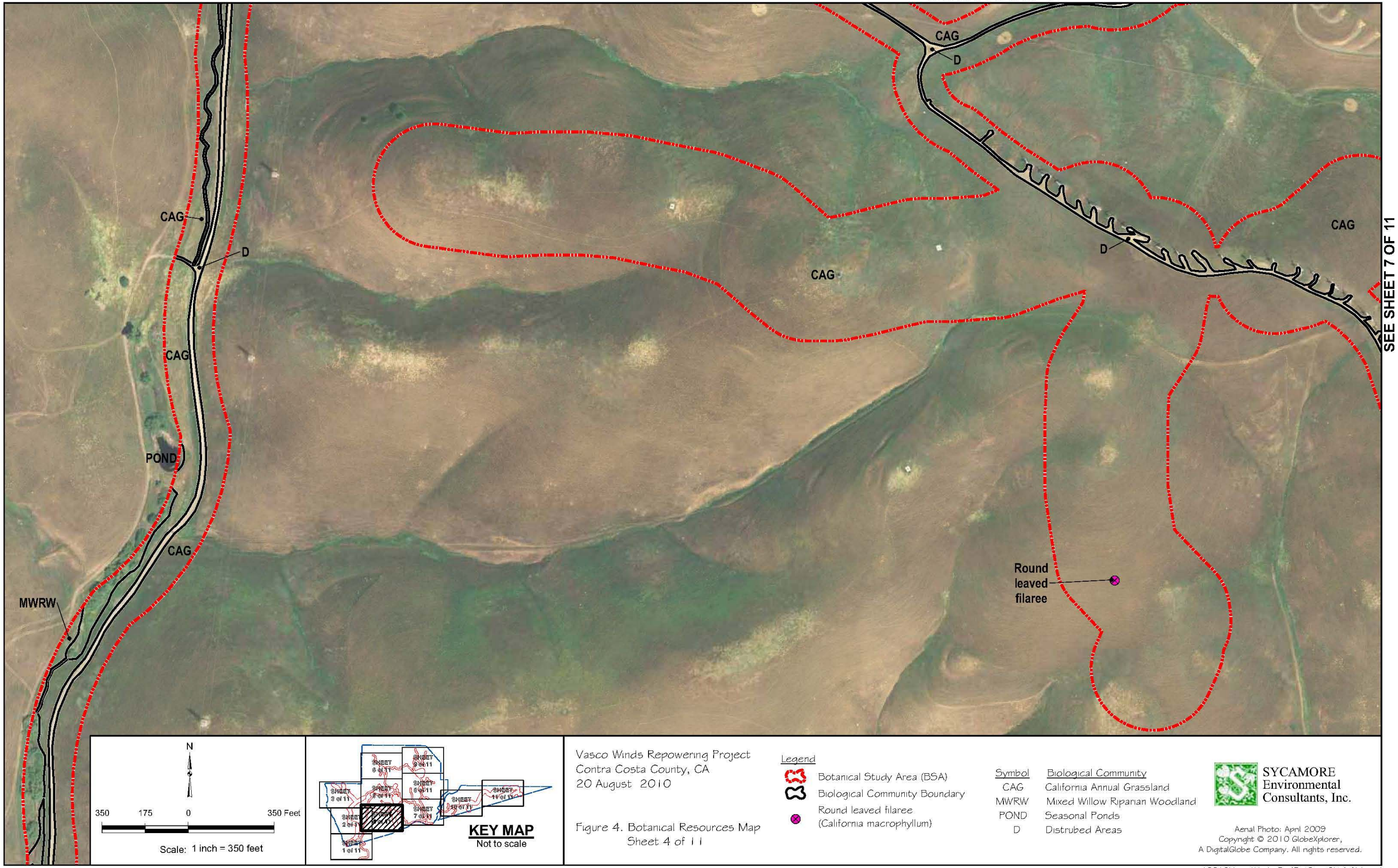
SEE SHEET 5 OF 11



SEE SHEET 7 OF 11

Vasco Winds Repowering Project
Contra Costa County, CA
20 August 2010

Figure 4. Botanical Resources Map
Sheet 4 of 11

Legend

- Botanical Study Area (BSA)
- Biological Community Boundary
- Round leaved filaree (California macrophyllum)

Symbol	Biological Community
CAG	California Annual Grassland
MWRW	Mixed Willow Riparian Woodland
POND	Seasonal Ponds
D	Distrubed Areas

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SEE SHEET 2 OF 11

10013VascoWinds Fig4BotSrvy Sht5of11.mxd

Vasco Winds Repowering Project
Contra Costa County, CA
20 August 2010

Figure 4. Botanical Resources Map
Sheet 5 of 11

Legend
- Botanical Study Area (BSA)
- Biological Community Boundary

Symbol	Biological Community
CAG	California Annual Grassland
VNG	Valley Needle Grass
MWRW	Mixed Willow Riparian Woodland
POND	Seasonal Ponds
D	Disturbed Areas

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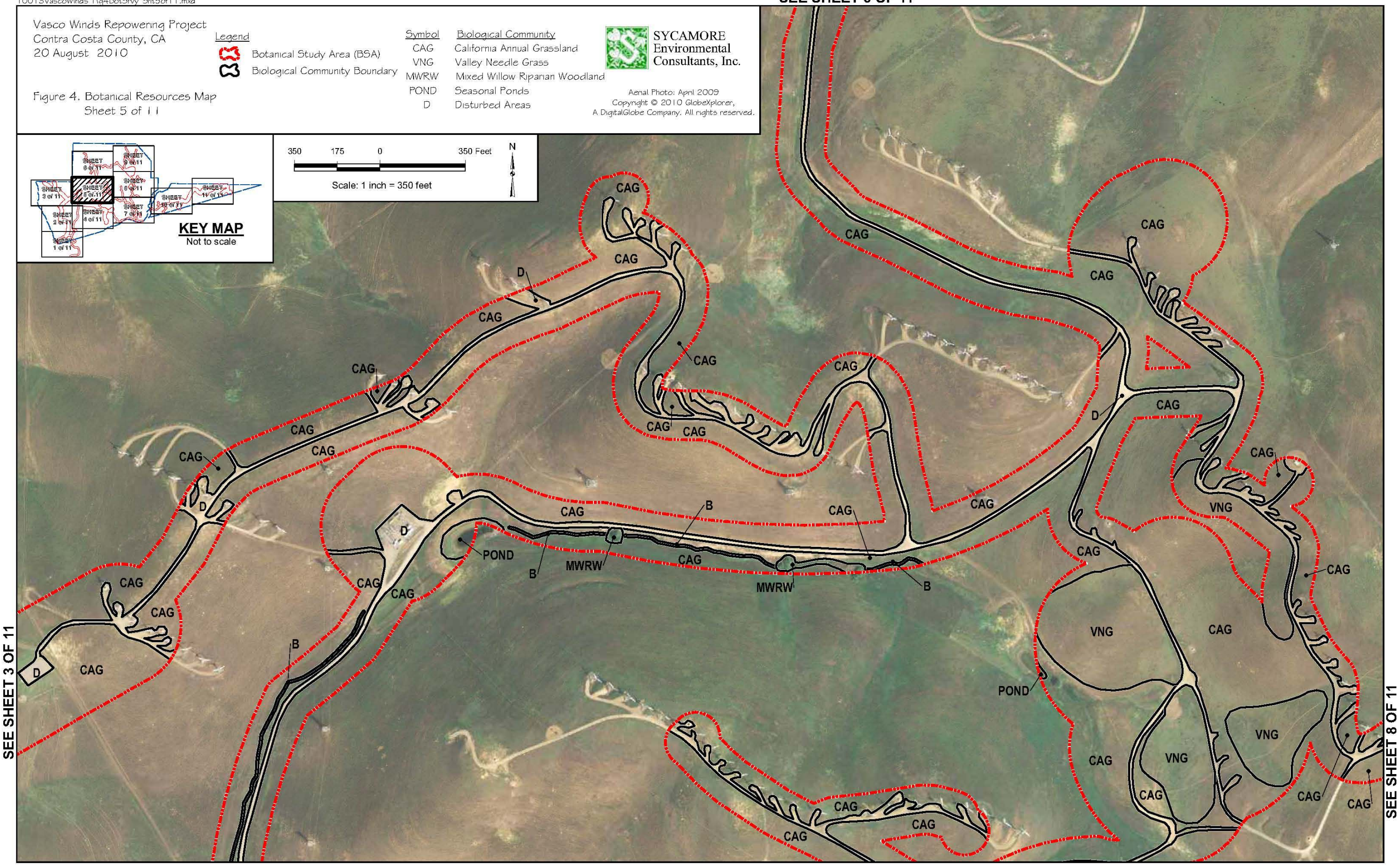

Vasco Winds Repowering Project
Contra Costa County, CA
20 August 2010

Figure 4. Botanical Resources Map
Sheet 6 of 11

Legend

- Botanical Study Area (BSA)
- Biological Community Boundary
- Project Boundary

Symbol	Biological Community
CAG	California Annual Grassland
POND	Seasonal Ponds
D	Disturbed Areas

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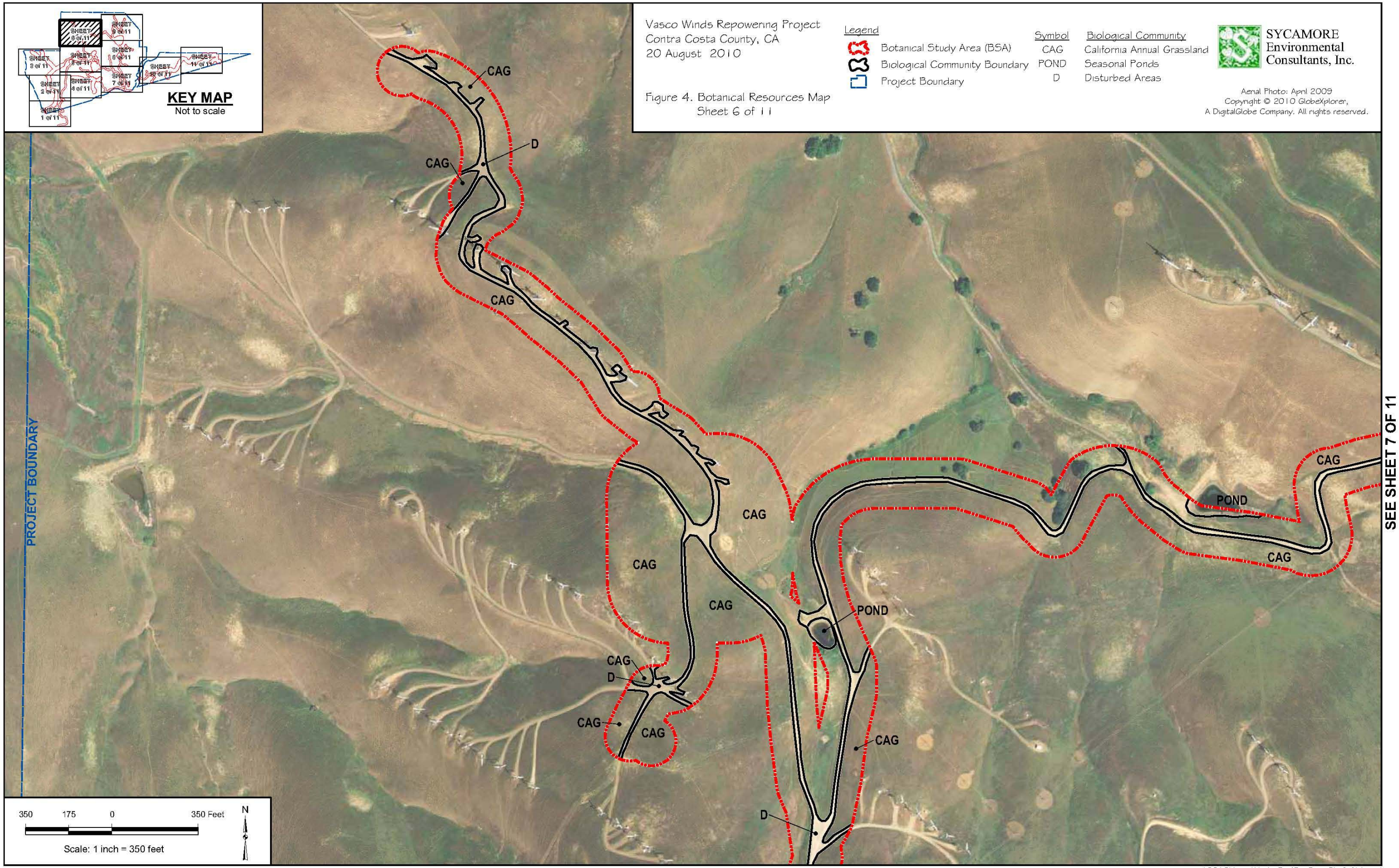

SEE SHEET 7 OF 11

SEE SHEET 5 OF 11

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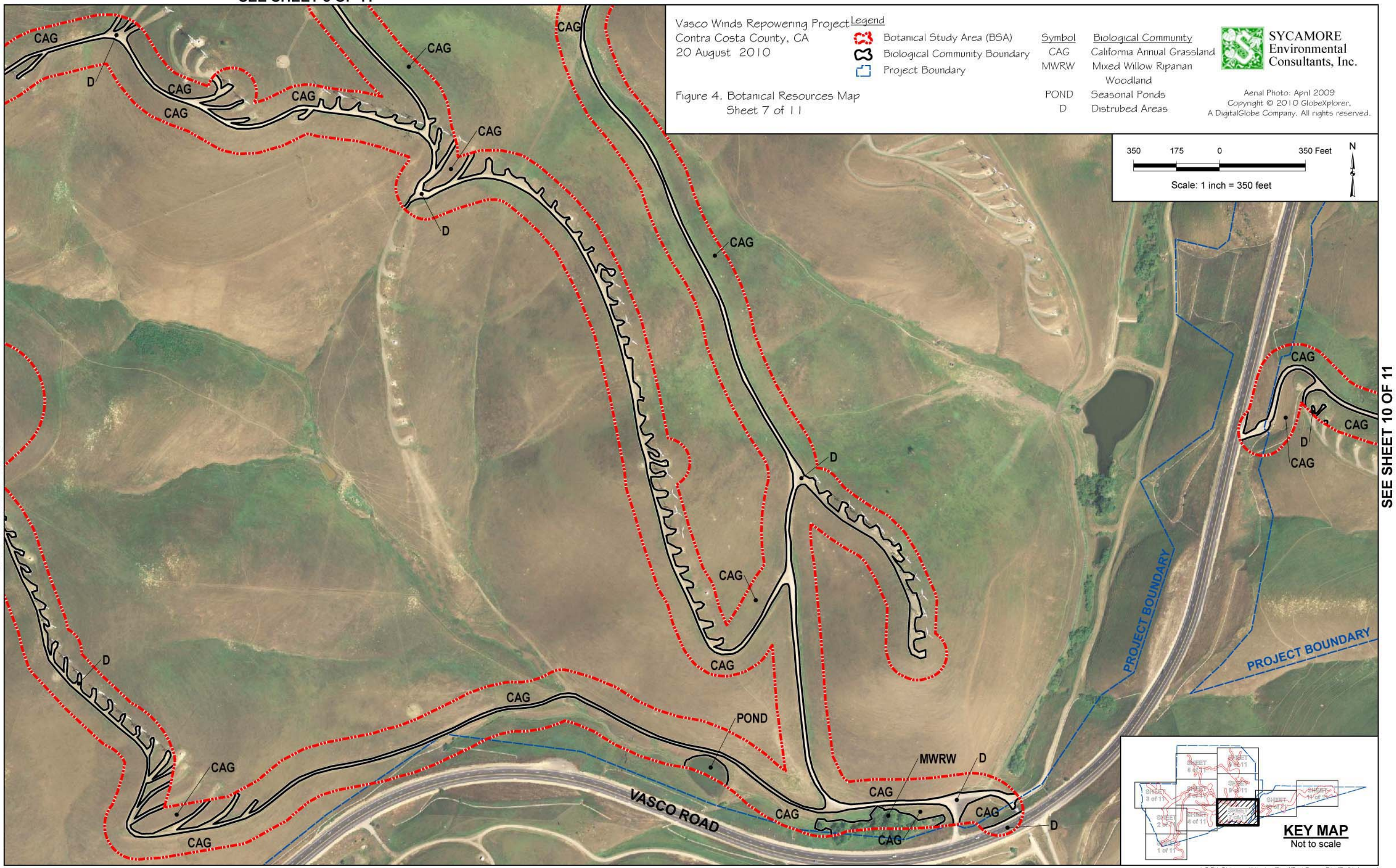
SEE SHEET 8 OF 11

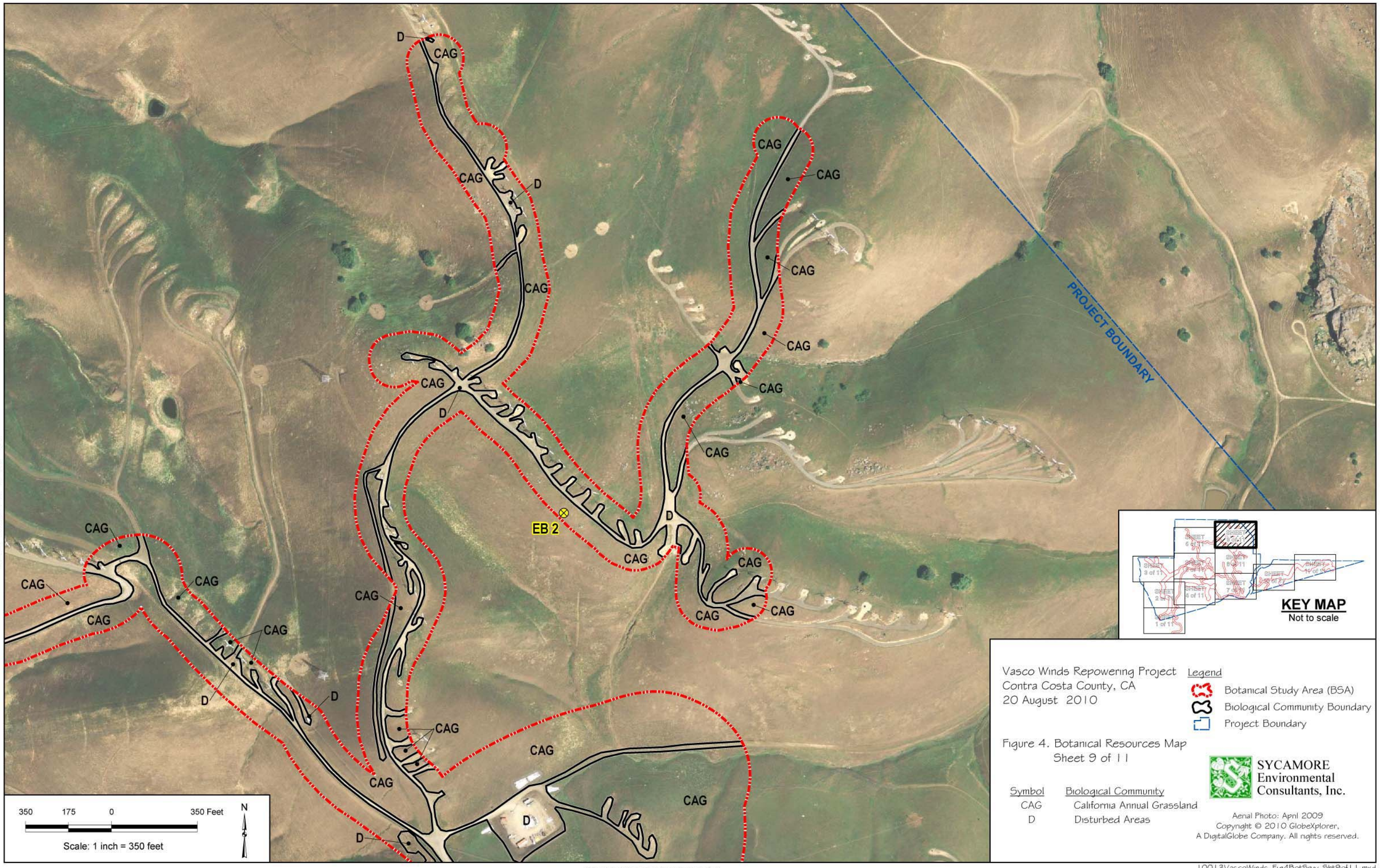


SEE SHEET 9 OF 11

SEE SHEET 5 OF 11

SEE SHEET 10 OF 11

SEE SHEET 7 OF 11



Vasco Winds Repowering Project
Contra Costa County, CA
20 August 2010

Legend
- Botanical Study Area (BSA)
- Biological Community Boundary
- Project Boundary

Figure 4. Botanical Resources Map
Sheet 9 of 11

Symbol	Biological Community
CAG	California Annual Grassland
D	Disturbed Areas

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10013VascoWinds_Fig4BotSrvy_Sht9of11.mxd

Vasco Winds Repowering Project
Contra Costa County, CA
20 August 2010

Figure 4. Botanical Resources Map
Sheet 10 of 11

Legend

- Botanical Study Area (BSA)
- Biological Community Boundary
- Project Boundary
- Elderberry Shrub Location

Symbol	Biological Community
CAG	California Annual Grassland
VNG	Purple Needle Grassland
AS	Alkaline Seep
LAA	*Lupinus albifrons* Alliance
D	Disturbed Areas

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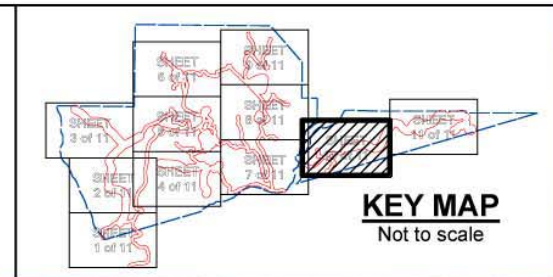

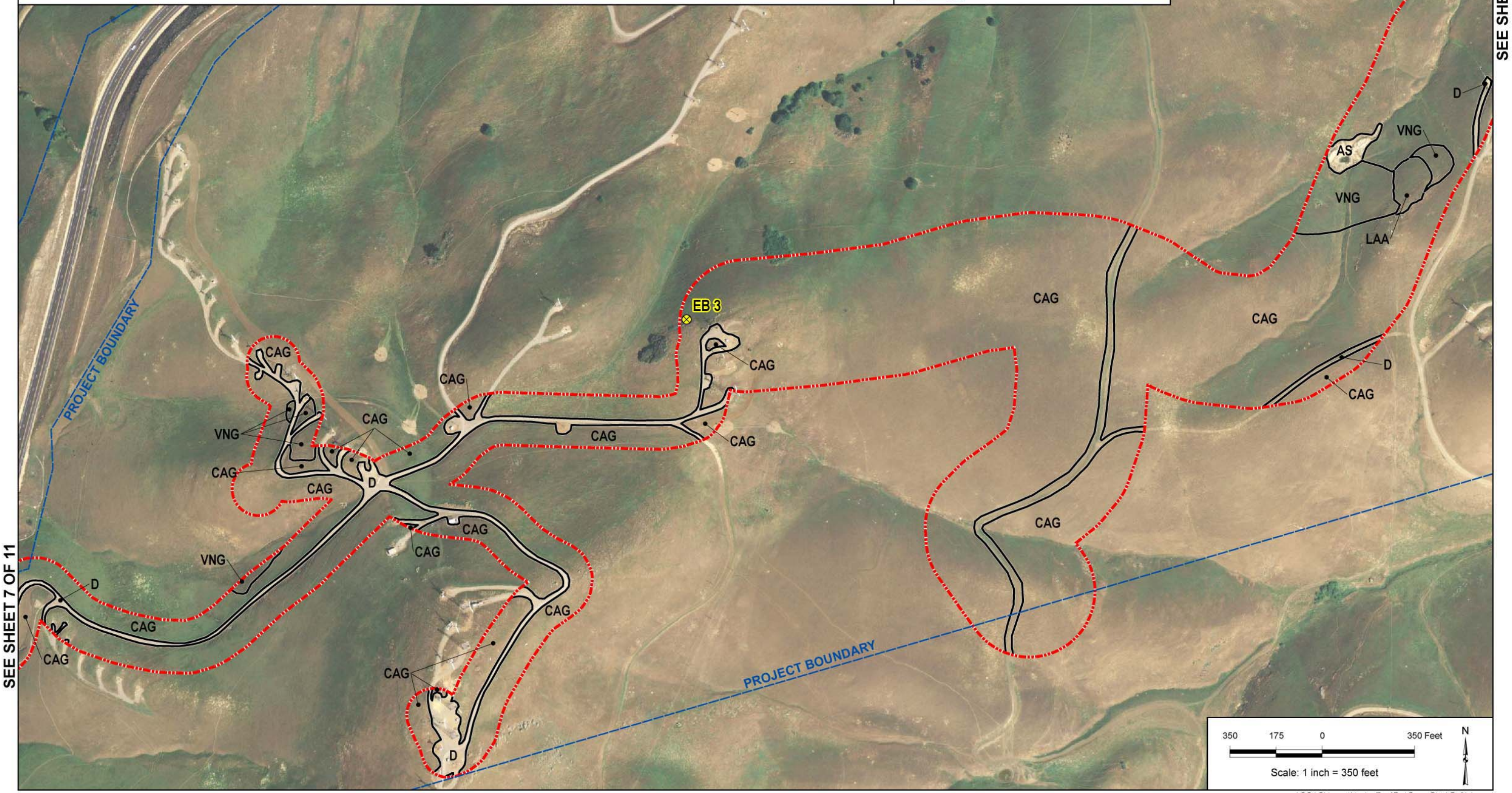

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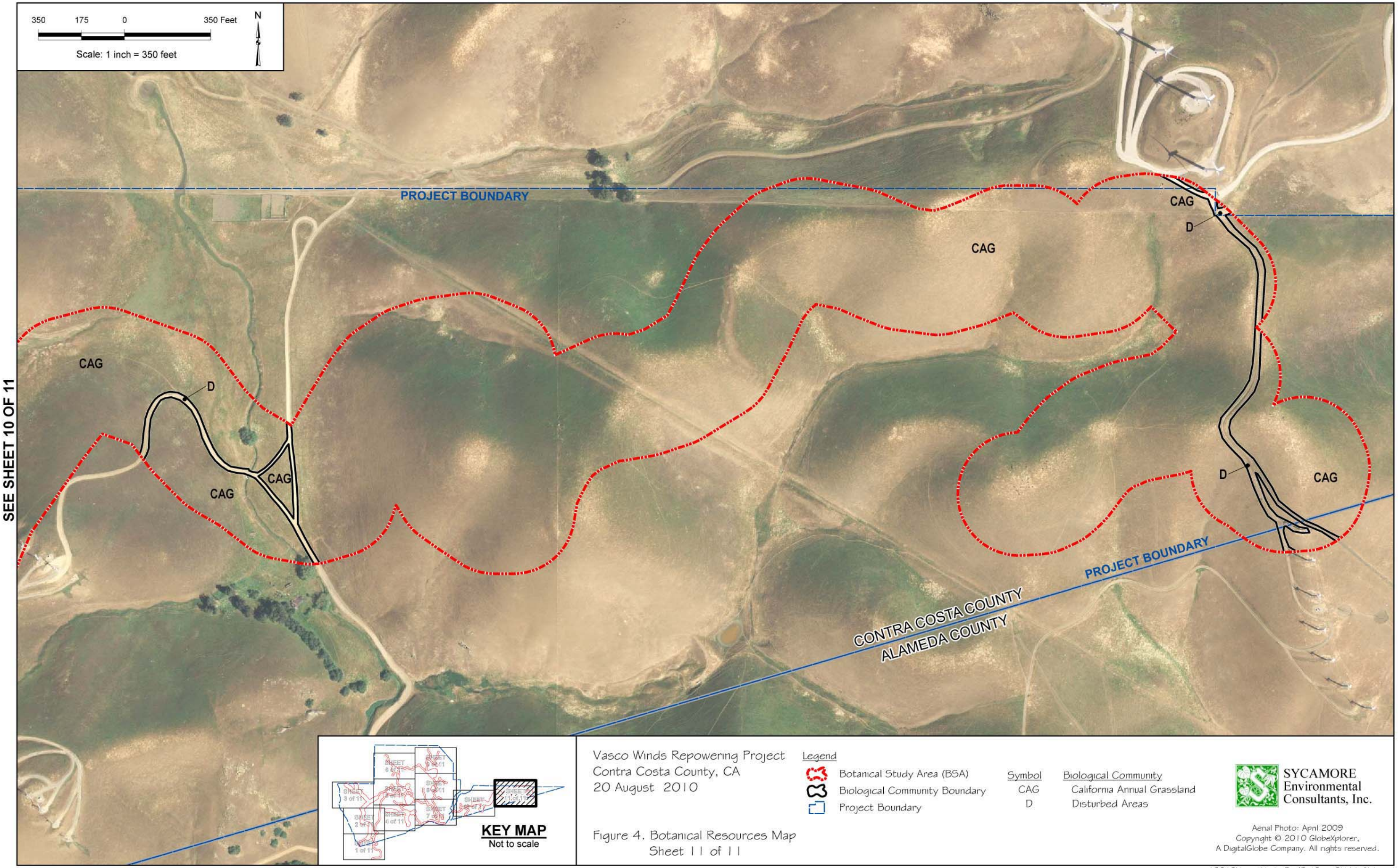

SEE SHEET 10 OF 11

Vasco Winds Repowering Project
Contra Costa County, CA
20 August 2010

Legend

- Botanical Study Area (BSA)
- Biological Community Boundary
- Project Boundary

Symbol	Biological Community
CAG	California Annual Grassland
D	Disturbed Areas

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Figure 4. Botanical Resources Map
Sheet 11 of 11

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10013VascoWinds_Fig4BotSrvy_Sht11of11.mxd

1. California Annual Grassland

This is the dominant community type in the BSA (Appendix D; Photos 1, 2, and 12). This community consists mostly of nonnative grasses and native and nonnative herbaceous species. Species present include wild oat (*Avena fatua*), ripgut grass (*Bromus diandrus*), soft brome (*Bromus hordeaceus*), Medusa head (*Taeniatherum caput-medusae*), shepherd's purse (*Capsella bursa-pastoris*), mouse-ear chickweed (*Cerastium glomeratum*), field bindweed (*Convolvulus arvensis*), miniature lupine (*Lupinus bicolor*), California burclover (*Medicago polymorpha*), clover (*Trifolium* spp.), common vetch (*Vicia sativa* ssp. *sativa*), and filaree (*Erodium* spp.). California annual grassland has a state rarity rank of S5 and is not considered to be of high inventory priority to CNDDB (DFG 2007).

2. Valley Needlegrass Grassland

This community occurs in small patches at various locations throughout the BSA (Appendix D; Photo 9). Purple needlegrass (*Nassella pulchra*) is the dominant grass species in this community. Other species present in this community are similar to those in the California Annual Grassland community described above. The name "Valley Needlegrass Grassland" (Holland 1986) is synonymous with the "*Nassella pulchra* Alliance" as described in (DFG 2009b). Valley Needlegrass Grassland has a state rarity rank of S3 and is considered to be of high inventory priority to CNDDB (DFG 2010c).

3. *Lupinus albifrons* Alliance (Silver Bush Lupine Scrub)

This community was observed at one location in the eastern portion of the BSA (Figure 4; Sheet 10). This community is similar to California Annual Grassland except that a significant cover of silver bush lupine (*Lupinus albifrons* var. *albifrons*) is present (Appendix D; Photos 3, 4, and 11). Other species present in this community are similar to those in the California Annual Grassland community described above. Silver Bush Lupine Scrub has a state rarity rank of S4 and is not considered of high inventory priority to CNDDB (DFG 2009b).

4. Alkali Seep

This community occurs at one location in the eastern portion of the BSA (Figure 4; Sheet 10). The small (0.40 ac) Alkali Seep is located in an area that has been excavated and bermed to create a stock pond for livestock (Appendix D; Photo 6). Water was observed seeping out of the upslope portion of this community during the March, May, and July 2010 botanical surveys. Species present include *Scirpus maritimus*, alkali heath (*Frankenia salina*), saltgrass (*Distichlis spicata*), nutsedge (*Cyperus eragrostis*), and *Chenopodium murale*. Alkali Seep has a state rarity rank of S2 and is considered to be of high inventory priority to CNDDB (DFG 2010c).

5. Mixed Willow Riparian Woodland

This community occurs primarily along Kellogg Creek in the southwest portion of the BSA (Figure 4; Sheets 1 and 2). One small area was also mapped along an unnamed tributary of Brushy Creek in the south central portion of the BSA (Figure 4; Sheet 7) (Appendix D; Photos 5 and 8). Willow species present include red willow (*Salix laevigata*), arroyo willow (*Salix lasiolepis*), and Goodding's black willow (*Salix gooddingii*). Species present in the sparse to dense understory include hoary nettle (*Urtica dioica* ssp. *holosericea*), *Verbena lasiostachys*, *Phalaris brachystachys*, buttercup (*Ranunculus californicus*), curly dock (*Rumex crispus*), bull thistle (*Cirsium vulgare*), poison hemlock (*Conium maculatum*), and carrot (*Daucus carota*). Mixed Willow Riparian Woodland is not listed in or described

in Sawyer et al. (2009) or DFG (2009b). Mixed Willow Riparian Woodland is listed in DFG (2003) as a high inventory priority to CNDDB.

6. Bulrush Series

This community types occurs along the portion of Kellogg Creek in the southwest portion BSA (Figure 4; Sheets 1 and 2). This community consists of seasonally flooded and or saturated areas adjacent to Kellogg Creek (Appendix D; Photos 7 and 8). Species present include tule (*Scirpus acutus* var. *occidentalis*), perennial pepperweed (*Lepidium latifolium*), southern cattail (*Typha domingensis*), annual beard grass (*Polypogon monspeliensis*), Baltic rush (*Juncus balticus*), nutsedge, curly dock Persian speedwell (*Veronica persica*), brass-buttons (*Cotula coronopifolia*), Coyote bush (*Baccharis pilularis*), and aster (*Aster chilensis*). The Bulrush Series is not listed in or described in Sawyer et al. (2009) or DFG (2009b). Bulrush Series is listed in DFG (2003) as a high inventory priority to CNDDB.

7. Seasonal Ponds

Eight seasonal ponds occur at various locations in the BSA (Figure 4; Sheets 1, 2, 4, 5, 6, and 7). These features appear to have been excavated to provide a source of water for livestock (Appendix D; Photo 10). These features contained standing water during the March, May, and July 2010 botanical surveys. Species present around the margins of these features included tule and southern cattail.

8. Disturbed Areas

Disturbed areas in the BSA include dirt roads, equipment storage areas, and various wind turbine infrastructure.

D. The Existing Level of Disturbance

The BSA occurs within an existing wind farm. Many dirt roads, wind turbines, and associated infrastructure occur in the BSA. The majority of the BSA is grazed by cattle.

V. BOTANICAL RESOURCES IN THE BOTANICAL STUDY AREA

A. Determination of Special-Status Plants in the Botanical Study Area

File data from USFWS and CNDDB were used to determine the special-status plants that could occur in the BSA. A CNDDB summary report for the Byron Hot Springs and the eight surrounding USGS quads is in Appendix B. The USFWS lists of special-status species that could occur in or be affected by the project is in Appendix C.

Field surveys were conducted by Sycamore Environmental botanists to determine if individuals of or habitat for special-status species identified in the file data was present in the BSA. Special-status species for which suitable habitat is present in the BSA are listed in Table 3. Special-status plants are listed species, candidate or proposed species under the federal or state endangered species acts, species listed under the California Native Plant Protection Act, and species that are in the CNPS "Inventory of Rare and Endangered Plants of California" (CNPS 2010).

Table 3. Special-Status Plants and Natural Communities with the Potential to Occur in the BSA.

Special-Status Plant Species	Common Name	Federal Status [a]	State Status [a] / CNPS [b]	Source [c]
Amsinckia grandiflora	Large-flowered fiddleneck	E, CH	E/ 1B.1	1, 2
Amsinckia lunaris	Bent-flowered fiddleneck	--	--/ 1B.2	2
Androsace elongata ssp. *acuta*	California androsace	--	--/ 4.2	3
Atriplex cordulata	Heartscale	--	--/ 1B.2	2
Atriplex depressa	Brittlescale	--	--/ 1B.2	2
Atriplex joaquiniana	San Joaquin saltbush (spearscale)	--	--/ 1B.2	2, 3
Balsamorhiza macrolepis var. *macrolepis*	Big-scale balsamroot	--	--/ 1B.2	2
Blepharizonia plumosa	Big tarplant	--	--/ 1B.1	2
California macrophyllum	Round-leaved filaree	--	--/ 1B.1	2, 3
Carex vulpinoidea	Fox sedge	--	--/ 2.2	2
Caulanthus coulteri var. *lemmonii*	Lemmon's jewelflower	--	--/ 1B.2	2
Centromadia parryi ssp. *congdonii*	Congdon's tarplant	--	--/ 1B.2	2
Cordylanthus mollis ssp. *hispidus*	Hispid bird's beak	--	--/ 1B.1	2
Cordylanthus palmatus	Palmate-bracted bird's beak	E	E/ 1B.1	1
Deinandra bacigalupii	Livermore tarplant	--	--/ 1B.2	2
Delphinium recurvatum	Recurved larkspur	--	--/ 1B.2	2
Eriogonum truncatum	Mt. Diablo buckwheat	--	--/ 1B.1	2
Eschscholzia rhombipetala	Diamond-petaled California poppy	--	--/ 1B.1	2
Fritillaria agrestis	Stinkbells	--	--/ 4.2	2, 3
Helianthella castanea	Diablo helianthella	--	--/ 1B.2	2
Hesperolinon breweri	Brewer's western flax	--	--/ 1B.2	2
Lasthenia conjugens	Contra Costa goldfields	E, CH	--/ 1B.1	1, 2
Madia radiata	Showy madia	--	--/ 1B.1	2

Table 3. Continued.

Special-Status Plant Species	Common Name	Federal Status [a]	State Status [a] / CNPS [b]	Source [c]
Plagiobothrys glaber	Hairless popcorn-flower	--	--/ 1A	2
Scutellaria galericulata	Marsh skullcap	--	--/ 2.2	2
Trifolium depauperatum var. *hydrophilum*	Saline clover	--	--/ 1B.2	2
Tropidocarpum capparideum	Caper-fruited tropidocarpum	--	--/ 1B.1	2
Natural Communities				
Alkali seep	NA	--	--/ --	2, 3
Valley needlegrass grassland	NA	--	--/ --	2, 3

[a] **Listing Status** Federal status determined from USFWS letter (USFWS 2010). State status determined from DFG (2010a, b, and c). Codes used in table are:

E = Endangered; **T** = Threatened; **P** = Proposed; **C** = Candidate; **CH** = Critical habitat; **R** = California Rare; ***** = Possibly extinct.

[b] **Other Codes** CNPS (2010). Codes in table are as follows:

CNPS List (plants only): **1A** = Presumed Extinct in CA; **1B** = Rare or Endangered (R/E) in CA and elsewhere; **2** = R/E in CA and more common elsewhere; **3** = Need more information; **4** = Plants of limited distribution

CNPS List Decimal Extensions: .1 = Seriously endangered in California (over 80% of occurrences threatened / high degree and immediacy of threat); **.2** = Fairly endangered in CA (20-80% of occurrences threatened); **.3 =** Not very endangered in CA (< 20% of occurrences threatened or no current threats known).

[c] **Sources** **1** = From USFWS letter (USFWS 2010). **2** = From CNDDB. **3 =** Observed or included by Sycamore Environmental.

B. Special-Status Species not in the Project Study Area

Special-status plant species for which suitable habitat is not present, or whose distributional limits preclude the possibility of their occurrence in the BSA, are not discussed in Section V.C of this report. An evaluation of these species is in Appendix E.

C. Evaluation of Special-Status Plants

Large-flowered fiddleneck (*Amsinckia grandiflora*)

HABITAT AND BIOLOGY: An annual herb found in cismontane woodland and Valley and foothill grassland from 900 to 1,000 ft. Blooms April through May (CNPS 2010).

RANGE: In CA, historically known from Alameda, Contra Costa, and San Joaquin counties (USFWS 1985). Currently known from only two natural populations. One population consists of two small colonies on U.S. Department of Energy land in Corral Hollow in Alameda and San Joaquin counties (USFWS 1997). The second population was recently found in western San Joaquin County.

KNOWN RECORDS: There are no CNDDB records for this species on the Byron Hot Springs quad. The closest CNDDB record is from 1992, approximately 2.3 mi northwest of the BSA on the Tassajara quad. The plants were observed in annual grassland on Millsholm loam with *Avena fatua*, *Bromus mollis*, *B. rubens*, *Nassella pulchra*, *Poa scabrella*, *Delphinium patens*, *Quercus wislizenii*, *Q. douglasii*, and *Umbellularia californica*.

HABITAT PRESENT IN THE BSA: Habitat for this species occurs in the BSA.

DISCUSSION: Large-flowered fiddleneck was not observed in the BSA during botanical surveys conducted during the evident and identifiable period in May 2010. *Amsinckia menziesii* var. *intermedia* and *A. menziesii* var. *menziesii* were observed in the BSA. No other species of *Amsinckia* were observed in the BSA.

Bent-flowered fiddleneck (*Amsinckia lunaris*)

HABITAT AND BIOLOGY: An annual herb found in coastal bluff scrub, cismontane woodland, and Valley and foothill grassland from 10 to 1,650 ft. Blooms March through June (CNPS 2010).

RANGE: In CA, known from Alameda, Contra Costa, Colusa, Lake, Marin, Napa, San Benito, Santa Clara, Santa Cruz, San Mateo, and Yolo counties (CNPS 2010).

KNOWN RECORDS: There are no CNDDB records for this species on the Byron Hot Springs quad. The closest CNDDB record is from 1999, approximately 3 mi southeast of the BSA on the Altamont quad. This record provides not further information.

HABITAT PRESENT IN THE BSA: Habitat for this species occurs in the BSA.

DISCUSSION: Bent-flowered fiddleneck was not observed in the BSA during botanical surveys conducted during the evident and identifiable period in March and May 2010. *Amsinckia menziesii* var. *intermedia* and *A. menziesii* var. *menziesii* were observed in the BSA. No other species of *Amsinckia* were observed in the BSA.

California androsace (*Androsace elongata* ssp. *acuta*)

HABITAT AND BIOLOGY: An annual herb found in chaparral, cismontane woodland, coastal scrub, meadows and seeps, pinyon and juniper woodland, and Valley and foothill grassland from 500 to 3,950 ft. Blooms March through June (CNPS 2010).

RANGE: In CA, known from Alameda, Contra Costa, Colusa, Fresno, Glenn, Kern, Los Angeles, Merced, Riverside, San Bernardino, San Benito, Santa Clara, San Diego, Siskiyou, San Joaquin, San Luis Obispo, San Mateo, Stanislaus, and Tehama counties (CNPS 2010).

KNOWN RECORDS: There are no records for this species in CNDDB.

HABITAT PRESENT IN THE BSA: Habitat for this species occurs in the BSA.

DISCUSSION: California androsace was observed at one location in the BSA during botanical surveys conducted during the evident and identifiable period in March 2010. The total number of individuals at the collection site is unknown.

Heartscale (*Atriplex cordulata*)

HABITAT AND BIOLOGY: An annual herb found in saline or alkaline conditions of chenopod scrub, meadows and seeps, and sandy Valley and foothill grassland from 3 to 1,230 ft. Blooms April through October (CNPS 2010).

RANGE: In CA, known from Alameda, Butte, Fresno, Glenn, Kern, Madera, Merced, San Joaquin, San Luis Obispo, Solano, Stanislaus, Tulare, and Yolo counties (CNPS 2010).

KNOWN RECORDS: There are no CNDDB records for this species on the Byron Hot Springs quad. The closest CNDDB record is from 2005, approximately 3 mi south of the BSA on the Altamont quad. Plants found in alkaline areas with *Allenrolfea occidentalis*, *Hordeum marinum* ssp. *gussoneanum*, *Lolium perenne*, *Frankenia salina*, *Hemizonia pungens* var. *maritima*, *Atriplex joaquiniana*, and *A. depressa*.

HABITAT PRESENT IN THE BSA: Habitat for this species occurs in the BSA.

DISCUSSION: Heartscale was not observed in the BSA during botanical surveys conducted during the evident and identifiable period in May and July 2010. *Atriplex joaquiniana* was observed in the BSA. No other species of *Atriplex* were observed in the BSA.

Brittlescale (*Atriplex depressa*)

HABITAT AND BIOLOGY: An annual herb found in alkaline, clay soils of chenopod scrub, meadows and seeps, playas, Valley and foothill grassland, and vernal pools from 3 to 1,050 ft. Blooms May through October (CNPS 2010).

RANGE: In CA, known from Alameda, Contra Costa, Colusa, Fresno, Glenn, Merced, Solano, Stanislaus, Tulare, and Yolo counties (CNPS 2010).

KNOWN RECORDS: The closest CNDDB record is from 2000, approximately 1.2 mi north of the BSA on the Byron Hot Springs quad. This record states that plants were observed in an alkali meadow at the low end of drainage with other species of *Atriplex*.

HABITAT PRESENT IN THE BSA: Habitat for this species occurs in the BSA.

DISCUSSION: Brittlescale was not observed in the BSA during botanical surveys conducted during the evident and identifiable period in May and July 2010. *Atriplex joaquiniana* was observed in the BSA. No other species of *Atriplex* were observed in the BSA.

San Joaquin saltbush (spearscale) (*Atriplex joaquiniana*)

HABITAT AND BIOLOGY: An annual herb found in alkaline chenopod scrub, meadows and seeps, playas, and Valley and foothill grassland from 3 to 2,740 ft. Blooms April through October (CNPS 2010).

RANGE: In CA, known from Alameda, Contra Costa, Colusa, Fresno, Glenn, Merced, Monterey, Napa, San Benito, Santa Clara, San Joaquin, San Luis Obispo, Solano, Tulare, and Yolo counties (CNPS 2010).

KNOWN RECORDS: The closest CNDDB record is from 1988 and is located in the southwest corner of the BSA.

HABITAT PRESENT IN THE BSA: Habitat for this species occurs in the BSA.

DISCUSSION: San Joaquin saltbush was observed in the southwest portion of the BSA, adjacent to Kellogg Creek. Approximately 50 plants were observed (Figure 4; Sheet 1) in clay soils (Capay clay, 0 to 2 percent slopes). No other species of *Atriplex* were observed in the BSA.

Big-scale balsamroot (*Balsamorhiza macrolepis* var. *macrolepis*)

HABITAT AND BIOLOGY: A perennial herb found in chaparral, cismontane woodland, and Valley and foothill grassland from 295 to 4,600 ft. Blooms March through June (CNPS 2010).

RANGE: In CA, known from Alameda, Butte, Colusa, Lake, Mariposa, Napa, Placer, Santa Clara, Solano, Sonoma, and Tehama counties (CNPS 2010).

KNOWN RECORDS: There are no CNDDB records for this species on the Byron Hot Springs quad. The closest CNDDB record is from 1993, approximately 9.4 mi south of the BSA on the Altamont quad. Approximately 150 plants were observed growing along an intermittent drainage in annual grassland.

HABITAT PRESENT IN THE BSA: Habitat for this species occurs in the BSA.

DISCUSSION: Big-scale balsamroot was not observed in the BSA during botanical surveys conducted during the evident and identifiable period in March and May 2010. No species of *Balsamorhiza* were observed in the BSA.

Big tarplant (*Blepharizonia plumosa*)

HABITAT AND BIOLOGY: An annual herb found in Valley and foothill grasslands from 100 to 1,660 ft. Blooms July through October (CNPS 2010).

RANGE: In CA, known from Alameda, Contra Costa, and Stanislaus counties (CNPS 2010).

KNOWN RECORDS: The closest CNDDB record is from 1978, approximately 3.9 mi north of the BSA on the Byron Hot Springs quad. This record provides no further information.

HABITAT PRESENT IN THE BSA: Habitat for this species occurs in the BSA.

DISCUSSION: Big tarplant was not observed in the BSA during botanical surveys conducted during the evident and identifiable period in late July 2010. No species of *Blepharizonia* were observed in the BSA.

Round-leaved filaree (*California macrophyllum*)

HABITAT AND BIOLOGY: An annual herb found in clay soils of cismontane woodland and Valley and foothill grassland from 50 to 3,936 ft. Blooms March through May (CNPS 2010).

RANGE: In CA, known from Alameda, Butte, Contra Costa, Colusa, Fresno, Glenn, Kings, Kern, Lake, Lassen, Los Angeles, Merced, Monterey, Napa, Riverside, Santa Barbara, San Benito, Santa Clara, Santa Cruz Isl., San Diego, San Joaquin, San Luis Obispo, San Mateo, Solano, Sonoma, Stanislaus, Tehama, Ventura, and Yolo counties (CNPS 2010).

KNOWN RECORDS: The closest CNDDB record is from 2008, approximately 2 mi south of the BSA on the Byron Hot Springs quad. Five plants were observed adjacent to a soil borrow pit growing with *Lolium multiflorum, Erodium cicutarium, Hesperevax sparsiflora, Eremocarpus setigerus,* and *Trifolium hirtum*.

HABITAT PRESENT IN THE BSA: Habitat for this species occurs in the BSA.

DISCUSSION: Round-leaved filaree was observed at one location in the BSA during botanical surveys conducted in March 2010 (Figure 4; Sheet 4). Approximately 30 plants were observed growing in California annual grassland on a ± southwest facing slope on heavy clay soil (Altamont clay, 15 to 30 percent slopes).

Fox sedge (*Carex vulpinoidea*)

HABITAT AND BIOLOGY: A perennial herb found in freshwater marshes and swamps, and riparian woodlands from 98 to 3,940 ft. Blooms May through June (CNPS 2010).

RANGE: In CA, known from Butte, Kern, Los Angeles, Shasta, Siskiyou, San Joaquin, Tehama, and Trinity counties (CNPS 2010).

KNOWN RECORDS: There are no CNDDB records for this species on the Byron Hot Springs quad. The closest CNDDB record is from 2002, approximately 15.5 mi northeast of the BSA on the Woodward Island quad.

HABITAT PRESENT IN THE BSA: Habitat for this species occurs in the BSA.

DISCUSSION: Fox sedge was not observed in the BSA during botanical surveys conducted during the evident and identifiable period in May 2010. No species of *Carex* were observed in the BSA.

Lemmon's jewelflower (*Caulanthus coulteri* var. *lemmonii*)

HABITAT AND BIOLOGY: An annual herb found in pinyon and juniper woodland and Valley and foothill grassland from 260 to 4,000ft. Blooms March through May (CNPS 2010).

RANGE: In CA, known from Alameda, Fresno, Kings, Kern, Merced, Monterey, Santa Barbara, San Benito, San Joaquin, San Luis Obispo, Stanislaus, and Ventura counties (CNPS 2010).

KNOWN RECORDS: There are no CNDDB records for this species on the Byron Hot Springs quad. The closest CNDDB record is from 1935, approximately 10.9 mi southeast of the BSA on the Midway quad. Plants were observed growing on a southwest facing slope in white sandy clay soil with *Nemophila heterophylla*.

HABITAT PRESENT IN THE BSA: Habitat for this species occurs in the BSA.

DISCUSSION: Lemmon's jewelflower was not observed in the BSA during botanical surveys conducted during the evident and identifiable period in March and May 2010. No species of *Caulanthus* were observed in the BSA.

Congdon's tarplant (*Centromadia parryi* ssp. *congdonii*)

HABITAT AND BIOLOGY: An annual herb found in Valley and foothill grasslands from 3 to 754 ft. Blooms May through October (CNPS 2010).

RANGE: In CA, known from Contra Costa, Monterey, Santa Clara, Santa Cruz, San Luis Obispo, San Mateo, and Solano counties (CNPS 2010).

KNOWN RECORDS: The closest CNDDB record is from 2004, approximately 2.2 mi south of the BSA on the Byron Hot Springs and Altamont quads. Approximately 5,000 plants were observed growing in Altamont clay soils on the fringe of alkali and freshwater seasonal wetlands in alkali and annual grassland. Associated species included *Centaurea solstitialis*, *Picris echioides*, *Distichlis spicata*, *Hordeum marinum* ssp. *gussoneanum*, and *Bromus hordeaceus*.

HABITAT PRESENT IN THE BSA: Habitat for this species occurs in the BSA.

DISCUSSION: Congdon's tarplant was not observed in the BSA during botanical surveys conducted during the evident and identifiable period in May and July 2010. No species of *Centromadia* were observed in the BSA.

Hispid bird's beak (*Cordylanthus mollis* ssp. *hispidus*)

HABITAT AND BIOLOGY: A hemiparasitic annual herb found in alkaline soils in meadows and seeps, playas, and Valley and foothill grasslands from 3 to 510 ft. Blooms June through September (CNPS 2010).

RANGE: In CA, known from Alameda, Fresno, Kern, Merced, Placer, and Solano counties (CNPS 2010).

KNOWN RECORDS: There are no CNDDB records for this species on the Byron Hot Springs quad. The closest CNDDB record is from 1999, approximately 3 mi south of the BSA on the Altamont quad. Hundreds of plants were observed in alkali grassland/alkali sink scrub with *Distichlis spicata*, *Allenrolfea occidentalis*, *Suaeda moquinii*, *Salicornia subterminalis*, *Frankenia grandiflora*, and *Cordylanthus palmatus* growing on saline and/or sodic soils with 1-5% slope.

HABITAT PRESENT IN THE BSA: Habitat for this species occurs in the BSA.

DISCUSSION: Hispid bird's beak was not observed in the BSA during botanical surveys conducted during the evident and identifiable period in July 2010. No species of *Cordylanthus* were observed in the BSA.

Palmate-bracted bird's beak (*Cordylanthus palmatus*)

HABITAT AND BIOLOGY: A hemiparasitic herb found in alkaline soil of chenopod scrub and Valley and foothill grassland from 15 to 510 ft. Blooms May through October (CNPS 2010).

RANGE: In CA, known from Alameda, Colusa, Fresno, Glenn, Madera, San Joaquin, and Yolo counties (CNPS 2010).

KNOWN RECORDS: There are no CNDDB records for this species on the Byron Hot Springs quad. The closest CNDDB record is from 2008, approximately 3 mi southwest of the BSA on the Livermore and Altamont quads. Thousands of plants were observed growing along braided drainage channels on Pescadero clay and Solano loam.

HABITAT PRESENT IN THE BSA: Habitat for this species occurs in the BSA.

DISCUSSION: Palmate-bracted bird's beak was not observed in the BSA during botanical surveys conducted during the evident and identifiable period in May and July 2010. No species of *Cordylanthus* were observed in the BSA.

Livermore tarplant (*Deinandra bacigalupii*)

HABITAT AND BIOLOGY: An annual herb found in alkaline soils of meadows and seeps from 500 to 610 ft. Blooms June through October (CNPS 2010).

RANGE: In CA, known from fewer than five occurrences near Livermore in Alameda County (CNPS 2010).

KNOWN RECORDS: There are no CNDDB records for this species on the Byron Hot Springs quads. The closest CNDDB record is from 2004, approximately 2.7 mi south of the BSA on the Altamont quad. Plants were observed in alkali swales and drainages and associated grassland on sandy alkaline soil.

HABITAT PRESENT IN THE BSA: Habitat for this species occurs in the BSA.

DISCUSSION: Livermore tarplant was not observed in the BSA during botanical surveys conducted during the evident and identifiable period in July 2010. No species of *Deinandra* were observed in the BSA.

Recurved larkspur (*Delphinium recurvatum*)

HABITAT AND BIOLOGY: A perennial herb found in alkaline chenopod scrub, cismontane woodland, and Valley and foothill grassland from 10 to 2,450 ft. Grows in poorly drained, fine textured, alkaline soils (Hickman 1993). Blooms March through June (CNPS 2010).

RANGE: In CA, known from Alameda, Butte, Contra Costa, Colusa, Fresno, Glenn, Kings, Kern, Madera, Merced, Monterey, San Joaquin, San Luis Obispo, Solano, and Tulare counties (CNPS 2010).

KNOWN RECORDS: The closest CNDDB record is from 1991, approximately 2.2 mi east of the BSA on the Clifton Court Forebay quad. A total of 150 plants were observed at the margins of mima-topography adjacent to alkaline soil depressions, in grassland with *Distichlis* sp., *Hordeum depressum*, *Frankenia salina*, *Lepidium* sp., *Lolium* sp., and *Spergularia* sp., on fine, gravelly alkaline clay soils.

HABITAT PRESENT IN THE BSA: Habitat for this species occurs in the BSA.

DISCUSSION: Recurved larkspur was not observed in the BSA during botanical surveys conducted during the evident and identifiable period in March and May 2010. *Delphinium hesperium* ssp. *pallescens* was observed in the BSA. No other species of *Delphinium* were observed in the BSA.

Mt. Diablo buckwheat (*Eriogonum truncatum*)

HABITAT AND BIOLOGY: An annual herb found on exposed clay or sandy soils in chaparral, coastal scrub, and Valley and foothill grasslands from 1 to 1,150 ft. Blooms April through September (CNPS 2010).

RANGE: In CA, known historically from Alameda, Contra Costa, and Solano counties (CNPS 2010). Rediscovered in May 2005 in Mount Diablo State Park; now known from one extant occurrence for which quad location needs confirmation.

KNOWN RECORDS: There are no CNDDB records for this species on the Byron Hot Springs or eight surrounding quads. The closest CNDDB record is from 1933, approximately 7 mi west of the BSA on the Diablo quad. Plants were found growing on grassy east facing slopes.

HABITAT PRESENT IN THE BSA: Habitat for this species occurs in the BSA.

DISCUSSION: Mt. Diablo buckwheat was not observed in the BSA during botanical surveys conducted during the evident and identifiable period in March, May, and July 2010. No species of *Eriogonum* were observed in the BSA.

Diamond-petaled California poppy (*Eschscholzia rhombipetala*)

HABITAT AND BIOLOGY: An annual herb found in Valley and foothill grassland in alkaline, clay soil from 0 to 3,200 ft. Blooms March through April (CNPS 2010).

RANGE: In CA, known from Alameda, Contra Costa, Colusa, San Joaquin, San Luis Obispo, and Stanislaus counties (CNPS 2010).

KNOWN RECORDS: The closest CNDDB record for this species is from 1888, and occupies the eastern half of the BSA. The location information for this is based on the statement "hills south of Byron". Based on this general location description CNDDB has indicated that this record could occur on the Clifton Court Forebay, Brentwood, Byron Hot Springs, Woodward Island, Altamont, or Midway quads in Contra Costa, San Joaquin, and Alameda counties. The polygon that the CNDDB mapped for this record has a radius of 5 mi, or a total area of 78.5 mi ^{2} (50,240 ac).

HABITAT PRESENT IN THE BSA: Habitat for this species occurs in the BSA.

DISCUSSION: Diamond-petaled California poppy was not observed in the BSA during botanical surveys conducted during the evident and identifiable period in March 2010. *Eschscholzia californica* was observed in the BSA. No other species of *Eschscholzia* were observed in the BSA.

Stinkbells (*Fritillaria agrestis*)

HABITAT AND BIOLOGY: A bulbiferous herb found in chaparral, cismontane woodland, pinyon and juniper woodland and Valley and foothill grassland from 30 to 5,100 ft. Blooms March through June (CNPS 2010).

RANGE: In CA, known from Alameda, Contra Costa, Fresno, Kern, Mendocino, Merced, Monterey, Mariposa, Placer, Sacramento, Santa Barbara, San Benito, Santa Clara, Santa Cruz, San Luis Obispo, San Mateo, Stanislaus, Tuolumne, Ventura, and Yuba counties (CNPS 2010).

KNOWN RECORDS: The closest CNDDB record is from 1992, approximately 1.2 mi south of the BSA on the Byron Hot Springs quad. Approximately 250 plants were observed growing on south and southwest facing slopes in nonnative annual grassland with *Bromus mollis*, *B. diandrus*, and *Hordeum* sp.

HABITAT PRESENT IN THE BSA: Habitat for this species occurs in the BSA.

DISCUSSION: Stinkbells was observed at one location in the BSA during botanical surveys conducted in March 2010 (Figure 4; Sheet 3). Approximately 45 plants were observed growing in California annual grassland on a ± northwest facing slope in heavy clay soil (Altamont clay, 15 to 30 percent slopes).

Diablo helianthella (*Helianthella castanea*)

HABITAT AND BIOLOGY: A perennial herb usually found in chaparral/oak woodland interface in rocky azonal soils in broadleaved upland forest, chaparral, cismontane woodland, coastal scrub, riparian woodland, and Valley and foothill grassland from 190 to 4,300 ft (CNPS 2010; DFG 2010c). Often found in partial shade (DFG 2010c). Blooms April through June (CNPS 2010).

RANGE: In CA, known from Alameda, Contra Costa, Marin, San Francisco, and San Mateo counties (CNPS 2010).

KNOWN RECORDS: The closest CNDDB record is from 1988, approximately 0.2 mi west of the BSA on the Tassajara quad. A total of 70 plants were observed at this location.

HABITAT PRESENT IN THE BSA: Marginal habitat for this species occurs in the BSA.

DISCUSSION: Diablo helianthella was not observed in the BSA during botanical surveys conducted in late March and early April 2010. According to CNPS (2010) the blooming period for this species is April through June. However, there are 5 records of this species in CA herbaria for collections made in March (CCH 2010). Therefore, the late March and early April 2010 botanical surveys were conducted during the evident and identifiable period for this species. No species of *Helianthella* were observed in the BSA.

Brewer's western flax (*Hesperolinon breweri*)

HABITAT AND BIOLOGY: An annual herb found in chaparral, cismontane woodland, and Valley and foothill grassland from 100 to 2,950 ft. Usually found on serpentinite soils. Blooms May through July (CNPS 2010).

RANGE: In CA, known from Contra Costa, Napa, and Solano counties (CNPS 2010).

KNOWN RECORDS: There are no CNDDB records for this species on the Byron Hot Springs quads. The closest CNDDB record is from 1988, approximately 0.2 mi west of the BSA on the Tassajara quad. A total of 400 plants were observed growing on an east facing slope.

HABITAT PRESENT IN THE BSA: Habitat for this species occurs in the BSA.

DISCUSSION: Brewer's western flax was not observed in the BSA during botanical surveys conducted during the evident and identifiable period in May and July 2010. No species of *Hesperolinon* were observed in the BSA.

Contra Costa goldfields (*Lasthenia conjugens*)

HABITAT AND BIOLOGY: An annual herb found in mesic habitats of cismontane woodland, alkaline playas, Valley and foothill grassland, and vernal pools from 0 to 1,540 ft. Blooms March through June (CNPS 2010).

RANGE: In CA, known from Alameda, Contra Costa, Mendocino, Monterey, Marin, Napa, Santa Barbara, Santa Clara, Solano, and Sonoma counties (CNPS 2010).

KNOWN RECORDS: There are no CNDDB records for this species on the Byron Hot Springs quad. The closest CNDDB record is from 1895, approximately 13 mi northwest of the BSA on the Antioch North and Antioch South quads.

HABITAT PRESENT IN THE BSA: Habitat for this species occurs in the BSA.

DISCUSSION: Contra Costa goldfields was not observed in the BSA during botanical surveys conducted during the evident and identifiable period in March and May 2010. No species of *Lasthenia* were observed in the BSA.

Showy madia (*Madia radiata*)

HABITAT AND BIOLOGY: An annual herb found in cismontane woodland and Valley and foothill grassland from 82 to 2,952 ft. Blooms March through May (CNPS 2010).

RANGE: In CA, known from Contra Costa, Fresno, Kings, Kern, Monterey, Santa Barbara, San Benito, Santa Clara, San Joaquin, San Luis Obispo, and Stanislaus counties (CNPS 2010).

KNOWN RECORDS: There are no CNDDB records for this species on the Byron Hot Springs quad. The closest CNDDB record is from 1941, approximately 9 mi northwest of the BSA on the Antioch South quad.

HABITAT PRESENT IN THE BSA: Habitat for this species occurs in the BSA.

DISCUSSION: Showy madia was not observed in the BSA during botanical surveys conducted during the evident and identifiable period in March and May 2010. *Madia elegans* ssp. *vernalis* was observed in the BSA. No other species of *Madia* were observed in the BSA.

Hairless popcorn-flower (*Plagiobothrys glaber*)

HABITAT AND BIOLOGY: An annual herb found in alkaline meadows and seeps, and coastal salt marshes and swamps from 50 to 600 ft. Blooms March through May (CNPS 2010).

RANGE: In CA, known historically from Alameda, Marin, San Benito, and Santa Clara counties (CNPS 2010). Possibly relocated near Antioch; identification uncertain. All collections since 1930's located in the Hollister area. Presumed extinct in California (CNPS 2010).

KNOWN RECORDS: There are no CNDDB records for this species on the Byron Hot Springs quad. The closest CNDDB record is from 1942, approximately 5.4 mi south of the BSA on the Altamont and Livermore quads.

HABITAT PRESENT IN THE BSA: Habitat for this species occurs in the BSA.

DISCUSSION: Hairless popcorn-flower was not observed in the BSA during botanical surveys conducted during the evident and identifiable period in March and May 2010. *Plagiobothrys acanthocarpus*, *P. canescens*, and *P. trachycarpus* were observed in the BSA. No other species of *Plagiobothrys* were observed in the BSA.

Marsh skullcap (*Scutellaria galericulata*)

HABITAT AND BIOLOGY: A rhizomatous herb found in lower montane coniferous forest, meadow and seeps, and marshes and swamps from 0 to 6,890 ft. Blooms June through September (CNPS 2010).

RANGE: In CA, known from El Dorado, Lassen, Modoc, Nevada, Placer, Plumas, Shasta, and San Joaquin counties (CNPS 2010).

KNOWN RECORDS: There are no CNDDB records for this species on the Byron Hot Springs quad. The closest CNDDB record is from 1978, approximately 11 mi northeast of the BSA on the Woodward Island quad. Plant(s) observed in "pristine tidal marsh and swamp."

HABITAT PRESENT IN THE BSA: Marginal habitat for this species occurs in the BSA. The BSA is outside the range of the species.

DISCUSSION: Marsh skullcap was not observed in the BSA during botanical surveys conducted during the evident and identifiable period in July 2010. No species of *Scutellaria* were observed in the BSA.

Saline clover (*Trifolium depauperatum* var. *hydrophilum*)

HABITAT AND BIOLOGY: An annual herb found in marshes and swamps, mesic and alkaline soils of Valley and foothill grassland, and vernal pools from 0 to 985 ft. Blooms April through June (CNPS 2010).

RANGE: In CA, known from Alameda, Colusa, Monterey, Napa, San Benito, Santa Clara, Santa Cruz, San Luis Obispo, San Mateo, Solano, and Sonoma counties (CNPS 2010).

KNOWN RECORDS: There are no CNDDB records for this species on the Byron Hot Springs quad. The closest CNDDB record is from an unknown date, approximately 7.7 mi southwest of the BSA on the Livermore quad.

HABITAT PRESENT IN THE BSA: Habitat for this species occurs in the BSA.

DISCUSSION: Saline clover was not observed in the BSA during botanical surveys conducted during the evident and identifiable period in May 2010. *Trifolium bifidum* var. *decipiens*, *T. ciliolatum*, *T. depauperatum* var. *truncatum*, *T. glomeratum*, *T. gracilentum* var. *gracilentum*, *T. hirtum*, *T. incarnatum*, *T. microcephalum*, *T. microdon*, *T. oliganthum*, *T. repens*, *T. subterraneum*, and *T. willdenovii* were observed in the BSA. No other species of *Trifolium* were observed in the BSA.

Caper-fruited tropidocarpum (*Tropidocarpum capparideum*)

HABITAT AND BIOLOGY: An annual herb found in alkaline Valley and foothill grassland from 3 to 1,495 ft. Blooms March through April (CNPS 2010).

RANGE: In CA, known from Alameda, Contra Costa, Fresno, Glenn, Monterey, Santa Clara, San Joaquin, and San Luis Obispo counties (CNPS 2010).

KNOWN RECORDS: The closest CNDDB record is from 1936, approximately 3.7 mi southeast of the BSA on the Byron Hot Springs quad. The record states that surveys were conducted in 1978, 1979, and 1981 on the Byron Hot Springs quad, but no plants were found and plants at that location are considered extirpated.

HABITAT PRESENT IN THE BSA: Habitat for this species occurs in the BSA.

DISCUSSION: Caper-fruited tropidocarpum was not observed in the BSA during botanical surveys conducted during the evident and identifiable period in March 2010. No species of *Tropidocarpum* were observed in the BSA.

D. Evaluation of Special-Status Natural Communities

The CNDDB considers communities with state rarity rankings of S1-S3 to be of "high inventory priority" (DFG 2003, 2007, 2009b). A community with an S3 ranking is considered "rare and threatened" throughout its range by Sawyer et al. (2009). In the BSA, communities identified by CNDDB as a "high inventory priority" include Valley Needlegrass Grassland (14.37 ac; S3) and Alkali Seep (0.40 ac; S2). Mixed Willow Riparian Woodland (3.11ac) and Bulrush Series (4.07 ac) are not listed in DFG (2009b), but are identified as a "high inventory priority" in DFG (2003). No other special-status communities occur in the BSA.

E. Summary of Findings

The BSA provides suitable habitat for 27 special-status plant species. Botanical surveys were conducted from 29 March through 1 April, 19 through 22 May, and 26 through 28 July 2010 to coincide with the

evident and identifiable period of special-status plants species with the potential to occur in the BSA. No federal or state listed plants were observed in the BSA.

Four special-status plant species were observed in the BSA during the 2010 botanical surveys. Approximately 50 individuals of San Joaquin saltbush (*Atriplex joaquiniana*), a CNPS list 1.B2 species, were observed in the southwest portion of the BSA. California androsace (*Androsace elongata* ssp. *acuta*), a CNPS list 4.2 species, was observed in the BSA. Thirty individuals of round-leaved filaree (*California macrophyllum*), a CNPS list 1B.1 species, were observed at one location in the BSA. Approximately 45 individuals of stinkbells (*Fritillaria agrestis*), a CNPS list 4.2 species, were observed at one location in the BSA. No other special-status plant species were observed in the BSA during the botanical surveys.

Communities identified in the BSA by CNDDB as a "high inventory priority" include Valley Needlegrass Grassland, Alkali Seep, Mixed Willow Riparian Woodland, and Bulrush Series. No other "high inventory priority" communities were observed in the BSA.

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VII. PREPARERS

R. John Little, Ph.D., Botany, Claremont Graduate School, Claremont, CA. Over 30 years experience managing and conducting environmental projects involving impact assessment and preparation of numerous NEPA/CEQA compliance documents, Biological Assessments, and Caltrans Natural Environmental Studies. Experience includes conducting special-status plant and wildlife species surveys, jurisdictional wetland delineations, general biological surveys, permitting and biological report preparation. Dr. Little is a trained wetland delineator, an ISA Certified Arborist (WE-1057A), holds a California Department of Fish and Game Scientific Collecting Permit (#801073-04), and DFG Rare, Threatened and Endangered Plant Voucher Collecting Permit (#09054).
Responsibilities: Project Manager, senior technical lead, report preparation, botanical survey fieldwork, and plant identification.

Adam C. Forbes, M.S., Range Science (emphasis on plant systematics), New Mexico State University, Las Cruces, NM. Over 10 years experience conducting biological studies for the public and private sector. As a botanist/ biologist with Sycamore Environmental, Mr. Forbes conducts plant and wildlife surveys, prepares and edits reports, serves as assistant project manager, and conducts informal consultations with regulatory agency personnel. Responsibilities also include assisting with proposal preparation and marketing activities. Provides technical support for wetland delineations, biological resource evaluations, mitigation plans, and other documents used in the CEQA/NEPA process. He holds a California Department of Fish and Game Rare, Threatened and Endangered Plant Voucher Collecting Permit (#10021), and a DFG Scientific Collecting Permit (#802060-04).
Responsibilities: Report preparation, botanical survey fieldwork, and plant identification.

Chuck Hughes, M.S., Plant Biology, Michigan State University, East Lansing, MI. Prepares biological/botanical resource evaluations, jurisdictional delineations, arborist reports, impact analyses, and mitigation and restoration plans. Serves as assistant project manager. He is an ISA Certified Arborist (WE-6885A) and is listed on a Fish and Wildlife Service recovery permit for vernal pool crustaceans (TE799564-2). He holds a California Department of Fish and Game Rare, Threatened and Endangered Plant Voucher Collecting Permit (#08053), and a DFG Scientific Collecting Permit (#801246-05).
Responsibilities: Report preparation, botanical survey fieldwork, and plant identification.

Michael Bower, M.S., Ecology, University of California, Davis, CA. Conducts plant and wildlife surveys, provides technical support for wetland delineations, biological resource evaluations, mitigation plans, and other documents used in the CEQA/NEPA process, queries the California Natural Diversity Database (CNDDB/ RareFind), and researches special-status species for projects. He holds a California Department of Fish and Game Rare, Threatened and Endangered Plant Voucher Collecting Permit (#2081(a)-09-14-V).
Responsibilities: Botanical survey fieldwork, report preparation, and plant identification.

Aramis Respall, Over fifteen years experience in drafting and design for public and private projects using Autodesk land development and ESRI ArcGIS geospatial programs. Primary experience evolved from conventional surveying and civil engineering practices to advanced GPS and GIS based technology. Past project experience include CAD/GIS support for road and highway designs, facilities management, highway and airport master planning, noise studies, power transmission line alignments, and various private development projects such as subdivision layouts and golf courses. Prepares figures for biological and permitting documents such as project location maps, aerial photographs, biological resource maps, CNDDB proximity maps, waters and wetland delineation, proposed project impacts, tree location maps and other supporting graphics. Provides geospatial analysis and support for projects involving geodesy, hydrology, watershed studies, project impact analysis, CNDDB species, critical habitat and mitigation.

Responsibilities: Figure preparation and spatial analysis.

Cynthia Little, Principal, Sycamore Environmental.
Responsibilities: Senior editor, quality control.

APPENDIX A.

Plant Species Observed

Vasco Winds Repowering Project
Contra Costa and Alameda Counties, CA

Plant Species Observed.

FAMILY	SCIENTIFIC NAME	COMMON NAME	N/I [1]
FERNS & ALLIES			
Pteridaceae	*Pellaea andromedifolia*	Coffee fern	N
	Pentagramma triangularis	Goldback fern	N
DICOTS			
Amaranthaceae	*Amaranthus albus*	Tumbleweed	I
Anacardiaceae	*Toxicodendron diversilobum*	Western poison oak	N
Apiaceae	*Apium graveolens*	Celery	I
	Bowlesia incana	Bowlesia	N
	Conium maculatum	Poison hemlock	I
	Daucus carota	Carrot	I
	Foeniculum vulgare	Fennel	I
	Sanicula bipinnata	Poison sanicle	N
	Sanicula bipinnatifida	Purple sanicle	N
	Scandix pectin-veneris	Venus' needle	I
	Torilis nodosa		I
Asclepiadaceae	*Asclepias californica*	California milkweed	N
	Asclepias fascicularis	Narrow-leaf milkweed	N
Asteraceae	*Achillea millefolium*	Yarrow	N
	Achyrachaena mollis	Blow-wives	N
	Agoseris grandiflora		N
	Anthemis cotula	Mayweed	I
	Artemisia sp.	Sagebrush	--
	Aster chilensis	Aster	N
	Baccharis pilularis	Coyote bush	N
	Calendula sp.		I
	Carduus pycnocephalus	Italian thistle	I
	Carduus tenuiflorus	Plumeless thistle	I
	Centaurea calcitrapa	Purple star-thistle	I
	Centaurea melitensis	Tocalote	I
	Centaurea solstitialis	Yellow star-thistle	I
	Chamomilla suaveolens	Pineapple weed	I
	Cichorium intybus	Chicory	I
	Cirsium cymosum	Peregrine thistle	N
	Cirsium vulgare	Bull thistle	I
	Conyza sp.		--
	Cotula coronopifolia	Brass-buttons	I
	Cynara cardunculus	Artichoke thistle	I
	Filago californica	Herba impia	N
	Gnaphalium sp.	Cudweed	--
	Grindelia camporum var. *camporum*	Gumplant	N
	Hemizonia fitchii	Fitch's Hemizonia	N
	Hesperevax sparsiflora var. *sparsiflora*	Hesperevax	N
	Heterotheca sessiflora ssp. *bolanderi*	Telegraph weed	N
	Holocarpha obconica		N
	Holocarpha virgata ssp. *virgata*		N
	Hypochaeris glabra	Smooth cat's ear	I

	Hypochaeris radicata	Rough cat's ear	I
	Iva axillaris ssp. *robustior*	Poverty weed	N
	Lactuca serriola	Prickly lettuce	I
	Lessingia sp.		N
	Madia elegans ssp. *vernalis*	Common madia	N
	Micropus sp.		N
	Microseris bigelovii		N
	Microseris douglasii ssp. *tenella*		N
	Monolopia major		N
	Picris echioides	Bristly ox-tongue	I
	Psilocarphus tenellus var. *tenellus*	Woolly-heads	N
	Senecio vulgaris	Common groundsel	I
	Silybum marianum	Milk thistle	I
	Sonchus asper ssp. *asper*	Prickly sow thistle	I
	Sonchus oleraceus	Common sow thistle	I
	Tragopogon dubius	Goat's beard	I
	Tragopogon porrifolius	Oyster plant	I
	Wyethia helenioides	Mules ears	N
	Xanthium spinosum	Spiny cocklebur	N
Boraginaceae	*Amsinckia menziesii* var. *intermedia*	Fiddleneck	N
	Amsinckia menziesii var. *menziesii*	Rancher's fireweed	N
	Plagiobothrys acanthocarpus	Popcornflower	N
	Plagiobothrys canescens	Popcornflower	N
	Plagiobothrys trachycarpus	Popcornflower	N
Brassicaceae	*Athysanus pusillus*		N
	Brassica nigra	Black mustard	N
	Capsella bursa-pastoris	Shepherd's purse	I
	Hirschfeldia incana	Mediterranean hoary mustard	I
	Lepidium latifolium	Perennial pepperweed	I
	Lepidium latipes var. *latipes*	Dwarf peppergrass	N
	Lepidium nitidum var. *nitidum*	Peppergrass	N
	Raphanus raphanistrum	Jointed charlock	I
	Rorippa nasturtium-aquaticum	Water cress	N
	Sinapis arvensis	Charlock	I
Caprifoliaceae	*Sambucus mexicana*	Blue elderberry	N
Caryophyllaceae	*Cerastium glomeratum*	Mouse-ear chickweed	I
	Silene gallica	Catchfly	I
	Spergularia sp.	Sand-spurrey	--
	Stellaria pallida	Chickweed	I
Chenopodiaceae	*Atriplex joaquiniana*	San Joaquin saltbush	N
	Chenopodium album	Lamb's quarters	I
	Chenopodium murale	Pigweed	I
Convolvulaceae	*Calystegia* sp.	Morning-glory	N
	Calystegia subacaulis ssp. *subacaulis*	Morning-glory	N
	Convolvulus arvensis	Field bindweed	I
	Cressa truxillensis	Alkali weed	N
Crassulaceae	*Crassula* sp.		--
Cucurbitaceae	*Marah* sp.	Man-root	N
Euphorbiaceae	*Eremocarpus setigerus*	Turkey mullein	N
Fabaceae	*Astragalus asymmetricus*		N
	Astragalus gambelianus	Gambel's dwarf milkvetch	N
	Lathyrus vestitus var. *vestitus*	Wild pea	N
	Lotus corniculatus	Birdfoot trefoil	I
	Lotus wrangelianus		N
	Lupinus albifrons var. *albifrons*	Silver bush lupine	N
	Lupinus bicolor	Miniature lupine	N
	Lupinus microcarpus var. *microcarpus*	Chick lupine	N
	Lupinus succulentus	Arroyo lupine	N
	Medicago polymorpha	California burclover	I
	Melilotus indica	Sourclover	I

	Trifolium bifidum var. *decipiens*	Clover	N
	Trifolium ciliolatum	Clover	N
	Trifolium depauperatum var. *truncatum*	Clover	N
	Trifolium glomeratum	Clover	I
	Trifolium gracilentum var. *gracilentum*	Clover	N
	Trifolium hirtum	Rose clover	I
	Trifolium incarnatum	Crimson clover	I
	Trifolium microcephalum	Clover	N
	Trifolium microdon	Clover	N
	Trifolium oliganthum	Clover	N
	Trifolium repens	White clover	I
	Trifolium subterraneum	Subterranean clover	I
	Trifolium willdenovii	Clover	N
	Vicia americana var. *americana*	American vetch	N
	Vicia sativa ssp. *sativa*	Common vetch	I
	Vicia villosa	Hairy vetch	I
Fagaceae	*Quercus lobata*	Valley oak	N
	Quercus palmeri	Palmer oak	N
Frankeniaceae	*Frankenia salina*	Alkali heath	N
Gentianaceae	*Centaurium muehlenbergii*	Centaury	N
Geraniaceae	*Erodium botrys*	Filaree	I
	Erodium cicutarium	Filaree	I
	Erodium (=*California*) *macrophyllum*	California filaree	N
	Erodium moschatum	Filaree	I
	Geranium dissectum	Cranesbill	I
	Geranium molle	Cranesbill	I
Grossulariaceae	*Ribes quercetorum*	Oak gooseberry	N
Hippocastanaceae	*Aesculus californica*	California buckeye	N
Hydrophyllaceae	*Phacelia imbricata* ssp. *imbricata*		N
	Pholistoma membranaceum	Pholistoma	N
Juglandaceae	*Juglans californica* var. *hindsii* [2]	Northern CA black walnut	N
Lamiaceae	*Marrubium vulgare*	Horehound	I
	Stachys ajugoides var. *ajugoides*	Hedge nettle	N
Lythraceae	*Lythrum hyssopifolia*		I
Malvaceae	*Malva nicaeensis*	Bull mallow	I
	Malva parviflora	Little mallow	I
	Malvella leprosa	Alkali-mallow	N
Onagraceae	*Clarkia purpurea* ssp. *quadrivulnera*	Four-spot	N
	Epilobium foliosum	Fireweed	N
Papaveraceae	*Eschscholzia californica*	California poppy	N
Plantaginaceae	*Plantago elongata*	Plantain	N
	Plantago erecta	Plantain	N
	Plantago lanceolata	English plantain	I
Polemoniaceae	*Linanthus bicolor*		N
Polygonaceae	*Polygonum arenastrum*	Common knotweed	I
	Pterostegia drymarioides	Pterostegia	N
	Rumex crispus	Curly dock	I
	Rumex pulcher	Fiddle dock	I
Portulacaceae	*Calandrinia ciliata*	Redmaids	N
	Claytonia perfoliata ssp. *perfoliata*	Miner's lettuce	N
Potamogetonaceae	*Potamogeton foliosus* var. *foliosus*	Leafy pondweed	N
Primulaceae	*Anagallis arvensis*	Scarlet pimpernel	I
	Androsace elongata ssp. *acuta*	Rock jasmine	N
	Dodecatheon sp.	Shooting star	N
Ranunculaceae	*Delphinium hesperium* ssp. *pallescens*	Western larkspur	N
	Ranunculus californicus	Buttercup	N
Rosaceae	*Aphanes occidentalis*		N
	Prunus dulcis	Almond	I
Rubiaceae	*Galium aparine*	Goose grass	N
	Galium murale	Tiny bedstraw	I

	Galium parisiense	Wall bedstraw	I
	Sherardia arvensis	Field madder	I
Salicaceae	*Populus fremontii* ssp. *fremontii*	Fremont cottonwood	N
	Salix gooddingii	Goodding's black willow	N
	Salix laevigata	Red willow	N
	Salix lasiolepis	Arroyo willow	N
Saxifragaceae	*Lithophragma parviflorum* var. *parviflorum*	Woodland star	N
	Saxifraga californica	Saxifrage	N
Scrophulariaceae	*Bellardia trixago*	Bellardia	I
	Castilleja attenuata	Valley tassels	N
	Castilleja exerta ssp. *exerta*	Purple owl's-clover	N
	Kickxia sp.	Fluellin	I
	Mimulus guttatus	Yellow monkeyflower	N
	Triphysaria pusilla		N
	Veronica persica	Persian speedwell	I
Solanaceae	*Solanum americanum*	Nightshade	N
	Solanum umbelliferum	Nightshade	N
	Solanum xanti	Nightshade	N
Urticaceae	*Hesperocnide tenella*	Western nettle	N
	Urtica dioica ssp. *holosericea*	Hoary nettle	N
	Urtica urens	Dwarf nettle	I
Verbenaceae	*Verbena lasiostachys*		N
Violaceae	*Viola pedunculata*	Johnny-jump-up	N
MONOCOTS			
Cyperaceae	*Cyperus eragrostis*	Nutsedge	N
	Eleocharis sp.	Spikerush	N
	Scirpus maritimus		N
	Scirpus acutus var. *occidentalis*	Tule	N
Juncaceae	*Juncus balticus*	Baltic rush	N
	Juncus bufonius var. *congestus*	Toad rush	N
	Juncus sp.		N
Liliaceae	*Allium serra*	Onion	N
	Brodiaea elegans ssp. *elegans*	Harvest brodiaea	N
	Chlorogalum pomeridianum var. *pomeridianum*	Soap plant	N
	Dichelostemma multiflorum	Wild hyacinth	N
	Fritillaria agrestis	Stinkbells	N
	Triteleia laxa	Ithuriel's spear	N
Poaceae	*Aegilops triuncialis*	Barbed goat grass	I
	Avena barbata	Slender wild oat	I
	Avena fatua	Wild oat	I
	Brachypodium distachyon	False-brome	I
	Bromus diandrus	Ripgut grass	I
	Bromus hordeaceus	Soft brome	I
	Bromus madritensis ssp. *rubens*	Foxtail chess	I
	Crypsis schoenoides	Swamp grass	I
	Cynodon dactylon	Bermuda grass	I
	Distichlis spicata	Saltgrass	N
	Elymus multisetus	Big squirreltail	N
	Elymus glaucus	Blue wildrye	N
	Glyceria leptostachya [3]	Narrow manna grass	N
	Glyceria occidentalis	Mannagrass	N
	Hordeum brachyantherum ssp. *brachyantherum*	Barley	N
	Hordeum marinum ssp. *gussoneanum*	Mediterranean barley	I
	Hordeum murinum ssp. *leporinum*	Foxtail	I
	Leymus triticoides		N
	Lolium multiflorum	Italian ryegrass	I
	Melica californica	California melic	N
	Nassella pulchra	Purple needlegrass	N
	Phalaris brachystachys		I
	Phalaris paradoxa		I

	Poa secunda ssp. *secunda*	Bluegrass	N
	Poa annua	Annual bluegrass	I
	Polypogon monspeliensis	Annual beard grass	I
	Taeniatherum caput-medusae	Medusa head	I
	Vulpia myuros	Zorro fescue	I
Typhaceae	*Typha domingensis*	Southern cattail	N

[1] N = Native; I= Introduced.

[2] Trees of this species have hybridized extensively with other *Juglans* spp. and have naturalized widely in a non-historic range (CNPS 2010). Northern CA black walnut trees receiving CNPS 1B.1 status are restricted to those trees which recruited naturally long ago and have not hybridized. The walnut trees in the BSA are not large and have no special-status.

[3] On-line second edition of *The Jepson Manual* treatment used for nomenclature of this taxon. Taxon not included in Hickman, ed. (1993).

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APPENDIX B.

CNDDB Summary Report
(Byron Hot Springs and eight surrounding quads)

Vasco Winds Repowering Project
Contra Costa and Alameda Counties, CA

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California Department of Fish and Game
Natural Diversity Database
Selected Elements by Scientific Name - Landscape
Vasco Winds Repowering Project

	Scientific Name	Common Name	Element Code	Federal Status	State Status	Global Rank	State Rank	CNPS	CDFG
1	***Accipiter cooperii***	Cooper's hawk	ABNKC12040			G5	S3		
2	***Actinemys marmorata***	western pond turtle	ARAAD02030			G3G4	S3		SC
3	***Agelaius tricolor***	tricolored blackbird	ABPBXB0020			G2G3	S2		SC
4	***Alkali Meadow***	Alkali Meadow	CTT45310CA			G3	S2.1		
5	***Alkali Seep***	Alkali Seep	CTT45320CA			G3	S2.1		
6	***Ambystoma californiense***	California tiger salamander	AAAAA01180	Threatened	unknown code...	G2G3	S2S3		SC
7	***Amsinckia grandiflora***	large-flowered fiddleneck	PDBOR01050	Endangered	Endangered	G1	S1	1B.1	
8	***Amsinckia lunaris***	bent-flowered fiddleneck	PDBOR01070			G2	S2.2	1B.2	
9	***Andrena blennospermatis***	Blennosperma vernal pool andrenid bee	IIHYM35030			G2	S2		
10	***Anniella pulchra pulchra***	silvery legless lizard	ARACC01012			G3G4T3T4Q	S3		SC
11	***Anomobryum julaceum***	slender silver moss	NBMUS80010			G4G5	S2	2.2	
12	***Antrozous pallidus***	pallid bat	AMACC10010			G5	S3		SC
13	***Aquila chrysaetos***	golden eagle	ABNKC22010			G5	S3		
14	***Arctostaphylos auriculata***	Mt. Diablo manzanita	PDERI04040			G2	S2.2	1B.3	
15	***Arctostaphylos manzanita ssp. laevigata***	Contra Costa manzanita	PDERI04273			G5T2	S2	1B.2	
16	***Ardea herodias***	great blue heron	ABNGA04010			G5	S4		
17	***Astragalus tener var. tener***	alkali milk-vetch	PDFAB0F8R1			G1T1	S1.1	1B.2	
18	***Athene cunicularia***	burrowing owl	ABNSB10010			G4	S2		SC
19	***Atriplex cordulata***	heartscale	PDCHE040B0			G2?	S2.2?	1B.2	
20	***Atriplex depressa***	brittlescale	PDCHE042L0			G2Q	S2.2	1B.2	
21	***Atriplex joaquiniana***	San Joaquin spearscale	PDCHE041F3			G2	S2	1B.2	
22	***Balsamorhiza macrolepis var. macrolepis***	big-scale balsamroot	PDAST11061			G3G4T2	S2.2	1B.2	
23	***Blepharizonia plumosa***	big tarplant	PDAST1C011			G1	S1.1	1B.1	
24	***Branchinecta longiantenna***	longhorn fairy shrimp	ICBRA03020	Endangered		G1	S1		
25	***Branchinecta lynchi***	vernal pool fairy shrimp	ICBRA03030	Threatened		G3	S2S3		
26	***Branchinecta mesovallensis***	midvalley fairy shrimp	ICBRA03150			G2	S2		
27	***Buteo regalis***	ferruginous hawk	ABNKC19120			G4	S3S4		
28	***Buteo swainsoni***	Swainson's hawk	ABNKC19070		Threatened	G5	S2		
29	***California macrophylla***	round-leaved filaree	PDGER01070			G3	S3.1	1B.1	
30	***Calochortus pulchellus***	Mt. Diablo fairy-lantern	PMLIL0D160			G2	S2.1	1B.2	
31	***Carex vulpinoidea***	brown fox sedge	PMCYP03EN0			G5	S2.2	2.2	
32	***Caulanthus coulteri var. lemmonii***	Lemmon's jewel-flower	PDBRA0M0E0			G4T2	S2.2	1B.2	
33	***Centromadia parryi ssp. congdonii***	Congdon's tarplant	PDAST4R0P1			G4T3	S3.2	1B.2	

	Scientific Name	Common Name	Element Code	Federal Status	State Status	Global Rank	State Rank	CNPS	CDFG
34	***Circus cyaneus***	northern harrier	ABNKC11010			G5	S3		SC
35	***Cismontane Alkali Marsh***	Cismontane Alkali Marsh	CTT52310CA			G1	S1.1		
36	***Coastal and Valley Freshwater Marsh***	Coastal and Valley Freshwater Marsh	CTT52410CA			G3	S2.1		
37	***Cordylanthus mollis ssp. hispidus***	hispid bird's-beak	PDSCR0J0D1			G2T2	S2.1	1B.1	
38	***Cordylanthus palmatus***	palmate-bracted bird's-beak	PDSCR0J0J0	Endangered	Endangered	G1	S1.1	1B.1	
39	***Corynorhinus townsendii***	Townsend's big-eared bat	AMACC08010			G4	S2S3		SC
40	***Cryptantha hooveri***	Hoover's cryptantha	PDBOR0A190			GH	SH	1A	
41	***Deinandra bacigalupii***	Livermore tarplant	PDAST4R0V0			G1	S1.2	1B.2	
42	***Delphinium californicum ssp. interius***	Hospital Canyon larkspur	PDRAN0B0A2			G3T2?	S2?	1B.2	
43	***Delphinium recurvatum***	recurved larkspur	PDRAN0B1J0			G2	S2.2	1B.2	
44	***Desmocerus californicus dimorphus***	valley elderberry longhorn beetle	IICOL48011	Threatened		G3T2	S2		
45	***Elanus leucurus***	white-tailed kite	ABNKC06010			G5	S3		
46	***Eremophila alpestris actia***	California horned lark	ABPAT02011			G5T3Q	S3		
47	***Eriogonum truncatum***	Mt. Diablo buckwheat	PDPGN085Z0			G1	S1.1	1B.1	
48	***Eryngium racemosum***	Delta button-celery	PDAPI0Z0S0		Endangered	G2Q	S2.1	1B.1	
49	***Eschscholzia rhombipetala***	diamond-petaled California poppy	PDPAP0A0D0			G1	S1.1	1B.1	
50	***Falco mexicanus***	prairie falcon	ABNKD06090			G5	S3		
51	***Fritillaria agrestis***	stinkbells	PMLIL0V010			G3	S3.2	4.2	
52	***Helianthella castanea***	Diablo helianthella	PDAST4M020			G3	S3.2	1B.2	
53	***Helminthoglypta nickliniana bridgesi***	Bridges' coast range shoulderband	IMGASC2362			G2T1	S1		
54	***Hesperolinon breweri***	Brewer's western flax	PDLIN01030			G2	S2.2	1B.2	
55	***Hibiscus lasiocarpos var. occidentalis***	woolly rose-mallow	PDMAL0H0R3			G4	S2.2	2.2	
56	***Hygrotus curvipes***	curved-foot hygrotus diving beetle	IICOL38030			G1	S1		
57	***Lanius ludovicianus***	loggerhead shrike	ABPBR01030			G4	S4		SC
58	***Lasiurus blossevillii***	western red bat	AMACC05060			G5	S3?		SC
59	***Lasiurus cinereus***	hoary bat	AMACC05030			G5	S4?		
60	***Lasthenia conjugens***	Contra Costa goldfields	PDAST5L040	Endangered		G1	S1.1	1B.1	
61	***Laterallus jamaicensis coturniculus***	California black rail	ABNME03041		Threatened	G4T1	S1		
62	***Lathyrus jepsonii var. jepsonii***	Delta tule pea	PDFAB250D2			G5T2	S2.2	1B.2	
63	***Lepidurus packardi***	vernal pool tadpole shrimp	ICBRA10010	Endangered		G3	S2S3		
64	***Lilaeopsis masonii***	Mason's lilaeopsis	PDAPI19030		Rare	G3	S3.1	1B.1	
65	***Limosella subulata***	Delta mudwort	PDSCR10050			G4?Q	S2.1	2.1	
66	***Linderiella occidentalis***	California linderiella	ICBRA06010			G3	S2S3		
67	***Lytta molesta***	molestan blister beetle	IICOL4C030			G2	S2		
68	***Madia radiata***	showy golden madia	PDAST650E0			G2	S2.1	1B.1	

	Scientific Name	Common Name	Element Code	Federal Status	State Status	Global Rank	State Rank	CNPS	CDFG
69	***Masticophis flagellum ruddocki***	San Joaquin whipsnake	ARADB21021			G5T2T3	S2?		SC
70	***Masticophis lateralis euryxanthus***	Alameda whipsnake	ARADB21031	Threatened	Threatened	G4T2	S2		
71	***Metapogon hurdi***	Hurd's metapogon robberfly	IIDIP08010			G1G3	S1S3		
72	***Neotoma fuscipes annectens***	San Francisco dusky-footed woodrat	AMAFF08082			G5T2T3	S2S3		SC
73	***Northern Claypan Vernal Pool***	Northern Claypan Vernal Pool	CTT44120CA			G1	S1.1		
74	***Perdita scitula antiochensis***	Antioch andrenid bee	IIHYM01031			G1T1	S1		
75	***Perognathus inornatus inornatus***	San Joaquin pocket mouse	AMAFD01061			G4T2T3	S2S3		
76	***Phrynosoma blainvillii***	coast horned lizard	ARACF12100			G4G5	S3S4		SC
77	***Plagiobothrys glaber***	hairless popcorn-flower	PDBOR0V0B0			GH	SH	1A	
78	***Rana boylii***	foothill yellow-legged frog	AAABH01050			G3	S2S3		SC
79	***Rana draytonii***	California red-legged frog	AAABH01022	Threatened		G4T2T3	S2S3		SC
80	***Scutellaria galericulata***	marsh skullcap	PDLAM1U0J0			G5	S2.2?	2.2	
81	***Senecio aphanactis***	chaparral ragwort	PDAST8H060			G3?	S1.2	2.2	
82	***Spea hammondii***	western spadefoot	AAABF02020			G3	S3		SC
83	***Sycamore Alluvial Woodland***	Sycamore Alluvial Woodland	CTT62100CA			G1	S1.1		
84	***Symphyotrichum lentum***	Suisun Marsh aster	PDASTE8470			G2	S2	1B.2	
85	***Taxidea taxus***	American badger	AMAJF04010			G5	S4		SC
86	***Trifolium depauperatum var. hydrophilum***	saline clover	PDFAB400R5			G5T2?	S2.2?	1B.2	
87	***Tropidocarpum capparideum***	caper-fruited tropidocarpum	PDBRA2R010			G1	S1.1	1B.1	
88	***Valley Needlegrass Grassland***	Valley Needlegrass Grassland	CTT42110CA			G1	S3.1		
89	***Valley Sink Scrub***	Valley Sink Scrub	CTT36210CA			G1	S1.1		
90	***Viburnum ellipticum***	oval-leaved viburnum	PDCPR07080			G5	S2.3	2.3	
91	***Vulpes macrotis mutica***	San Joaquin kit fox	AMAJA03041	Endangered	Threatened	G4T2T3	S2S3		

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APPENDIX C.

USFWS Species Lists

Vasco Winds Repowering Project
Contra Costa and Alameda Counties, CA

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United States Department of the Interior
FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825

August 9, 2010

Document Number: 100809083846

R. John Little, Ph.D.
Sycamore Environmental Consultants, Inc.
6355 Riverside Blvd., Suite C
Sacramento, CA 95831

Subject: Species List for Vasco Winds Repowering Project

Dear: Dr. Little

We are sending this official species list in response to your August 9, 2010 request for information about endangered and threatened species. The list covers the California counties and/or U.S. Geological Survey 7½ minute quad or quads you requested.

Our database was developed primarily to assist Federal agencies that are consulting with us. Therefore, our lists include all of the sensitive species that have been found in a certain area *and also ones that may be affected by projects in the area*. For example, a fish may be on the list for a quad if it lives somewhere downstream from that quad. Birds are included even if they only migrate through an area. In other words, we include all of the species we want people to consider when they do something that affects the environment.

Please read Important Information About Your Species List (below). It explains how we made the list and describes your responsibilities under the Endangered Species Act.

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be November 07, 2010.

Please contact us if your project may affect endangered or threatened species or if you have any questions about the attached list or your responsibilities under the Endangered Species Act. A list of Endangered Species Program contacts can be found at www.fws.gov/sacramento/es/branches.htm.

Endangered Species Division

U.S. Fish & Wildlife Service

Sacramento Fish & Wildlife Office

Federal Endangered and Threatened Species that Occur in
or may be Affected by Projects in the Counties and/or
U.S.G.S. 7 1/2 Minute Quads you requested

Document Number: 100809083846

Database Last Updated: April 29, 2010

Quad Lists

Listed Species

Invertebrates

Branchinecta conservatio

Conservancy fairy shrimp (E)

Branchinecta longiantenna

Critical habitat, longhorn fairy shrimp (X)

longhorn fairy shrimp (E)

Branchinecta lynchi

Critical habitat, vernal pool fairy shrimp (X)

vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus

valley elderberry longhorn beetle (T)

Lepidurus packardi

vernal pool tadpole shrimp (E)

Fish

Hypomesus transpacificus

delta smelt (T)

Oncorhynchus mykiss

Central Valley steelhead (T) (NMFS)

Oncorhynchus tshawytscha

Central Valley spring-run chinook salmon (T) (NMFS)

winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Ambystoma californiense

California tiger salamander, central population (T)

Rana draytonii

California red-legged frog (T)

Critical habitat, California red-legged frog (X)

Reptiles

Masticophis lateralis euryxanthus

Alameda whipsnake [=striped racer] (T)

Thamnophis gigas

giant garter snake (T)

Mammals

Vulpes macrotis mutica
San Joaquin kit fox (E)

Plants

Lasthenia conjugens
Contra Costa goldfields (E)
Critical habitat, Contra Costa goldfields (X)

Proposed Species

Amphibians

Rana draytonii
Critical habitat, California red-legged frog (PX)

Quads Containing Listed, Proposed or Candidate Species:

BYRON HOT SPRINGS (463C)

County Lists

Alameda County

Listed Species

Invertebrates

Branchinecta longiantenna
Critical habitat, longhorn fairy shrimp (X)
longhorn fairy shrimp (E)

Branchinecta lynchi
Critical habitat, vernal pool fairy shrimp (X)
vernal pool fairy shrimp (T)

Euphydryas editha bayensis
bay checkerspot butterfly (T)

Lepidurus packardi
Critical habitat, vernal pool tadpole shrimp (X)
vernal pool tadpole shrimp (E)

Speyeria callippe callippe
callippe silverspot butterfly (E)

Fish

Acipenser medirostris
green sturgeon (T) (NMFS)

Eucyclogobius newberryi
tidewater goby (E)

Hypomesus transpacificus
Critical habitat, delta smelt (X)

Oncorhynchus kisutch
coho salmon - central CA coast (E) (NMFS)

Oncorhynchus mykiss
Central California Coastal steelhead (T) (NMFS)
Critical habitat, Central California coastal steelhead (X) (NMFS)

Oncorhynchus tshawytscha
Central Valley spring-run chinook salmon (T) (NMFS)
Critical habitat, winter-run chinook salmon (X) (NMFS)
winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Ambystoma californiense
California tiger salamander, central population (T)
Critical habitat, CA tiger salamander, central population (X)

Rana draytonii
California red-legged frog (T)
Critical habitat, California red-legged frog (X)

Reptiles

Masticophis lateralis euryxanthus
Alameda whipsnake [=striped racer] (T)
Critical habitat, Alameda whipsnake (X)

Birds

Pelecanus occidentalis californicus
California brown pelican (E)

Rallus longirostris obsoletus
California clapper rail (E)

Sternula antillarum (=Sterna, =albifrons) browni
California least tern (E)

Mammals

Reithrodontomys raviventris
salt marsh harvest mouse (E)

Vulpes macrotis mutica
San Joaquin kit fox (E)

Plants

Amsinckia grandiflora
large-flowered fiddleneck (E)

Arctostaphylos pallida
pallid manzanita (=Alameda or Oakland Hills manzanita) (T)

Clarkia franciscana
Presidio clarkia (E)

Cordylanthus palmatus
palmate-bracted bird's-beak (E)

Lasthenia conjugens
Contra Costa goldfields (E)
Critical habitat, Contra Costa goldfields (X)

Proposed Species

Amphibians

Rana draytonii
Critical habitat, California red-legged frog (PX)

Contra Costa County

Listed Species

Invertebrates

Apodemia mormo langei
Lange's metalmark butterfly (E)

Branchinecta conservatio
Conservancy fairy shrimp (E)

Branchinecta longiantenna
Critical habitat, longhorn fairy shrimp (X)
longhorn fairy shrimp (E)

Branchinecta lynchi
Critical habitat, vernal pool fairy shrimp (X)
vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus
valley elderberry longhorn beetle (T)

Lepidurus packardi
vernal pool tadpole shrimp (E)

Speyeria callippe callippe
callippe silverspot butterfly (E)

Fish

Acipenser medirostris
green sturgeon (T) (NMFS)

Eucyclogobius newberryi
tidewater goby (E)

Hypomesus transpacificus
Critical habitat, delta smelt (X)
delta smelt (T)

Oncorhynchus kisutch
coho salmon - central CA coast (E) (NMFS)

Oncorhynchus mykiss
Central California Coastal steelhead (T) (NMFS)
Critical habitat, Central California coastal steelhead (X) (NMFS)
Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha
Central Valley spring-run chinook salmon (T) (NMFS)
Critical Habitat, Central Valley spring-run chinook (X) (NMFS)
Critical habitat, winter-run chinook salmon (X) (NMFS)
winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Ambystoma californiense
California tiger salamander, central population (T)

Rana draytonii
California red-legged frog (T)
Critical habitat, California red-legged frog (X)

Reptiles

Masticophis lateralis euryxanthus
Alameda whipsnake [=striped racer] (T)
Critical habitat, Alameda whipsnake (X)

Thamnophis gigas
giant garter snake (T)

Birds

Charadrius alexandrinus nivosus
western snowy plover (T)

Pelecanus occidentalis californicus
California brown pelican (E)

Rallus longirostris obsoletus
California clapper rail (E)

Sternula antillarum (=Sterna, =albifrons) browni
California least tern (E)

Mammals

Reithrodontomys raviventris
salt marsh harvest mouse (E)

Vulpes macrotis mutica
San Joaquin kit fox (E)

Plants

Amsinckia grandiflora
large-flowered fiddleneck (E)

Arctostaphylos pallida
pallid manzanita (=Alameda or Oakland Hills manzanita) (T)

Cordylanthus mollis ssp. mollis
soft bird's-beak (E)

Erysimum capitatum ssp. angustatum
Contra Costa wallflower (E)
Critical Habitat, Contra Costa wallflower (X)

Holocarpha macradenia
Critical habitat, Santa Cruz tarplant (X)
Santa Cruz tarplant (T)

Lasthenia conjugens
Contra Costa goldfields (E)
Critical habitat, Contra Costa goldfields (X)

Oenothera deltoides ssp. howellii
Antioch Dunes evening-primrose (E)
Critical habitat, Antioch Dunes evening-primrose (X)

Proposed Species

Amphibians

Rana draytonii

Critical habitat, California red-legged frog (PX)

Plants

Cordylanthus mollis ssp. mollis

Critical habitat, soft bird's-beak (PX)

Key:

(E) *Endangered* - Listed as being in danger of extinction.

(T) *Threatened* - Listed as likely to become endangered within the foreseeable future.

(P) *Proposed* - Officially proposed in the Federal Register for listing as endangered or threatened.

(NMFS) Species under the Jurisdiction of the National Oceanic & Atmospheric Administration Fisheries Service. Consult with them directly about these species.

Critical Habitat - Area essential to the conservation of a species.

(PX) *Proposed Critical Habitat* - The species is already listed. Critical habitat is being proposed for it.

(C) *Candidate* - Candidate to become a proposed species.

(V) Vacated by a court order. Not currently in effect. Being reviewed by the Service.

(X) *Critical Habitat* designated for this species

Important Information About Your Species List

How We Make Species Lists

We store information about endangered and threatened species lists by U.S. Geological Survey 7½ minute quads. The United States is divided into these quads, which are about the size of San Francisco.

The animals on your species list are ones that occur within, or may be affected by projects within, the quads covered by the list.

- Fish and other aquatic species appear on your list if they are in the same watershed as your quad or if water use in your quad might affect them.
- Amphibians will be on the list for a quad or county if pesticides applied in that area may be carried to their habitat by air currents.
- Birds are shown regardless of whether they are resident or migratory. Relevant birds on the county list should be considered regardless of whether they appear on a quad list.

Plants

Any plants on your list are ones that have actually been observed in the area covered by the list. Plants may exist in an area without ever having been detected there. You can find out what's in the surrounding quads through the California Native Plant Society's online Inventory of Rare and Endangered Plants.

Surveying

Some of the species on your list may not be affected by your project. A trained biologist and/or botanist, familiar with the habitat requirements of the species on your list, should

determine whether they or habitats suitable for them may be affected by your project. We recommend that your surveys include any proposed and candidate species on your list. See our Protocol and Recovery Permits pages.

For plant surveys, we recommend using the Guidelines for Conducting and Reporting Botanical Inventories. The results of your surveys should be published in any environmental documents prepared for your project.

Your Responsibilities Under the Endangered Species Act

All animals identified as listed above are fully protected under the Endangered Species Act of 1973, as amended. Section 9 of the Act and its implementing regulations prohibit the take of a federally listed wildlife species. Take is defined by the Act as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" any such animal.

> Take may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or shelter (50 CFR §17.3).

Take incidental to an otherwise lawful activity may be authorized by one of two procedures:

- If a Federal agency is involved with the permitting, funding, or carrying out of a project that may result in take, then that agency must engage in a formal consultation with the Service.

  During formal consultation, the Federal agency, the applicant and the Service work together to avoid or minimize the impact on listed species and their habitat. Such consultation would result in a biological opinion by the Service addressing the anticipated effect of the project on listed and proposed species. The opinion may authorize a limited level of incidental take.

- If no Federal agency is involved with the project, and federally listed species may be taken as part of the project, then you, the applicant, should apply for an incidental take permit. The Service may issue such a permit if you submit a satisfactory conservation plan for the species that would be affected by your project.

  Should your survey determine that federally listed or proposed species occur in the area and are likely to be affected by the project, we recommend that you work with this office and the California Department of Fish and Game to develop a plan that minimizes the project's direct and indirect impacts to listed species and compensates for project-related loss of habitat. You should include the plan in any environmental documents you file.

Critical Habitat

When a species is listed as endangered or threatened, areas of habitat considered essential to its conservation may be designated as critical habitat. These areas may require special management considerations or protection. They provide needed space for growth and normal behavior; food, water, air, light, other nutritional or physiological requirements; cover or shelter; and sites for breeding, reproduction, rearing of offspring, germination or seed dispersal.

Although critical habitat may be designated on private or State lands, activities on these lands are not restricted unless there is Federal involvement in the activities or direct harm to listed wildlife.

If any species has proposed or designated critical habitat within a quad, there will be a separate line for this on the species list. Boundary descriptions of the critical habitat may be found in the Federal Register. The information is also reprinted in the Code of Federal Regulations (50 CFR 17.95). See our Map Room page.

Candidate Species

We recommend that you address impacts to candidate species. We put plants and animals on our candidate list when we have enough scientific information to eventually propose them for listing as threatened or endangered. By considering these species early in your planning process you may be able to avoid the problems that could develop if one of these candidates was listed before the end of your project.

Species of Concern

The Sacramento Fish & Wildlife Office no longer maintains a list of species of concern. However, various other agencies and organizations maintain lists of at-risk species. These lists provide essential information for land management planning and conservation efforts. More info

Wetlands

If your project will impact wetlands, riparian habitat, or other jurisdictional waters as defined by section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act, you will need to obtain a permit from the U.S. Army Corps of Engineers. Impacts to wetland habitats require site specific mitigation and monitoring. For questions regarding wetlands, please contact Mark Littlefield of this office at (916) 414-6580.

Updates

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be November 07, 2010.

APPENDIX D.

Photographs

Vasco Winds Repowering Project
Contra Costa and Alameda Counties, CA

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Photo 1. View toward southwest at California Annual Grassland in northwestern portion of BSA. 1 April 2010

Photo 2. View toward southeast at California Annual Grassland in northwestern portion of BSA. 1 April 2010

Photo 3. View toward southwest at Silver Bush Lupine Scrub in eastern portion of BSA. 29 March 2010.

Photo 4. View toward west at Silver Bush Lupine Scrub in eastern portion of BSA. 29 March 2010.

Photo 5. View toward west at Mixed Willow Riparian (left) and California Annual Grassland (right) in south central portion of BSA. 19 May 2010.

Photo 6. View toward northeast at Alkali Seep in eastern portion of BSA. 19 May 2010.

Photo 7. View toward north at Bulrush Series in southwest portion of BSA. 11 August 2010.

Photo 8. View toward north at Bulrush Series (foreground) and Mixed Willow Riparian (background) from southwest portion of BSA. 21 May 2010.

Photo 9. View toward northwest at Valley Needlegrass Grassland in central portion of BSA. 20 May 2010.

Photo 10. View toward west at Seasonal Pond (left) and California Annual Grassland (right) in north central portion of BSA. 21 May 2010.

Photo 11. View toward north at Silver Bush Lupine Scrub in eastern portion of BSA. 28 July 2010.

Photo 12. View toward east at California Annual Grassland in eastern portion of BSA. 28 July 2010.

APPENDIX E.

Species Evaluated Table

Vasco Winds Repowering Project
Contra Costa and Alameda Counties, CA

Special-Status Species Common Name	Federal Status a, b	State Status / CNPS a, d	Source [c]	Habitat Requirements	Potential to Occur in the BSA
Amsinckia grandiflora Large-flowered fiddleneck	E, CH	E/ 1B.1	1, 2	Annual herb found in cismontane woodland and Valley and foothill grassland from 900 to 1,000 ft. Blooms April through May (CNPS 2010). Historically found in Alameda, Contra Costa, and San Joaquin counties (USFWS 1985). Currently known from only two natural populations. One population consists of 2 small colonies on U.S. Department of Energy land in Corral Hollow in Alameda and San Joaquin counties (USFWS 1997). The site is grassy, steep, on a west and south-facing slope of a small ravine with light textured clay soil (USFWS 1985). The second population was recently found in western San Joaquin County. The species has been introduced into six sites, however, only two of these reintroductions appear to be successful (USFWS 1997).	Yes. See text.
Amsinckia lunaris Bent-flowered fiddleneck	--	--/ 1B.2	2	Annual herb found in coastal bluff scrub, cismontane woodland, and Valley and foothill grassland from 10 to 1,650 ft. Known from Alameda, Contra Costa, Colusa, Lake, Marin, Napa, San Benito, Santa Clara, Santa Cruz, San Mateo, and Yolo counties. Blooms March through June (CNPS 2010).	Yes. See text.
Androsace elongata ssp. *acuta* California androsace	--	--/ 4.2	3	Annual herb found in chaparral, cismontane woodland, coastal scrub, meadows and seeps, pinyon and juniper woodland, and Valley and foothill grassland from 500 to 3,950 ft. Known from Alameda, Contra Costa, Colusa, Fresno, Glenn, Kern, Los Angeles, Merced, Riverside, San Bernardino, San Benito, Santa Clara, San Diego, Siskiyou, San Joaquin, San Luis Obispo, San Mateo, Stanislaus, and Tehama counties. Blooms March though June (CNPS 2010).	Yes. See text.
Anomobryum julaceum Slender silver moss	--	--/ 2.2	2	A moss that occurs in broadleaved upland forest, lower montane coniferous forest, and North Coast coniferous forest from 330 to 3,300 ft. Known from Butte, Contra Costa, Humboldt, Los Angeles, Mariposa, Santa Barbara, Santa Cruz, Shasta, and Sonoma counties. CNPS does not list a blooming period (CNPS 2010).	No. Suitable habitat for this species does not occur in the BSA.
Arctostaphylos auriculata Mt. Diablo manzanita	--	--/ 1B.3	2	Evergreen shrub found in sandstone chaparral from 442 to 2,133 ft. Known from fewer than twenty occurrences in Contra Costa County. Blooms January through March (CNPS 2010).	No. Suitable habitat for this species does not occur in the BSA.
Arctostaphylos manzanita ssp. *laevigata* Contra Costa manzanita	--	--/ 1B.2	2	An evergreen shrub found in rocky chaparral from 1,640 to 3,608 ft. Known from Contra Costa County. Blooms January through February (CNPS 2010).	No. Suitable habitat for this species does not occur in the BSA.

Arctostaphylos pallida Pallid manzanita	T	E/ 1B.1	1	An evergreen shrub found broadleaved upland forest, closed-cone coniferous forest, chaparral, cismontane woodland, and coastal scrub on siliceous shale or sandy or gravelly soils from 600 to 1,525 ft. Known from fewer than 10 occurrences in the Contra Costa Hills of the Diablo Range in Alameda and Contra Costa counties. Blooms December through March (CNPS 2010).	No. Suitable habitat for this species does not occur in the BSA.
Aster lentus Suisun Marsh aster	--	--/ 1B.2	2	Rhizomatous perennial herb found in brackish and freshwater marshes and swamps from 0 to 10 ft. Known from Contra Costa, Napa, Sacramento, San Joaquin, Solano, and Sonoma counties. Blooms May through November (CNPS 2010).	No. Suitable habitat for this species does not occur in the BSA.
Astragalus tener var. *tener* Alkali milk-vetch	--	--/ 1B.2	1, 2	Annual herb found in alkaline conditions of playas, adobe clay Valley and foothill grassland, and vernal pools from 3 to 200 ft. Known from Alameda, Contra Costa, Merced, Monterey, Napa, San Benito, Santa Clara, San Francisco, San Joaquin, Solano, Sonoma, Stanislaus, and Yolo counties. Blooms March through June (Hickman 1993; CNPS 2010).	No. Suitable habitat for this species does not occur in the BSA.
Atriplex cordulata Heartscale	--	--/ 1B.2	2	Annual herb found in saline or alkaline conditions of chenopod scrub, meadows and seeps, and sandy Valley and foothill grassland from 3 to 1,230 ft. Known from Alameda, Butte, Fresno, Glenn, Kern, Madera, Merced, San Joaquin, San Luis Obispo, Solano, Stanislaus, Tulare, and Yolo counties. Blooms April through October (CNPS 2010).	Yes. See text.
Atriplex depressa Brittlescale	--	--/ 1B.2	2	Annual herb found in alkaline, clay soils of chenopod scrub, meadows and seeps, playas, Valley and foothill grassland, and vernal pools from 3 to 1,050 ft. Known from Alameda, Contra Costa, Colusa, Fresno, Glenn, Merced, Solano, Stanislaus, Tulare, and Yolo counties. Blooms May through October (CNPS 2010).	Yes. See text.
Atriplex joaquiniana San Joaquin saltbush (spearscale)	--	--/ 1B.2	2	Annual herb found in alkaline chenopod scrub, meadows and seeps, playas, and Valley and foothill grassland from 3 to 2,740 ft. Known from Alameda, Contra Costa, Colusa, Fresno, Glenn, Merced, Monterey, Napa, San Benito, Santa Clara, San Joaquin, San Luis Obispo, Solano, Tulare, and Yolo counties. Blooms April through October (CNPS 2010).	Yes. See text.
Balsamorhiza macrolepis var. *macrolepis* Big-scale balsamroot	--	--/ 1B.2	2	Perennial herb found in chaparral, cismontane woodland, and Valley and foothill grassland from 295 to 4,600 ft. Sometimes found on serpentinite soil. Known from Alameda, Butte, Colusa, Lake, Mariposa, Napa, Placer, Santa Clara, Solano, Sonoma, and Tehama counties. Blooms March through June (CNPS 2010).	Yes. See text.
Blepharizonia plumosa Big tarplant	--	--/ 1B.1	2	Annual herb found in Valley and foothill grasslands from 100 to 1,660 ft. Known from Alameda, Contra Costa, and Stanislaus counties. Blooms July through October (CNPS 2010).	Yes. See text.
California macrophyllum Round-leaved filaree	--	--/ 1B.1	2, 3	Annual herb found in clay soils of cismontane woodland and Valley and foothill grassland from 50 to 3,936 ft. Known from Alameda, Butte, Contra Costa, Colusa, Fresno, Glenn, Kings, Kern, Lake, Lassen, Los Angeles, Merced, Monterey, Napa, Riverside, Santa Barbara, San Benito, Santa Clara, Santa Cruz Isl., San Diego, San Joaquin, San Luis Obispo, San Mateo, Solano, Sonoma, Stanislaus, Tehama, Ventura, and Yolo counties. Blooms March through May (CNPS 2010).	Yes. See text.

Calochortus pulchellus Mt. Diablo fairy-lantern	--	--/ 1B.2	2	Perennial bulbiferous herb found on wooded and brushy slopes in chaparral, cismontane woodland, riparian woodland, and Valley and foothill grassland from 100 to 1,550 ft. Known from Alameda, Contra Costa, and Solano counties. Blooms April through June (CNPS 2010; DFG 2010c).	No. Suitable habitat for this species does not occur in the BSA.
Carex vulpinoidea Fox sedge	--	--/ 2.2	2	A perennial herb found in freshwater marshes and swamps, and riparian woodlands from 98 to 3,940 ft. Known from Butte, Kern, Los Angeles, Shasta, Siskiyou, San Joaquin, Tehama, and Trinity counties. Blooms May through June (CNPS 2010).	Yes. See text.
Caulanthus coulteri var. *lemmonii* Lemmon's jewelflower	--	--/ 1B.2	2	An annual herb found in pinyon and juniper woodland and Valley and foothill grassland from 262 to 4,001ft. Known from Alameda, Fresno, Kings, Kern, Merced, Monterey, Santa Barbara, San Benito, San Joaquin, San Luis Obispo, Stanislaus, and Ventura counties. Blooms from March through May (CNPS 2010).	Yes. See text.
Centromadia parryi ssp. *congdonii* Congdon's tarplant	--	--/ 1B.2	2	An annual herb found in Valley and foothill grasslands from 3 to 754 ft. Known from Alameda, Contra Costa, Monterey, Santa Clara, Santa Cruz, San Luis Obispo, San Mateo, and Solano counties. Blooms May through October (Nov.) (CNPS 2010).	Yes. See text.
Clarkia franciscana Presidio clarkia	E	E/ 1B	2	Annual herb found in serpentinite coastal scrub and Valley and foothill grasslands from 82 to 1,100 ft. Known from Alameda and San Francisco counties. Known from fewer than five occurrences. Blooms May through July (CNPS 2010).	No. Suitable habitat for this species does not occur in the BSA.
Cordylanthus mollis ssp. *hispidus* Hispid bird's beak	--	--/ 1B.1	2	A hemiparasitic annual herb found in alkaline soils in meadows and seeps, playas, and Valley and foothill grasslands from 3 to 508 ft. Known from Alameda, Fresno, Kern, Merced, Placer, and Solano counties. Blooms June through September (CNPS 2010).	Marginal. See text.
Cordylanthus mollis ssp. *mollis* Soft bird's beak	E, PCH	R/ 1B.2	1	Annual hemiparasitic herb found in coastal salt marshes and swamps from 0 to 10 ft. Known from fewer than 15 occurrences in Contra Costa, Marin, Napa, Sacramento, Solano, and Sonoma counties. Blooms July through November (CNPS 2010).	No. Suitable habitat for this species does not occur in the BSA.
Cordylanthus palmatus Palmate-bracted bird's beak	E	E/ 1B.1	1	Annual hemiparasitic herb found in alkaline soil of chenopod scrub and Valley and foothill grassland from 15 to 510 ft. Known from Alameda, Colusa, Fresno, Glenn, Madera, San Joaquin, and Yolo counties. Blooms May through October (CNPS 2010).	Yes. See text.
Cryptantha hooveri Hoover's cryptantha	--	--/ 1A	2	Annual herb found on coarse sand in inland dunes and Valley and foothill grasslands from 30 to 492 ft. Known from Contra Costa, Kern, Madera, and Stanislaus. Blooms April through May (CNPS 2010; DFG 2010c).	No. Suitable habitat for this species does not occur in the BSA.
Deinandra bacigalupii Livermore tarplant	--	--/ 1B.2	2	An annual herb found in alkaline soils of meadows and seeps from 500 to 610 ft. Known from fewer than five occurrences near Livermore in Alameda County. Blooms June through October (CNPS 2010).	Yes. See text.
Delphinium californicum ssp. *interius* Hospital Canyon larkspur	--	--/ 1B.2	2	A perennial herb found in openings of chaparral and mesic cismontane woodlands from 754 to 3,592 ft. Known from Alameda, Contra Costa, Madera, San Benito, San Joaquin, and Stanislaus. Blooms April through June (CNPS 2010).	No. Suitable habitat for this species does not occur in the BSA.

Delphinium recurvatum Recurved larkspur	--	--/ 1B.2	2	Perennial herb found in alkaline chenopod scrub, cismontane woodland, and Valley and foothill grassland from 10 to 2,450 ft. Known from Alameda, Butte, Contra Costa, Colusa, Fresno, Glenn, Kings, Kern, Madera, Merced, Monterey, San Joaquin, San Luis Obispo, Solano, and Tulare counties. Blooms March through June (CNPS 2010). Grows in poorly drained, fine textured, alkaline soils (Hickman 1993).	Yes. See text.
Eriogonum truncatum Mt. Diablo buckwheat	--	--/ 1B.1	2	Annual herb found on exposed clay or sandy soils in chaparral, coastal scrub, and Valley and foothill grasslands from 1 to 1,150 ft. Historically known from Alameda, Contra Costa, and Solano counties. Rediscovered in May 2005 in Mount Diablo State Park; now known from one extant occurrence for which quad location needs confirmation. Blooms April through September (November – December) (CNPS 2010).	Marginal. See text.
Eryngium racemosum Delta coyote-thistle (button-celery)	--	E/ 1B.1	2	Annual to perennial herb found in vernally mesic, clay depressions in riparian scrub from 10 to 100 ft. Known from Calaveras, Contra Costa, Merced, San Joaquin, and Stanislaus counties. Blooms June through September (CNPS 2010).	No. Suitable habitat for this species does not occur in the BSA.
Erysimum capitatum ssp. *angustatum* Contra Costa wallflower	E, CH	E/ 1B.1	1	A perennial herb found in inland dunes from 10 to 66 ft. Known only from the Antioch Dunes in Contra Costa County. Blooms March through July (CNPS 2010).	No. Suitable habitat for this species does not occur in the BSA.
Eschscholzia rhombipetala Diamond-petaled California poppy	--	--/ 1B.1	2	Annual herb found in Valley and foothill grassland in alkaline, clay soil from 0 to 3,200 ft. Known from Alameda, Contra Costa, Colusa, San Joaquin, San Luis Obispo, and Stanislaus counties. Blooms March through April (CNPS 2010).	Yes. See text.
Fritillaria agrestis Stinkbells	--	--/ 4.2	2, 3	Bulbiferous herb found in chaparral, cismontane woodland, pinyon and juniper woodland and Valley and foothill grassland from 30 to 5,100 ft. Known from Alameda, Contra Costa, Fresno, Kern, Mendocino, Merced, Monterey, Mariposa, Placer, Sacramento, Santa Barbara, San Benito, Santa Clara, Santa Cruz, San Luis Obispo, San Mateo, Stanislaus, Tuolumne, Ventura, and Yuba counties. Blooms March through June (CNPS 2010).	Yes. See text.
Helianthella castanea Diablo helianthella	--	--/ 1B.2	2	A perennial herb usually found in chaparral/oak woodland interface in rocky azonal soils in broadleaved upland forest, chaparral, cismontane woodland, coastal scrub, riparian woodland, and Valley and foothill grassland from 190 to 4,300 ft. Often found in partial shade. Known from Alameda, Contra Costa, Marin, San Francisco, and San Mateo counties. Blooms April through June (CNPS 2010; DFG 2010c).	Marginal. See text.
Hesperolinon breweri Brewer's western flax	--	--/ 1B.2	2	Annual herb found in chaparral, cismontane woodland, and Valley and foothill grassland from 100 to 2,950 ft. Usually found on serpentinite soils. Known from Contra Costa, Napa, and Solano counties. Blooms May through July (CNPS 2010).	Yes. See text.

Hibiscus lasiocarpus var. *occidentalis* Woolly rose-mallow	--	--/1B.2	2	A perennial, rhizomatous, aquatic emergent herb found in freshwater marshes and swamps from 0 to 400 ft. Occurs in freshwater-soaked river banks and low peat islands in sloughs. In California, known from the Delta watershed (DFG 2010c). Known from Butte, Contra Costa, Colusa, Glenn, Sacramento, San Joaquin, Solano, Sutter, and Yolo counties. Blooms June through September (CNPS 2010).	No. Suitable habitat for this species does not occur in the BSA.
Holocarpha macradenia Santa Cruz tarplant	T, CH	E/ 1B.1	1	An annual herb found in coastal prairie, coastal scrub, and Valley and foothill grassland from 30 to 730 ft. Often found in clay or sandy soils. All extant Contra Costa County occurrences are introduced, and nearly half have failed. The last remaining natural populations in the San Francisco Bay Area were extirpated by development in 1993 (CNPS 2010). Known from Alameda, Contra Costa, Monterey, Marin, and Santa Cruz counties. Blooms June through October (CNPS 2010).	No. Suitable habitat for this species does not occur in the BSA.
Lasthenia conjugens Contra Costa goldfields	E, CH	--/ 1B.1	1, 2	Annual herb found in mesic habitats of cismontane woodland, alkaline playas, Valley and foothill grassland, and vernal pools from 0 to 1,540 ft. Known from Alameda, Contra Costa, Mendocino, Monterey, Marin, Napa, Santa Barbara, Santa Clara, Solano, and Sonoma counties. Blooms March through June (CNPS 2010).	Yes. See text.
Lathyrus jepsonii var. *jepsonii* Delta tule-pea	--	--/ 1B.2	2	Perennial herb found in freshwater and brackish marshes and swamps from 0 to 13 ft. Known from Alameda, Contra Costa, Napa, Sacramento, Santa Clara, San Joaquin, Solano, and Sonoma counties. Blooms May through July (occasionally September) (CNPS 2010).	No. Suitable habitat for this species does not occur in the BSA.
Lilaeopsis masonii Mason's lilaeopsis	--	R/ 1B.1	2	Rhizomatous herb found in brackish and freshwater marshes and swamps and riparian scrub from 0 to 33 ft. Known from Alameda, Contra Costa, Marin, Napa, Sacramento, San Joaquin, and Solano counties. Locally common in Suisun Bay. Blooms April through November (CNPS 2010).	No. Suitable habitat for this species does not occur in the BSA.
Limosella subulata Delta mudwort	--	--/ 2.1	2	Stoloniferous herb found in marshes and swamps from 0 to 10 ft. Known from Contra Costa, Sacramento, San Joaquin, and Solano counties. Blooms May through August (CNPS 2010).	No. Suitable habitat for this species does not occur in the BSA.
Madia radiata Showy madia	--	--/ 1B.1	2	An annual herb found in cismontane woodland and Valley and foothill grassland from 82 to 2,952 ft. Known from Contra Costa, Fresno, Kings, Kern, Monterey, Santa Barbara, San Benito, Santa Clara, San Joaquin, San Luis Obispo, and Stanislaus. Blooms March through May (CNPS 2010).	Yes. See text.
Oenothera deltoides ssp. *howellii* Antioch Dunes evening-primrose	E, CH	E/ 1B.1	1	Perennial herb found in inland dunes from 0 to 100 ft. Known from Sacramento and Contra Costa counties. Known from three native occurrences in Contra Costa and Sacramento counties. Blooms March to September (CNPS 2010).	No. Suitable habitat for this species does not occur in the BSA.
Plagiobothrys glaber Hairless popcorn-flower	--	--/ 1A	2	An annual herb found in alkaline meadows and seeps, and coastal salt marshes and swamps from 50 to 600 ft. Historically known from Alameda, Marin, San Benito, and Santa Clara counties. Last confirmed sighting in 1954. Possibly relocated near Antioch; identification uncertain. All collections since 1930's located in the Hollister area. Presumed extinct in California. Blooms March through May (CNPS 2010).	Yes. See text.

Scutellaria galericulata Marsh skullcap	--	--/ 2.2	2	Rhizomatous herb found in lower montane coniferous forest, meadow and seeps, and marshes and swamps from 0 to 6,890 ft. Known from El Dorado, Lassen, Modoc, Nevada, Placer, Plumas, Shasta, and San Joaquin counties. Blooms from June through September (CNPS 2010).	Marginal. See text.
Senecio aphanactis Chaparral ragwort	--	--/ 2.2	2	Annual herb found in chaparral, cismontane woodland, and coastal scrub from 45 to 2,625 ft. Sometimes found in alkaline areas. Known from Alameda, Contra Costa, Fresno, Los Angeles, Merced, Monterey, Orange, Riverside, Santa Barbara, Santa Clara, Santa Catalina Isl., Santa Cruz Isl., San Diego, San Luis Obispo, Solano, Santa Rosa Isl., Ventura counties. Blooms January through April (CNPS 2010).	No. Suitable habitat for this species does not occur in the BSA.
Trifolium depauperatum var. *hydrophilum* Saline clover	--	--/ 1B.2	2	Annual herb found in marshes and swamps, mesic and alkaline soils of Valley and foothill grassland, and vernal pools from 0 to 985 ft. Known from Alameda, Colusa, Monterey, Napa, San Benito, Santa Clara, Santa Cruz, San Luis Obispo, San Mateo, Solano, and Sonoma counties. Blooms April through June (CNPS 2010).	Yes. See text.
Tropidocarpum capparideum Caper-fruited tropidocarpum	--	--/ 1B.1	2	An annual herb found in alkaline Valley and foothill grassland from 3 to 1,495 ft. Known from Alameda, Contra Costa, Fresno, Glenn, Monterey, Santa Clara, San Joaquin, and San Luis Obispo counties. Blooms March through April (CNPS 2010).	Yes. See text.
Viburnum ellipticum Oval-leaved viburnum	--	--/ 2.3	2	Deciduous shrub found in chaparral, cismontane woodland, and lower montane coniferous forest from 705 to 4,590 ft. Known from Contra Costa, El Dorado, Fresno, Glenn, Humboldt, Mendocino, Napa, Placer, Shasta, and Sonoma counties. Blooms May through June (CNPS 2010).	No. Suitable habitat for this species does not occur in the BSA.
Natural Communities					
Alkali meadow	--	--/ --	2	Gradations of dense to fairly open growth of relatively few species of perennial grasses and sedges. Most often low growing, but occasional tufts of *Sporobolus airoidea* up to 1 m high. Occurs on fine-textured, more or less permanently moist, alkaline soils. Characteristic species may include: *Allenrolfea occidentalis, Anemopsis californica, Carex* sp., *Cordylanthus mollis* ssp. *hispidus, Distichlis spicata* var. *stricta, Juncus* sp., *Muhlenbergia asperifolia, Phragmites australis, Sida leprosa*, *Sisyrinchium halophyullum*, *Spartina gracilis*, *Sporobolus airoides*, and *Triglochin concinna debilis*. Occurs from the Modoc Plateau to Owens Valley at elevations of 3,500 to 7,000 ft in valley bottoms and on the lower portions of alluvial slopes. Also occurs around alkali seeps arising from the Valley Springs Formation of the eastern Central Valley from Kern to Placer counties, on salt-affected grasslands of the San Joaquin Valley trough and the Livermore Valley, and the salty grasslands of the western Sacramento Valley from San Joaquin to Glenn and Colusa counties (Holland 1986).	No. This community type does not occur in the BSA.

Alkali seep	--	--/ --	2, 3	This community consists of low-growing perennial herbs, usually forming relative complete cover. In areas with mild winters, growing occurs throughout the year. Found on permanently moist or wet seeps. Often associated with alkali meadows. Characteristic species include: *Distichlis spicata* var. *stricta, Najas marina, Nitrophila occidentalis, Potamogeton latifolius, P. pectinatus, Ruppia maritime, Zannichellia palustris.* Distribution is scattered throughout the desert regions of California and is less common in other areas (Holland 1986).	Yes. See text.
Cismontane alkali marsh	--	--/ --	2	A somewhat salty marsh with standing water or saturated soils present during most or all of the year. Dominated by perennial, emergent, herbaceous monocots. Most growth and flowering occurs in summer (Holland 1986).	No. This community type does not occur in the BSA.
Coastal and Valley Freshwater Marsh	--/ --	--/ --	2	A permanently flooded freshwater marsh dominated by emergent perennial monocots 4 to 5 ft tall. Often lacks a significant current that allows deep, peaty soils to accumulate. Characteristic species include *Carex* sp., *Eleocharis* sp., *Scirpus* sp., *Typha* sp., and *Verbena bonariensis*. Most extensive in the upper portion of the Sacramento-San Joaquin River Delta. Commonly occurs in the Sacramento and San Joaquin valleys in river oxbows and other flood plain areas (Holland 1986).	No. This community type does not occur in the BSA.
Northern claypan vernal pool	--/--	--/ --	2	A low, amphibious, herbaceous, emergent wetland community dominated by annual herbs and grasses. Pools may be small or quite large. Intergrades with cismontane swale with cismontane alkali marsh, which has water present throughout the year. Typical species include *Allocarya* sp., *Boisduvalia glabella, Cressa truxillensis*, *Downingia* sp., *Eryngium aristulatum*, *Lasthenia* sp., *Plagiobothrys leptocladus, P. stipitatus* var. *stipitatus*, and *Spergularia marina* (Holland 1986).	No. This community type does not occur in the BSA.
Sycamore Alluvial Woodland	--/ --	--/ --	2	Open to moderately closed, winter-deciduous broadleaved riparian woodland dominated by well-spaced *Platanus racemosa* trees. Understory consists of nonnative grasses or *Baccharis viminea*. Occurs along channels of intermittent streams, usually with rocky substrates (Holland 1986).	No. This community type does not occur in the BSA.
Valley needlegrass grassland	--/--	--/--	2	Dominated by the perennial tussock-forming bunchgrass *Nassella pulchra* with annuals occurring between bunches. Usually on fine-textured (often clay) soils, moist or waterlogged in winter, but very dry in summer. Often intergrades with Oak Woodlands on moister, better-drained sites. Historically extensively occurred around Sacramento, San Joaquin, and Salinas valleys, as well as the Los Angeles Basin. Range is now greatly reduced (Holland 1986).	Yes. See text.

Valley sink scrub				An open to dense shrubland dominated by alkali-tolerant chenopods, specifically *Allenrolfea occidentalis* or *Sueda* sp. Sparse herbaceous cover dominated by *Bromus rubens* develop occasionally. Understory usually lacking. Soils are heavy, saline and/or alkaline clays of lakebeds or playas. Soil surfaces have a white salty crust over dark, sticky clay. Intergradation occurs on less severe sites with Valley Saltbrush Scrub. Historically surrounded the large San Joaquin Valley lakes (Kern, Buena, Vista, Tulare, Goose) and north along the trough of the San Joaquin Valley through Merced County to the grasslands of the Sacramento Valley (Solano to Glenn County, west of the Sacramento River). Essentially extirpated due to flood control, agricultural development, and ground water pumping (Holland 1986).	No. This community type does not occur in the BSA.

[a] **Listing Status** Federal status determined from USFWS letter (USFWS 2010a and b). State status determined from DFG (2010a, b, and c). Codes used in table are:
E = Endangered; **T** = Threatened; **P** = Proposed; **C** = Candidate; **R** = California Rare; ***** = Possibly extinct.

[b] **Other Codes** CNPS (2010); BLM. Codes used in table are as follows:
CNPS List (plants only): **1A** = Presumed Extinct in CA; **1B** = Rare or Endangered (R/E) in CA and elsewhere; **2** = R/E in CA and more common elsewhere; **3** = Need more information; **4** = Plants of limited distribution

CNPS List Decimal Extensions: .1 = Seriously endangered in California (over 80% of occurrences threatened / high degree and immediacy of threat); **.2** = Fairly endangered in CA (20-80% of occurrences threatened); **.3 =** Not very endangered in CA (< 20% of occurrences threatened or no current threats known).

[c] **Sources** **1** = From USFWS letter (USFWS 2010a and b). **2** = From CNDDB. **3** = Observed or included by Sycamore Environmental (Sycamore Environmental 2009).

APPENDIX E

DEIR Air Quality Appendix C

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	Estimated Daily Emissions (pounds/year)				
Construction Activity	**ROG**	**NOx**	**CO**	**PM10**	**PM2.5**
Existing Turbine Removal and Restoration of Turbine Sites	11.77	108.80	36.48	4.02	3.69
Road, Pad, and Collector Line Construction	45.07	411.48	141.04	16.57	15.25
Batch Plant	1.55	18.08	5.15	0.57	0.53
Turbine Installation	3.88	36.12	12.23	1.33	1.23
Restoration of Temporary Roads and Temporary Disturbance Areas	3.42	33.31	10.31	1.20	1.11
Off-site Vehicle Trips	11.66	110.38	92.52	5.01	4.61
Total (average pounds/day)	77.36	718.17	297.73	28.71	26.41
Proposed BAAQMD Significance Threshold	54	54	NA	82	54

	~~**58.94**~~	~~**565.42**~~	~~222.75~~	~~21.56~~	~~19.84~~
	77.36	**718.17**	**297.73**	**28.71**	**26.41**
	1.312521	1.270153	1.336611	1.331633	1.331149

	Estimated Daily Emissions (tons/year)				
Construction Activity	**ROG**	**NOx**	**CO**	**PM10**	**PM2.5**
Off-site Vehicle Trips	0.70	8.34	5.39	0.38	0.35
Total	0.70	8.34	5.39	0.38	0.35
SJVAPCD Signficance Threshold	25	25	NA	15	NA

	Estimated Total Emissions (metric tons/year)			
Construction Activity	**CO2**	**CH4**	**N2O**	**CO2e**
Existing Turbine Removal and Restoration of Turbine Sites	1,297.70	0.10	0.03	1,309.91
Road, Pad, and Collector Line Construction	4,478.63	0.39	0.11	4,521.67
Batch Plant	218.83	0.01	0.01	220.80
Turbine Installation	428.51	0.03	0.01	432.54
Restoration of Temporary Roads and Temporary Disturbance Areas	375.66	0.03	0.01	379.20
Water Use - Indirect Emissions	17.82	0.03	0.08	17.93
Off-site Vehicle Trips	2,547.42	0.01	0.02	2,552.91
Total	9,364.57	0.61	0.27	9,434.97
Amoratized (30 years)	312.15	0.02	0.01	314.50

ONROAD CRITERIA POLLUTANT EMISSIONS

Emission Factors

Vehicle Type	Running Exhaust Emission Factors (pounds/mile)					Starting Emission Factors (pounds/trip)				
	ROG	NOx	CO	PM10	PM2.5	ROG	NOx	CO	PM10	PM2.5
Light duty truck - 15 mph	0.0003	0.0012	0.0077	0.0001	0.0001	0.0021	0.0019	0.0308	4.409E-05	4.409E-05
Light duty truck - 25 mph	0.0001	0.0010	0.0064	0.0001	0.0001					
Light duty truck - 65 mph	0.0001	0.0010	0.0038	0.0000	0.0000					
Heavy duty truck -15 mph	0.0061	0.0384	0.0242	0.0019	0.0017	0.0179	0.0240	0.3031	1.764E-05	1.764E-05
Heavy duty truck -25 mph	0.0027	0.0316	0.0150	0.0011	0.0010					
Heavy duty truck -65 mph	0.0021	0.0311	0.0110	0.0014	0.0013					

Note: used EMFAC 2007, for model years 1985 through 2011.

Average Daily Construction Emissions in BAAQMD (average pounds/day)

Vehicle Type	Trips/proj	miles/trip	ROG	NOx	CO	PM10	PM2.5
Light duty truck - 15 mph	12840	1	57.63	63.80	890.82	2.63	2.52
Light duty truck - 25 mph	12840	1	1.84	12.65	82.32	0.82	0.76
Light duty truck - 65 mph	12840	23	28.65	291.02	1108.75	13.67	12.69
Heavy duty truck -15 mph	16510	4	699.35	2928.41	6602.87	125.79	115.75
Heavy duty truck -25 mph	16510	1	44.62	520.92	247.54	18.27	16.81
Heavy duty truck -65 mph	16150	29	989.15	14543.01	5158.46	677.33	623.15
Heavy duty truck -15 mph	5,850	6	424.20	1626.50	4395.99	66.91	61.57
Heavy duty truck -25 mph	5,850	1	15.81	184.58	87.71	6.47	5.96
Heavy duty truck -65 mph	5,850	19	234.75	3451.38	1224.22	160.75	147.89
Total Average Daily Emissions	NA	NA	11.66	110.38	92.52	5.01	4.61

104

All trips per day are roundtrips. The light-duty truck trips represent 60 daily trips, for 214 days.
The heavy-duty truck trip amount is the total project trip amount (16,510).
It is assumed that each light-duty trip would include 1.0 mile of 15 mph travel (ridge line) and 1.0 mile of 25 mph travel (access roads).
It is assumed that each heavy-duty trip would include 4.0 miles of 15 mph travel (ridge line) and 1.0 mile of 25 mph travel (access roads).
Average truck round-trip length from the Alameda/San Joaquin County line to the site is 34 miles.
It is assumed that there would be an average of 32.5 trips (the maximum daily trips would be 65) per day for approximately 180 days (total of 5,850 tanker trips).
Water tanker truck round trips are assumed to be 26 miles.
The emissions for 15 mph include the start-up emissions.

Daily Construction Emissions in SJVAPCD (tons/year)

Vehicle Type	Trips/year	miles/trip	ROG	NOx	CO	PM10	PM2.5
Heavy duty truck -65 mph	10,000	16	517.42	5207.76	4793.32	231.57	213.06
Heavy duty truck -65 mph	6,510	56	886.80	11476.09	5988.53	527.34	485.17
Total	NA	NA	0.70	8.34	5.39	0.38	0.35

It is assumed that all light-duty truck trips would occur in the BAAQMD; i.e., no light-duty truck trips would originate from San SJVAPCD.
Average round-truck trip length from the Port of Stockton to the Alameda/San Joaquin County line is 56 miles.
Average round-truck trip length from the Tracey to the Alameda/San Joaquin County line is 16 miles.
The emissions include start-up emissions; it is assumed that each round-trip would result in one start-up in SJV.

ONROAD GREENHOUSE GAS EMISSIONS

Emission Factors

Vehicle Type	Running Exhaust Emission Factors (pounds/mile)			Starting Emission Factors (pounds/start-up)		
	CO2	CH4	N2O	CO2	CH4	N2O
Light duty truck - 15 mph	1.5504	0.0002	0.0001	0.0249	2.898E-06	1.873E-06
Light duty truck - 25 mph	1.0666	0.0001	0.0001			
Light duty truck - 65 mph	1.0567	0.0000	0.0001			
Heavy duty truck -15 mph	5.5704	0.0000	0.0000	0.2419	5.873E-07	6.241E-07
Heavy duty truck -25 mph	4.3574	0.0000	0.0000			
Heavy duty truck -65 mph	3.6664	0.0000	0.0000			

Note: used EMFAC 2007, for model years 1989 through 2009; average of speeds 25 mph and 55 mph.

Annual Construction On-road Emissions (pounds and metric tons/year)

Vehicle Type	Trips/year	miles/trip	CO2	CH4	N2O	CO2e
Light duty truck - 15 mph	12,840	1	20,546.07	2.39	1.55	21,058.49
Light duty truck - 25 mph	12,840	1	13,695.29	1.50	1.03	14,034.64
Light duty truck - 65 mph	12,840	23	312,058.06	0.00	23.47	319,005.58
Heavy duty truck -15 mph	6,510	4	148,202.53	0.36	0.38	148,324.00
Heavy duty truck -25 mph	6,510	1	28,366.82	0.07	0.07	28,390.07
Heavy duty truck -65 mph	6,510	45	1,074,086.06	2.61	2.77	1,074,966.40
Heavy duty truck -15 mph	10,000	4	227,653.66	0.55	0.59	227,840.25
Heavy duty truck -25 mph	10,000	1	43,574.23	0.11	0.11	43,609.94
Heavy duty truck -65 mph	10,000	85	3,116,481.15	7.57	8.04	3,119,035.48
Heavy duty truck -15 mph	5,850	6	198,351.24	0.48	0.51	198,513.81
Heavy duty truck -25 mph	5,850	1	25,490.92	0.06	0.07	25,511.82
Heavy duty truck -65 mph	5,850	19	407,525.74	0.99	1.05	407,859.76
Total (metric tons)			2,547.42	0.01	0.02	2,552.91

For light duty truck trips (commuting workers), it is assumed that an average of 60 trips a day for 214 days would be required (at total of 12,840 trips). It is assumed that commuting worker round-trips would average 25 miles and 23 of the miles would occur at a speed of 65 miles/hour, and 1 mile would occur at a speed of 25 miles per hour, and 1 mile at a speed of 15 miles per hour. For heavy duty truck trips (equipment and material deliveries), it is assumed that an average of 6,510 round trips would be required from the Port of Stockton (round-trip = 90 miles). It is assumed that 85 miles of the trip would be at 65 mph, 1 mile would be at 25 mph, and 4 miles would occur at a speed of 15 miles per hour.

The other heavy truck trips (10,000) would come from Tracy, estimated to be 50 mile-round trip

It is assumed that there would be an average of 32.5 trips (the maximum daily trips would be 65) per day for approximately 180 days (total of 5,850 tanker trips). Water tanker truck round trips are assumed to be 26 miles.

The emissions for 15 mph include the start-up emissions, each round-trip would generate two start-ups.

Notes: 0.907194 metric tons = 1 ton; 2000 pounds = 1 ton.

Global Warming Potential for CH4 = 23; GWP for N2O = 296.

Gasoline emission of GHG

483.815	g CO2/mile	Offroad at 25 mph
0.0563	g CH4/mile	(CCAR, 2009)
0.03639	g NO2/mile	(CCAR, 2009)
CH4 emissions =	0.000116	ratio of CH4 emission to CO2 Emissions
N2O emissions =	0.000075	ratio of N20 emission to CO2 Emissions

Diesel emission of GHG (CCAR, 2009)

1976.527	g CO2/mile	Offroad at 25 mph
0.0048	g CH4/mile	(CCAR, 2009)
0.0051	g NO2/mile	(CCAR, 2009)
CH4 emissions =	0.000002	ratio of CH4 emission to CO2 Emissions
N2O emissions =	0.000003	ratio of N20 emission to CO2 Emissions

References:

California Climate Action Registry, General Reporting Protocol, Reporting Entity-Wide Greenhouse Gas Emissions, Version 3.1, January 2009. Tables C.3 and C.6.

Gasoline emissions are averaged for vehicle models from 1985 to present.

Title: Vasco On-road Emissions
Version: Emfac2007 V2.3, November 1 2006
Run Date: 4/23/2010 20:03:19
Scen Year: 2011 -- All model years in the range 1985 to 2011 selected
Season: Annual
Area: Contra Costa
****
Year: 2011 -- Model Years 1985 to 2011 Inclusive -- Annual
Version: Emfac2007 V2.3, November 1 2006
County Average Contra Costa County Average
Table 1:00 Running Exhaust Emissions (grams/mile)

Pollutant Name: Reactive Org Gases; Temperature 50 F; Relative Humidity 60%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
15	0	0.124	0	2.768	0	0	0.315
25	0	0.065	0	1.226	0	0	0.149
65	0	0.044	0	0.958	0	0	0.11

Pollutant Name: Carbon Monoxide; Temperature 50 F; Relative Humidity 60%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
15	0	3.514	0	10.98	0	0	4.055
25	0	2.908	0	6.801	0	0	3.19
65	0	1.703	0	4.996	0	0	1.941

Pollutant Name: Oxides of Nitrogen; Temperature 50 F; Relative Humidity 60%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
15	0	0.548	0	17.398	0	0	1.77
25	0	0.447	0	14.312	0	0	1.452
65	0	0.447	0	14.085	0	0	1.436

Pollutant Name: Carbon Dioxide; Temperature 50 F; Relative Humidity 60%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
15	0	703.239	0	2526.74	0	0	835.462
25	0	483.815	0	1976.527	0	0	592.053
65	0	479.309	0	1663.101	0	0	565.147

Pollutant Name: Sulfur Dioxide; Temperature 50 F; Relative Humidity 60%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
15	0	0.007	0	0.024	0	0	0.008
25	0	0.005	0	0.019	0	0	0.006
65	0	0.005	0	0.016	0	0	0.005

Pollutant Name: Particulate Matter (PM10); Temperature 50 F; Relative Humidity 60%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
15	0	0.053	0	0.862	0	0	0.111
25	0	0.029	0	0.502	0	0	0.063
65	0	0.021	0	0.656	0	0	0.067

Pollutant Name: Gasoline - mi/gal; Temperature 50 F; Relative Humidity 60%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
15	0	12.484	0	6.752	0	0	12.462
25	0	18.125	0	11.606	0	0	18.101
65	0	18.369	0	11.267	0	0	18.342

Pollutant Name: Diesel - mi/gal; Temperature 50 F; Relative Humidity 60%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
15	0	29.156	0	3.883	0	0	4.402
25	0	29.156	0	4.935	0	0	5.432
65	0	29.156	0	5.889	0	0	6.367

Pollutant Name: Particulate Matter (PM10) - Tire Wear; Temperature 50 F; Relative Humidity 60%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
15	0	0.008	0	0.035	0	0	0.01
25	0	0.008	0	0.035	0	0	0.01
65	0	0.008	0	0.035	0	0	0.01

Pollutant Name: Particulate Matter (PM10) - Break Wear; Temperature 50 F; Relative Humidity 60%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
15	0	0.013	0	0.028	0	0	0.014
25	0	0.013	0	0.028	0	0	0.014
65	0	0.013	0	0.028	0	0	0.014

Title: Vasco On-road Emissions

Version: Emfac2007 V2.3, November 1 2006
Run Date: 4/23/2010 20:03:19
Scen Year: 2011 -- All model years in the range 1985 to 2011 selected
Season: Annual
Area: Contra Costa
****
Year: 2011 -- Model Years 1985 to 2011 Inclusive -- Annual
Version: Emfac2007 V2.3, November 1 2006
County Average Contra Costa County Average
Table 2:00 Starting Emissions (grams/trip)

Pollutant Name: Reactive Org Gases; Temperature 50 F; Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0	0.079	0	0.941	0	0	0.1
10	0	0.156	0	1.835	0	0	0.196
20	0	0.298	0	3.479	0	0	0.375
30	0	0.428	0	4.931	0	0	0.537
40	0	0.545	0	6.193	0	0	0.681
50	0	0.649	0	7.263	0	0	0.808
60	0	0.74	0	8.142	0	0	0.918
120	0	0.956	0	6.585	0	0	1.091
180	0	0.603	0	6.987	0	0	0.757
240	0	0.639	0	7.376	0	0	0.801
300	0	0.674	0	7.753	0	0	0.845
360	0	0.709	0	8.116	0	0	0.887
420	0	0.743	0	8.467	0	0	0.929
480	0	0.776	0	8.806	0	0	0.969
540	0	0.808	0	9.131	0	0	1.009
600	0	0.84	0	9.444	0	0	1.047
660	0	0.871	0	9.744	0	0	1.085
720	0	0.902	0	10.031	0	0	1.121

Pollutant Name: Carbon Monoxide; Temperature 50 F; Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0	1.022	0	14.755	0	0	1.353
10	0	2.013	0	28.91	0	0	2.66
20	0	3.896	0	55.422	0	0	5.135
30	0	5.65	0	79.536	0	0	7.427
40	0	7.275	0	101.252	0	0	9.535
50	0	8.77	0	120.569	0	0	11.459
60	0	10.136	0	137.489	0	0	13.2
120	0	13.978	0	84.533	0	0	15.675
180	0	8.273	0	87.004	0	0	10.166
240	0	8.803	0	89.556	0	0	10.745
300	0	9.285	0	92.19	0	0	11.279
360	0	9.718	0	94.906	0	0	11.767

420	0	10.103	0	97.703	0	0	12.21
480	0	10.439	0	100.581	0	0	12.607
540	0	10.726	0	103.541	0	0	12.959
600	0	10.965	0	106.582	0	0	13.265
660	0	11.156	0	109.705	0	0	13.526
720	0	11.297	0	112.909	0	0	13.741

Pollutant Name: Oxides of Nitrogen; Temperature 50 F; Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0	0.448	0	2.521	0	0	0.498
10	0	0.498	0	3.799	0	0	0.577
20	0	0.587	0	6.043	0	0	0.719
30	0	0.662	0	7.871	0	0	0.835
40	0	0.722	0	9.284	0	0	0.928
50	0	0.767	0	10.281	0	0	0.996
60	0	0.797	0	10.864	0	0	1.039
120	0	0.853	0	11.11	0	0	1.1
180	0	0.914	0	11.07	0	0	1.158
240	0	0.908	0	11.007	0	0	1.151
300	0	0.898	0	10.923	0	0	1.139
360	0	0.884	0	10.818	0	0	1.123
420	0	0.866	0	10.691	0	0	1.103
480	0	0.845	0	10.542	0	0	1.079
540	0	0.821	0	10.372	0	0	1.05
600	0	0.792	0	10.18	0	0	1.018
660	0	0.76	0	9.967	0	0	0.981
720	0	0.724	0	9.732	0	0	0.941

Pollutant Name: Carbon Dioxide; Temperature 50 F; Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0	13.751	0	4.629	0	0	13.531
10	0	16.239	0	9.232	0	0	16.07
20	0	21.726	0	18.361	0	0	21.645
30	0	27.893	0	27.388	0	0	27.881
40	0	34.741	0	36.313	0	0	34.778
50	0	42.269	0	45.135	0	0	42.338
60	0	50.477	0	53.854	0	0	50.558
120	0	110.888	0	91.597	0	0	110.424
180	0	126.711	0	108.215	0	0	126.267
240	0	142.32	0	123.852	0	0	141.876
300	0	157.713	0	138.509	0	0	157.251
360	0	172.892	0	152.184	0	0	172.394
420	0	187.856	0	164.879	0	0	187.303
480	0	202.605	0	176.593	0	0	201.979
540	0	217.139	0	187.326	0	0	216.422
600	0	231.459	0	197.078	0	0	230.632

660	0	245.563	0	205.849	0	0	244.608
720	0	259.453	0	213.64	0	0	258.351

Pollutant Name: Sulfur Dioxide; Temperature 50 F; Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0	0	0	0	0	0	0
10	0	0	0	0.001	0	0	0
20	0	0	0	0.001	0	0	0
30	0	0	0	0.002	0	0	0
40	0	0	0	0.002	0	0	0
50	0	0.001	0	0.002	0	0	0.001
60	0	0.001	0	0.003	0	0	0.001
120	0	0.001	0	0.002	0	0	0.001
180	0	0.001	0	0.003	0	0	0.001
240	0	0.002	0	0.003	0	0	0.002
300	0	0.002	0	0.003	0	0	0.002
360	0	0.002	0	0.003	0	0	0.002
420	0	0.002	0	0.003	0	0	0.002
480	0	0.002	0	0.003	0	0	0.002
540	0	0.002	0	0.004	0	0	0.002
600	0	0.002	0	0.004	0	0	0.002
660	0	0.003	0	0.004	0	0	0.003
720	0	0.003	0	0.004	0	0	0.003

Pollutant Name: Particulate Matter (PM10); Temperature 50 F; Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0	0.001	0	0.001	0	0	0.001
10	0	0.003	0	0.002	0	0	0.003
20	0	0.005	0	0.003	0	0	0.005
30	0	0.007	0	0.005	0	0	0.007
40	0	0.009	0	0.006	0	0	0.009
50	0	0.011	0	0.007	0	0	0.011
60	0	0.013	0	0.008	0	0	0.013
120	0	0.02	0	0.011	0	0	0.02
180	0	0.021	0	0.011	0	0	0.021
240	0	0.023	0	0.012	0	0	0.023
300	0	0.024	0	0.012	0	0	0.024
360	0	0.025	0	0.012	0	0	0.025
420	0	0.026	0	0.013	0	0	0.026
480	0	0.027	0	0.013	0	0	0.027
540	0	0.028	0	0.014	0	0	0.028
600	0	0.029	0	0.014	0	0	0.028
660	0	0.029	0	0.014	0	0	0.029
720	0	0.029	0	0.015	0	0	0.029

Activity/Equipment	Quantity	Horsepower	Usage			Total Const Workdays	Equipment Emission Rates (lb/hour)					Daily Emissions (lb/day)				
			hrs/day	days/proj	hrs/proj		ROG	NOx	CO	PM10	PM2.5	ROG	NOx	CO	PM10	PM2.5
Existing Turbine Removal and Restoration of Turbine Sites																
Crane	3	500	8	120	960	214	0.172	1.645	0.613	0.063	0.058	2.32	22.14	8.25	0.84	0.78
Lowboy/Truck/Trailer	3	500	8	120	960	214	0.237	2.123	0.706	0.078	0.072	3.19	28.57	9.49	1.06	0.97
Excavator	3	400	8	120	960	214	0.168	1.601	0.498	0.057	0.052	2.26	21.54	6.71	0.77	0.71
Grader	1	350	8	120	960	214	0.182	1.780	0.564	0.066	0.060	0.82	7.98	2.53	0.29	0.27
Dump Truck	3	500	8	120	960	214	0.237	2.123	0.706	0.078	0.072	3.19	28.57	9.49	1.06	0.97
											Subtotal	**11.77**	**108.80**	**36.48**	**4.02**	**3.69**
Road, Pad, and Collector Line Construction																
Road Grader	3	350	8	180	1440	214	0.182	1.780	0.564	0.066	0.060	3.67	35.93	11.39	1.32	1.22
Track Type Dozer	3	350	8	180	1440	214	0.298	2.606	1.098	0.112	0.103	6.02	52.61	22.16	2.26	2.08
Drum Type Compactor	3	250	8	180	1440	214	0.143	1.512	0.429	0.055	0.050	2.90	30.53	8.67	1.10	1.02
Water Truck*	13	350	6.3	180	1134	214	0.187	1.731	0.527	0.062	0.057	12.90	119.28	36.33	4.28	3.94
Diesel Pumps	5	71	9	180	1620	214	0.129	0.850	0.504	0.069	0.063	4.88	32.19	19.08	2.60	2.40
Lowboy/Truck/Trailer	3	500	8	180	1440	214	0.237	2.123	0.706	0.078	0.072	4.78	42.85	14.24	1.58	1.46
Backhoe/Front Loader	2	350	8	180	1440	214	0.179	1.830	0.553	0.063	0.058	2.42	24.63	7.45	0.85	0.78
Excavator	2	350	8	180	1440	214	0.157	1.520	0.457	0.053	0.049	2.12	20.46	6.16	0.72	0.66
Rock Crusher	1	350	8	180	1440	214	0.239	2.684	0.732	0.088	0.081	1.61	18.06	4.93	0.59	0.54
Cement Trucks	3	335	8	180	1440	214	0.187	1.731	0.527	0.062	0.057	3.78	34.95	10.65	1.26	1.15
Subtotal											Subtotal	**45.07**	**411.48**	**141.04**	**16.57**	**15.25**
Batch Plant																
Backhoe/Front Loader	1	350	8	120	960	214	0.179	1.830	0.553	0.063	0.058	0.81	8.21	2.48	0.28	0.26
Generator	1	350	8	120	960	214	0.166	2.199	0.596	0.064	0.059	0.75	9.87	2.67	0.29	0.26
Subtotal											Subtotal	**1.55**	**18.08**	**5.15**	**0.57**	**0.53**
Turbine Installation																
Crane	2	500	8	90	720	214	0.172	1.645	0.613	0.063	0.058	1.16	11.07	4.13	0.42	0.39
Lowboy/Truck/Trailer	2	500	8	90	720	214	0.237	2.123	0.706	0.078	0.072	1.59	14.28	4.75	0.53	0.49
Excavator	2	400	8	90	720	214	0.168	1.601	0.498	0.057	0.052	1.13	10.77	3.35	0.38	0.35
Subtotal											Subtotal	**3.88**	**36.12**	**12.23**	**1.33**	**1.23**
Restoration of Temporary Roads and Temporary Disturbance Areas																
Road Grader	3	350	8	90	720	214	0.182	1.780	0.564	0.066	0.060	1.83	17.96	5.69	0.66	0.61
Excavator	3	350	8	90	720	214	0.157	1.520	0.457	0.053	0.049	1.59	15.34	4.62	0.54	0.50
											Subtotal	**3.42**	**33.31**	**10.31**	**1.20**	**1.11**
											Total Daily Average Equipment Emissions =	**65.69**	**607.79**	**205.21**	**23.69**	**21.80**

Note: PM10 and PM2.5 emissions are based on PM emissions factors from the Offroad model
with PM10 and PM2.5 fractions applied to the PM EF (SCAQMD, 2006)

Total annual construction emissions are divided by the number of total construction workdays for the daily average emissions.

It is assumed that water trucks would be turned off while filling, which would be approximatley 30% (4/13) of the time = 9 x 0.62 = 6.3 hours

*To reflect the revised project description related to water use, the amount of water trucks has increased from 2 water trucks per day to 13 water trucks per day.

References:

SCAQMD (South Coast Air Quality Management District). 2006. Final Methodology to Calculate
PM2.5 and PM2.5 Signficance Thresholds, Appendix A - Updated CEIDARS Table with PM2.5 Fractions.

CY	Equipment	Fuel	MaxHP	Class	C/R	Pre	Hand	Port	County	Air Basin	Air Dist.	Population	Activity	Consumption gal/day	Diesel Consumption gal/hour	ROG Exhaust		CO Exhaust		NOX Exhaust		CO2 Exhaust		SO2 Exhaust		PM Exhaust		CH4 Exhaust	
																	lb/hour		lb/hour		lb/hour		lb/hour		lb/hour		lb/hour		lb/hour
2011	Pavers	D	500	Construction and Mining Equipment	U	N	NHH	NP	Contra Costa	SF	BA	3.49E+00	7.98E+00	8.47E+01	**10.61**	9.96E-04	**0.25**	4.29E-03	**1.08**	9.50E-03	**2.38**	9.30E-01	**233.083**	9.13E-06	**0.002**	3.80E-04	**0.095**	8.99E-05	**0.023**
2011	Rollers	D	250	Construction and Mining Equipment	U	N	NHH	NP	Contra Costa	SF	BA	1.06E+01	2.05E+01	1.42E+02	**6.93**	1.47E-03	**0.14**	4.40E-03	**0.43**	1.55E-02	**1.51**	1.56E+00	**152.195**	1.76E-05	**0.002**	5.61E-04	**0.055**	1.33E-04	**0.013**
2011	Rollers	D	500	Construction and Mining Equipment	U	N	NHH	NP	Contra Costa	SF	BA	7.46E+00	1.43E+01	1.43E+02	**10.00**	1.34E-03	**0.19**	5.19E-03	**0.73**	1.39E-02	**1.94**	1.57E+00	**219.580**	1.54E-05	**0.002**	5.13E-04	**0.072**	1.21E-04	**0.017**
2011	Scrapers	D	500	Construction and Mining Equipment	U	N	NHH	NP	Contra Costa	SF	BA	4.23E+01	1.29E+02	1.89E+03	**14.65**	2.25E-02	**0.35**	9.06E-02	**1.40**	2.07E-01	**3.21**	2.07E+01	**320.930**	2.04E-04	**0.003**	8.30E-03	**0.129**	2.03E-03	**0.031**
2011	Trenchers	D	500	Construction and Mining Equipment	U	N	NHH	NP	Contra Costa	SF	BA	2.25E+00	3.90E+00	5.53E+01	**14.18**	6.42E-04	**0.33**	2.95E-03	**1.51**	6.25E-03	**3.21**	6.07E-01	**311.282**	5.95E-06	**0.003**	2.50E-04	**0.128**	5.80E-05	**0.030**
2011	Bore/Drill Rigs	D	500	Construction and Mining Equipment	U	N	NHH	P	Contra Costa	SF	BA	7.85E+00	1.81E+01	2.55E+02	**14.09**	1.28E-03	**0.14**	5.02E-03	**0.55**	1.35E-02	**1.49**	2.82E+00	**311.602**	2.77E-05	**0.003**	4.72E-04	**0.052**	1.16E-04	**0.013**
2011	Excavators	D	250	Construction and Mining Equipment	U	N	NHH	NP	Contra Costa	SF	BA	1.31E+02	5.12E+02	3.68E+03	**7.19**	3.50E-02	**0.14**	9.62E-02	**0.38**	3.48E-01	**1.36**	4.06E+01	**158.594**	4.56E-04	**0.002**	1.19E-02	**0.046**	3.16E-03	**0.012**
2011	Excavators	D	350	Construction and Mining Equipment	U	N	NHH	NP	Contra Costa	SF	BA				**8.55**		**0.16**		**0.46**		**1.52**		**188.598**		**0.002**		**0.053**		**0.014**
2011	Excavators	D	400	Construction and Mining Equipment	U	N	NHH	NP	Contra Costa	SF	BA				**9.23**		**0.17**		**0.50**		**1.60**		**203.600**		**0.002**		**0.057**		**0.015**
2011	Excavators	D	500	Construction and Mining Equipment	U	N	NHH	NP	Contra Costa	SF	BA	9.45E+01	3.69E+02	3.91E+03	**10.60**	3.48E-02	**0.19**	1.07E-01	**0.58**	3.25E-01	**1.76**	4.31E+01	**233.604**	4.23E-04	**0.002**	1.18E-02	**0.064**	3.14E-03	**0.017**
2011	Cranes	D	500	Construction and Mining Equipment	U	N	NHH	P	Contra Costa	SF	BA	1.17E+01	4.11E+01	3.36E+02	**8.18**	3.54E-03	**0.17**	1.26E-02	**0.61**	3.38E-02	**1.64**	3.70E+00	**180.049**	3.63E-05	**0.002**	1.29E-03	**0.063**	3.20E-04	**0.016**
2011	Graders	D	250	Construction and Mining Equipment	U	N	NHH	NP	Contra Costa	SF	BA	8.74E+01	2.28E+02	1.78E+03	**7.81**	1.90E-02	**0.17**	5.37E-02	**0.47**	1.89E-01	**1.66**	1.96E+01	**171.930**	2.21E-04	**0.002**	6.87E-03	**0.060**	1.71E-03	**0.015**
2011	Graders	D	350	Construction and Mining Equipment	U	N	NHH	NP	Contra Costa	SF	BA				**8.85**		**0.18**		**0.56**		**1.78**		**194.817**		**0.002**		**0.066**		**0.016**
2011	Graders	D	500	Construction and Mining Equipment	U	N	NHH	NP	Contra Costa	SF	BA	2.47E+00	6.45E+00	6.71E+01	**10.40**	6.59E-04	**0.20**	2.27E-03	**0.70**	6.33E-03	**1.96**	7.39E-01	**229.147**	7.26E-06	**0.002**	2.37E-04	**0.073**	5.95E-05	**0.018**
2011	Off-Highway Trucks	D	250	Construction and Mining Equipment	U	N	NHH	NP	Contra Costa	SF	BA	2.12E+01	1.16E+02	8.73E+02	**7.53**	8.95E-03	**0.15**	2.37E-02	**0.41**	8.53E-02	**1.47**	9.62E+00	**165.862**	1.08E-04	**0.002**	2.98E-03	**0.051**	8.08E-04	**0.014**
2011	Off-Highway Trucks	D	350	Construction and Mining Equipment	U	N	NHH	NP	Contra Costa	SF	BA				**9.45**		**0.19**		**0.53**		**1.73**		**208.474**		**0.002**		**0.062**		**0.017**
2011	Off-Highway Trucks	D	500	Construction and Mining Equipment	U	N	NHH	NP	Contra Costa	SF	BA	2.98E+01	1.63E+02	2.01E+03	**12.33**	1.93E-02	**0.24**	5.75E-02	**0.71**	1.73E-01	**2.12**	2.22E+01	**272.393**	2.18E-04	**0.003**	6.39E-03	**0.078**	1.74E-03	**0.021**
2011	Crushing/Proc. Equipment	D	250	Construction and Mining Equipment	U	N	NHH	P	Contra Costa	SF	BA	8.38E-01	2.20E+00	2.43E+01	**11.05**	2.28E-04	**0.21**	6.40E-04	**0.58**	2.59E-03	**2.35**	2.68E-01	**243.636**	3.02E-06	**0.003**	8.27E-05	**0.075**	2.06E-05	**0.019**
2011	Crushing/Proc. Equipment	D	350	Construction and Mining Equipment	U	N	NHH	P	Contra Costa	SF	BA				**13.37**		**0.24**		**0.73**		**2.68**		**295.214**		**0.003**		**0.088**		**0.022**
2011	Crushing/Proc. Equipment	D	500	Construction and Mining Equipment	U	N	NHH	P	Contra Costa	SF	BA	4.72E+00	1.24E+01	2.09E+02	**16.85**	1.78E-03	**0.29**	5.94E-03	**0.96**	1.97E-02	**3.18**	2.31E+00	**372.581**	2.26E-05	**0.004**	6.61E-04	**0.107**	1.61E-04	**0.026**
2011	Rough Terrain Forklifts	D	500	Construction and Mining Equipment	U	N	NHH	NP	Contra Costa	SF	BA	1.10E+00	3.43E+00	3.99E+01	**11.63**	3.39E-04	**0.20**	1.09E-03	**0.64**	3.46E-03	**2.02**	4.40E-01	**256.560**	4.31E-06	**0.003**	1.21E-04	**0.071**	3.06E-05	**0.018**
2011	Rubber Tired Loaders	D	500	Construction and Mining Equipment	U	N	NHH	NP	Contra Costa	SF	BA	7.61E+01	2.04E+02	2.19E+03	**10.74**	2.10E-02	**0.21**	7.29E-02	**0.71**	2.04E-01	**2.00**	2.41E+01	**236.275**	2.36E-04	**0.002**	7.59E-03	**0.074**	1.89E-03	**0.019**
2011	Rubber Tired Dozers	D	250	Construction and Mining Equipment	U	N	NHH	NP	Contra Costa	SF	BA	1.08E+01	4.84E+01	4.04E+02	**8.35**	6.43E-03	**0.27**	1.80E-02	**0.74**	5.61E-02	**2.32**	4.43E+00	**183.058**	4.99E-05	**0.002**	2.43E-03	**0.100**	5.80E-04	**0.024**
2011	Rubber Tired Dozers	D	350	Construction and Mining Equipment	U	N	NHH	NP	Contra Costa	SF	BA				**9.85**		**0.30**		**1.10**		**2.61**		**215.749**		**0.002**		**0.112**		**0.027**
2011	Rubber Tired Dozers	D	500	Construction and Mining Equipment	U	N	NHH	NP	Contra Costa	SF	BA	1.66E+01	7.44E+01	9.00E+02	**12.10**	1.29E-02	**0.35**	6.06E-02	**1.63**	1.13E-01	**3.04**	9.85E+00	**264.785**	9.66E-05	**0.003**	4.80E-03	**0.129**	1.17E-03	**0.031**
2011	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Contra Costa	SF	BA	2.40E+01	6.37E+01	4.96E+02	**7.79**	4.25E-03	**0.13**	1.23E-02	**0.39**	4.48E-02	**1.41**	5.47E+00	**171.743**	6.15E-05	**0.002**	1.49E-03	**0.047**	3.84E-04	**0.012**
2011	Tractors/Loaders/Backhoes	D	350	Construction and Mining Equipment	U	N	NHH	NP	Contra Costa	SF	BA				**10.92**		**0.18**		**0.55**		**1.83**		**240.521**		**0.003**		**0.063**		**0.016**
2011	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Contra Costa	SF	BA	3.87E+01	1.03E+02	1.61E+03	**15.63**	1.28E-02	**0.25**	4.14E-02	**0.80**	1.27E-01	**2.47**	1.77E+01	**343.689**	1.99E-04	**0.004**	4.51E-03	**0.088**	1.16E-03	**0.023**
2011	Crawler Tractors	D	500	Construction and Mining Equipment	U	N	NHH	NP	Contra Costa	SF	BA	6.98E+01	2.01E+02	2.37E+03	**11.79**	2.80E-02	**0.28**	1.11E-01	**1.10**	2.57E-01	**2.56**	2.60E+01	**258.706**	2.56E-04	**0.003**	1.02E-02	**0.101**	2.52E-03	**0.025**
2011	Other Construction Equipment	D	500	Construction and Mining Equipment	U	N	NHH	NP	Contra Costa	SF	BA	2.01E+01	3.87E+01	4.46E+02	**11.52**	3.09E-03	**0.16**	1.10E-02	**0.57**	3.50E-02	**1.81**	4.92E+00	**254.264**	4.83E-05	**0.002**	1.17E-03	**0.060**	2.79E-04	**0.014**
2011	Generator Sets	D	250	Light Commercial Equipment	U	N	NHH	P	Total	Total	Total	6.48E+00	5.99E+00	5.76E+01	**9.62**	4.26E-04	**0.14**	1.39E-03	**0.46**	5.60E-03	**1.87**	6.36E-01	**212.314**	7.16E-06	**0.002**	1.61E-04	**0.054**	3.85E-05	**0.013**
2011	Generator Sets	D	350	Light Commercial Equipment	U	N	NHH	P	Total	Total	Total				**11.87**		**0.17**		**0.60**		**2.20**		**262.009**		**0.003**		**0.064**		**0.015**
2011	Generator Sets	D	500	Light Commercial Equipment	U	N	NHH	P	Total	Total	Total	1.44E+01	1.33E+01	2.03E+02	**15.25**	1.35E-03	**0.20**	5.30E-03	**0.80**	1.79E-02	**2.69**	2.24E+00	**336.550**	2.20E-05	**0.003**	5.32E-04	**0.080**	1.22E-04	**0.018**
2011	Pumps	D	120	Light Commercial Equipment	U	P	NHH	P	Contra Costa	SF	BA	1.11E+02	1.22E+02	4.36E+02	**3.57**	7.88E-03	**0.13**	3.08E-02	**0.50**	5.20E-02	**0.85**	4.76E+00	**77.879**	5.58E-05	**0.001**	4.20E-03	**0.069**	7.11E-04	**0.012**

Note: emission factors for 350 hp and 400 hp equipment are estimated using ratios associated with the available 250 and 500 hp equipment.

Indirect Water Useage Emissions

Water Demand

50 mill gallons/proj (Source: ~~PD Section 3.4.4~~ Responses to Data Request March 17, 2011)

Water Energy use factor* (CEC, 2005)

1,500 kW-hr/MG

*Includes supply and conveyance, treatment, and distribution.

Water Related Electrical Consumption

75,000 kW-hr/yr
75 MW-hr/yr

Electricity Use Emission Factors (PG&E, 2010 and CCAR, 2009)

	CO2	CH4	N2O
lbs/MW-hr	524	0.0302	0.0081

Electricity Use for Water Emissions

	CO2	CH4	N2O
lb/yr	39,300.00	2.27	0.61
CO2e lb/yr	39,300.00	56.63	179.82
CO2e ton/yr	19.65	0.03	0.09
CO2e MT/yr	17.82	0.03	0.08
Total CO2e MT/yr		**17.93**	

Global Warming Potential for CH4 = 25; GWP for N2O = 296.

Subsequent to the release of the DEIR, anticipated construction water usage has changed from 10.54 million gallons to 50 million gallons.

References:

California Energy Commission (CEC), 2005. California's Water - Energy Relationship Prepared in Suppot of the 2005 Integrated Energy Policy Report Proceeding (04-IEPR-01E), November 2005 (Table 1-3, page 11).

California Climate Action Registry, 2009. General Reporting Protocol, Reporting Entity-Wide Greenhouse Gas Emissions, Version 3.1, January 2009.Tables C.4 and C.7.

Pacific Gas and Electric (PG&E). 2008. Carbon Footprint Calculator website (http://www.pge.com/myhome/environment/calculator/) accessed April 16, 2010.

Activity/Equipment	Quantity	Horsepower	Usage			Equipment Emission Rates (lb/hour)			Annual Emissions (metric tons per year)			
			hrs/day	days/year	hrs/year	CO2	CH4	N2O	CO2	CH4	N2O	CO2e
Existing Turbine Removal and Restoration of Turbine Sites												
Crane	3	500	8	120	960	180.049	0.016	0.00461	235.21	0.02	0.01	237.46
Lowboy/Truck/Trailer	3	500	8	120	960	272.393	0.021	0.00698	355.84	0.03	0.01	359.18
Excavator	3	400	8	120	960	203.600	0.015	0.00522	265.97	0.02	0.01	268.45
Grader	1	350	8	120	960	194.817	0.016	0.00499	84.83	0.01	0.00	85.64
Dump Truck	3	500	8	120	960	272.393	0.021	0.00698	355.84	0.03	0.01	359.18
								Subtotal	**1,297.70**	**0.10**	**0.03**	**1,309.91**
Road, Pad, and Collector Line Construction												
Road Grader	3	350	8	180	1440	194.817	0.016	0.00499	381.75	0.03	0.01	385.38
Track Type Dozer	3	350	8	180	1440	215.749	0.027	0.00553	422.77	0.05	0.01	427.19
Drum Type Compactor	3	250	8	180	1440	152.195	0.013	0.00390	298.23	0.03	0.01	301.08
Water Truck*	13	350	6.3	180	1134	208.474	0.017	0.00534	1,394.05	0.11	0.04	1,407.22
Diesel Pumps	5	71	9	180	1620	77.879	0.012	0.00199	286.14	0.04	0.01	289.29
Lowboy/Truck/Trailer	3	500	8	180	1440	272.393	0.021	0.00698	533.76	0.04	0.01	538.77
Backhoe/Front Loader	2	350	8	180	1440	240.521	0.016	0.00616	314.21	0.02	0.01	317.08
Excavator	2	350	8	180	1440	188.598	0.014	0.00483	246.38	0.02	0.01	248.67
Rock Crusher	1	350	8	180	1440	295.214	0.022	0.00756	192.83	0.01	0.00	194.61
Cement Trucks	3	335	8	180	1440	208.474	0.017	0.00534	408.51	0.03	0.01	412.37
								Subtotal	**4,478.63**	**0.39**	**0.11**	**4,521.67**
Batch Plant												
Backhoe/Front Loader	1	350	8	120	960	240.521	0.016	0.00616	104.74	0.01	0.00	105.69
Generator	1	350	8	120	960	262.009	0.015	0.00671	114.09	0.01	0.00	115.11
								Subtotal	**218.83**	**0.01**	**0.01**	**220.80**
Turbine Installation												
Crane	2	500	8	90	720	180.049	0.016	0.00461	117.60	0.01	0.00	118.73
Lowboy/Truck/Trailer	2	500	8	90	720	272.393	0.021	0.00698	177.92	0.01	0.00	179.59
Excavator	2	400	8	90	720	203.600	0.015	0.00522	132.99	0.01	0.00	134.22
								Subtotal	**428.51**	**0.03**	**0.01**	**432.54**
Restoration of Temporary Roads and Temporary Disturbance Areas												
Road Grader	3	350	8	90	720	194.817	0.016	0.00499	190.88	0.02	0.00	192.69
Excavator	3	350	8	90	720	188.598	0.014	0.00483	184.78	0.01	0.00	186.50
Total equipment count	65							Subtotal	**375.66**	**0.03**	**0.01**	**379.20**
								Total Equipment Emissions	**6,799.33**	**0.58**	**0.17**	**6,864.13**

Notes: 0.907194 metric tons = 1 ton; 2000 pounds = 1 ton.

Global Warming Potential for CH4 = 23; GWP for N2O = 296.

It is assumed that water trucks would be turned off while filling, which would be approximatley 30% (4/13) of the time = 9 x 0.62 = 6.3 hours

*To reflect the revised project description related to water use, the amount and use of water trucks has increased from 2 water trucks, eight hours per day to 13 water trucks per day.

Diesel emission of GHG (CCAR, 2009)

10150 g CO2/gal

0.26 g N2O/gal

N2O emissions = 0.000026 ratio of N20 emission to CO2 Emissions

References:

California Climate Action Registry, General Reporting Protocol, Reporting Entity-Wide Greenhouse Gas Emissions, Version 3.1, January 2009. Tables C.3 and C.6.

Energy Displaced From the Electrical Grid

	MW-hrs
Proposed	141,000
Existing	94,000
Change	47,000

Electricity Use Emission Factors (PG&E, 2010 and CCAR, 2009)

	CO2	CH4	N2O
lbs/MW-hr	524	0.0302	0.0081

Emission Reduction (GHG Avoided)

	CO2	CH4	N2O
lb/yr	24,628,000	1,419	381
CO2e lb/yr	24,628,000	35,485	112,687
CO2e ton/yr	12,314	18	56
CO2e MT/yr	11,169	16	51
Total CO2e MT/yr		**11,236**	

Global Warming Potential for CH4 = 25; GWP for N2O = 296.

References:

California Energy Commission (CEC), 2005. California's Water - Energy Relationship Prepared in Suppot of the 2005 Integrated Energy Policy Report Proceeding (04-IEPR-01E), November 2005 (Table 1-3, page 11).

California Climate Action Registry, 2009. General Reporting Protocol, Reporting Entity-Wide Greenhouse

Gas Emissions, Version 3.1, January 2009.Tables C.4 and C.7.

Pacific Gas and Electric (PG&E). 2008. Carbon Footprint Calculator website (http://www.pge.com/myhome/environment/calculator/) accessed April 16, 2010.