Appendix C
Biological Resources Supporting Information

Appendix C1
Patterson Pass Biological Survey Results

April 9, 2014

Mr. Brian Sarantos
Project Developer
EDF Renewable Energy
4000 Executive Parkway, Suite 100
San Ramon, CA 94583

Subject: Biological Survey Results at the Patterson Pass Wind Project, Alameda County, California

Dear Mr. Sarantos:

As you requested, this report provides biological survey results for EDF Renewable Energy's (EDF RE's) proposed Patterson Pass Wind Project (Patterson or Proposed Project), located in Alameda County, California. EDF has submitted an application to Alameda County (County) for the Proposed Project and the County has initiated preparation of a Programmatic Environmental Impact Report (PEIR) (which includes a project specific analysis of Patterson and a programmatic analysis of the overall repowering program in the Altamont Pass Wind Resource Area (APWRA).

The Proposed Project will consist of the decommissioning of the existing wind facility, which includes approximately 321 Nordtank and Bonus wind turbines installed in the 1980's, and the installation of 8-12 modern wind turbines, with associated facilities. The model of wind turbine to be used for the repowering has not yet been selected but would generally consist of turbines between 2.4 and 3.0 megawatts (MW's), all generally similar in size and appearance, with relatively minor differences in blade length and total height. Existing roads would be used the extent feasible, although temporary widening and the construction of new roads will be required.

We understand that the County is largely using the biological information contained in the East Alameda Conservation Strategy (EACS) as the basis to assess impacts in PEIR, as well as to assign feasible mitigation measures, where necessary, to reduce or mitigate impacts. The EACS consists of information on land cover types, wetlands, and special-status species occurrences and habitats for all federally and state listed species in the region as well as several other non-listed species (i.e., burrowing owl). Consistent with your request, ICF biologists have conducted additional biological field surveys at the Proposed Project, to verify and further define the presence of land cover types, wetlands, and special-status species which may occur in the project area. Lastly, ICF biologists have also attended field reviews of the project site with representatives from the U.S. Fish and Wildlife Service (USFWS) (March 10, 2014), U.S. Army Corps of Engineers (USACE) (March 3, 2014), and the California Department of Fish and Wildlife (CDFW) (January 21, 2014) to discuss and review the proposed project, and coordination with those agencies is ongoing.

Methods

The following field surveys have been conducted to date to further describe the presence or potential presence of the remaining species and habitats on the project site.

- A wetland delineation conducted to U.S. Army Corps of Engineers protocols described in the *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987[1]) and the supplemental procedures provided in the Regional Supplement to the *Corps of Engineers Manual for the Arid West Region* (U.S. Army Corps of Engineers 2008[2]).
- A field assessment for California tiger salamander following the USFWS's *Interim Guidance on Site Assessment and Field Surveys for Determining Presence of a Negative Finding of the California Tiger Salamander* (U.S. Fish and Wildlife Service 2003[3]).
- A field assessment for California red-legged frog following the USFWS's *Revised Guidance on Site Assessments and Field Surveys for the California Red-legged Frog* (U.S. Fish and Wildlife Service 2005[4]).
- A field assessment for vernal pool branchiopods.
- A field survey of potential habitat (elderberry shrubs) for the Valley elderberry longhorn beetle.
- An assessment for Alameda whipsnake.

The methods of each of these surveys and assessments are summarized briefly below.

Wetland Delineation

ICF International botanists/wetland ecologists, Robert Preston and Lisa Webber, conducted wetland delineation field surveys. Mr. Preston and Ms. Webber visited the project area on November 13 and December 10 and 11, 2013, and Mr. Preston visited the area on December 2, 2013. The delineation was conducted in accordance with the guidance provided in the 1987 *U.S. Army Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987:53–69), the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual for the Arid West Region* (U.S. Army Corps of Engineers 2008), and 33 *Code of Federal Regulations [CFR] 328.3(e)* and *329.11(a)(1)*. The ordinary high water mark (OHWM) was identified according to U.S. Army Corps of Engineers' Regulatory Guidance Letter No. 05-05 and the arid west field guide (U.S. Army Corps of Engineers 2005[5];

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[1] Environmental Laboratory. 1987. *U.S. Army Corps of Engineers Wetlands Delineation Manual*. (Technical Report Y-87-1.) Vicksburg, MS: U.S. Army Waterways Experiment Station.

[2] U.S. Army Corps of Engineers. 2008. *Regional Supplement to the Corps of Engineers Wetlands Delineation Manual: Arid West Region (Version 2.0)*. ed. J. S. Wakeley, R. W. Lichvar, and C.V. Noble. ERDC/EL TR-08-28. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

[3] U.S. Fish and Wildlife Service. 2003. Interim Guidance on Site Assessment and Field Surveys for Determining Presence or a Negative Finding of the California Tiger Salamander.

[4] U.S. Fish and Wildlife Service. 2005. Revised Guidance on Site Assesments and Field Surveys for the California Red-legged Frog.

[5] U.S. Army Corps of Engineers. 2005. Ordinary High Water Mark Identification (Regulatory Guidance Letter No. 05-05). December 7, 2005.

Lichvar and McColley 2008[6]). Following the wetland delineation field surveys, a wetland delineation report was prepared (ICFI 2014[7]) and submitted to the USACE with a request for a verification of the mapping and requesting a preliminary jurisdictional determination (PJD). The USACE representative conducted a site visit with Ms. Webber on March 3, 2014 , which resulted in minor changes to the wetland delineation. A supplemental wetland delineation map and supporting data was submitted to the USACE on March 19, 2014 and the PJD is pending as of the preparation of this report.

California Tiger Salamander

In November 2013, ICF biologist John Howe assessed the project area for its potential to support California tiger salamander following the USFWS's *Interim Guidance on Site Assessment and Field Surveys for Determining Presence of a Negative Finding of the California Tiger Salamander* (U.S. Fish and Wildlife Service 2003). Prior to conducting the field assessment, Mr. Howe reviewed CNDDB (California Department of Fish and Wildlife 2014[8]) records for California tiger salamander within 3.1 miles (5 kilometers) and reviewed aerial photographs for ponds, vernal pools, and streams within 1.24 miles (2 kilometers) of the project area. Aquatic features within the project area were assessed on November 12 and 13, 2013. A datasheet for each aquatic feature was filled out and representative photographs were taken as outlined in the site assessment guidance. The information recorded included the type of aquatic feature, average and maximum depths, surface area, a description of emergent and bank vegetation, a description of adjacent upland habitat, and the general condition of the feature.

California Red-legged Frog

In November 2013, ICF biologist John Howe assessed the project area for its potential to support California red-legged frog following the USFWS's *Revised Guidance on Site Assessments and Field Surveys for the California Red-legged Frog* (U.S. Fish and Wildlife Service 2005). Prior to conducting the field assessment, Mr. Howe reviewed CNDDB (California Department of Fish and Wildlife 2014) records for California red-legged frog and aerial photographs for ponds and streams within 1 mile (1.6 kilometers) of the project area. Aquatic features within the project area were assessed on November 12 and 13, 2013. A datasheet for each aquatic feature was filled out and representative photographs were taken as outlined in the site assessment guidance. The information recorded included the type of aquatic feature, average and maximum depths, surface area, a description of

[6] Lichvar, R.W. and S.M. McColley. 2008. A Field Guide to the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States, A Delineation Manual. Available: http://www.spk.usace.army.mil/Portals/12/documents/regulatory/pdf/Ordinary_High_Watermark_Manual_Aug_2008.pdf.

[7] ICF International. 2014. *Patterson Pass Wind Farm Repowering Project Delineation of Potential Waters of the United States*. February. (ICF 00563.13.) Sacramento, CA. Prepared for EDF Renewable Energy, San Ramon, CA.

[8] California Department of Fish and Wildlife. 2014. *California Natural Diversity Database, RareFind 4*. Report for Midway and surrounding USGS quadrangles. Sacramento, CA.

emergent and bank vegetation, a description of adjacent upland habitat, and the general condition of the feature.

Vernal Pool Branchiopods

Concurrently with assessments for California red-legged frog and California tiger salamander, ICF biologist John Howe also identified two areas that could support vernal pool branchiopods. One is a seasonal wetland in the northeast corner of the site that could support vernal pool fairy shrimp and longhorn fairy shrimp. This pool may not pool for a sufficient duration to support vernal pool tadpole shrimp. Two pooled areas within a drainage that runs through the western portion of the project site could support vernal pool tadpole shrimp but may contain too much flow during the wet season to support vernal pool fairy shrimp and longhorn fairy shrimp.

Valley Elderberry Longhorn Beetle

During the course of the habitat assessment for California red-legged frog and California tiger salamander, ICF biologist John Howe identified several elderberry shrubs in the western portion of the project area. Elderberry shrubs, meeting certain size requirements and within the range of the elderberry longhorn beetle, are considered habitat for the Valley elderberry longhorn beetle (VELB). All accessible elderberry shrubs found within the project area were therefore mapped using a Global Positioning System (GPS) unit. A large cluster of shrubs was identified on field maps and later digitized using GIS where access was not possible. The biologists conducted stem counts of accessible elderberry shrubs and recorded all stem diameters measuring at least 1 inch in diameter at ground level, consistent with current guidance from the USFWS. Each of the accessible stems was thoroughly searched for VELB exit holes. The biologists also recorded the shrub heights and dripline diameters, noted whether the shrub was located in riparian habitat or not, noted the general condition of the shrubs, and took representative photographs of the shrubs and any observed or suspect exit holes.

Alameda Whipsnake

During the course of the habitat assessment for California red-legged frog and California tiger salamander, ICF biologist John Howe also assessed the project area for Alameda Whipsnake habitat. Mr. Howe observed the general site conditions and noted what suitable habitat elements were present or absent from the project site.

Results

Wetland Delineation

The project area was found to support five distinct vegetation communities— nonnative annual grassland, emergent wetland, riparian wetland, seasonal wetland, and ephemeral drainage (which support nonnative annual grassland vegetation). In addition, unvegetated ponds occur in the delineation area. A total of 12.051 acres of waters of the United States were identified in the 953-acre delineation area, including emergent wetlands (4.992 acres), riparian wetlands (4.000 acres), seasonal wetlands (1.405 acres), ephemeral drainages (0.814 acre), and ponds (0.840 acre). Wetland delineation maps of the project area (revised based on a verification visit with the USACE and pending verification by the USACE) are attached as Appendix A. A brief summary of the upland and wetland habitat types and communities identified in the project area is provided below.

Nonnative Annual Grassland

Nonnative annual grassland, the most common biological community in the project area, corresponds to the California annual grassland land cover type identified in the East Alameda County Conservation Strategy (EACCS). It is an herbaceous community dominated by naturalized annual grasses with intermixed perennial and annual forbs. Annual grasslands in the project area are heavily grazed, which resulted in many species being unidentifiable at the time of the November and December 2013 surveys and/or the extent of species to be indistinct. Dominant species observed include soft chess brome (*Bromus hordeaceous*), big heronbill (*Erodium botrys*), redstemmed filaree (*E. cicutarium*), Italian ryegrass (*Festuca perennis* [*Lolium multiflorum*]), and Mediterranean barley (*Hordeum marinum* var. *gussoneanum*).

Emergent Wetland

Emergent wetlands occur within drainages that are perennially wet due to groundwater seeps and in basin-shaped features around ponds. This community type corresponds to the perennial freshwater marsh land cover type identified in the EACCS. Species observed in emergent wetlands in drainages include saltgrass (*Distichlis spicata*), Mediterranean barley, Baltic rush (*Juncus balticus*) , Chilean rabbit's-foot grass (*Polypogon australis*), watercress (*Nasturtium officinale* [*Rorippa nasturtium-aquaticum*]), willows (*Salix* spp.), and stinging nettle (*Urtica dioica* ssp. *holosericea*).

Species observed in emergent wetlands around ponds include willowherb (*Epilobium ciliatum*), Italian ryegrass, smartweed (*Persicaria lapathifolium*), Chilean rabbit's-foot grass, celery-leaved buttercup (*Ranunculus scleratus*), arroyo willow (*Salix lasiolepis*), small-flowered saltcedar (*Tamarix parviflora*), cattail (*Typha* sp.), and stinging nettle.

Riparian Wetland

Riparian wetlands occur in perennial drainages in the western part of the delineation area. This community type corresponds to the mixed willow riparian scrub land cover type identified in the EACCS. These drainages support a woody riparian overstory, dominated by red willow (*Salix lasiandra*) and arroyo willow, and an herbaceous understory similar to the emergent wetland vegetation, with species such as Baltic rush, watercress, and rabbit's-foot grass.

Seasonal Wetland

Seasonal wetlands in the delineation area occur in shallow depressions generally associated with ephemeral drainages and emergent wetlands. This community type corresponds to the seasonal wetland land cover type identified in the EACCS. During the November and December 2013 surveys, vegetation in these areas was heavily grazed, resulting in few identifiable remnants of vegetation and seedlings that were too small to reliably identify to species. Recognizable species observed included Mediterranean barley and Italian ryegrass, as well as several upland species that likely colonized during the dry season, including soft chess, black mustard (*Brassica nigra*), redstemmed filaree, and common tarweed (*Holocarpha virgata*).

Ephemeral Drainage

Ephemeral drainages occur in low-lying areas and valley bottoms in the delineation area. This community type corresponds to the stream land cover type identified in the EACCS. Some of the ephemeral drainages are associated with wetlands or ponds, or they transition to emergent wetlands where there is a seep in a drainage. Ephemeral drainages are unvegetated or support nonnative annual grassland species, as described above.

Pond

In the delineation area, ponds are small permanent bodies of water that have been constructed for the purposes of retaining runoff water for livestock use. This community type corresponds to the pond land cover type identified in the EACCS. The surface area of these features varies, depending on the time of year. Ponds are mostly unvegetated, but support a narrow fringe of cattail or scattered cattail plants. Within the delineation area, ponds are partially to entirely surrounded by emergent wetland vegetation.

California Red-legged Frog

Eight CNDDB records for California red-legged occur within 1 mile of the project area (California Department of Fish and Wildlife 2014). There are four records of California red-legged frog in five of the ponds within the project area from July 2005 (California Department of Fish and Wildlife 2014). Additionally, there is one other record from July 2005 in the CNNDB (occurrence #880), which is not associated with a pond. The record is approximately 0.1 mile east of one of the ponds in the project area, and the observation was made on the same date and has the same source as the other four records in the project area, which suggests that the CNDDB polygon for this record is actually the pond within the project area. A single adult California red-legged frog was also observed in this pond on November 12, 2013 by ICF biologist John Howe. Consequently, there appear to be five records of California red-legged frog in the project area.

Eighteen ponds and several streams were identified within 1 mile of the project area, which includes five ponds that are known to be occupied by California red-legged frog. All of the ponds within the project area were observed to have water at the time of the surveys and had average depths that were estimated to be between 1 to 6 feet. All of the ponds were observed with areas of emergent cattails and open water. The other aquatic feature (stream, ephemeral drainages, vernal pool, and seasonal wetlands) do not represent suitable habitat for California red-legged frog breeding. The stream going through the western half of the project area generally consists of an incised channel with sections of saturated perennial wetlands that form from seeps throughout the drainage. There are two sections of the channel that pool to maximum depth of approximately 12 inches during the wet season, which make them not likely suitable for California red-legged frog breeding. They were dry during the November 2013 site visits. No bullfrogs where observed in any of the aquatic habitats within the project area.

Figure 1 indicates the location of suitable aquatic habitats for California red-legged frog within the project area.

California Tiger Salamander

Seventeen CNDDB records for California tiger salamander occur within 3.1 miles of the project area (California Department of Fish and Wildlife 2014). The nearest California tiger salamander CNDDB record (occurrence #810) to the site is a road-caused mortality on Patterson Pass Road immediately adjacent to the project area from October 2001.

Twenty-four ponds and several streams were identified within 1.24 miles of the project area, which includes five ponds and one stream within the project area that could support California tiger salamander. All of the ponds within the action area were observed to have water at the time of the surveys and had average depths that were estimated to be between 1 to 6 feet. All of the ponds were observed with areas of emergent cattails and open water. A stream that runs through the northwest corner of the project area has two large pools within it that appear to pool water seasonally and have an estimated maximum depth of 12 inches. The other sections of this stream, the ephemeral drainages, and the vernal pool within the project area do not appear to have sections that pool water (stream and drainages) or do not appear to pool to a sufficient depth or for a long enough duration (seasonal wetland or vernal pool) to support California tiger salamander. No bullfrogs where observed in any of the aquatic habitats within the project area. The ponds and the two instream pools all appear to be suitable for California tiger salamander.

Figure 1 indicates the location of suitable aquatic habitats for California tiger salamander within the project area.

Vernal Pool Branchiopods

ICF biologist John Howe conducted an assessment of aquatic habitats in the project area for their suitability to support California tiger salamander and California red-legged frog during which he identified two areas that could support vernal pool branchiopods. One of these is a small depression near the northeast corner of the project area (Figure 1). This feature was estimated to pool seasonally to an average depth of 8 inches and a maximum depth of 24 inches. The depression was dry at the time of the assessment. The wetland delineation conducted by ICF in November and December 2013 identified this feature as a seasonal wetland with an area of 0.031 acre. At the time of the delineation it was observed to be vegetated with upland species though it did have hydric soils and observable inundation in aerial photos from March 2011 and May 2013 (ICF 2014). This seasonal wetland is considered to be suitable for vernal pool branchiopods though it may not pool for a long enough duration to support vernal pool tadpole shrimp.

The other area consists of two pools within a drainage in the northwest corner of the project area (Figure 1). Both of the pools are upstream of culverted road crossings over the drainage. The pools both were estimated to pool seasonally to an average depth of 6 inches and a maximum depth of 12 inches. Both pools were observed to be dry at the time of the assessment. These pools were estimated to be 0.05 acre and 0.35 acre. The wetland delineation conducted by ICF identified the pools and associated drainage to be part of a larger emergent wetland and were not delineated separately. These pools are considered suitable for vernal pool tadpole shrimp but may not support vernal pool fairy shrimp and longhorn fairy shrimp due to flows passing through these pools.

Figure 1 indicates the location of the two areas identified as potential habitat for vernal pool branchiopods.

Valley Elderberry Longhorn Beetle

ICF biologists recorded a total of 39 shrubs, potential habitat for VELB, within the project area. The results of the elderberry shrub surveys are summarized in Table 1 below. Due to the steepness of the terrain several shrubs were not accesses at the time of the survey. Stem diameter classes were estimated using binoculars. Shrub cluster #8 was also in a very steep area and though accessed to count the shrubs and look for exit holes surveys, the stem counts provided in the table were estimated due to safety issues in accessing every shrub. The estimates were made with the knowledge that EDF would not directly impact these shrubs. The locations of the elderberry shrubs are shown in Figure 1.

Table 1. Elderberry Shrub Survey Results

Shrub/Cluster Number	Stem Diameter Class at Ground Level in Inches			Shrub Height in Feet	Exit Holes Present?	Shrub in Riparian Habitat?
	≥1–≤3	>3–<5	≥ 5			
1	0	2	1	11	No	Yes
2	5	1	3	15	Yes	Yes
3	2	0	0	7	No	Yes
4	0	0	1	15	Yes	Yes
5	0	0	1	25	NA	Yes
6[1]	0	0	1	25	NA	Yes
7[1]	0	0	1	15	NA	Yes
8[2] (32 shrubs)	NA	NA	NA	10-15	Yes	No

[1] Couldn't safely access shrubs. Stem counts estimated using binoculars and/or based on overall size of the shrub.
[2]For shrub cluster 8, stem counts were not estimated due to safety issues in accessing all of the shrubs. Exit holes were observed on most of the shrubs that were accessible.

As shown in Table 1 above, 39 elderberry shrubs that had one or more stems greater than 1 inch in diameter at ground level were identified within the action area at the time of the surveys. Seven of these shrubs are located in riparian habitat along an unnamed stream running through the western portion of the project area. Several shrubs were observed with exit holes on live and dead stems that were similar in size and shape to those exit holes made by valley elderberry longhorn beetle, which suggests that the species occurs within the project area.

Figure 1 indicates the location of the elderberry shrubs within the project area.

Alameda Whipsnake

The project area is generally within the range of Alameda whipsnake, which is currently defined as Contra Costa County, most of Alameda County, and small portions of northern Santa Clara and western San Joaquin Counties (U.S. Fish and Wildlife Service 2011[9]). The CNDDB record locations for Alameda whipsnake are suppressed in the dataset due to the sensitivity of the species; however

[9] U.S. Fish and Wildlife Service. 2011. Alameda whipsnake (*Masticophis lateralis euryxanthus*) 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Sacramento, CA. September.

the CNDDB does note that there are seven extant records within the Midway USGS quadrangle, in which the project area is found. The available information for these records indicate they are south of the action area by approximately 2.5 miles. There are no CNDDB records for the quadrangles to the east (Tracy), west (Altamont), or north (Clifton Court Forebay) of the action area; however there are records for the Byron Hot Springs quadrangle, which is northwest of the Midway quadrangle. A review of aerial imagery for this quadrangle show what appears to be chaparral and/or coast scrub approximately 9 miles northwest of the project area.

The project area provides habitats that could be used by Alameda whipsnake (grasslands and rock outcrops). Alameda whipsnake species typically occurs in these habitats when adjacent to (within 500 feet) chaparral or coastal scrub habitats; however, the species has been reported as far 4.5 miles from the nearest chaparral or coastal scrub (U.S. Fish and Wildlife Service 2011). The nearest chaparral or coastal scrub mapped in the EACCS landcover data is approximately 2.5 miles south of the action area. There is no chaparral or coastal scrub mapped within the EACCS landcover dataset to the north or east of the project area. The nearest chaparral or coastal scrub to the west of the project area is west of I-680, which is approximately 17 miles away.

Alameda whipsnake could occur in the project area; however this likelihood is considered low because it does not contain chaparral or coastal scrub habitat, the nearest primary habitat is 2.5 miles south of the project area, and the project area does not provide a linkage between this habitat and any suitable habitat to the north, west, or east of the project area.

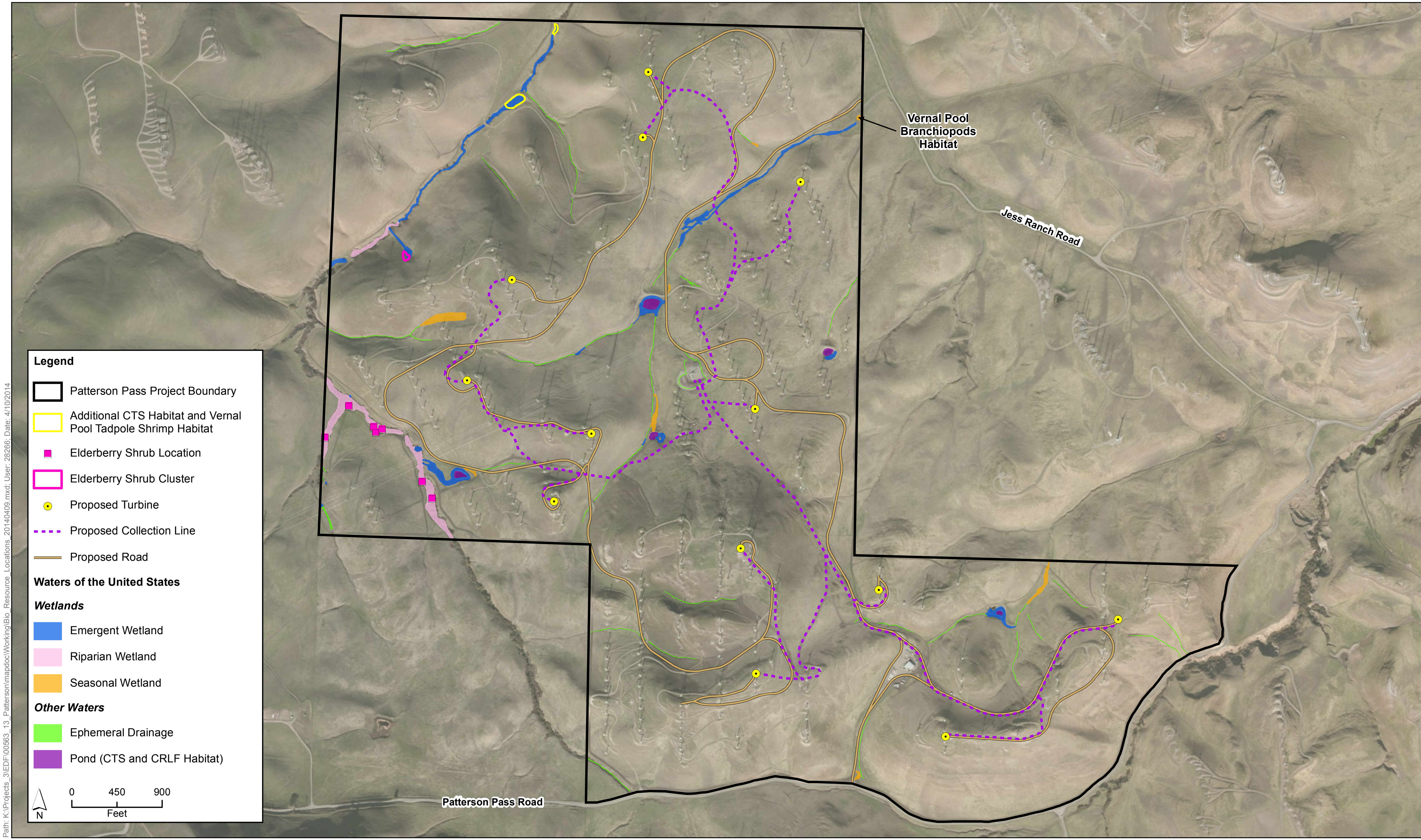
Thank you for the opportunity to assist you with the Proposed Project. If you have any questions regarding the information in this report, please contact me at 916-231-9565 or (brad.schafer@icfi.com).

Sincerely,

Brad Schafer
Project Manager/Biologist

Attachment-Figure 1 and Attachment A.

cc: Rick Miller and Kathryn Malone, EDF-RE
Brad Norton, ICF International



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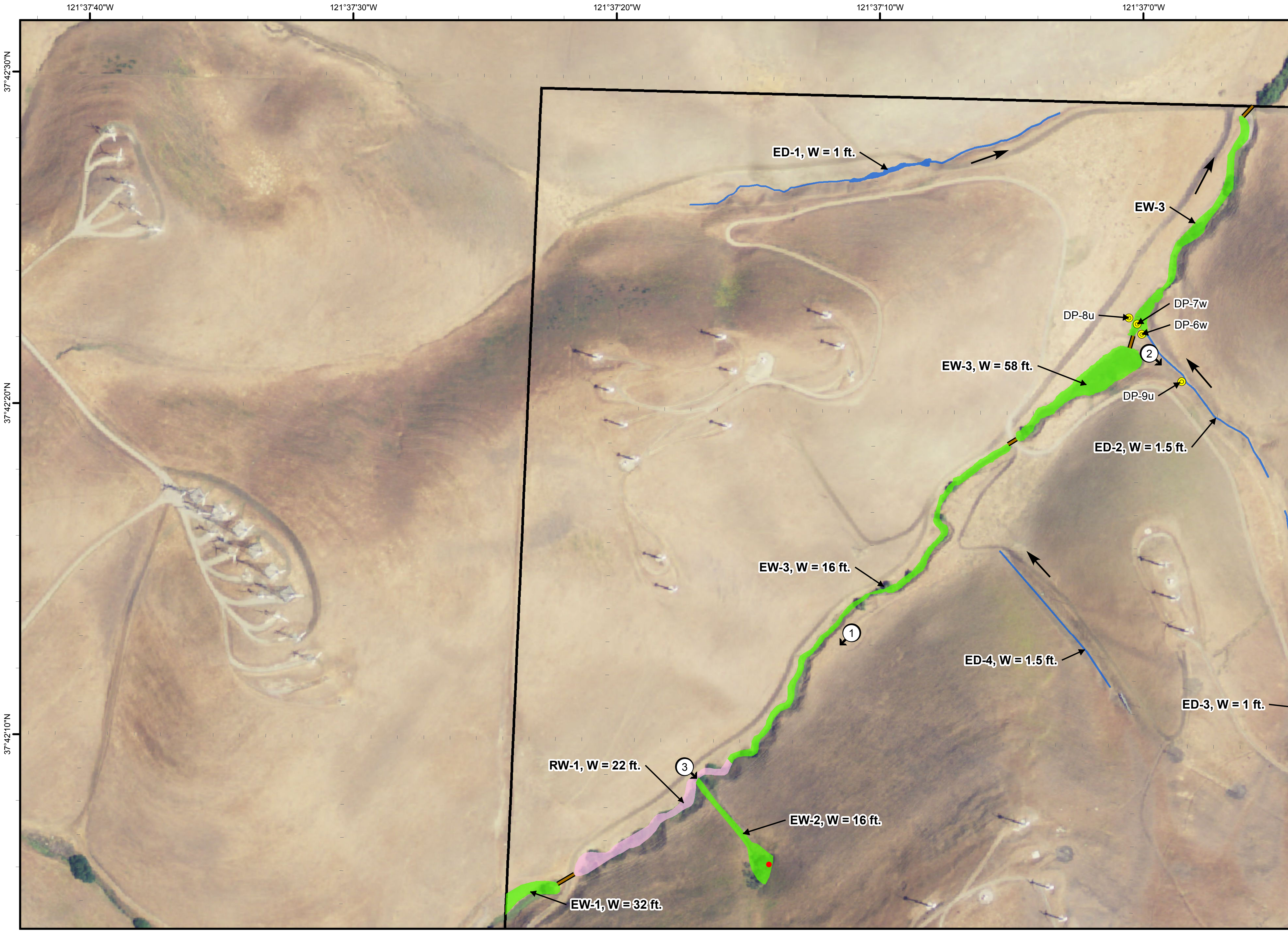
ICF INTERNATIONAL

Figure 1
Biological Resources Locations

Attachment A. Wetland Delineation Maps



Patterson Pass Wind Project
March 2014
Sheet 1 of 6

Legend

Delineation Area (953 acres)
Seep Location
Photo Points
Data Points
Direction of Flow
Culvert

Waters of the United States

Wetlands

Emergent Wetland (EW) - 4.992 acres
Riparian Wetland (RW) - 4.000 acres

Other Waters

Ephemeral Drainage (ED) - 0.849 acre

N

0 150 300
Feet
1 inch = 300 feet

1 2 3 4 5 6

Notes:

Imagery Source: NAIP 2012
USGS Topo Quad: Midway
PLSS: Sections: 2, 11 and 12; Township: 03S; Range 03E

Prepared by: Lisa Webber/916.737.3000
Delineated by: Lisa Webber and Robert Preston
Field survey dates: November 2013, December 2013 and March 2014
Drawn by: Edward Douglas

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ICF INTERNATIONAL

Appendix A
Delineation of Potential Waters of the United States, Including Wetlands

Patterson Pass Wind Project
March 2014
Sheet 2 of 6

Legend

Delineation Area (953 acres)
Seep Location
Photo Points
Data Points
Direction of Flow
Culvert

Waters of the United States

Wetlands

Emergent Wetland (EW) - 4.992 acres
Seasonal Wetland (SW) - 1.323 acres

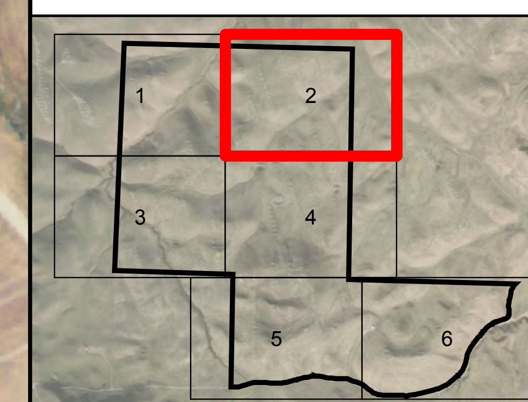
Other Waters

Ephemeral Drainage (ED) - 0.849 acre

N

0 150 300
Feet

1 inch = 300 feet



Notes:

Imagery Source: NAIP 2012
USGS Topo Quad: Midway
PLSS: Sections: 2, 11 and 12; Township: 03S; Range 03E

Prepared by: Lisa Webber/916.737.3000
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Field survey dates: November 2013, December 2013 and March 2014
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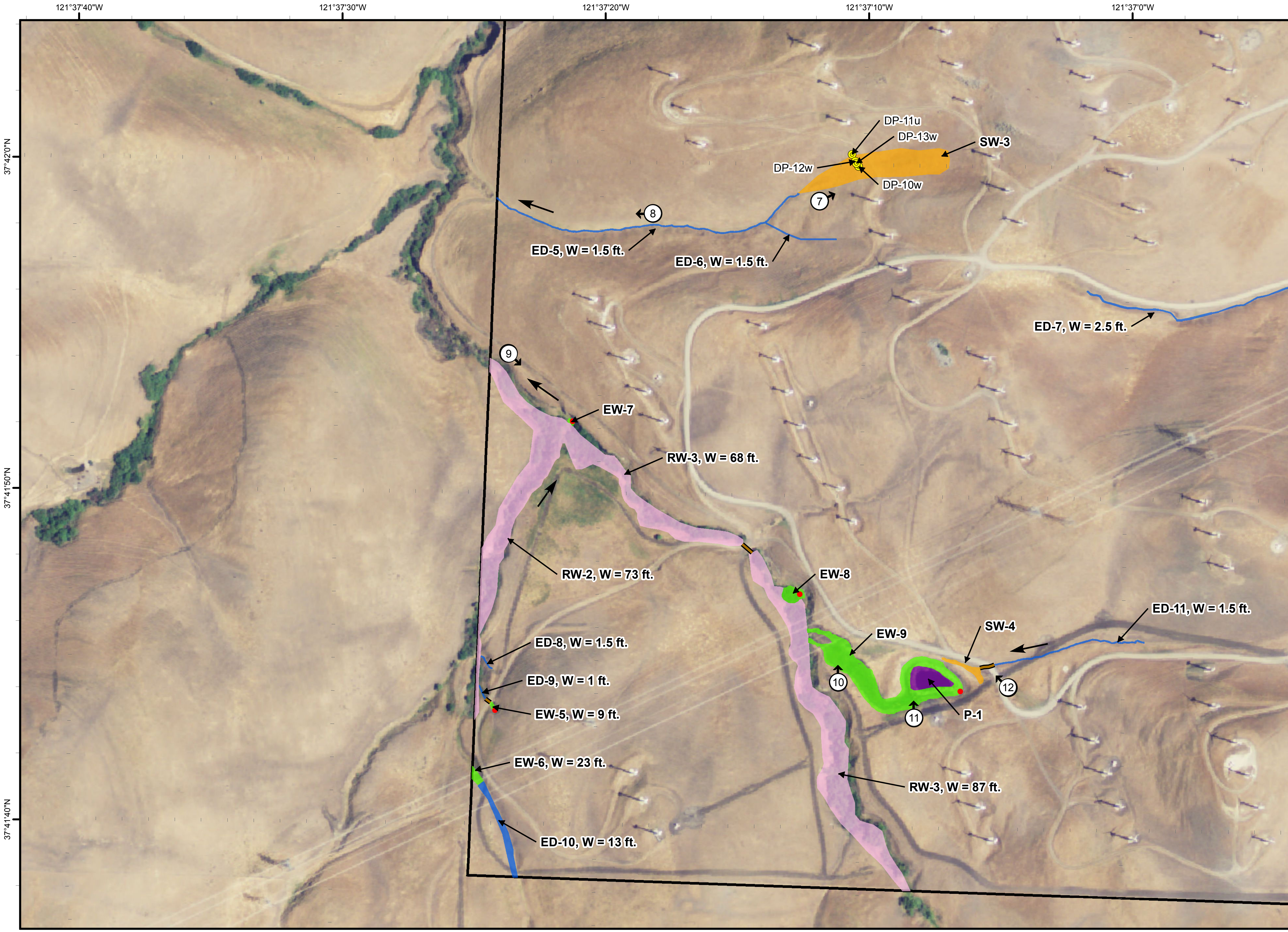
ICF INTERNATIONAL

Appendix A
Delineation of Potential Waters of the United States, Including Wetlands



Patterson Pass Wind Project
March 2014
Sheet 3 of 6

Legend

- Delineation Area (953 acres)
- Seep Location
- Photo Points
- Data Points
- Direction of Flow
- Culvert

Waters of the United States

Wetlands

- Emergent Wetland (EW) - 4.992 acres
- Riparian Wetland (RW) - 4.000 acres
- Seasonal Wetland (SW) - 1.323 acres

Other Waters

- Ephemeral Drainage (ED) - 0.849 acre
- Pond (P) - 0.840 acre

N

0 150 300
Feet

1 inch = 300 feet

1 2 3 4 5 6

Notes:

Imagery Source: NAIP 2012
USGS Topo Quad: Midway
PLSS: Sections: 2, 11 and 12; Township: 03S; Range 03E

Prepared by: Lisa Webber/916.737.3000
Delineated by: Lisa Webber and Robert Preston
Field survey dates: November 2013, December 2013 and March 2014
Drawn by: Edward Douglas

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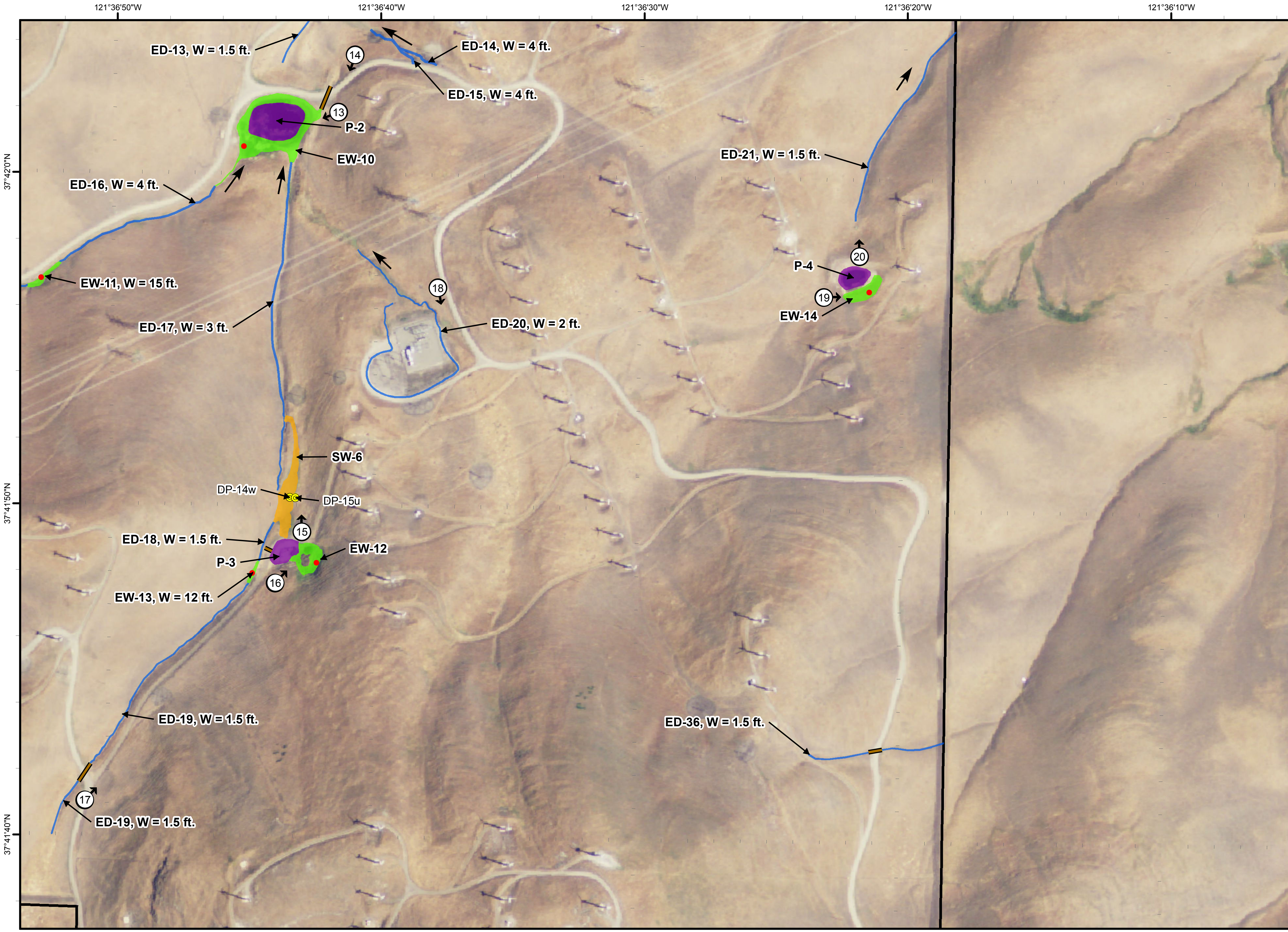
ICF INTERNATIONAL

Appendix A
Delineation of Potential Waters of the United States, Including Wetlands



Patterson Pass Wind Project
March 2014
Sheet 4 of 6

Legend

Delineation Area (953 acres)
Seep Location
Photo Points
Data Points
Direction of Flow
Culvert

Waters of the United States

Wetlands

Emergent Wetland (EW) - 4.992 acres
Seasonal Wetland (SW) - 1.323 acres

Other Waters

Ephemeral Drainage (ED) - 0.849 acre
Pond (P) - 0.840 acre

N

0 150 300
Feet

1 inch = 300 feet

1 2 3 4 5 6

Notes:

Imagery Source: NAIP 2012
USGS Topo Quad: Midway
PLSS: Sections: 2, 11 and 12; Township: 03S; Range 03E

Prepared by: Lisa Webber/916.737.3000
Delineated by: Lisa Webber and Robert Preston
Field survey dates: November 2013, December 2013 and March 2014
Drawn by: Edward Douglas

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Appendix A
Delineation of Potential Waters of the United States, Including Wetlands

Patterson Pass Wind Project
March 2014
Sheet 5 of 6

Legend

Delineation Area (953 acres)

Photo Points

Direction of Flow

Culvert

Waters of the United States

Wetlands

Seasonal Wetland (SW) - 1.323 acres

Other Waters

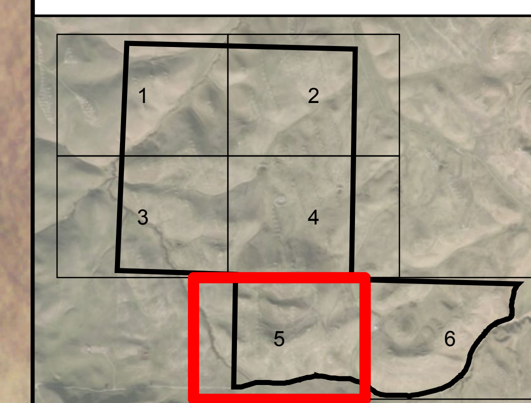
Ephemeral Drainage (ED) - 0.849 acre

N

0 150 300

Feet

1 inch = 300 feet



Notes:

Imagery Source: NAIP 2012
USGS Topo Quad: Midway
PLSS: Sections: 2, 11 and 12; Township: 03S; Range 03E

Prepared by: Lisa Webber/916.737.3000
Delineated by: Lisa Webber and Robert Preston
Field survey dates: November 2013, December 2013 and March 2014
Drawn by: Edward Douglas

Path: K:\Projects_3\EDF\00563_13_Patterson\mapdoc\Working\WUS_Mapbook_20140306.mxd; Author: psilveira; Date: 3/6/2014

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Appendix A
Delineation of Potential Waters of the United States, Including Wetlands

Patterson Pass Wind Project
March 2014
Sheet 6 of 6

Legend

Delineation Area (953 acres)

Seep Location

Photo Points

Direction of Flow

Waters of the United States

Wetlands

Emergent Wetland (EW) - 4.992 acres

Seasonal Wetland (SW) - 1.323 acres

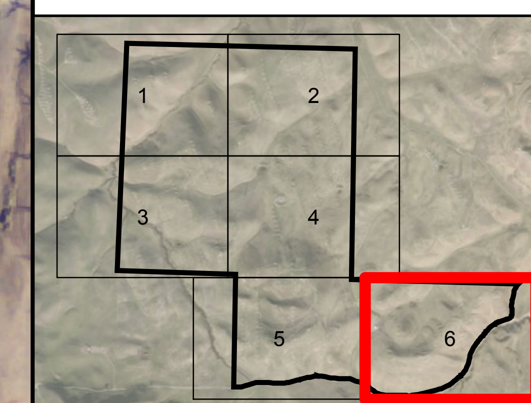
Other Waters

Ephemeral Drainage (ED) - 0.849 acre

Pond (P) - 0.840 acre

0 150 300
Feet

1 inch = 300 feet



Notes:

Imagery Source: NAIP 2012
USGS Topo Quad: Midway
PLSS: Sections: 2, 11 and 12; Township: 03S; Range 03E

Prepared by: Lisa Webber/916.737.3000
Delineated by: Lisa Webber and Robert Preston
Field survey dates: November 2013, December 2013 and March 2014
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Path: K:\Projects_3\EDF\00563_13_Patterson\mapdoc\Working\WUS_Mapbook_20140306.mxd; Author: psilveira; Date: 3/6/2014

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Appendix A
Delineation of Potential Waters of the United States, Including Wetlands

Appendix C2

East Alameda County Conservation Strategy Mitigation Ratios and Locations

Table 3-4. Standardized Mitigation Ratios for Vernal Pool Fairy Shrimp in the EACCS Study Area

	Location of Mitigation[1,2]				
Location of Impact[1]	Inside Critical Habitat in EACCS study area	Outside Critical Habitat and Inside Vernal Pool Recovery Unit	Outside Critical Habitat and Outside Vernal Pool Recovery Unit	Outside EACCS Study Area	Notes
Inside Critical Habitat in EACCS study area	9:1—(6 acres preservation; 3 acres restoration) *requires site-specific USFWS approval	10:1—(6.5 acres preservation; 3.5 acres restoration) *requires site-specific USFWS approval	11:1—(7 acres preservation; 4 acres restoration) *requires site-specific USFWS approval	Requires site-specific agency approval	In order to preserve 90% of vernal pool fairy shrimp habitat, consistent with the goals and objectives of the EACCS, a high ratio is required due to the rarity of this habitat type.
Outside Critical Habitat and Inside Vernal Pool Recovery Unit	9:1—(6 acres preservation; 3 acres restoration)	9:1—(6 acres preservation; 3 acres restoration)	10:1—(6.5 acres preservation; 3.5 acres restoration)	Requires site-specific agency approval	
Outside Critical Habitat and Outside Vernal Pool Recovery Unit	9:1—(6 acres preservation; 3 acres restoration)	10:1—(6.5 acres preservation; 3.5 acres restoration)	11:1—(7 acres preservation; 4 acres restoration)	Requires site-specific agency approval	

[1] Reference Figure 3-6 for the location of key mitigation features for vernal pool fairy shrimp.

[2] In order to meet CDFG's standard of full mitigation for state listed species under CESA, project applicants will have to demonstrate habitat enhancement, not just permanent protection, on properties used for mitigation. If credits are purchased at a CDFG approved mitigation bank, this enhancement is assumed, therefore the full mitigation standard would be met upon purchase of the credits.

Table 3-5. Standardized Mitigation Ratios for Longhorn Fairy Shrimp in the EACCS Study Area

	Location of Mitigation[1, 2]				
Location of Impact[1]	Inside Critical Habitat in EACCS study area	Outside Critical Habitat and Inside Vernal Pool Recovery Unit	Outside Critical Habitat and Outside Vernal Pool Recovery Unit	Outside EACCS Study Area	Notes
Inside Critical Habitat in EACCS study area	9:1—(6 acres preservation; 3 acres restoration) *requires site-specific USFWS approval	10:1—(6.5 acres preservation; 3.5 acres restoration) *requires site-specific USFWS approval	11:1—(7 acres preservation; 4 acres restoration) *requires site-specific USFWS approval	Requires site-specific agency approval	In order to preserve 90% of longhorn fairy shrimp habitat, consistent with the goals and objectives of the EACCS, a high ratio is required due to the rarity of this habitat type.
Outside Critical Habitat and Inside Vernal Pool Recovery Unit	9:1—(6 acres preservation; 3 acres restoration)	9:1—(6 acres preservation; 3 acres restoration)	10:1—(6.5 acres preservation; 3.5 acres restoration)	Requires site-specific agency approval	
Outside Critical Habitat and Outside Vernal Pool Recovery Unit	9:1—(6 acres preservation; 3 acres restoration)	10:1—(6.5 acres preservation; 3.5 acres restoration)	11:1—(7 acres preservation; 4 acres restoration)	Requires site-specific agency approval	

1 Reference Figure 3-7 for the location of key mitigation features for longhorn fairy shrimp.

2 In order to meet CDFG's standard of full mitigation for state listed species under CESA, project applicants will have to demonstrate habitat enhancement, not just permanent protection, on properties used for mitigation. If credits are purchased at a CDFG approved mitigation bank, this enhancement is assumed, therefore the full mitigation standard would be met upon purchase of the credits.

Table 3-6. Standardized Mitigation Ratios for Callippe Silverspot Butterfly in the EACCS Study Area

	Location of Mitigation[1, 2]				
Location of Impact	Within CZ where impact occurred	Adjacent to CZ where impact occurred and inside mitigation area shown in Figure 3-8	In CZ Not Adjacent to CZ where impact occurred but inside mitigation area shown in Figure 3-8	Outside mitigation area shown in Figure 3-8 including an area outside EACCS Study Area	Notes
Inside Conservation Zones CZ1, CZ8, CZ11, CZ12, CZ14, CZ15, CZ16	3:1	3.5:1	4:1	Requires site-specific agency approval	

1 Reference Figure 3-8 for the location of key mitigation features for callippe silverspot butterfly.

2 In order to meet CDFG's standard of full mitigation for state listed species under CESA, project applicants will have to demonstrate habitat enhancement, not just permanent protection, on properties used for mitigation. If credits are purchased at a CDFG approved mitigation bank, this enhancement is assumed, therefore the full mitigation standard would be met upon purchase of the credits.

Table 3-7. Standardized Mitigation Ratios for California Red-Legged Frog in the EACCS Study Area

	Location of Mitigation[1, 2]					
Location of Impact[1]	Inside Critical Habitat in EACCS study area in same CRLF Mitigation Area based on Figure 3-9	Inside Critical Habitat in EACCS study area in different CRLF Mitigation Area based on Figure 3-9	Outside Critical Habitat but inside same CRLF Mitigation Area based on Figure 3-9	Outside Critical Habitat in EACCS study area in different CRLF Mitigation Area based on Figure 3-9	Outside EACCS Study Area	Notes
Inside Critical Habitat in EACCS study area	3:1	Requires site specific agency approval	Requires site-specific agency approval	Requires site-specific agency approval	Requires site-specific agency approval	
Outside Critical Habitat in EACCS study area	2.5:1	3:1	3:1	3.5:1	Requires site-specific agency approval	

1 Reference Figure 3-9 for the location of key mitigation features for California red-legged frog.

2 In order to meet CDFG's standard of full mitigation for state listed species under CESA, project applicants will have to demonstrate habitat enhancement, not just permanent protection, on properties used for mitigation. If credits are purchased at a CDFG approved mitigation bank, this enhancement is assumed, therefore the full mitigation standard would be met upon purchase of the credits.

Table 3-8. Standardized Mitigation Ratios for California Tiger Salamander in the EACCS Study Area

	Location of Mitigation[1, 2]						
Location of Impact[1]	Inside Critical Habitat in EACCS study area	Outside Critical Habitat but inside CTS North Mitigation Area, north of I-580	Outside Critical Habitat but inside CTS North Mitigation Area, south of I-580	Outside Critical Habitat but inside CTS South Mitigation Area, west of I-680	Outside Critical Habitat but inside CTS South Mitigation Area, east of I-680	Outside of EACCS Study Area	Notes
Inside Critical Habitat in EACCS study area	3:1	Requires site specific agency approval	Requires site-specific agency approval	Requires site-specific agency approval	Requires site-specific agency approval	Requires site-specific agency approval	
Outside Critical Habitat but inside CTS North Mitigation Area, north of I-580	2.5:1	3:1	3.5:1	4:1	4:1	Requires site-specific agency approval	Shaffer et al. 2004 found that there is some genetic distinction between CTS in the Central Valley Ecological Zone and the Western California Ecological Zone. Those zones were used to create CTS North and South Mitigation Areas.
Outside Critical Habitat but inside CTS North Mitigation Area, south of I-580	3:1	3.5:1	3:1	4:1	4:1	Requires site-specific agency approval	
Outside Critical Habitat but inside CTS South Mitigation Area, west of I-680	3:1	4:1	4:1	3:1	3.5:1	Requires site-specific agency approval	
Outside Critical Habitat but inside CTS South Mitigation Zone, east of I-680	3:1	4:1	4:1	3.5:1	3:1	Requires site-specific agency approval	

1 Reference Figure 3-10 for the location of key mitigation features for California tiger salamander.

2 In order to meet CDFG's standard of full mitigation for state listed species under CESA, project applicants will have to demonstrate habitat enhancement, not just permanent protection, on properties used for mitigation. If credits are purchased at a CDFG approved mitigation bank, this enhancement is assumed, therefore the full mitigation standard would be met upon purchase of the credits.

Table 3-9. Standardized Mitigation Ratios for Alameda Whipsnake in the EACCS Study Area

	Location of Mitigation[1]					
Location of Impact[1]	Inside Critical Habitat Unit in same recovery unit[2]	Inside Critical Habitat Unit in different recovery unit	Outside Critical Habitat but Inside Same Recovery Unit	Outside Critical Habitat and Inside Different Recovery Unit	Outside Critical Habitat and Outside Recovery Unit	Outside EACCS Study Area
Inside Critical Habitat	3:1	Requires site-specific agency approval	Requires site-specific agency approval	Requires site-specific agency approval	Requires site-specific agency approval	Requires site-specific agency approval
Outside Critical Habitat but Inside Recovery Unit	2.5:1	3:1	3:1	3.5:1	4:1	Requires site-specific agency approval
Outside Critical Habitat and Outside Recovery Unit	2.5:1	2.5:1	3:1	3:1	3:1	Requires site-specific agency approval

[1] Reference Figure 3-12 for the location of key mitigation features for Alameda whipsnake.

[2] Agency approval will be required to mitigate impacts that occur inside Critical Habitat Unit 5a in Critical Habitat Unit 5b and vice versa, even though they are inside the same recovery unit.

Table 3-10. Standardized Mitigation Ratios for Non-Listed Species in the EACCS Study Area

	Location of Mitigation[1, 2]					
Location of Impact[1]	Within East Bay Hills Mitigation Area	Within Livermore Valley Mitigation Area	Within Altamont Hills Mitigation Area	Within Northern Diablo Range Mitigation Area	Outside EACCS Study Area	Notes
Within East Bay Hills Mitigation Area	3:1	3.5:1	4:1	3.5:1	Requires site-specific agency approval	
Within Livermore Valley Mitigation Area	3.5:1	3:1	3.5:1	3.5:1	Requires site-specific agency approval	
Within Altamont Hills Mitigation Area	4:1	3.5:1	3:1	3.5:1	Requires site-specific agency approval	
Within Northern Diablo Range Mitigation Area	3.5:1	3.5:1	3.5:1	3:1	Requires site-specific agency approval	

[1] Reference Figure 3-11 for the location of key mitigation features for non-listed species in the EACCS study area.

[2] In order to meet CDFG's standard of full mitigation for state listed species under CESA, project applicants will have to demonstrate habitat enhancement, not just permanent protection, on properties used for mitigation. If credits are purchased at a CDFG approved mitigation bank, this enhancement is assumed, therefore the full mitigation standard would be met upon purchase of the credits.

Table 3-11. Standardized Mitigation Ratios for San Joaquin Kit Fox in the EACCS Study Area

Location of Impact[1]	Location of Mitigation[1, 2] Inside SJKF North Mitigation Area as shown in Figure 3-13	Inside SJKF East Mitigation Area as shown in Figure 3-13	Inside SJKF South Mitigation Area as shown in Figure 3-13	Inside SJKF Central-West Mitigation Area as shown in Figure 3-13	Outside of EACCS Study Area	Notes
Inside SJKF North Mitigation Area as shown in Figure 3-13	3:1	3:1	3:1	N/A	Requires site-specific agency approval	
Inside SJKF East Mitigation Area as shown in Figure 3-13	3.5:1	3:1	3.5:1	N/A	Requires site-specific agency approval	Ratios may rise in areas of documented high occurrence or movement corridors.
Inside SJKF South Mitigation Area as shown in Figure 3-13	3.5:1	3:1	3:1	N/A	Requires site-specific agency approval	
Inside SJKF Central-West Mitigation Area as shown in Figure 3-13	N/A	N/A	N/A	N/A	Requires site-specific agency approval	

1 Reference Figure 3-13 for the location of mitigation areas for San Joaquin kit fox.

2 In order to meet CDFG's standard of full mitigation for state listed species under CESA, project applicants will have to demonstrate habitat enhancement, not just permanent protection, on properties used for mitigation. If credits are purchased at a CDFG approved mitigation bank, this enhancement is assumed, therefore the full mitigation standard would be met upon purchase of the credits.

Table 3-12. Standardized Mitigation Ratios for Focal Plant Species in the EACCS Study Area[1]

	Location of Mitigation[2, 3]					
Location of Impact[2]	Within East Bay Hills Mitigation Area	Within Livermore Valley Mitigation Area	Within Altamont Hills Mitigation Area	Within Northern Diablo Range Mitigation Area	Outside EACCS Study Area	Notes
Within East Bay Hills Mitigation Area	5:1	With agency approval	With agency approval	With agency approval	With agency approval	
Within Livermore Valley Mitigation Area	With agency approval	5:1	With agency approval	With agency approval	With agency approval	
Within Altamont Hills Mitigation Area	With agency approval	With agency approval	5:1	With agency approval	With agency approval	
Within Northern Diablo Range Mitigation Area	With agency approval	With agency approval	With agency approval	5:1	With agency approval	

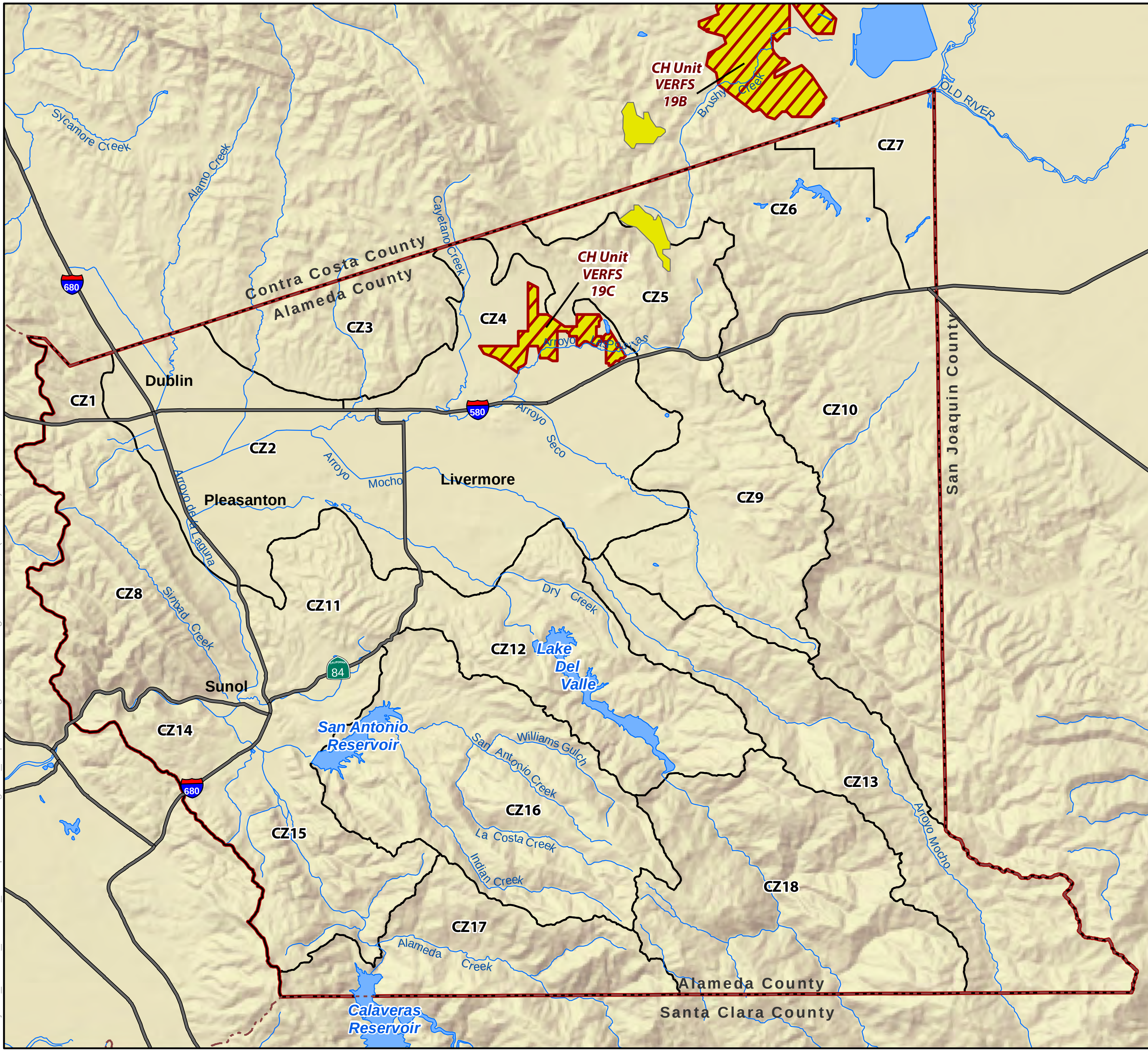
1 Mitigation ratios for focal plant species refer to the size of the population that is effected or protected. Restoration ratio refers to reestablishing or increasing the size of an existing population. The quality/vigor of a population would need to be considered when making final determinations.

2 Reference Figure 3-11 for the location of key mitigation features for plants and non-listed species in the EACCS study area.

3 In order to meet CDFG's standard of full mitigation for state listed species under CESA, project applicants will have to demonstrate habitat enhancement, not just permanent protection, on properties used for mitigation. If credits are purchased at a CDFG approved mitigation bank, this enhancement is assumed, therefore the full mitigation standard would be met upon purchase of the credits.

Figure 3-6
Vernal Pool Fairy Shrimp Standardized Mitigation Reference Map

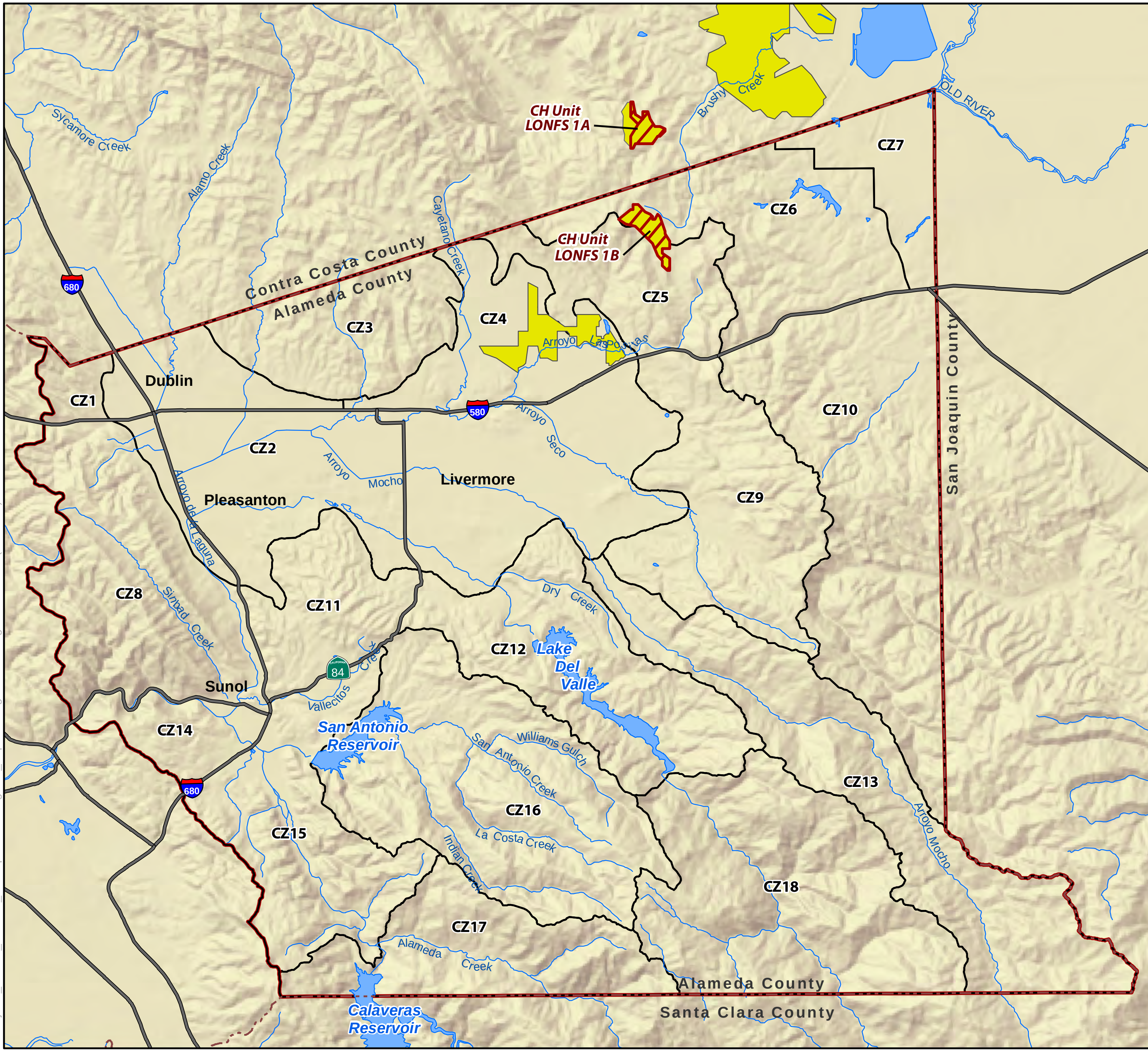
October 2010



Source: California Spatial Information Library; FR listing and critical habitat documents.

Figure 3-7
Longhorn Fairy Shrimp Standardized Mitigation Reference Map

October 2010



Study Area Boundary
Conservation Zones
Critical Habitat
Highways
Streams
Vernal Pool Recovery Unit: Altamont Hills

Source: California Spatial Information Library; FR listing and critical habitat documents.

0 1 2 4
Miles

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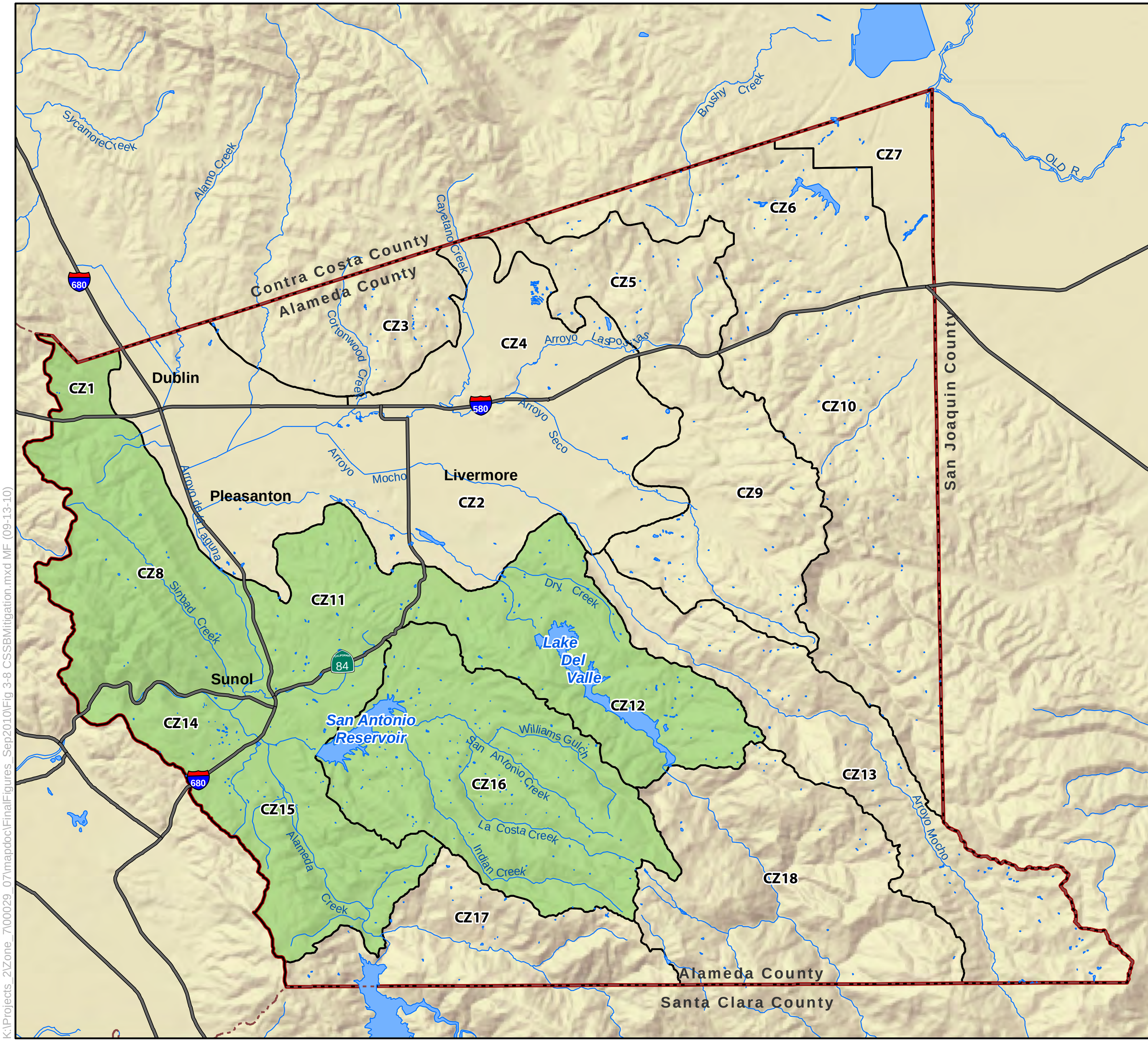
Figure 3-8
Callippe Silverspot Butterfly Standardized Mitigation Reference Map

October 2010



Study Area Boundary
Conservation Zones
Highways
Streams
Reservoirs
Callippe Silverspot Butterfly Mitigation Zones

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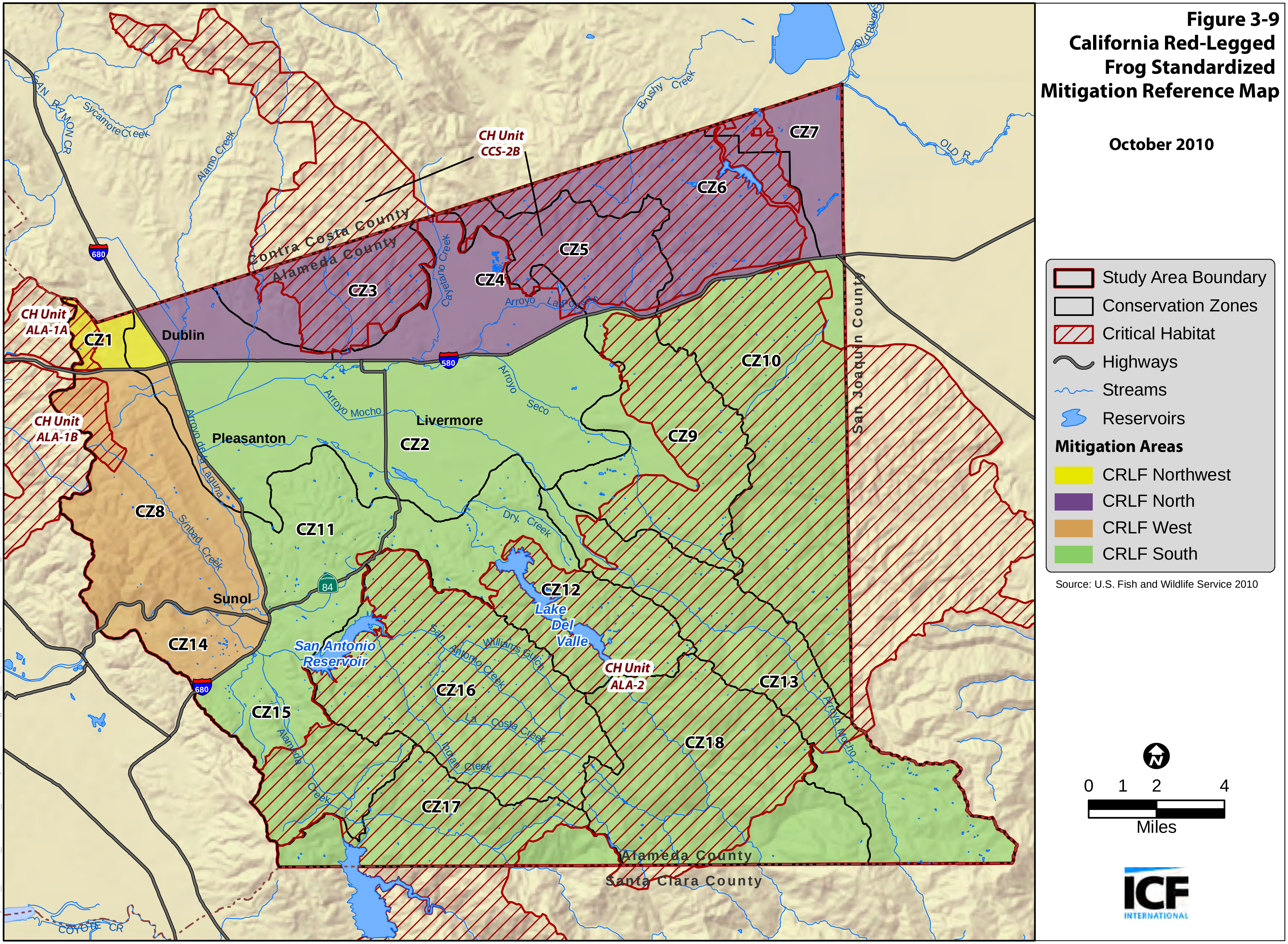
Figure 3-9
California Red-Legged Frog Standardized Mitigation Reference Map

October 2010



Source: U.S. Fish and Wildlife Service 2010

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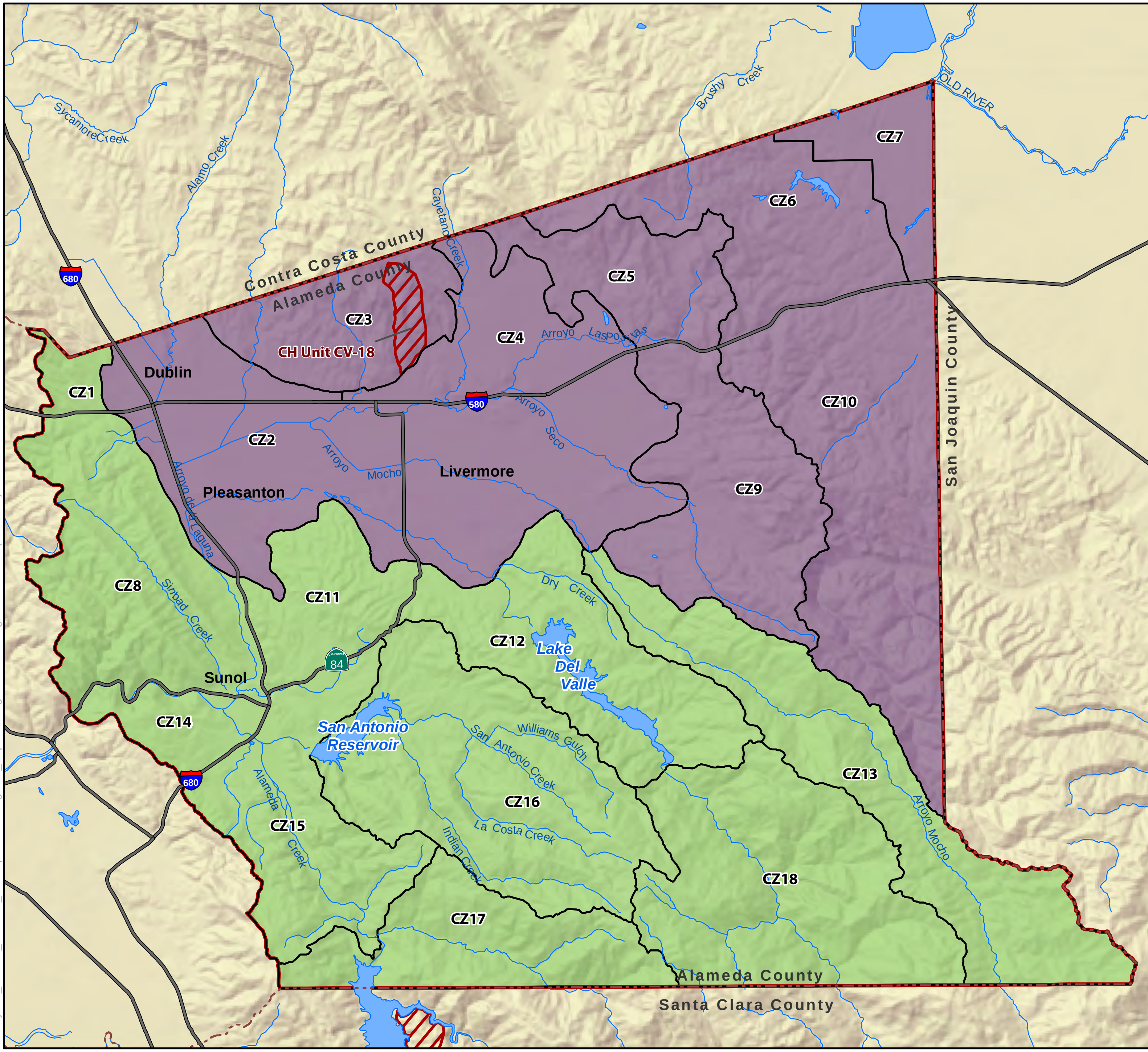
Figure 3-10 California Tiger Salamander Standardized Mitigation Reference Map

October 2010



Source: California Spatial Information Library; FR listing and critical habitat documents; California Gap Analysis, University of California Santa Barbara 1998.

Note: See Chapter 3 for explanation of Mitigation Areas.

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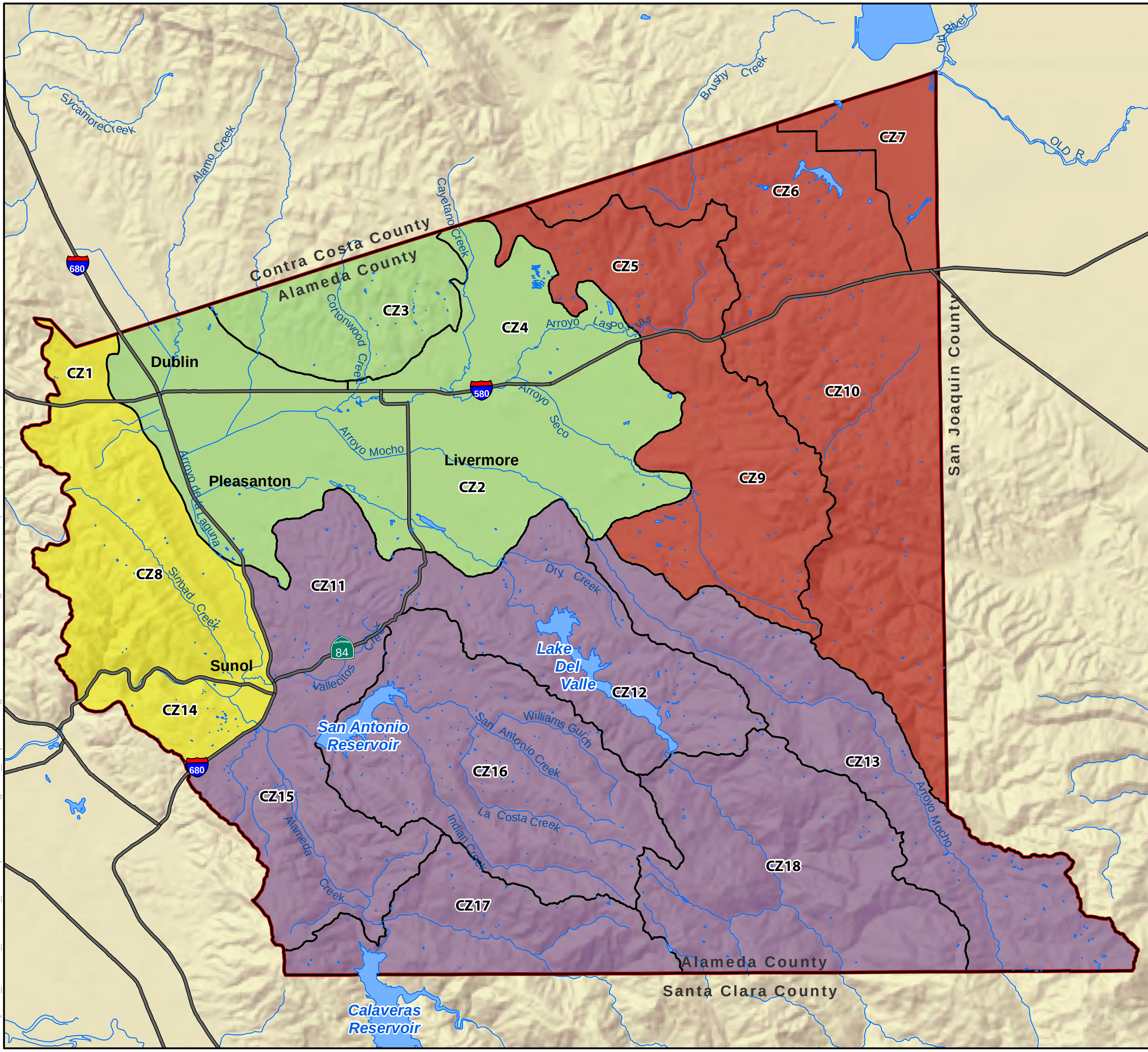

Figure 3-11
Plants and Non-listed Wildlife Species Standardized Mitigation Reference Map

October 2010

Study Area Boundary
Highways
Streams
Reservoirs
Conservation Zones

Non-listed Species Mitigation Areas

East Bay Hills
Livermore Valley
Altamont Hills
Northern Diablo Range

N

0 1 2 4
Miles

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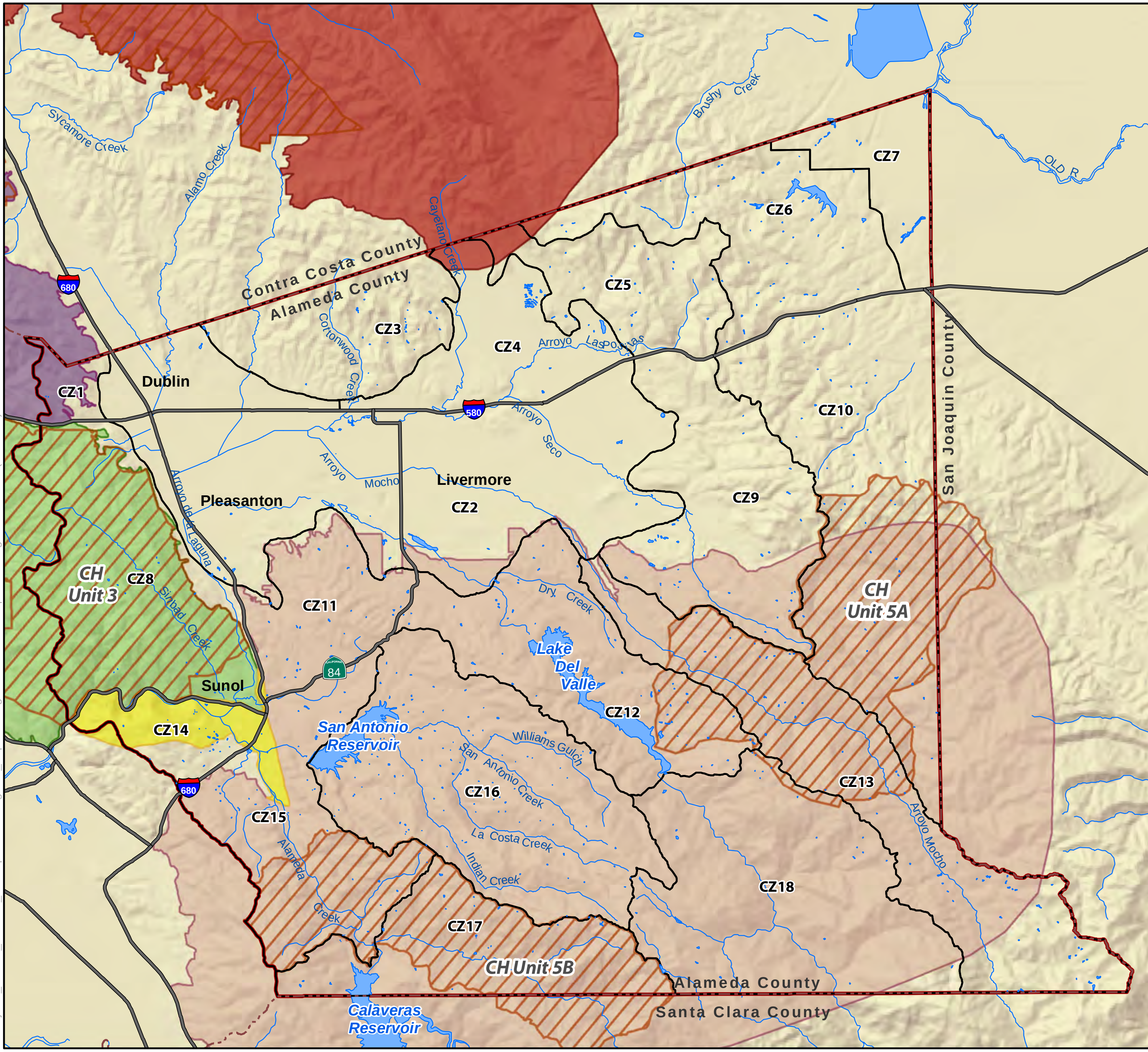
Figure 3-12
Alameda Whipsnake Standardized Mitigation Reference Map

October 2010



Study Area Boundary
Conservation Zones
Critical Habitat
Highways
Streams

USFWS Recovery Units

Unit 2
Unit 3
Unit 4
Unit 5
Unit 7

Source:
California Spatial Information Library.
U.S. Fish and Wildlife Service, 2002.
USFWS Recovery Plan

0 1 2 4
Miles

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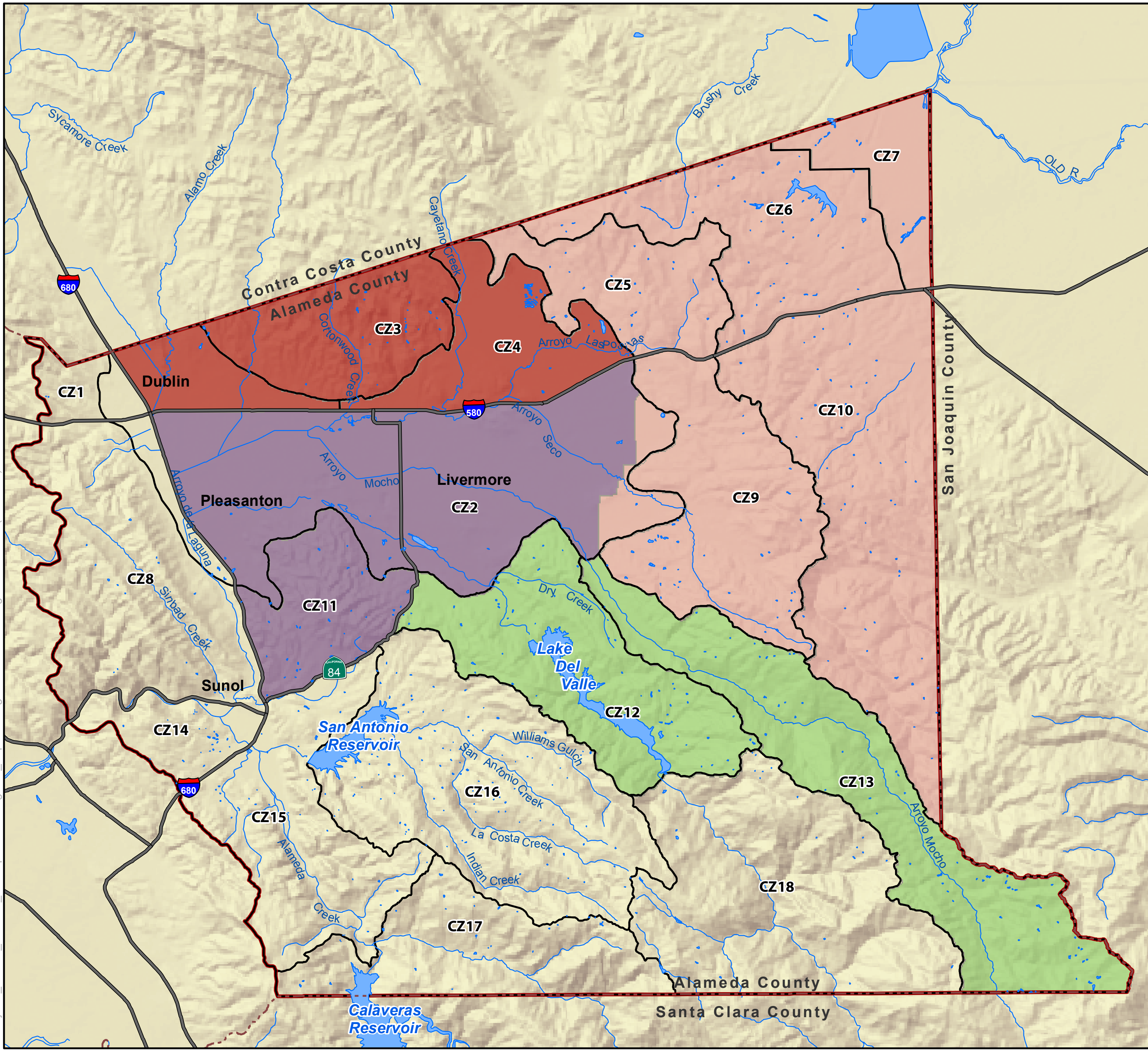
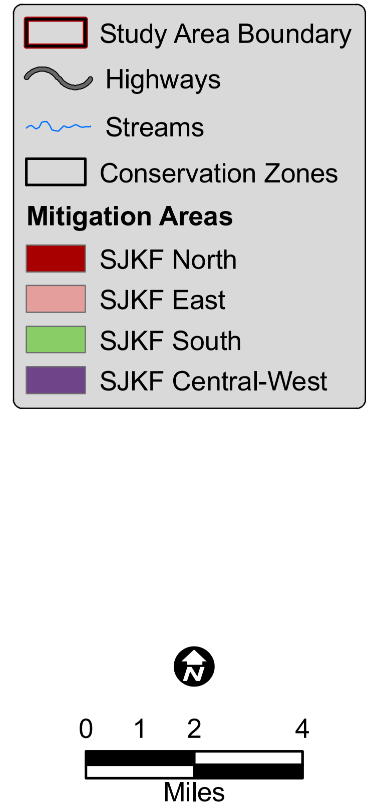
Figure 3-13
San Joaquin Kit Fox Standardized Mitigation Reference Map

October 2010





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Appendix C3

An Example Resource Equivalency Analysis for a Typical Wind Energy Project in the Altamont Pass Wind Resource Area, Alameda County

Appendix C3

An Example Resource Equivalency Analysis for a Typical Wind Energy Project in the Altamont Pass Wind Resource Area, Alameda County

Introduction

ICF International (ICF) developed this example Resource Equivalency Analysis (REA) as an approach to estimate quantitatively the amount of compensatory mitigation that is needed to mitigate impacts on raptors from windfarm operations. The REA is based on the approach used by the U.S. Fish and Wildlife Service (USFWS) to evaluate the mitigation requirements for golden eagles (U.S. Fish and Wildlife Service 2013). In this paper we provide background information on the REA process, methods, results, and conclusion for a sample wind project in the Altamont Pass Wind Resource Area (APWRA). USFWS's REA is based on a modeling approach used in natural resource damage assessment as a way to ensure that environmental impacts are mitigated, and as a tool to account for environmental debits and credits with respect to fatalities and mitigation. Additional information on USFWS's model can be found in *Eagle Conservation Plan Guidance* [ECP Guidance], *Appendix G. Examples Using Resource Equivalency Analysis to Estimate Compensatory Mitigation for the Take of Golden and Bald Eagles from Wind Energy Development* (U.S. Fish and Wildlife Service 2013).

Resource Equivalency Analysis Background

REA is a method of determining compensation using non-monetary metrics. REA, habitat equivalency analysis, habitat evaluation procedures, and other quantitative tools have been used for years to evaluate ways to mitigate environmental impacts and select among various preferred mitigation alternatives. REAs were first used in the late 1990s for an oil-spill Natural Resource Damage Assessment (NRDA) case on the North Cape of Rhode Island (Sperduto et al. 1999, 2003). They have subsequently been used for a variety of other resources, including resources as varied as marbled murrelets and coral reefs. The use of REAs is consistent with the Comprehensive Environmental Response, Compensation, and Liability Act; the Oil Pollution Act; and California's Lempert-Keene-Seastrand Oil Spill Prevention and Response Act (Government Code Section 8670 et seq.). These regulations authorize trustee agencies to seek monetary compensation for injured natural resources (National Oceanic and Atmospheric Administration 1995). REA has also been internationally adopted by the European Union for addressing a full range of environmental liabilities (Cole & Kriström 2008).

A recent opinion paper by Cole (2011) advocates the use of REA as a method to specify appropriate types and amounts of compensation at windfarms. Additionally, USFWS recently provided REA examples in its ECP Guidance (U.S. Fish and Wildlife Service 2013:Appendix G) to illustrate the calculation of compensatory mitigation for the annual loss of bald and golden eagles caused by windfarm operations. USFWS's REA model is provided in a spreadsheet format. Inputs to the model include maximum lifespan, age of first reproduction, number of years females reproduce, productivity, age distribution of birds killed, productivity of mitigation, and a discount rate (i.e., the rate used in calculating the present value of expected yearly benefits and costs – 3%). This information is used to calculate direct losses, indirect losses, generational impacts, debits, productivity of mitigation, and credits owed. Based on these inputs, the model calculates the total debit in bird-years[1] associated with a specific timeframe. Additionally, USFWS's REA example notes that the REA metric of bird-years lends itself to consideration of other compensatory mitigation options, and implies that with enough reliable information, any compensatory mitigation that directly leads to an increased number of birds could be considered for compensation within the context of the REA (U.S. Fish and Wildlife Service 2013:Appendix G). The result of the REA is a comparison of the debit in bird years from the impact with the suggested benefit in bird years from the mitigation (i.e., the model demonstrates that the debits and the credits are equal).

Methods

We adjusted USFWS's golden eagle REA to include information specific to red-tailed hawks, burrowing owls, and American kestrels. These species were selected because they have been identified as *focal species* by Alameda County and other parties for the purposes of managing raptor impacts in the APWRA. The general rationale for using these species as focal species is that they are susceptible to turbine-related fatalities in significant numbers and they occupy ecological niches similar to those of many of the raptors in the region; consequently, management for these focal species could be expected to have benefits for other raptors and other migratory birds. The inputs used in the red-tailed hawk REA are listed in Table 1, the inputs used in the burrowing owl REA are listed in Table 2, and the inputs used in the American kestrel REA are listed in Table 3.

Table 1. REA Inputs to Develop a Framework of Compensatory Mitigation for Potential Take of Red-Tailed Hawk (RTHA) from Wind Energy Development in the APWRA

Parameter	REA Input	Reference
Start year	2015	Start of impact; expected to be 2015 for repowering program.
Estimated take (per year)	22	Estimated in PEIR based on Vasco monitoring results. Estimate to be adjusted in subsequent years following monitoring under Mitigation Measure BIO-11g. Estimate provided is for a "typical" 80 MW project such as Golden Hills.
Average maximum lifespan	25	Preston and Beane 2009.
Age distribution of birds killed at wind facilities (based on age distribution of RTHA population)	0–1=30% 1–4=45% 4+=25%	Preston and Beane 2009.
Age start reproducing	2+(age class 2–3)	Preston and Beane 2009.

[1] A *bird-year* refers to all ecological services provided by one bird for 1 year.

Parameter	REA Input	Reference
Expected years of reproduction	23	Years of reproduction is based on the maximum lifespan minus the age at which RTHA starts reproducing. Preston and Beane 2009.
% of adult females that reproduce annually	84%	Preston and Beane 2009.
Productivity (mean number of individuals fledged per occupied nest annually)	1.4	Preston and Beane 2009. Productivity varies across the country; several values are 1.4, including productivity in Montana. A CDFW study of the Los Banos Wildlife Area in California showed productivity of 2.1 (Schaap 2007).
Year 0–1 survival	61%	Estimated from literature.
Year 1–2 survival	79%	Estimated from literature.
Year 2–3 survival	79%	Estimated from literature.
Year 3–4 survival	79%	Estimated from literature.
Year 4+ survival	90.90%	Estimated from literature.
Relative productivity of mitigation (conservation and enhancement of lands resulting in additional survivorship)	0.10 birds/acre/year	Estimated as described below.
Number of years of avoided loss from mitigation	30	Requirement under MM BIO-11h is that conservation lands would be preserved in perpetuity. A 30-year conservation benefit is assumed.
Discount rate	3%	A 3% discount rate is commonly used for valuing lost natural resource services (Lind 1982; Freeman 1993; National Oceanic and Atmospheric Administration 1999; court decisions on NRDA cases).

Table 2. REA Inputs to Develop a Framework of Compensatory Mitigation for Potential Take of Burrowing Owl (BUOW) from Wind Energy Development in the APWRA

Parameter	REA Input	Reference
Start year	2015	Start of impact; expected to be 2015 for repowering program.
Estimated take (per year)	5	Estimated in PEIR based on Vasco monitoring results. Estimate to be adjusted in subsequent years following monitoring under Mitigation Measure BIO-11g. Estimate provided is for a “typical” 80 MW project such as Golden Hills. Estimate rounded up from 4.4.
Maximum lifespan	8	Poulin et al. 2011. Longevity record based on banding data is 8 years.

Parameter	REA Input	Reference
Age distribution of birds killed at wind facilities (based on age distribution of BUOW population)	0–1=50% 1+=50%	Unknown. An even age distribution of juveniles and adults was assumed.
Age start reproducing	1	Poulin et al. 2011 (actual is 10 months).
Expected years of reproduction	7	Years of reproduction is based on the maximum lifespan minus the age at which BUOW starts reproducing. Poulin et al. 2011.
% of adult females that reproduce annually	100%	Unknown. Assumed all adult females breed annually.
Productivity (mean number of individuals fledged per occupied nest annually)	4.5	Poulin et al. 2011. Productivity varies across country from 1.6 to 7.4. Selected median of 4.5.
Year 0–1 survival	30%	Poulin et al. 2011 notes 30% survival rate for juveniles in southern California.
Year 1–2 survival	81%	Poulin et al. 2011 notes 81% survival rate for adults in southern California.
Year 2–3 survival	81%	Poulin et al. 2011 notes 81% survival rate for adults in southern California.
Year 3–4 survival	81%	Poulin et al. 2011 notes 81 % survival rate for adults in southern California.
Year 4+ survival	81%	Poulin et al. 2011 notes 81 % survival rate for adults in southern California.
Relative productivity of mitigation (conservation and enhancement of lands resulting in additional survivorship)	0.10 birds/acre/year	Estimated as described below.
Number of years of avoided loss from mitigation	30	Requirement under MM BIO-11h is that conservation lands would be preserved in perpetuity. A 30-year conservation benefit is assumed.
Discount rate	3%	A 3% discount rate is commonly used for valuing lost natural resource services (Lind 1982; Freeman 1993; National Oceanic and Atmospheric Administration 1999; court decisions on NRDA cases).

Table 3. REA Inputs to Develop a Framework of Compensatory Mitigation for Potential Take of American Kestrel (AMKE) from Wind Energy Development in the APWRA

Parameter	REA Input	Reference
Start year	2015	Start of impact; expected to be 2015 for repowering program.
Estimated take (per year)	26	Estimated in PEIR based on Vasco monitoring results. Estimate to be adjusted in subsequent years following monitoring under Mitigation Measure BIO-11g. Estimate provided is for a "typical" 80 MW project such as Golden Hills. Estimate rounded from 26.3.
Average maximum lifespan	11	Smallwood and Bird 2002.
Age distribution of birds killed at wind facilities	0–1=57% 2–11=43%	Calculated proportion of population in each age class from survival rates and assumed they would be killed in proportion to availability.
Age start reproducing	1	Smallwood and Bird 2002.
Expected years of reproduction	10	Years of reproduction is based on the maximum lifespan minus the age at which BUOW starts reproducing. Smallwood and Bird 2002.
% of adult females that reproduce annually	80%	Estimated.
Productivity (mean number of individuals fledged per occupied nest annually)	3.1	Smallwood and Bird 2002.
Year 0–1 survival	62.9%	Smallwood and Bird 2002.
Year 1–2 survival	57.1%	Smallwood and Bird 2002.
Year 2–3 survival	57.1%	Smallwood and Bird 2002.
Year 3–4 survival	57.1%	Smallwood and Bird 2002.
Year 4+ survival	57.1%	Smallwood and Bird 2002.
Relative productivity of mitigation (conservation and enhancement of lands resulting in additional survivorship)	0.10 birds/acre/year	Estimated as described below.
Number of years of avoided loss from mitigation	30	Requirement under MM BIO-11h is that conservation lands would be preserved in perpetuity. A 30-year conservation benefit is assumed.
Discount rate	3%	A 3% discount rate is commonly used for valuing lost natural resource services (Lind 1982; Freeman 1993; National Oceanic and Atmospheric Administration 1999; court decisions on NRDA cases).

In addition to the life history factors, the key assumptions related to the REA are (1) the expected annual fatalities, (2) the relative benefits of the mitigation, (3) the years of benefit/avoided loss from the mitigation, (4) the start year of the fatalities, and (5) the start year of the mitigation. The expected fatality rate was determined using the methods described in the PEIR, based on the expected rate of red-tailed hawk, burrowing owl, and American kestrel fatalities (birds/MW/year) observed at the Vasco winds project site, extrapolated to a typical 80 MW project.

The relative benefits of the mitigation were estimated by assuming that survival benefits arise from the management of conservation lands, including the removal of rodenticide, eliminating the killing of ground squirrels with lead shot, increasing prey abundance, and other management factors that increase the survival of the focal species. As ground squirrel density and availability is a key element of raptor survivorship and therefore productivity, greater numbers of ground squirrels would be expected to benefit individuals. Additionally, raptors are known to die from secondary poisoning after consuming vertebrate prey that has ingested rodenticides (Mineau et al. 1999); consequently, eliminating toxins will also increase survival. Considering these factors, we assumed that these management actions and the conservation of lands would result in a productivity increase (resulting in additional RTHA, BUOW, and AMKE in the environment) of 0.1bird per acre of habitat managed. Such quantification is difficult based on the currently available scientific literature; however, we believe these assumptions to be reasonable metrics that could be updated as new information becomes available in the future.

The period over which the mitigation would provide benefits was assigned a 30-year duration. Although the conserved lands would be preserved in perpetuity, the duration of the average life of a wind project was assigned to the duration of mitigation.

Finally, to simplify the example and the interpretation of the results, and considering that projects would be phased over time under the repowering program, the start year of the fatalities and the start year of the mitigation were considered to be the same: 2015.

ICF modified the USFWS golden eagle REA model to approximate the life-history information associated with RTHA, BUOW, and AMKE as described above. In this process we used the variable *acres* needed to result in increased productivity rather than showing the unit of benefit in terms of *poles* retrofitted to result in avoided fatalities and/or loss of productivity.

Results

The results from the red-tailed hawk REA using the inputs described above determine the total lost bird-years from the expected impact (Table 4) and the relative productivity of the mitigation (Table 5). These metrics are used to calculate the compensatory mitigation requirement as shown in Table 6. This calculation endeavors to ensure that the compensatory mitigation provides a credit that is equal to the debit for the expected take.

Table 4. Total Lost Bird-Years

	PV[2] Bird-Years		
Year	RTHA	BUOW	AMKE
2015	131.47	13.06	40.14
2016	127.64	12.68	38.97
2017	123.93	12.31	37.84
2018	120.32	11.95	36.74
2019	116.81	11.60	35.67
2020	113.41	11.26	34.63
2021	110.10	10.93	33.62
2022	106.90	10.62	32.64
2023	103.78	10.31	31.69
2024	100.76	10.01	30.77
Total PV Bird-Years	1,155.12	114.71	352.70

Table 5. Relative Productivity of Conserving/Enhancing 1 Acre

	PV Bird-Years/Conserved Acre		
Year	RTHA	BUOW	AMKE
2015	0.598	0.178	0.154
2016	0.580	0.173	0.150
2017	0.563	0.168	0.146
2018	0.547	0.163	0.141
2019	0.531	0.158	0.137
2020	0.515	0.153	0.133
2021	0.500	0.149	0.129
2022	0.486	0.145	0.126
2023	0.472	0.140	0.122
2024	0.458	0.136	0.118
2025	0.445	0.132	0.115
2026	0.432	0.128	0.112
2027	0.419	0.125	0.108
2028	0.407	0.121	0.105
2029	0.395	0.118	0.102
2030	0.384	0.114	0.099
2031	0.372	0.111	0.096
2032	0.362	0.108	0.093
2033	0.351	0.104	0.091

[2] PV = Present Value- within the context of a Resource Equivalency Analysis (REA), refers to the value of debits and credits based on an assumed annual discount rate (3%). This term is commonly used in economics and implies that resources lost or gained in the future are of less value to us today.

	PV Bird-Years/Conserved Acre		
Year	RTHA	BUOW	AMKE
2034	0.341	0.101	0.088
2035	0.331	0.098	0.085
2036	0.321	0.096	0.083
2037	0.312	0.093	0.081
2038	0.303	0.090	0.078
2039	0.294	0.087	0.076
2040	0.285	0.085	0.074
2041	0.277	0.082	0.072
2042	0.269	0.080	0.070
2043	0.261	0.078	0.067
2044	0.254	0.075	0.066
Total PV Bird-Years	12.064	3.589	3.117

Table 6. Credit Owed for a 10-year Take

	RTHA	BUOW	AMKE	
Total Debit	1,155.12	114.71	352.70	PV Bird-Years
÷ Relative Productivity of Conservation of 1 Acre	12.06	3.59	3.12	Avoided loss of PV bird-years/acre
= Credit owed	95.78	31.96	113.04	Acres to be conserved

The REA for red-tailed hawk indicates that approximately 96 acres of conserved lands (preserved for at least 30 years), managed for red-tailed hawks, would be required to compensate for the loss from 10 years of estimated take (22 birds/year) from a typical 80 MW wind project.

The REA for burrowing owl indicates that approximately 32 acres of conserved lands (preserved for at least 30 years), managed for burrowing owl, would be required to compensate for the loss from 10 years of estimated take (5 birds/year) from a typical 80 MW wind project.

The REA for American kestrel indicates that approximately 113 acres of conserved lands (preserved for at least 30 years), managed for American kestrel, would be required to compensate for the loss from 10 years of estimated take (26 birds/year) from a typical 80 MW wind project.

Detailed calculations are provided in REA spreadsheet models, available for review from Alameda County.

Conclusions

This analysis provides an empirical evaluation of the mitigation that is needed to offset impacts on red-tailed hawk, burrowing owl, and American kestrel using the REA process; however, it should be noted that a variety of assumptions and variable life history information can substantively influence the results provided by the worksheets. Similarly, the expected benefits of the mitigation could vary depending on the specific conditions of the mitigation site. This REA example is intended to be used as a framework, guide, and planning tool for the County and applicants to estimate compensatory mitigation for specific projects. Under this approach, each applicant would input the estimated number of fatalities expected annually to calculate the mitigation needed for that species. If an applicant believes there is additional or more current literature that should be cited, the life history and ecological information could also be updated.

Assuming that a single mitigation site could provide resource values for red-tailed hawk, western burrowing owl, and American kestrel (given that all three species forage, breed, and winter in the region), a single mitigation site of 113 acres could serve as mitigation for all three species. Therefore, in this example, an 80 MW project with projected fatalities of 22 (RTHA), 5 (BUOW) and 26 (MAKE) would require 113 acres of mitigation every 10 years.

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