

**Appendix D**  
**Folsom DS/FDR Biological Assessment**

Subject: Folsom DS/FDR

2

If you have any questions or concerns, please call Shawn Oliver at 916-989-7256.

Sincerely,

MICHAEL R FINNEGAN

Michael R. Finnegan  
Area Manager

Enclosure

cc: Ms. Stephanie Rickabaugh  
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(w/encl)

bc: CC-488 411  
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# United States Department of the Interior

BUREAU OF RECLAMATION  
Central California Area Office  
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PROJECT REF ID: T1

CC-411  
ENV-6.00

FEB 23 2007

Ms. Susan Moore  
Field Supervisor  
U.S. Fish and Wildlife Service  
2800 Cottage Way, Room W-2605  
Sacramento, CA 95825

**Subject: Request for Formal Consultation on the Folsom Dam Safety and Flood Damage Reduction Action (Folsom DS/FDR)**

Dear Ms. Moore:

As required by Section 7 of the Endangered Species Act, we are requesting formal consultation with your office.

The Folsom DS/FDR is located on the American River in Sacramento, Placer, and El Dorado Counties, California. We address the project's effects on threatened or endangered species and/or critical habitat in the enclosed Biological Assessment.

We conclude that construction of the Folsom DS/FDR, with our recommended measures, will not adversely affect the El Dorado bedstraw (*Galium californicum* ssp. *sierrae*), Layne's butterweed (*Senecio layneae*), California red-legged frog (*Rana aurora draytonii*), giant garter snake (*Thamnophis gigas*), or bald eagle (*Haliaeetus leucocephalus*).

We conclude that the construction of the Folsom DS/FDR, with our recommended measures, may result in impacts to individual vernal pool fairy shrimp (*Branchinecta lynchi*), California vernal pool tadpole shrimp (*Lepidurus packardii*), or valley elderberry longhorn beetles (*Desmocerus californicus dimorphus*), but that it is not likely to adversely affect the viability of the populations of these species in this area.

Please provide your concurrence on our findings no later than 135 days from receipt of this request. If we don't hear from you within 30 days, we will assume that you have sufficient information to initiate consultation and will provide us with your biological opinion by March 28, 2007. We would like the opportunity to comment on the draft biological opinion prior to its finalization. Please address your response with Shawn Oliver, Natural Resource Specialist, Bureau of Reclamation, 7794 Folsom Dam Road, Folsom, CA 95630.

# RECLAMATION

*Managing Water in the West*

## **Folsom Dam Safety and Flood Damage Reduction Action Biological Assessment**



**U.S. Department of the Interior  
Bureau of Reclamation**



**US Army Corps  
Of Engineers®**

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# Folsom Dam Safety and Flood Damage Reduction Action Biological Assessment

*prepared by:*

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**U.S. Department of the Interior  
Bureau of Reclamation**



**US Army Corps  
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Appendix B. Elderberry Mitigation

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Appendix D. White Paper: *A Brief Synthesis on Mercury in the Environment*

## ACRONYMS AND ABBREVIATIONS

|                      |   |
|----------------------|---|
| BA                   | biological assessment                               |
| CESA                 | California Endangered Species Act                   |
| CNDDDB               | California Natural Diversity Database               |
| Corps                | United States Army Corps of Engineers               |
| CRLF                 | California red-legged frog                          |
| DWR                  | Department of Water Resources                       |
| ESA                  | Federal Endangered Species Act                      |
| Folsom DS/FDR Action | Folsom Dam Safety and Flood Damage Reduction Action |
| MIAD                 | Mormon Island Auxiliary Dam                         |
| OHWM                 | Ordinary high water mark                            |
| Reclamation          | United States Bureau of Reclamation                 |
| Reclamation Board    | State Reclamation Board                             |
| SAFCA                | Sacramento Area Flood Control Agency                |
| USFWS                | United States Fish and Wildlife Service             |
| VELB                 | valley elderberry longhorn beetle                   |

# 1.0 INTRODUCTION

The proposed Folsom Dam Safety/Flood Damage Reduction (DS/FDR) Action reflects a cooperative effort by the U.S. Department of the Interior, Bureau of Reclamation (Reclamation) and the U.S. Army Corps of Engineers (Corps), as well as the Corps' non-federal sponsors, the State Reclamation Board (Reclamation Board)/Department of Water Resources (DWR) and the Sacramento Area Flood Control Agency (SAFCA). The Folsom DS/FDR Action is intended to implement Reclamation's dam safety and security obligations and the Corps' flood damage reduction objectives at Folsom Dam and appurtenant facilities. These facilities impound waters of the American River forming Folsom Reservoir and are collectively referred within this document as the Folsom Facility (Folsom Facility).

The Folsom DS/FDR Action responds to certain objectives of each of the aforementioned agencies. Reclamation's Safety of Dams Program objectives focus on reducing the risk of failure under hydrologic (flood), seismic (earthquake), and static (seepage) loads. Folsom Dam has been designated as a National Critical Infrastructure Facility and any compromise of the facility could result in grave property damage and loss of life. Reclamation's Security Program objectives are being upgraded to protect public safety by securing Folsom Dam, the appurtenant structures, and other Reclamation facilities, including the Folsom power plant. The Corps' flood damage reduction objective is to improve the annual recurrence level of flood protection provided to the lower American River corridor. Similarly, SAFCA and DWR seek to improve the level of flood protection for the Sacramento region. Reclamation is the lead agency for this action and is the responsible party for all of the environmental mitigation associated with the Safety of Dams construction, and construction of the auxiliary spillway and six submerged tainter gates.

The Folsom DS/FDR study area includes the area surrounding the Folsom Facility. The Folsom Facility falls within the borders of Placer, Sacramento, and El Dorado Counties, in the State of California. The study area primarily consists of federally-owned lands that are currently leased to and managed by the California Department of Parks and Recreation. The Folsom DS/FDR Action footprint associated with this assessment is composed of areas that may be potentially affected by the Folsom DS/FDR Action in the vicinity of Folsom Reservoir including: potential dike construction zones, potential borrow areas, potential contractor use areas, existing haul roads and proposed haul roads. A depiction of the Folsom DS/FDR Action footprint and vicinity is provided in Figure 1-1.

## 1.1 Project History

The Folsom Dam and associated facilities were constructed by the Corps, with construction completed in 1956. Currently, the Bureau of Reclamation manages Folsom Reservoir, while

the majority of the surrounding lands are managed by the State of California's Parks and Recreation Department.

During initial construction of Folsom Dam and immediately upon completion of construction, major storm and flood events occurred on the American River which were precursor events to an event which occurred in February 1986. At that time, a series of major storms occurred in the Sacramento region that brought approximately 10 inches of rain over a period of 11 days, and exposed deficiencies in the flood control system of the region. Dam operators at Folsom and Nimbus Dams were required to release approximately 130,000 cfs, which is 15,000 cfs more than the downstream levees were designed to accommodate at a sustained flow rate. Water levels rose well above the designated freeboard of the downstream levees. Although major failure of the dam and levees did not occur, questions arose about the level of protection the structures could actually provide.

Also in the 1980s, seismic concerns were identified at Mormon Island Auxiliary Dam (MIAD) by the Corps and Reclamation. The Corps and Reclamation jointly determined that liquefaction of the foundation and the subsequent failure of MIAD could occur during seismic (earthquake) activity. A phased structural modification program was rapidly undertaken in the early 1990s by Reclamation when reservoir levels were lower than normal as result of drought. The modifications partially reduced the risk of seismically induced liquefaction.

In 2000, Reclamation identified the potential need for additional dam safety modifications to address other hydrologic, seismic and static risks. Hydrologic risk is characterized as the risk of any or all of the 11 earthen embankment dams and dikes being overtopped during a Probable Maximum Flood (PMF) event leading to rapid uncontrollable erosion and failure.

In addition to the seismic concerns at MIAD, it was also determined that modifications would be required to prevent the main dam from sliding along the dam rock foundation contact and as the deformation of main dam pier and gate elements leading to the displacement and/or failure of the structures, resulting in an uncontrollable breach. Additionally, it was determined that modifications would be required to reduce the static risk of potential seepage paths developing undetected within select earthen embankment dams and dikes leading also to uncontrolled erosion and subsequent failure.

## **1.2 Folsom DS/FDR Action Description**

### **1.2.1 Construction**

The Folsom DS/FDR Action includes several elements that, when combined, meet all of Reclamation's Safety of Dams needs, as well as the Corp's Flood Damage Reduction needs. These elements include modifications to the Main Dam, the stilling basin, the Left and Right

Wing Dams, the auxiliary spillway, the Mormon Island Auxiliary Dam (MIAD) and Dikes 1 through 8, as well as several construction use areas. Construction details are described in the project description supplied the Service on February 22, 2007.

The original project description and consultation letter included a description of the Corps' proposed 3.5-ft dam raise alternative and the impacts associate with the construction of that feature. Reclamation is not including that feature or the potential impacts of constructing that feature in this consultation due to the uncertainty of whether or not the raise is needed to meet project goals. If the raise is not needed to meet the FDR goals of the project, or the benefits of the raise do not justify the costs, then the feature will not be constructed. The Corps will not make a final decision on the raise alternative when more detailed design information is available. Supplemental environmental compliance documentation will be completed as necessary.

### **1.2.2 Operations**

When the Folsom DS/FDR Action is completed, Folsom Dam will have four methods of discharging flows from the reservoir: three power penstocks, eight flood control outlets, tainter/radial spillway gates set near the main spillway crest (five service and three emergency), and six submerged tainter gates in the proposed auxiliary spillway. To ensure adequate tailwater, the three emergency spillway gates may not be used unless the total outflow from the dam exceeds 240,000 cfs. This restriction makes the emergency gates unusable for normal flood control purposes and limits the use of the gates to dam safety outflows.

In general, utilization of these features in conjunction with the auxiliary spillway would allow the objective release of 115,000 cfs to be achieved sooner in a flood event, and would reduce peak flows for large, infrequent hydrologic events. A maximum flood release of 160,000 cfs, which is the emergency downstream channel capacity, would be made through the auxiliary spillway when necessary, based on observed and anticipated reservoir inflows. After construction of the auxiliary spillway, emergency releases of 160,000 cfs or above would not be made any sooner during the event than would occur under existing conditions.

Variations in releases utilizing project features would not be any larger than those allowed under the existing conditions. These larger, earlier flows would conserve flood storage space.

It is anticipated that a revised Water Control Manual, and the supporting environmental compliance coordination and documentation would be completed at least one year prior to completion of construction of the project. However, if this does not occur, the project features would be operated under existing operating criteria. Under this scenario, the same amount of water would ultimately be released with and without the project features (due to operational constraints), but operators would have the ability to release more water sooner in a hydrologic event.

The full flood damage reduction benefits of the JFP auxiliary spillway would not be fully realized until revision of the Water Control Manual and optimization of the operation of the JFP spillway is in place.

### **1.2.3 Cumulative Impacts**

The USFWS expressed concern about the potential effects of the project on listed aquatic species, chiefly over sediment containing mercury being mobilized during construction. The Folsom DS/FDR Action has the greatest potential to affect aquatic species through the effects of dredging fine sediments from the bottom of Folsom Reservoir during construction of the JFP spillway. Additional impacts could occur through enlargement of the stilling basin at the base of the auxiliary spillway. The principal concern associated with the dredging and excavation of the JFP spillway and the stilling basin is the potential for fine sediment and associated mercury to be released from Folsom Reservoir.

Most project elements (construction of the auxiliary spillway approach, staging and site development areas, security upgrades) would occur in the dry. As they are occurring in out of water areas, they would have the potential to affect the aquatic environment of Folsom Reservoir only through the incidental discharge of sediment or toxic substances into the reservoir. If such a discharge did occur it would be extremely small and would not have the potential to affect the Lower American River, as it would have to pass through both Folsom Reservoir and Lake Natomas before reaching the Lower American River.

To minimize the effects of re-suspending fine sediments outside of the immediate construction area, the construction area would be isolated from the rest of Folsom Reservoir, including the normal outlet structure, using silt curtains, sheet piles and other sediment minimization devices and practices. Fine sediments would be dredged and removed to upland storage locations prior to blasting and excavation of the underlying bedrock. This work would occur when the reservoir is not likely to spill. These mechanisms and practices are expected to contain all fine sediments and associated mercury within Folsom Reservoir, and most of this would be contained within the construction area. Any mercury that was released from Folsom Reservoir would enter Lake Natomas, which would act as a large settling basin. Transit time for sediments through Lake Natomas has been estimated to be approximately 3 days, indicating the low velocities within Lake Natomas and the ample opportunity for settling this would allow.

Should suspended sediments and associated mercury enter Lake Natomas and the Lower American River, only a small portion (0.8 to 2.5 percent, Domagalski 2001, Domagalski et al. 2000) likely could be methylated. Rates of methyl mercury production depend not only on the abundance of inorganic mercury but also on a complex assortment of environmental variables which affect the activities and species composition of anaerobic bacteria and the availability of the inorganic mercury for methylation (HSDB 2003, Beckvar et al. 1996, EPA 1997). These factors include temperature, dissolved organic carbon, salinity, acidity (pH), availability of wetlands and other anoxic environments, oxidation-reduction conditions, and the form and concentration of sulfur in water and sediments (Beckvar et al. 1996, EPA 1997).

Elemental and inorganic mercury can be converted to organic mercury by anaerobic bacteria. Within the project area and downstream waters, methylation rates are likely to be low, as relatively little of the total mercury concentration is readily available for transformation, the waters are not acidic, and there are few areas providing the anaerobic conditions that promote methylation.

It is expected that very little fine sediment and associated mercury is likely to be transported from the project area to the Lower American River below Lake Natomas. Most sediment is expected to remain within Folsom Reservoir and any sediment that is discharged from the reservoir would be expected to settle out in Lake Natomas. It typically takes three days, under normal conditions for a release to make it to the Lower American River from Folsom Dam. Therefore these activities would not affect listed species in the Lower American River, the Sacramento River, or further out in the system.

The project description is currently being updated to reflect the information that was developed for this document. As soon as a draft is available with the updates, it will be provided to the USFWS.

Appendix D provides more technical information on mercury.

### **1.3 Summary of Consultation to Date**

Other projects proposed in the immediate vicinity of the Folsom DS/FDR Action include the Folsom Bridge project, Common Features, the Auburn Folsom road widening project, the Reliable Water Supply Pipeline for Roseville, Folsom, and San Juan Water Districts, and the Sacramento Municipal Utility District Transmission Line Project. The Folsom Dam Road Closure and the Folsom Historic District Traffic Calming Program are not likely to affect biological resources and are not included in this evaluation.

In January 1996, the Corps submitted the final Biological Data Report for the American River Watershed Project to the U.S. Fish and Wildlife Service (FWS). This report addressed four project alternatives. In May 1996, the FWS provided a biological and conference opinion (file number 1-1-96-F-28) on the effects of the Corps' Detention Dam Plan on the delta smelt, delta smelt critical habitat, Sacramento splittail, valley elderberry longhorn beetle, and giant garter snake. In the Water Resources Development Act (WRDA) of 1996, Congress authorized construction of the Common Features Project, which consisted of features common to three of the alternatives. After reviewing detailed project designs the Corps subsequently reinitiated formal consultation and received a Biological Opinion for the American River Common Features Project on July 7, 1999 (file number 1-1-99-F-0078). A supplemental biological assessment prepared by the Corps for modifications to this project covered only the fish species.

For the Folsom Dam Raise project, the Corps provided a Biological Assessment that concluded project effects would only have impacts to the valley elderberry longhorn beetle

and to certain fish species that are not present in the project footprint for the Folsom DS/FDR Action (Corps 2001). A Biological Opinion was received in December 2004 and amended in May 2005.

The DEIS/EIR for the Folsom Bridge project (Corps 2006) found there would be no adverse effects to California red-legged frog, the giant garter snake, the vernal pool fairy shrimp, or the vernal pool tadpole shrimp from any of the alternatives evaluated for that project because "...no suitable habitat for special-status reptiles, amphibians, or invertebrates was noted during the wetland delineation for the proposed project" (Corps 2006). The DEIS/EIR for the Folsom Bridge project did identify potential effects to the bald eagle if this species were present during construction. This document also provided mitigation measures to reduce any potential effects.

The Sacramento Municipal Utility District Transmission Line Project will result in limited impacts to native vegetation. Construction activities will primarily take place in areas already affected either by the Folsom Bridge Project or the Folsom DS/FDR Action. Additional impacts to native vegetation in the Folsom DS/FDR Action area are not expected from this project. Construction activities for the Reliable Water Supply Project for the City of Roseville, City of Folsom, the San Juan Water District project and the Sacramento Municipal Utility District Transmission Line Project would be implemented concurrently with, and generally within the footprint of, construction activities implemented for the Folsom DS/FDR Action. Therefore, they would not contribute appreciably to additional direct or indirect impacts. There is currently no known starting date for the Reliable Water Supply Project, however, it is anticipated that construction will be initiated at some point during the 18 year construction period for the Folsom DS/FDR action.

USFWS is participating in the Folsom DS/FDR Action pursuant to the ESA and FWCA. Reclamation is consulting with USFWS for preparation of this Biological Assessment and a Coordination Action Report.

## 2.0 ENVIRONMENTAL SETTING

The Folsom DS/FDR Action footprint is located within the American River watershed and would affect lands around Folsom Reservoir that are impounded by Folsom Dam or are adjacent to the retention area. Folsom Reservoir is located at the western edge of the Sierra Nevada foothills, adjacent to the Central Valley. This region is characterized by rolling hills and upland plateaus, dissected by major river canyons. The climate is characterized by cool, wet winters and hot, dry summers.

Upland communities within the Folsom DS/FDR Action area include interior live oak woodland, blue oak woodland and savanna, California annual grassland and a few small areas with chaparral shrubs, sometimes associated with oak woodland. Riparian, aquatic and seasonally wet areas include cottonwood-willow riparian, freshwater marsh, and seasonal wetlands. Developed areas within the Folsom DS/FDR Action area include dams and dikes, the facilities associated with the main dam, and campgrounds, day-use areas and boat launches that are State Park facilities. Areas devoid of vegetation include portions of the reservoir shoreline fluctuation zone and barren areas where previous construction has taken place.

## 3.0 FEDERALLY PROTECTED SPECIES

A list of special status species with potential to occur in the Folsom DS/FDR Action area was compiled through a series of literature, website and database sources. This search included a review of California Department of Fish and Game's (CDFG) California Natural Diversity Database (CNDDDB) (CDFG 2005a) and the U.S. Fish and Wildlife Service (USFWS) Sacramento District website (USFWS 2006). Both the CNDDDB and the USFWS website were queried by 7.5-minute quadrangle. The list of Folsom DS/FDR Action quadrangles (quads) included Folsom and Clarksville, Rocklin, and Pilot Hill. The list from the USFWS list is provided in Appendix C. Additional species were included in the analysis based on known distribution, habitat requirements, and/or incidental sightings. Other literature sources including Zeiner et al. (1988, 1990a, 1990b) the California Wildlife Habitat Relationship (CWHR) database (CDFG 2000), and others are referenced as appropriate.

Eight federally-protected species were identified as potentially occurring in the Folsom DS/FDR Action area: two plants, three invertebrates, one amphibian, one reptile, and one bird. These species are El Dorado bedstraw (*Galium californicum* ssp. *sierrae*), Layne's butterweed (*Senecio layneae*), vernal pool fairy shrimp (*Branchinecta lynchi*), California vernal pool tadpole shrimp (*Lepidurus packardi*), valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), California red-legged frog (*Rana aurora draytonii*), giant garter snake (*Thamnophis gigas*), and bald eagle (*Haliaeetus leucocephalus*). Two bird species that were formerly protected under the federal Endangered Species Act (ESA) may occur in the Folsom DS/FDR Action area. The American peregrine falcon (*Falco peregrinus anatum*) was de-listed in 1999 (Federal Register 1999) and the Aleutian Canada goose (*Branta canadensis leucopareia*) was de-listed in 2001 (Federal Register 2001). Since these species have been de-listed for more than five years, they are not discussed further in this document.

### 3.1 Plants

#### 3.1.1 El Dorado Bedstraw

The El Dorado bedstraw (*Galium californicum* ssp. *sierrae*) is federally listed as endangered (Federal Register 1996b), is state-listed as rare, and is a California Native Plant Society (CNPS) List 1B species.

#### Natural History

This bedstraw is a perennial herb that blooms from May to June. A member of the Rubiaceae family, this species is only found in El Dorado County. The El Dorado bedstraw is found within chaparral, cismontane woodland, lower montane and coniferous forest habitats and gabbroic soils in an elevation range from 100 to 585 meters (CNPS 2001).

### **Status within the Folsom DS/FDR Action Area**

It is unlikely that El Dorado bedstraw occurs in the primary Folsom DS/FDR Action area based on the small extent of chaparral and the absence of coniferous forest. However, the Folsom DS/FDR Action area is in the lower extent of the elevation range for this species, and cismontane woodland is present. Therefore, there is a small probability that this species would be present. Habitat for this species may be present in areas around the reservoir that fall within the project action area.

No critical habitat has been determined or proposed for El Dorado bedstraw. The upper end of the South Fork arm of Folsom Reservoir lies within the Salmon Falls section of the Pine Hills Preserve. This area was identified as Priority 1 land in the recovery plan that includes El Dorado bedstraw (USFWS 2002b).

### **3.1.2 Layne's Butterweed**

Layne's butterweed (*Senecio layneae*) is federally listed as threatened (Federal Register 1996b), is state listed as rare, and is a CNPS List 1B species.

#### **Natural History**

This butterweed is a perennial herb that blooms from April to May in chaparral and cismontane woodland habitats on serpentinite, gabbroic, or rocky soils. A member of the Asteraceae family, the Layne's butterweed is found in El Dorado, Tuolumne and Yuba Counties. Habitat areas fall within 200 to 1,000 meters in elevation (CNPS 2001).

### **Status within the Folsom DS/FDR Action Area**

Layne's butterweed is not likely to occur in the Folsom DS/FDR Action area based on the limited extent of chaparral and the lack of serpentinite soils. Habitat for this species may be present in areas around the reservoir that fall within the project action area.

No critical habitat has been determined or proposed for Layne's butterweed. The upper end of the South Fork arm of Folsom Reservoir lies within the Salmon Falls section of the Pine Hills Preserve. This area was identified as Priority 1 land in the recovery plan that includes Layne's butterweed (USFWS 2002b).

## **3.2 Invertebrates**

### **3.2.1 Vernal Pool Fairy Shrimp**

Vernal pool fairy shrimp (*Branchinecta lynchi*) was federally listed as threatened in 1994 (Federal Register 1994). Critical habitat has been designated for this species, but includes no land in the Folsom DS/FDR Action area (Federal Register 2003).

### **Natural History**

This species is restricted to seasonal vernal pools (Eng, et al. 1990; Federal Register 1994). Water quality is one of the most important factors in habitat suitability of vernal pool fairy shrimp. They prefer cool-water pools that have low dissolved solids, conductivity, alkalinity and chloride (Eriksen and Belk 1999, Federal Register 1994). This fairy shrimp is found primarily in the Central Valley and the foothills of the Sierra Nevada in northern California from 10 to 290 meters in elevation (Eng et al. 1990, Eriksen and Belk 1999, Federal Register 1994).

Surveys conducted by Sugnet and Associates (1993) listed 178 records of this species representing 32 populations out of 3092 “discrete locations” containing potential habitat (Federal Register 1994). The geographic distribution of this species ranges from Stillwater Plain in Shasta County through the Central Valley to Pixley in Tulare County. They also occur along the coast range from Northern Solano County to Pinnacles in San Benito County (Federal Register 1994).

Fairy shrimp are adapted for survival in water bodies that are transient and their cysts (protected eggs) can withstand long dry periods. They require cool waters early in the rainy season for hatching and are highly susceptible to contaminants. Dispersal of cysts is thought to occur by animal vectors, including grazing animals or waterfowl.

### **Status within the Folsom DS/FDR Action Area**

Evidence of seasonal ponding was observed in August surveys east of MIAD, at locations that may be included in the Folsom DS/FDR Action as contractor use areas. A total of 0.04 acre (1,842 square feet) of seasonal wetlands has been mapped at these locations. Vernal pool fairy shrimp have been observed less than one mile away from the Folsom DS/FDR Action area (David Murth pers. obs., as cited in LSA 2003). Although the seasonal pools within the study area contain less water than is typical for this species’ habitat, the close proximity of the Folsom DS/FDR Action area to a known occurrence provides at least a low potential for this species to occur.

### **3.2.2 Vernal Pool Tadpole Shrimp**

The vernal pool tadpole shrimp (*Lepidurus packardii*) is federally listed as endangered (Federal Register 1994). Critical habitat has been designated for this species, but includes no land in the Folsom DS/FDR Action area (Federal Register 2003).

### **Natural History**

This species is a small crustacean found in ephemeral freshwater pools. The vernal pool tadpole shrimp is known from 18 populations in the Central Valley, ranging from east of Redding in Shasta County south to San Luis National Wildlife Refuge in Merced County.

They inhabit vernal pools ranging in size from five square meters (54 square feet) to 36 hectares (89 acres). Water contained in occupied pools can range from clear to highly turbid and often has low conductivity, total dissolved solids, and alkalinity (Federal Register 1994,

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Eng et al. 1990). Temperatures in pools where this tadpole shrimp have been found to vary from three to 23°C (Gallagher 1996). Vernal pool formations occur in grass-bottomed swales of grasslands, in old alluvial soils underlain by hardpan or in mud bottomed pools (Federal Register 1994). Pools with cobbly hardpan bottoms also serve as habitat (Gallagher 1996). Gallagher (1996) found that the depth, volume, and duration of inundation of a pool were important for the presence of this tadpole shrimp in vernal pools when compared to the needs of other branchiopods. Vernal pool tadpole shrimp needs deeper and longer-lasting pools if they are to persist over a rainy season in which both wet and dry periods occur.

This species is relatively long lived when compared to the life histories of similar branchiopods. Sexually mature adults are often present within three to six weeks after pools begin inundating and remain reproductive until pools dry up in late spring or early summer. A female may lay up to six clutches in a single season totaling up to 861 eggs. These eggs are “glued” to plant matter and sediment particles where some percentage will immediately hatch while others will remain in the soil to hatch during later rainy seasons (Federal Register 1994).

#### **Status within the Folsom DS/FDR Action Area**

Because of the high probability of the occurrence of VELB in the Folsom DS/FDR Action area, protocol surveys were conducted by both ENTRIX and USFWS. Surveys for VELB record the number of elderberry shrubs, their stem diameters, and the presence and number of exit holes formed by VELB as they exit the branch. Certain elderberry shrubs had previously been identified for mitigation for the Folsom Bridge Project and the Corps’ originally proposed Folsom Dam Modification Project. These plants are not included in the following counts. The surveys for VELB resulted in the recording of 140 elderberry shrubs within the Folsom DS/FDR Action area or 100 feet of this area. The 116 plants that are within the Action area will be adversely affected. The 24 plants in the 100-foot buffer area would be indirectly affected by dust or other construction-related consequences. However, Reclamation is proposing to transplant the shrubs that are within the 100-foot buffer area, so these will also be directly affected. Of the 140 shrubs, 127 will be transplanted and 13 are considered non-transplantable. Shrubs were identified as non-transplantable either due to their location or because they are growing in ground that they cannot be extracted from in a transplantable condition, such as boulders.

Compensation for indirect effects from other projects has already been provided for certain of these shrubs. In the one to three inches diameter category, 258 stems were recorded. In the greater than 3 to 5 inches diameter category, 159 stems were recorded. In the greater than 5 inches diameter category, 197 stems were recorded. Stem diameters (recorded near ground level) ranged from less than one inch to over eight inches. Elderberry shrubs for which heights were recorded ranged in height from three to twenty-seven feet, with an average height of approximately ten feet. Exit holes, both new and old, were observed during the survey.

### 3.2.3 Valley Elderberry Longhorn Beetle

Because of the high probability of the occurrence of VELB in the Folsom DS/FDR Action area, protocol surveys were conducted by both ENTRIX and USFWS. Surveys for VELB record the number of elderberry shrubs, their stem diameters, and the presence and number of exit holes formed by VELB as they exit the branch. Certain elderberry shrubs had previously been identified for mitigation for the Folsom Bridge Project and the Corps' originally proposed Folsom Dam Modification Project. These plants are not included in the following counts. The surveys for VELB resulted in the recording of 140 elderberry shrubs within the Folsom DS/FDR Action area or 100 feet of this area. The 116 plants that are within the Action area will be adversely affected. The 24 plants in the 100-foot buffer area would be indirectly affected by dust or other construction-related consequences. However, Reclamation is proposing to transplant the shrubs that are within the 100-foot buffer area, so these will also be directly affected. Of the 140 shrubs, 127 will be transplanted and 13 are considered non-transplantable. Shrubs were identified as non-transplantable either due to their location or because they are growing in ground that they cannot be extracted from in a transplantable condition, such as boulders.

Compensation for indirect effects from other projects has already been provided for certain of these shrubs. In the one to three inches diameter category, 258 stems were recorded. In the greater than 3 to 5 inches diameter category, 159 stems were recorded. In the greater than 5 inches diameter category, 197 stems were recorded. Stem diameters (recorded near ground level) ranged from less than one inch to over eight inches. Elderberry shrubs for which heights were recorded ranged in height from three to twenty-seven feet, with an average height of approximately ten feet. Exit holes, both new and old, were observed during the survey.

#### Natural History

This species is associated with various species of elderberry (*Sambucus* spp.). While the beetle historically ranged throughout the Central Valley, recent surveys suggest the beetle is now restricted to scattered localities along the Sacramento, American, San Joaquin, Kings, Kaweah, and Tule rivers and their tributaries.

This species generally occurs in savanna areas and along waterways and in floodplains that support remnant stands of riparian vegetation containing elderberry shrubs. In order to serve as habitat, elderberry stems must be greater than 1.0 inches in diameter at ground level (DBH). In a comprehensive 1991 survey conducted by the USFWS, 50 percent of exit holes were found on branches between 2-4 inches in diameter. Occasional exit holes were found on branches thinner than 1.5 inches in diameter and no exit holes were found on branches measuring less than 0.6 inches in diameter. Most exit holes are found in mature, healthy and unstressed plants (USFWS 1991).

Both larvae and adult VELB feed on elderberry shrubs. Females mate and lay eggs in crevices in the elderberry bark. As larvae hatch they bore into the tree where they feed internally on the pith of the trunk and larger branches where they may stay up to two years.

VELB larvae chew an exit hole in the elderberry trunk, through which the adult beetle later exits the plant (CDFG 2003). Larvae then pupate and emerge as adult beetles. Adults are active between March and June when they will feed externally on elderberry flowers and foliage and mate (USFWS 2006a).

### **Status within the Folsom DS/FDR Action Area**

The Folsom DS/FDR Action area includes blue elderberry (*Sambucus mexicana*), the obligate host of the VELB. Exit holes have been observed in the elderberry shrubs in the Folsom DS/FDR Action area. Therefore this species is assumed to occur within the Folsom DS/FDR Action area.

Because of the high probability of the occurrence of VELB in the Folsom DS/FDR Action area, protocol surveys were conducted by both ENTRIX and USFWS. Surveys for VELB record the number of elderberry shrubs, their stem diameters, and the presence and number of exit holes formed by VELB as they exit the branch. Specific elderberry shrubs had previously been identified for mitigation for the Folsom Bridge Project and the Corps' originally proposed Folsom Dam Modification Project. These plants are not included in the following counts. The surveys for VELB resulted in the recording of 137 elderberry shrubs within the Folsom DS/FDR Action area or 100 feet of this area. The 117 plants that are within the Action area will be adversely affected. The 20 plants in the 100-foot buffer area would be indirectly affected by dust or other construction-related consequences. However, Reclamation is proposing to transplant the shrubs that are within the 100-foot buffer area, so these will also be directly affected. Of the 137 shrubs, 124 will be transplanted and 13 are considered non-transplantable. Shrubs were identified as non-transplantable either due to their location or because they are growing in ground that they cannot be extracted from in a transplantable condition, such as boulders.

Compensation for indirect effects from other projects has already been provided for certain of these shrubs. In the one to three inches diameter category, 258 stems were recorded. In the greater than 3 to 5 inches diameter category, 150 stems were recorded. In the greater than 5 inches diameter category, 195 stems were recorded. Stem diameters (recorded near ground level) ranged from less than one inch to over eight inches. Elderberry shrubs for which heights were recorded ranged in height from three to twenty-seven feet, with an average height of approximately ten feet. Exit holes, both new and old, were observed during the survey.

## **3.3 Amphibians**

### **3.3.1 California Red-Legged Frog**

The California red-legged frog (*Rana aurora draytonii*) is federally listed as threatened (Federal Register 1996a) and is a California species of special concern. Critical habitat was

designated in 2001 (Federal Register 2001). However, on November 6, 2002, the U.S. District Court for the District of Columbia entered a consent decree, vacating the critical habitat designation (except Units 5 and 31) and remanding the designation to the USFWS to conduct an economic analysis. The USFWS released a recovery plan in 2002 (USFWS 2002a). Critical habitat was again proposed on November 3, 2005 (Federal Register 2005b), and the final rule was published on April 16, 2006 (Federal Register 2006a). No critical habitat is within the Folsom DS/FDR Action area.

### **Natural History**

Historically, the California red-legged frog occurred in coastal mountains from Marin County south to northern Baja California, and along the floor and foothills of the Central Valley from about Shasta County south to Kern County (Jennings et al. 1992). Currently, this subspecies generally only occurs in the coastal portions of its historic range; it is apparently extirpated from the valley and foothills and in most of southern California south of Ventura County.

California red-legged frogs are usually associated with aquatic habitats, such as creeks, streams and ponds, and occur primarily in areas having pools approximately 3 feet deep, with adjacent dense emergent or riparian vegetation (Jennings and Hayes 1988). California red-legged frogs generally seem to stay near aquatic habitats, however, they are known to travel large distances seasonally within their local aquatic and terrestrial habitats (Jennings and Hayes 1994). Adults move between breeding and foraging habitats in spring and summer (Jennings and Hayes 1994). A few records exist that may indicate that they move into terrestrial riparian thickets during the fall (Jennings and Hayes 1994). During high water, this species are rarely observed (Jennings and Hayes 1994). Some individuals have been observed concealed in pockets or small mammal burrows beneath banks stabilized by shrubby riparian growth during periods of high water (Jennings and Hayes 1994), however much of the spatial ecology of this species is poorly understood.

California red-legged frogs breed from November to March. Egg masses are attached to emergent vegetation (Jennings and Hayes 1994) and hatch within fourteen days. Metamorphosis generally occurs between July and September. Postmetamorphs grow rapidly; males can reach sexual maturity by their second year after metamorphosis and females by their third year. Both sexes may not reproduce until three or four years after metamorphosis (Jennings and Hayes 1994).

### **Status within the Folsom DS/FDR Action Area**

Within the Folsom DS/FDR Action area, perennial and intermittent creeks and Folsom Reservoir may provide marginally suitable habitat for this species. This species has been extirpated from this portion of the foothills. While red-legged frogs have been discovered in Calaveras County in 2003, creeks within the Folsom DS/FDR Action area are occupied by bullfrogs and fish, and therefore, likely preclude the reestablishment of California red-legged frogs here. According to CNDDDB, a juvenile California red-legged frog was observed along a small drainage adjacent to Fitch Way on the east side of the reservoir approximately one

mile up the South Fork American River arm. Despite the proximity on this occurrence to the area, vegetation surveys have failed to discover suitable vegetation to support red-legged frogs. Therefore, it is unlikely that this species occurs within the Folsom DS/FDR Action area.

## 3.4 Reptiles

### 3.4.1 Giant Garter Snake

The giant garter snake (*Thamnophis gigas*) is federally listed as threatened (Federal Register 1993) and is stated-listed as threatened under the California Endangered Species Act (CESA). No critical habitat has been designated for the giant garter snake, but a draft recovery plan for this snake has been written (USFWS 1999a). The Folsom DS/FDR Action area lies within the Midvalley Recovery Unit defined in this recovery plan.

#### Natural History

This species historically ranged in the Sacramento and San Joaquin valleys from Butte County in the north to Kern County in the south (Rossman et al. 1996). Its current range is much reduced, and it is apparently extirpated south of northern Fresno Co. (Bury 1971, Rossman et al. 1996).

Habitat requirements consist of adequate water during the snake's active season (early-spring through mid-fall) to provide food and cover. Emergent herbaceous wetland vegetation, such as cattails and bulrushes, serve as cover and foraging habitat during the active season; grassy banks and openings in waterside vegetation for basking; and uplands for cover and refuge from flood waters during the snake's dormant season in the winter (Hansen 1988). Giant garter snakes are absent from larger rivers and other water bodies that support introduced populations of large, predatory fish, and from wetlands with sand, gravel, or rock substrates (Hansen 1980, Rossman and Stewart 1987, Brode 1988, Hansen 1988).

The giant garter snake inhabits marshes, sloughs, ponds, small lakes, low-gradient streams, and other waterways and agricultural wetlands, such as irrigation and drainage canals and rice fields. Giant garter snakes feed on small fishes, tadpoles, and frogs (Fitch 1941, Hansen 1980, Hansen 1988). Giant garter snakes are found in small mammal burrows and other soil crevices above prevailing flood elevations throughout their winter dormancy period (November to mid-March). They typically select burrows with sunny aspects along south and west facing slopes. Upon emergence, males immediately begin searching for mates. The breeding season is March and April, and females give birth to live young from late July through early September (Hansen and Hansen 1990). Brood size is variable, ranging from 10 to 46 young (Hansen and Hansen 1990). Young immediately scatter into dense cover and absorb their yolk sacs, after which they begin feeding on their own. Sexual maturity is achieved by age three in males and age five for females.

### **Status within the Folsom DS/FDR Action Area**

It is unlikely that the seasonal wetlands in the Folsom DS/FDR Action area hold water throughout the summer and into the fall. Intermittent and perennial creeks flowing into Folsom Reservoir could potentially support giant garter snakes. Potential habitat exists within the vicinity of the Folsom DS/FDR Action area, and individuals may be found within Folsom DS/FDR Action boundaries, it is unlikely that a viable population occurs within the Folsom DS/FDR Action area. In addition, this species has not been recorded from within the Folsom DS/FDR Action area. Occurrence records for this species are markedly west and south of the Folsom DS/FDR Action area.

## **3.5 Birds**

### **3.5.1 Bald Eagle**

The bald eagle (*Haliaeetus leucocephalus*) was formerly federally listed as endangered under the Endangered Species List of 1967 (32 FR 4001). In 1995, the bald eagle was downlisted to threatened (Federal Register 1995) and later was proposed for delisting as recovered in 1999 (Federal Register 1999). In 2006, USFWS re-opened the public comment period on the proposed delisting (Federal Register 2006b). At this time, the bald eagle remains federally listed as threatened, is listed as California Endangered under CESA and is a California fully protected species. No critical habitat has been designated for the bald eagle. Bald eagle populations in California were addressed in the recovery plan for the Pacific states of the lower 48 coterminous states (USFWS 1986).

### **Natural History**

Bald eagles occur throughout North America north of northern Mexico. Breeding populations of bald eagles are generally found along coastal regions and major river and reservoir systems where there are tall trees or cliffs appropriate for nests. Suitable roost sites consisting of large sturdy trees with an open structure that allows access to perch; and feeding areas that include open water such as rivers, lakes, or the ocean, often where there are trees, cliffs, or large objects on which to perch (Harris 2002). During migration they may be found widely throughout their range. They winter primarily in coastal estuaries and river systems, and at large lakes and reservoirs that retain ice-free areas with many birds often gathering where there are concentrated food resources. In Alaska, thousands of bald eagles migrate each fall to take advantage of salmon runs (USFWS 2004a).

Nesting habitat for bald eagles in California and the Pacific northwest is typically within multi-storied, uneven-aged coniferous forest stands with at least some large trees and a relatively open canopy cover of between 20 to 60 percent (Lehman 1979; Anthony and Isaacs 1981). Nest trees are typically among the largest live trees in the area, often over 100 feet tall, and with a deformed top and large open branches in the top half of the tree. Nest site selection is also influenced by topography, distance to water, and distance from disturbance

(Lehman et al. 1980, Grubb et al. 1992). In California, 73 percent of the nest sites are within 0.5 mile of a body of water, and 89 percent are within 1 mile; no nests are known to be over 2 miles from water (Lehman et al. 1980). Perch trees are also needed by bald eagles for roosting and foraging. These trees typically provide an unobstructed view of the surrounding area and associated water body, and are often prominently located on the topography (USFWS 1986). Snag trees with exposed lateral limbs, or trees with dead tops, are often present in nesting territories and are used for perching or as points of access to and from the nest. Such trees also provide vantage points from which territories can be guarded and defended. Winter roost sites provide protection from inclement weather conditions and are characterized by more favorable microclimate conditions. These communal winter roosts can be at great distances from food sources (USFWS 1986).

**Status within the Folsom DS/FDR Action Area**

Bald eagles likely occur within the Folsom DS/FDR Action area as migrant and overwintering animals. There is potential for occurrence as breeding birds within the Folsom DS/FDR Action area based on the availability of adequate nesting sites and foraging habitat. Successful nesting has not yet been recorded at Folsom Reservoir. Based on anecdotal observations, a pair of immature eagles was noticed engaging in possible breeding behavior in early spring 2006. By March 2006, the eagles had left the Folsom DS/FDR Action area without any sign of successful breeding (SPR pers. comm.).

## **4.0 Analysis of Effects and Proposed Avoidance and Minimization Measures**

The effects for the action alternatives were estimated based on the following conditions pertaining to Folsom DS/FDR Action implementation:

- Excavation activities at borrow sites upstream of Folsom Dam would occur when sites are dry. Indirect effects to aquatic habitats may occur at these sites during the rainy season following excavation activities.
- Borrow sites upstream of Folsom Dam would be utilized to their maximum extent. Sites would be excavated to an approximate depth of 30 feet between the shoreline and the 400-foot contour and the reservoir rim. Upon completion of borrow excavation activities, borrow areas would be sloped or restored to accommodate recreational foot traffic.
- Implementation of a spill prevention plan would reduce the risk of fuel or oil spills from construction and transportation equipment.
- The implementation of BMPs would control soil erosion due to construction activities, and minimize potential construction-related effects on water quality.
- A revised Water Control Manual, and the supporting environmental compliance coordination and documentation are expected to be completed at least one year prior to completion of construction of the Folsom DS/FDR Action. However, if this does not occur, the Folsom DS/FDR Action features would still be operated under existing operating criteria. Under this scenario, the same amount of water would ultimately be released with and without the Folsom DS/FDR Action features (due to operational constraints), but operators would have the ability to release more water sooner in a hydrologic event. The full flood damage reduction benefits of the spillway would not be fully realized until revision of the Water Control Manual and optimization of operation of the spillway is in place.

### **4.1 El Dorado Bedstraw**

#### **Analysis of Effects**

##### **Construction Related Effects**

The El Dorado bedstraw is not likely to occur within the Folsom DS/FDR Action area. Therefore, no adverse effects to this species have been identified with the construction of any Folsom DS/FDR Action features, and no mitigation measures are proposed.

##### **Operational Related Effects**

The potential impacts from an increase in the reservoirs temporary storage capacity to this species were all associated with the 3.5-ft raise. There will not be any operations-related impacts to this species under the current project description.

## **4.2 Layne's Butterweed**

### **Analysis of Effects**

#### **Construction Related Effects**

Layne's butterweed is not likely to occur within the Folsom DS/FDR Action area. Therefore, no adverse effects to this species have been identified with the construction of any Folsom DS/FDR Action features, and no mitigation measures are proposed.

#### **Operational Related Effects**

The potential impacts from an increase in the reservoirs temporary storage capacity to this species were all associated with the 3.5-ft raise. There will not be any operations-related impacts to this species under the current project description.

## **4.3 Vernal Pool Fairy Shrimp**

### **Analysis of Effects**

#### **Construction Related Effects**

Evidence of seasonal ponding was observed in surveys in the vicinity of Dike 2 and southeast of MIAD, at locations that may be included in the Folsom DS/FDR Action as contractor use areas. A total of 0.03 acres of seasonal wetlands has been mapped at these locations. These seasonal ponds would likely be affected either directly (filling of habitat) or indirectly (water quality degradation, localized erosion, human intrusion, etc).

The sites in question are currently being surveyed for vernal pool fairy shrimp and vernal pool tadpole shrimp by a USFWS-approved biologist implementing proper survey protocols. The first survey, conducted during a dry period, was negative for the presence of either listed branchiopod species. Reclamation will conduct another survey for the listed branchiopods in wet conditions in early 2007. The USFWS will be provided with the survey data once each survey is complete.

If it is determined that this species is absent from the project footprint after the dry and wet season surveys, Folsom DS/FDR Action related effects to this species would not occur and therefore no avoidance and minimization measures would be necessary. If this species is

found, measures detailed in the following section would be implemented to reduce adverse effects to this species.

### **Operational Related Effects**

The potential impacts from an increase in the reservoirs temporary storage capacity to this species were all associated with the 3.5-ft raise. There will not be any operations-related impacts to this species under the current project description.

### **Proposed Avoidance and Minimization Measures**

The following avoidance and minimization measures are based on an existing USFWS Programmatic Consultation and Biological Opinion (USFWS 1996) and are subject to Section 7 consultation and USFWS approval. Avoidance and minimization measures may be adjusted at the direction of the USFWS.

Potential habitat for the vernal pool fairy shrimp that may be affected by construction activities for the Folsom DS/FDR Action has previously been altered by dam and dike construction for the Folsom Reservoir and does not represent undisturbed natural habitat.

For habitat that is directly or indirectly affected, vernal pool credits would be dedicated within a USFWS-approved ecosystem preservation bank. Based on USFWS evaluation of conservation values of the affected habitat, seasonal pool habitat may be preserved on the Folsom DS/FDR Action site or on another non-bank site as approved by the USFWS.

For habitat that is directly affected, vernal pool creation credits would be dedicated within a USFWS-approved habitat mitigation bank. Based on USFWS evaluation of site-specific conservation values of the affected habitat, vernal pool habitat would be created and monitored on the Folsom DS/FDR Action site or on another non-bank site as approved by the USFWS.

Vernal pool habitat and associated upland habitat used as on-site mitigation would be protected from adverse effects and managed in perpetuity with a Service approved conservation easement.

If habitat is to be avoided, an approved biologist (monitor) would inspect construction-related activities to ensure that no unnecessary take or destruction of habitat occurs. The biologist would have the authority to stop activities that may result in such take or destruction until corrective measures have been taken. The biologist also would be required to report immediately any unauthorized effects to Reclamation and to the USFWS and the California Department of Fish and Game.

Fencing would be maintained around any preserved seasonal pool habitat and a 250-foot wide buffer zone to prevent effects from vehicles and other construction-related activities.

All on-site construction personnel would receive instruction regarding the presence of listed species and the importance of avoiding effects to these species and their habitat.

## 4.4 Vernal Pool Tadpole Shrimp

### Analysis of Effects

#### Construction Related Effects

Evidence of seasonal ponding was observed in surveys in the vicinity of Dike 2 and southeast of MIAD, at locations that may be included in the Folsom DS/FDR Action as contractor use areas. A total of 0.03 acres of seasonal wetlands has been mapped at these locations. These seasonal ponds would likely be affected either directly (filling of habitat) or indirectly (water quality degradation, localized erosion, human intrusion, etc).

The sites in question are currently being surveyed for vernal pool branchiopods by a USFWS-approved biologist implementing proper survey protocols. If this species is found to be absent, Folsom DS/FDR Action related effects to this species would not occur and therefore no avoidance and minimization measures would be necessary. If this species is found, the following measures are proposed to reduce adverse effects to this species.

#### Operational Related Effects

The potential impacts from an increase in the reservoirs temporary storage capacity to this species were all associated with the 3.5-ft raise. There will not be any operations-related impacts to this species under the current project description.

#### Proposed Avoidance and Minimization Measures

The following avoidance and minimization measures are based on an existing USFWS Programmatic Consultation and Biological Opinion (BO) and are subject to Section 7 consultation and USFWS approval. Avoidance and minimization measures may be adjusted at the discretion of the USFWS. Potential habitat for California vernal pool tadpole shrimp that may be affected by construction activities for the Folsom DS/FDR Action has previously been altered by dam and dike construction for the Folsom Reservoir and does not represent undisturbed natural habitat.

For habitat that is directly or indirectly affected, vernal pool credits would be dedicated within a USFWS-approved ecosystem preservation bank. Based on Service evaluation of conservation values of the affected habitat, seasonal pool habitat may be preserved on the Folsom DS/FDR Action site or on another non-bank site as approved by the USFWS.

For habitat that is directly affected, vernal pool creation credits would be dedicated within a USFWS-approved habitat mitigation bank. Based on USFWS evaluation of site-specific conservation values of the affected habitat, seasonal pool habitat would be created and monitored on the Folsom DS/FDR Action site or on another non-bank site as approved by the USFWS.

Vernal pool habitat and associated upland habitat used as on-site avoidance and minimization would be protected from adverse effects and managed in perpetuity with a Service approved conservation easement.

If habitat is to be avoided, an approved biologist (monitor) would inspect construction-related activities to ensure that no unnecessary take or destruction of habitat occurs. The biologist would have the authority to stop activities that may result in such take or destruction until corrective measures have been taken. The biologist also would be required to report immediately any unauthorized effects to Reclamation and to the USFWS and the California Department of Fish and Game.

Fencing would be maintained around any preserved vernal pool habitat and a 250-foot wide buffer zone to prevent effects from vehicles and other construction-related activity.

All on-site construction personnel would receive instruction regarding the presence of protected species and the importance of avoiding effects to these species and their habitat.

## **4.5 Valley Elderberry Longhorn Beetle**

### **Analysis of Effects**

#### **Construction Related Effects**

Actions resulting in the loss of elderberry shrubs, the obligate host plant of the valley elderberry longhorn beetle (VELB), in the Folsom DS/FDR Action footprint may result in adverse effects to individual beetles, pupae, or larvae as well as loss of habitat. The following avoidance and minimization measures are summarized from the Conservation Guidelines for the Valley Elderberry Longhorn Beetle (USFWS, 1999).

Within the boundaries of the Folsom DS/FDR Action, beetles inhabiting elderberry shrubs in areas of the proposed retrofit of the existing dikes and dams, proposed borrow areas or in proposed staging areas, contractor use areas, processing plant sites or along proposed haul routes would be directly affected by activities by removal of or direct impacts to elderberry shrubs or indirectly affected by dust.

#### **Operational Related Effects**

A revised Water Control Manual, and the supporting environmental compliance coordination and documentation are expected to be completed at least one year prior to completion of construction of the Folsom DS/FDR Action. However, if this does not occur, the Folsom DS/FDR Action features would be operated under existing operating criteria and no impacts to the valley elderberry longhorn beetle or its habitat would be expected.

### **Proposed Avoidance and Minimization Measures**

The following avoidance and minimization measures are subject to and contingent upon a Section 7 consultation with the USFWS.

Where possible complete avoidance in conjunction with the establishment and maintenance of a 100 foot buffer zone surrounding any elderberry plants containing stems measuring 1.0 inches or greater in diameter. USFWS would be consulted before any disturbances within the buffer area are considered.

Elderberry plants that cannot be avoided would be transplanted if technically feasible. All elderberry plants containing stems measuring 1.0 inches or greater in diameter would be transplanted to a USFWS-approved conservation area between November 1, 2007 and February 15, 2008. Data on the number of stems in each category and the corresponding mitigation needs are provided in Appendix B.

Each elderberry stem measuring 1.0 inch or greater in diameter that is adversely affected would be compensated for in the conservation area, with elderberry seedlings or cuttings in accordance with the Service's 1999 Guidelines. Stems that cannot be feasibly transplanted will be compensated at a ratio two-times the normal amount. A minimum survival rate of at least 60 percent of the elderberry plants would be maintained throughout the monitoring period. If survival drops below this level, additional seedlings would be planted. Stock for plantings would be obtained from local sources.

Native plants associated with elderberry plants at the Folsom DS/FDR Action site or similar reference sites would be planted in accordance with the Service's 1999 guidelines. A minimum survival rate of at least 60 percent of the associated native plants would be maintained throughout the monitoring period. If survival drops below this level, additional seedlings or cuttings would be planted. Only stock from local sources would be used, unless such stock is not available, per the *Conservation Guidelines for the Valley Elderberry Longhorn Beetle* (USFWS 1999b).

## **4.6 California Red-Legged Frog**

### **Analysis of Effects**

#### **Construction Related Effects**

The California red-legged frog is not likely to occur within the Folsom DS/FDR Action area. Therefore, no adverse effects to the California red-legged frog have been identified with the construction of any Folsom DS/FDR Action features, and no mitigation measures are proposed. The construction of new flood protection berms, if required, would be analyzed in a supplemental Biological Assessment.

### **Operational Related Effects**

The potential impacts from an increase in the reservoirs temporary storage capacity to this species were all associated with the 3.5-ft raise. There will not be any operations-related impacts to this species under the current project description.

### **Proposed Avoidance and Minimization Measures**

No mitigation measures have been proposed since there is little likelihood of the frog occurring within the footprint of the proposed work. Furthermore, habitat for the frog in the construction area is marginal at best.

## **4.7 Giant Garter Snake**

### **Analysis of Effects**

#### **Construction Related Effects**

Giant garter snakes are not likely to occur in the Folsom DS/FDR Action area. Therefore, no adverse effects to the giant garter snake due to construction of any Folsom DS/FDR Action features have been identified, and no mitigation measures are proposed.

#### **Operational Related Effects**

The potential impacts from an increase in the reservoirs temporary storage capacity to this species were all associated with the 3.5-ft raise. There will not be any operations-related impacts to this species under the current project description.

#### **Proposed Avoidance and Minimization Measures**

No mitigation measures have been proposed since there is little likelihood of the giant garter snake occurring within the footprint of the proposed work.

## **4.8 Bald Eagle**

### **Analysis of Effects**

#### **Construction Related Effects**

Wintering bald eagles occurring within or less than 0.5 miles from proposed dike construction zones, haul routes, and borrow sites could incur effects as a result of noise and human presence. Alteration of aquatic habitat could temporarily prevent bald eagles from foraging in areas adjacent to on-going construction-related activities.

Construction activities, including earth moving, earthen dike retrofit, and haul route construction could result in permanent alteration of up to 95 acres of potential bald eagle

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wintering habitat. The avoidance and minimization measures detailed in the following section would reduce the effects to this species.

### **Operational Effects**

The potential impacts from an increase in the reservoirs temporary storage capacity to this species were all associated with the 3.5-ft raise. There will not be any operations-related impacts to this species under the current project description.

### **Proposed Avoidance and Minimization Measures**

Prior to the implementation of vegetation removal, a Service-approved biologist would conduct surveys to ensure no bald eagles are present within the area in which vegetation is to be removed. If no bald eagles are observed, then no further mitigation measures would be implemented.

If bald eagles are present, vegetation removal would to be postponed until eagles vacate the area of their own volition. Eagles would not be disturbed in order to clear them from the area.

If breeding bald eagles are found to be present within or less than 0.5 mile from the proposed Folsom DS/FDR Action boundaries, a 0.5-mile buffer would be established around the nest site. This buffer zone would not be entered for Folsom DS/FDR Action construction activities until the eagles have completed breeding activities and have vacated the area of their own volition.

## 5.0 DETERMINATION OF EFFECTS

Based on the above information and the data collected up to this point, and with implementation of the avoidance and minimization measures, this Biological Assessment concludes that the expected outcome is:

- Implementation of construction activities for the Folsom DS/FDR Action will not adversely affect the El Dorado bedstraw or Layne’s butterweed.
- Implementation of the Folsom DS/FDR Action, , may result in loss of individuals of the vernal pool fairy shrimp, but will not rise to the level of a population effect.
- Implementation of the Folsom DS/FDR Action, may result in loss of individuals of California vernal pool tadpole shrimp, but will not rise to the level of a population effect.
- Implementation of construction activities for the Folsom DS/FDR Action, will adversely affect the valley elderberry longhorn beetle. If it becomes necessary to utilize the increased capacity of the reservoir for emergency retention of floodwaters, Reclamation will re-initiate formal Section 7 consultation with the Service.
- Implementation of construction activities for the Folsom DS/FDR Action will not adversely affect the California red-legged frog. Implementation of construction activities for the Folsom DS/FDR Action will not adversely affect the giant garter snake.
- Implementation of the Folsom DS/FDR Action, will not adversely affect the bald eagle.
- Implementation of the Folsom DS/FDR Action will not have adverse impacts from mercury to listed aquatic species.

If additional surveys conducted prior to construction result in an indication that the above listed species will be adversely affected by the proposed action, Reclamation will immediately notify the appropriate agencies and reinitiate formal Section 7 consultation.

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**APPENDIX A. FEDERALLY LISTED, PROPOSED, AND CANDIDATE SPECIES  
POTENTIALLY PRESENT IN THE VICINITY OF THE FOLSOM DS/FDR ACTION**



| <b>Table A-1</b>   |                   |   |  |
|--|-------------------|---|--|
| <b>Federally Listed, Proposed, and Candidate Species Potentially Present in the Vicinity of the Folsom DS/FDR Action</b> |                   |   |  |
| <b>Name</b>  | <b>Status</b>     | <b>Habitat</b>  | <b>Potential to Occur</b>  |
| <b>Plants</b>  |                   |   |  |
| Pine Hill ceanothus<br><i>Ceanothus roderickii</i>   | FE, CR<br>CNPS 1B | Chaparral and cismontane woodland with serpentinite or gabbroic soils. Elevation: 260-630 m.  | No. Project area below species elevation range.  |
| Pine Hill flannelbush<br><i>Fremontodendron californicum</i> ssp. <i>decumbens</i>                                       | FE, CR<br>CNPS 1B | Chaparral and cismontane woodland with gabbroic or serpentinite soil. Also rocky areas. Elevation: 425-760 m.   | No. Project area below species elevation range.  |
| El Dorado bedstraw<br><i>Galium californicum</i> ssp. <i>sierrae</i>   | FE, CR<br>CNPS 1B | Chaparral, cismontane woodland and lower montane coniferous forest with gabbroic soils. Elevations: 100-585 m.  | Unlikely. No suitable soil or coniferous forest in project area.                                 |
| Sacramento Orcutt grass<br><i>Orcuttia viscida</i>   | FE, CE<br>CNPS 1B | Vernal pools. Elevation: 30-100 m.  | No. Suitable habitat is not present at the Project site, no vernal pools.                        |
| Layne's butterweed<br><i>Senecio layneae</i>   | FT, CR<br>CNPS 1B | Chaparral and cismontane woodland on serpentinite or gabbroic soils and/or rocky areas. Elevation: 200-1,000 m.   | Unlikely. No chaparral or serpentinite soil in project area.                                     |
| <b>Invertebrates</b>   |                   |   |  |
| Vernal pool fairy shrimp<br><i>Branchinecta lynchi</i>   | FT                | Endemic to the grasslands of the Central Valley, Central Coast mountains, and South Coast mountains, in rain-filled pools. Inhabit small, clear-water sandstone-depression pools and grassed swales, earth slumps, or basalt-flow depression pools. | Possible. Have been recorded in close proximity to project area, marginal habitat exists         |
| Valley elderberry longhorn beetle<br><i>Desmocerus californicus dimorphus</i>  | FT                | Occurs only in the Central Valley of California, in association with blue elderberry ( <i>Sambucus mexicana</i> ). Prefers to lay eggs in elderberry stems 2-8 inches in diameter; some preference shown for "stressed" elderberry shrubs.          | Yes. Suitable habitat present within project area. Obligate host also occurs within project area |

| Name  | Status          | Habitat  | Potential to Occur   |
|---|-----------------|--|--|
| <b>Invertebrates (continued)</b>                              |                 |  |  |
| vernal pool tadpole shrimp<br><i>Lepidurus packardi</i>       | FE              | Vernal pools in the Central Valley.  | Unlikely. Potential habitat within project area may not hold water long enough   |
| <b>Amphibians</b>   |                 |  |  |
| California tiger salamander<br><i>Ambystoma californiense</i> | FT<br>CSC       | California endemic, a lowland species restricted to the grasslands and lowest foothill regions of Central and Northern California, which is where its breeding habitat (long-lasting rain pools) occurs. During dry-season, uses small mammal burrows as refuge, travelling up to 1.6 kilometers (km). | No. Outside the spawning range for the species.  |
| California red-legged frog<br><i>Rana aurora draytonii</i>    | FT<br>CSC       | Lowlands and foothills in or near permanent sources of deep water with dense, shrubby or emergent riparian vegetation. Requires 11-20 weeks of permanent water for larval development and must have access to aestivation habitat.   | Possible. However, only marginal habitat exists within project area.   |
| <b>Reptiles</b>   |                 |  |  |
| Giant garter snake<br><i>Thamnophis gigas</i>                 | FT<br>CT        | Prefers freshwater marsh and low gradient streams. Has adapted to drainage canals and irrigation ditches. This is the most aquatic of the garter snakes in California.   | No. Although suitable habitat is present at the Project site, this species was not found during surveys in the Project area. |
| <b>Birds</b>  |                 |  |  |
| Aleutian Canada goose<br><i>Branta canadensis leucopareia</i> | FD <sup>1</sup> | (Wintering) Winters on lakes and inland prairies. Forages on natural pasture or that cultivated to grain; loaf on lakes, reservoirs, and ponds.  | Possible. Suitable habitat found within project area, although it is outside the reported wintering areas.                   |

| Name  | Status                        | Habitat  | Potential to Occur  |
|---|-------------------------------|--|---|
| <b>Birds (continued)</b>                                    |                               |  |   |
| American peregrine falcon<br><i>Falco peregrinus anatum</i> | FD <sup>2</sup><br>CE         | (Nesting) Near wetlands, lakes, rivers, or other water; on cliffs, banks, dunes, mounds; also, human-made structures. Nest consists of a scrape on a depression or ledge in an open site.  | Yes. Suitable nesting and foraging habitat present within project area. |
| Bald eagle<br><i>Haliaeetus leucocephalus</i>               | FT/FPD <sup>3</sup><br>CE/CFP | (Nesting and wintering) Ocean shore, lake margins, and rivers for both nesting and wintering. Most nests within 1 mile of water. Nests in large, old-growth, or dominant live tree with open branches, especially ponderosa pine. Roosts communally in winter. | Yes. Suitable habitat within project area.                              |

**Sources**

CDFG 2005a, CDFG 2005b, CDFG 2006a, CDFG 2006b, USFWS 2005a, Zeiner et al. 1988; 1990a; and 1990b.

**Codes**

<sup>1</sup> Delisted from federally threatened on 3/20/2001

<sup>2</sup> Delisted from federally endangered on 8/25/1999

<sup>3</sup> Proposed for federal delisting on 2/16/2006

FE: federally listed as endangered

FT = federally listed as threatened

FD: federally delisted

FPD: federally proposed for delisting

CE: State of California Endangered

CT: State of California Threatened

CR: State of California Rare

CFP: California Fully Protected

CSC: California Species of Concern

CNPS = California Native Plant Society

1b = rare, threatened or endangered in California and elsewhere

APPENDIX B. ELDERBERRY MITIGATION





Folsom DS/FDR Action – Biological Assessment

| <b>Table B-1. Transplantable Elderberry Shrubs</b>             |  |                                |                           |                               |                         |                               |  |
|--|--|--------------------------------|---------------------------|-------------------------------|-------------------------|-------------------------------|--|
| Location   | Stems (maximum diameter at ground level) | Exit Hole on Shrub (Yes or No) | Elderberry Seedling Ratio | Associated Native Plant Ratio | Number of Stems Counted | Required Elderberry Plantings | Required Associated Native Plant Plantings |
| <b>Dikes 1, 2, 3</b>   |  |                                |                           |                               |                         |                               |  |
| Non-Riparian   | 1-3"                                     | No                             | 1:1                       | 1:1                           | 3                       | 3                             | 3  |
|  |  | Yes                            | 2:1                       | 2:1                           | 6                       | 12                            | 24   |
| Total  |  |                                |                           |                               | 9                       | 15                            | 27   |
| Total Elderberry Shrubs (all shrubs assumed directly affected) |  |                                |                           |                               | 2                       |                               |  |
| Compensation Area required for transplants and seedlings       |  |                                |                           |                               |                         | 0.12                          |  |
| Compensation Area Required for Additional Native Plantings     |  |                                |                           |                               |                         | 0.12                          |  |
| Total  |  |                                |                           |                               |                         | 0.24                          |  |
| <b>Dikes 4 – 8, MIAD, Right Wing Dam, and Staging Areas</b>    |  |                                |                           |                               |                         |                               |  |
| Non-Riparian   | 1-3"                                     | No                             | 1:1                       | 1:1                           | 77                      | 77                            | 77   |
|  |  | Yes                            | 2:1                       | 2:1                           | 58                      | 116                           | 232  |
| Non-Riparian   | 3-5"                                     | No                             | 2:1                       | 1:1                           | 40                      | 80                            | 80   |
|  |  | Yes                            | 4:1                       | 2:1                           | 22                      | 88                            | 176  |
| Non-Riparian   | >5"                                      | No                             | 3:1                       | 1:1                           | 48                      | 144                           | 144  |
|  |  | Yes                            | 6:1                       | 2:1                           | 21                      | 126                           | 252  |
| Riparian   | 1-3"                                     | No                             | 2:1                       | 1:1                           | 2                       | 4                             | 4  |
|  |  | Yes                            | 4:1                       | 2:1                           | 0                       | 0                             | 0  |
| Riparian   | 3-5"                                     | No                             | 3:1                       | 1:1                           | 10                      | 30                            | 30   |
|  |  | Yes                            | 6:1                       | 2:1                           | 0                       | 0                             | 0  |
| Riparian   | >5"                                      | No                             | 4:1                       | 1:1                           | 10                      | 40                            | 40   |
|  |  | Yes                            | 8:1                       | 2:1                           | 0                       | 0                             | 0  |
| Total  |  |                                |                           |                               | 288                     | 705                           | 1035                                       |
| Total Elderberry Shrubs (all shrubs assumed directly affected) |  |                                |                           |                               | 63                      |                               |  |
| Compensation Area required for transplants and seedlings       |  |                                |                           |                               |                         | 5.83                          |  |
| Compensation Area required for additional native plants        |  |                                |                           |                               |                         | 3.22                          |  |
| Total  |  |                                |                           |                               |                         | 9.05                          |  |
| <b>Left Wing Dam (Auxiliary Spillway)</b>                      |  |                                |                           |                               |                         |                               |  |
| Non-Riparian   | 1-3"                                     | No                             | 1:1                       | 1:1                           | 58                      | 58                            | 58   |
|  |  | Yes                            | 2:1                       | 2:1                           | 2                       | 4                             | 8  |
| Non-Riparian   | 3-5"                                     | No                             | 2:1                       | 1:1                           | 51                      | 102                           | 102  |
|  |  | Yes                            | 4:1                       | 2:1                           | 8                       | 32                            | 64   |
| Non-Riparian   | >5"                                      | No                             | 3:1                       | 1:1                           | 85                      | 255                           | 255  |
|  |  | Yes                            | 6:1                       | 2:1                           | 4                       | 24                            | 48   |
| Riparian   | 1-3"                                     | No                             | 2:1                       | 1:1                           | 3                       | 6                             | 6  |
|  |  | Yes                            | 4:1                       | 2:1                           | 0                       | 0                             | 0  |
| Riparian   | 3-5"                                     | No                             | 3:1                       | 1:1                           | 1                       | 3                             | 3  |
|  |  | Yes                            | 6:1                       | 2:1                           | 0                       | 0                             | 0  |
| Riparian   | >5"                                      | No                             | 4:1                       | 1:1                           | 3                       | 12                            | 12   |
|  |  | Yes                            | 8:1                       | 2:1                           | 0                       | 0                             | 0  |
| Total  |  |                                |                           |                               | 215                     | 496                           | 556  |
| Total Elderberry Shrubs (all shrubs assumed directly affected) |  |                                |                           |                               | 55                      |                               |  |
| Compensation Area required for transplants and seedlings       |  |                                |                           |                               |                         | 4.13                          |  |
| Compensation Area required for additional native plants        |  |                                |                           |                               |                         | 0.50                          |  |
| Total  |  |                                |                           |                               |                         | 4.63                          |  |
| Total for All Areas  |  |                                |                           |                               |                         | 13.92                         |  |

**Table B-2. Non-Transplantable Elderberry Shrubs**

| Location  | Stems<br>(maximum<br>diameter at<br>ground level) | Exit<br>Hole<br>on<br>Shrub<br>(Yes<br>or No) | Elderberry<br>Seedling<br>Ratio | Associated<br>Native Plant<br>Ratio | Number<br>of<br>Stems<br>Observed | Required<br>Elderberry<br>Plantings | Required<br>Associated<br>Native Plant<br>Plantings |
|---|---|---|---------------------------------|-------------------------------------|-----------------------------------|-------------------------------------|---|
| <b>Left Wing Dam (Auxiliary Spillway)<sup>1</sup></b>                 |   |   |                                 |                                     |                                   |                                     |   |
| Non-Riparian  | 1-3"  | No  | 2:1                             | 1:1                                 | 5                                 | 10                                  | 10  |
|   |   | Yes   | 4 :1                            | 2:1                                 | 0                                 | 0                                   | 0   |
| Non-Riparian  | 3-5"  | No  | 4:1                             | 1:1                                 | 4                                 | 16                                  | 16  |
|   |   | Yes   | 8:1                             | 2:1                                 | 0                                 | 0                                   | 0   |
| Non-Riparian  | >5"   | No  | 6:1                             | 1:1                                 | 7                                 | 42                                  | 42  |
|   |   | Yes   | 12:1                            | 2:1                                 | 0                                 | 0                                   | 0   |
| Riparian  | 1-3"  | No  | 4:1                             | 1:1                                 | 7                                 | 28                                  | 28  |
|   |   | Yes   | 8:1                             | 2:1                                 | 0                                 | 0                                   | 0   |
| Riparian  | 3-5"  | No  | 6:1                             | 1:1                                 | 0                                 | 0                                   | 0   |
|   |   | Yes   | 12:1                            | 2:1                                 | 0                                 | 0                                   | 0   |
| Riparian  | >5"   | No  | 8:1                             | 1:1                                 | 10                                | 80                                  | 80  |
|   |   | Yes   | 16:1                            | 2:1                                 | 0                                 | 0                                   | 0   |
| <b>Total</b>  |   |   |                                 |                                     | <b>33</b>                         | <b>176</b>                          | <b>176</b>  |
| Total Elderberry Shrubs (all shrubs assumed directly affected)        |   |   |                                 |                                     | 11                                |                                     |   |
| Compensation Area Required for Additional Seedlings and Native Plants |   |   |                                 |                                     |                                   |                                     | 1.45  |

<sup>1</sup>- compensation for indirect impacts to 9 under other projects

APPENDIX C. U.S. FISH AND WILDLIFE SERVICE SPECIES LISTS FOR PROJECT  
QUADRANGLES







**APPENDIX A. FEDERALLY LISTED, PROPOSED, AND CANDIDATE SPECIES  
POTENTIALLY PRESENT IN THE VICINITY OF THE FOLSOM DS/FDR ACTION**



| <b>Table A-1</b>   |                   |   |  |
|--|-------------------|---|--|
| <b>Federally Listed, Proposed, and Candidate Species Potentially Present in the Vicinity of the Folsom DS/FDR Action</b> |                   |   |  |
| <b>Name</b>  | <b>Status</b>     | <b>Habitat</b>  | <b>Potential to Occur</b>  |
| <b>Plants</b>  |                   |   |  |
| Pine Hill ceanothus<br><i>Ceanothus roderickii</i>   | FE, CR<br>CNPS 1B | Chaparral and cismontane woodland with serpentinite or gabbroic soils. Elevation: 260-630 m.  | No. Project area below species elevation range.  |
| Pine Hill flannelbush<br><i>Fremontodendron californicum</i> ssp. <i>decumbens</i>                                       | FE, CR<br>CNPS 1B | Chaparral and cismontane woodland with gabbroic or serpentinite soil. Also rocky areas. Elevation: 425-760 m.   | No. Project area below species elevation range.  |
| El Dorado bedstraw<br><i>Galium californicum</i> ssp. <i>sierrae</i>   | FE, CR<br>CNPS 1B | Chaparral, cismontane woodland and lower montane coniferous forest with gabbroic soils. Elevations: 100-585 m.  | Unlikely. No suitable soil or coniferous forest in project area.                                 |
| Sacramento Orcutt grass<br><i>Orcuttia viscida</i>   | FE, CE<br>CNPS 1B | Vernal pools. Elevation: 30-100 m.  | No. Suitable habitat is not present at the Project site, no vernal pools.                        |
| Layne's butterweed<br><i>Senecio layneae</i>   | FT, CR<br>CNPS 1B | Chaparral and cismontane woodland on serpentinite or gabbroic soils and/or rocky areas. Elevation: 200-1,000 m.   | Unlikely. No chaparral or serpentinite soil in project area.                                     |
| <b>Invertebrates</b>   |                   |   |  |
| Vernal pool fairy shrimp<br><i>Branchinecta lynchi</i>   | FT                | Endemic to the grasslands of the Central Valley, Central Coast mountains, and South Coast mountains, in rain-filled pools. Inhabit small, clear-water sandstone-depression pools and grassed swales, earth slumps, or basalt-flow depression pools. | Possible. Have been recorded in close proximity to project area, marginal habitat exists         |
| Valley elderberry longhorn beetle<br><i>Desmocerus californicus dimorphus</i>  | FT                | Occurs only in the Central Valley of California, in association with blue elderberry ( <i>Sambucus mexicana</i> ). Prefers to lay eggs in elderberry stems 2-8 inches in diameter; some preference shown for "stressed" elderberry shrubs.          | Yes. Suitable habitat present within project area. Obligate host also occurs within project area |

| Name  | Status          | Habitat  | Potential to Occur   |
|---|-----------------|--|--|
| <b>Invertebrates (continued)</b>                              |                 |  |  |
| vernal pool tadpole shrimp<br><i>Lepidurus packardi</i>       | FE              | Vernal pools in the Central Valley.  | Unlikely. Potential habitat within project area may not hold water long enough   |
| <b>Amphibians</b>   |                 |  |  |
| California tiger salamander<br><i>Ambystoma californiense</i> | FT<br>CSC       | California endemic, a lowland species restricted to the grasslands and lowest foothill regions of Central and Northern California, which is where its breeding habitat (long-lasting rain pools) occurs. During dry-season, uses small mammal burrows as refuge, travelling up to 1.6 kilometers (km). | No. Outside the spawning range for the species.  |
| California red-legged frog<br><i>Rana aurora draytonii</i>    | FT<br>CSC       | Lowlands and foothills in or near permanent sources of deep water with dense, shrubby or emergent riparian vegetation. Requires 11-20 weeks of permanent water for larval development and must have access to aestivation habitat.   | Possible. However, only marginal habitat exists within project area.   |
| <b>Reptiles</b>   |                 |  |  |
| Giant garter snake<br><i>Thamnophis gigas</i>                 | FT<br>CT        | Prefers freshwater marsh and low gradient streams. Has adapted to drainage canals and irrigation ditches. This is the most aquatic of the garter snakes in California.   | No. Although suitable habitat is present at the Project site, this species was not found during surveys in the Project area. |
| <b>Birds</b>  |                 |  |  |
| Aleutian Canada goose<br><i>Branta canadensis leucopareia</i> | FD <sup>1</sup> | (Wintering) Winters on lakes and inland prairies. Forages on natural pasture or that cultivated to grain; loaf on lakes, reservoirs, and ponds.  | Possible. Suitable habitat found within project area, although it is outside the reported wintering areas.                   |

| Name  | Status                        | Habitat  | Potential to Occur  |
|---|-------------------------------|--|---|
| <b>Birds (continued)</b>                                    |                               |  |   |
| American peregrine falcon<br><i>Falco peregrinus anatum</i> | FD <sup>2</sup><br>CE         | (Nesting) Near wetlands, lakes, rivers, or other water; on cliffs, banks, dunes, mounds; also, human-made structures. Nest consists of a scrape on a depression or ledge in an open site.  | Yes. Suitable nesting and foraging habitat present within project area. |
| Bald eagle<br><i>Haliaeetus leucocephalus</i>               | FT/FPD <sup>3</sup><br>CE/CFP | (Nesting and wintering) Ocean shore, lake margins, and rivers for both nesting and wintering. Most nests within 1 mile of water. Nests in large, old-growth, or dominant live tree with open branches, especially ponderosa pine. Roosts communally in winter. | Yes. Suitable habitat within project area.                              |

**Sources**

CDFG 2005a, CDFG 2005b, CDFG 2006a, CDFG 2006b, USFWS 2005a, Zeiner et al. 1988; 1990a; and 1990b.

**Codes**

<sup>1</sup> Delisted from federally threatened on 3/20/2001

<sup>2</sup> Delisted from federally endangered on 8/25/1999

<sup>3</sup> Proposed for federal delisting on 2/16/2006

FE: federally listed as endangered

FT = federally listed as threatened

FD: federally delisted

FPD: federally proposed for delisting

CE: State of California Endangered

CT: State of California Threatened

CR: State of California Rare

CFP: California Fully Protected

CSC: California Species of Concern

CNPS = California Native Plant Society

1b = rare, threatened or endangered in California and elsewhere

## APPENDIX B. ELDERBERRY MITIGATION





| <b>Table B-1. Transplantable Elderberry Shrubs</b>                                 |   |  |                                 |                                     |                               |                                     |   |
|--|---|--|---------------------------------|-------------------------------------|-------------------------------|-------------------------------------|---|
| Location   | Stems<br>(maximum<br>diameter at<br>ground level) | Exit<br>Hole on<br>Shrub<br>(Yes or<br>No) | Elderberry<br>Seedling<br>Ratio | Associated<br>Native Plant<br>Ratio | Number<br>of Stems<br>Counted | Required<br>Elderberry<br>Plantings | Required<br>Associated<br>Native Plant<br>Plantings |
| <b>Dikes 4 – 8, MIAD, Right Wing Dam, and Staging Areas</b>                        |   |  |                                 |                                     |                               |                                     |   |
| Non-Riparian   | 1-3"  | No   | 1:1                             | 1:1                                 | 73*                           | 73                                  | 73  |
|  |   | Yes  | 2:1                             | 2:1                                 | 77                            | 154                                 | 308   |
| Non-Riparian   | 3-5"  | No   | 2:1                             | 1:1                                 | 43                            | 86                                  | 86  |
|  |   | Yes  | 4:1                             | 2:1                                 | 26                            | 104                                 | 208   |
| Non-Riparian   | >5"   | No   | 3:1                             | 1:1                                 | 47                            | 141                                 | 141   |
|  |   | Yes  | 6:1                             | 2:1                                 | 30                            | 180                                 | 360   |
| Riparian   | 1-3"  | No   | 2:1                             | 1:1                                 | 2                             | 4                                   | 4   |
|  |   | Yes  | 4:1                             | 2:1                                 | 0                             | 0                                   | 0   |
| Riparian   | 3-5"  | No   | 3:1                             | 1:1                                 | 10                            | 30                                  | 30  |
|  |   | Yes  | 6:1                             | 2:1                                 | 0                             | 0                                   | 0   |
| Riparian   | >5"   | No   | 4:1                             | 1:1                                 | 10                            | 40                                  | 40  |
|  |   | Yes  | 8:1                             | 2:1                                 | 0                             | 0                                   | 0   |
| Total  |   |  |                                 |                                     | 318                           | 812                                 | 1250  |
| Total Elderberry Shrubs (all shrubs assumed directly affected)                     |   |  |                                 |                                     | 72                            |                                     |   |
| Compensation Area required for transplants and seedlings                           |   |  |                                 |                                     |                               |                                     | 6.71  |
| Compensation Area required for additional native plants (10/1800 ft <sup>2</sup> ) |   |  |                                 |                                     |                               |                                     | 1.81  |
| Total  |   |  |                                 |                                     |                               |                                     | 8.52  |
| <b>Left Wing Dam (Auxiliary Spillway)</b>  |   |  |                                 |                                     |                               |                                     |   |
| Non-Riparian   | 1-3"  | No   | 1:1                             | 1:1                                 | 61                            | 61                                  | 61  |
|  |   | Yes  | 2:1                             | 2:1                                 | 9                             | 18                                  | 36  |
| Non-Riparian   | 3-5"  | No   | 2:1                             | 1:1                                 | 49                            | 98                                  | 98  |
|  |   | Yes  | 4:1                             | 2:1                                 | 15                            | 60                                  | 120   |
| Non-Riparian   | >5"   | No   | 3:1                             | 1:1                                 | 79                            | 237                                 | 237   |
|  |   | Yes  | 6:1                             | 2:1                                 | 4                             | 24                                  | 48  |
| Riparian   | 1-3"  | No   | 2:1                             | 1:1                                 | 3                             | 6                                   | 6   |
|  |   | Yes  | 4:1                             | 2:1                                 | 0                             | 0                                   | 0   |
| Riparian   | 3-5"  | No   | 3:1                             | 1:1                                 | 1                             | 3                                   | 3   |
|  |   | Yes  | 6:1                             | 2:1                                 | 0                             | 0                                   | 0   |
| Riparian   | >5"   | No   | 4:1                             | 1:1                                 | 3                             | 12                                  | 12  |
|  |   | Yes  | 8:1                             | 2:1                                 | 0                             | 0                                   | 0   |
| Total  |   |  |                                 |                                     | 224                           | 519                                 | 519   |
| Total Elderberry Shrubs (all shrubs assumed directly affected)                     |   |  |                                 |                                     | 54                            |                                     |   |
| Compensation Area required for transplants and seedlings                           |   |  |                                 |                                     |                               |                                     | 4.29  |
| Compensation Area required for additional native plants (10/1800 ft <sup>2</sup> ) |   |  |                                 |                                     |                               |                                     | 0.42  |
| Total  |   |  |                                 |                                     |                               |                                     | 4.71  |
| <b>Total for All Areas</b>   |   |  |                                 |                                     |                               |                                     | <b>13.23</b>  |

\*4 stems added as compensation for shrub that was unreachable for measuring

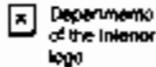
**Table B-2. Non-Transplantable Elderberry Shrubs**

| Location  | Stems<br>(maximum<br>diameter at<br>ground level) | Exit<br>Hole<br>on<br>Shrub<br>(Yes<br>or No) | Elderberry<br>Seedling<br>Ratio | Associated<br>Native Plant<br>Ratio | Number<br>of<br>Stems<br>Observed | Required<br>Elderberry<br>Plantings | Required<br>Associated<br>Native Plant<br>Plantings |
|---|---|---|---------------------------------|-------------------------------------|-----------------------------------|-------------------------------------|---|
| <b>Left Wing Dam (Auxiliary Spillway)<sup>1</sup></b>                 |   |   |                                 |                                     |                                   |                                     |   |
| Non-Riparian  | 1-3"  | No  | 2:1                             | 1:1                                 | 17                                | 34                                  | 34  |
|   |   | Yes   | 4:1                             | 2:1                                 | 0                                 | 0                                   | 0   |
| Non-Riparian  | 3-5"  | No  | 4:1                             | 1:1                                 | 14                                | 56                                  | 56  |
|   |   | Yes   | 8:1                             | 2:1                                 | 0                                 | 0                                   | 0   |
| Non-Riparian  | >5"   | No  | 6:1                             | 1:1                                 | 14                                | 84                                  | 84  |
|   |   | Yes   | 12:1                            | 2:1                                 | 0                                 | 0                                   | 0   |
| Riparian  | 1-3"  | No  | 4:1                             | 1:1                                 | 16                                | 64                                  | 64  |
|   |   | Yes   | 8:1                             | 2:1                                 | 0                                 | 0                                   | 0   |
| Riparian  | 3-5"  | No  | 6:1                             | 1:1                                 | 1                                 | 6                                   | 6   |
|   |   | Yes   | 12:1                            | 2:1                                 | 0                                 | 0                                   | 0   |
| Riparian  | >5"   | No  | 8:1                             | 1:1                                 | 10                                | 80                                  | 80  |
|   |   | Yes   | 16:1                            | 2:1                                 | 0                                 | 0                                   | 0   |
| <b>Total</b>  |   |   |                                 |                                     | <b>72</b>                         | <b>324</b>                          | <b>324</b>  |
| Total Elderberry Shrubs (all shrubs assumed directly affected)        |   |   |                                 |                                     | 13                                |                                     |   |
| Compensation Area Required for Additional Seedlings and Native Plants |   |   |                                 |                                     |                                   |                                     | 2.68  |

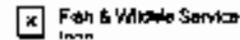
**APPENDIX C. U.S. FISH AND WILDLIFE SERVICE SPECIES LISTS FOR PROJECT  
QUADRANGLES**

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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

November 10, 2006

Document Number: 061110061148

Gretchen Lebednik  
ENTRIX, Inc.  
590 Ygnacio Valley Road Suite 200  
Walnut Creek, CA 94598

Subject: Species List for Folsom Dam Safety/Flood Damage Reduction Action

Dear Ms. Lebednik

We are sending this official species list in response to your November 10, 2006 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 February 08, 2007.

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/ies/branches.htm](http://www.fws.gov/sacramento/ies/branches.htm).

Endangered Species Division



[<- Revise Selection](#)[Print this page](#)

These buttons will not appear on your list.

[Make Official Letter ->](#)

**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: 061110061544

Database Last Updated: October 27, 2006

**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. See [www.fws.gov/sacramento/es/spp\\_concern.htm](http://www.fws.gov/sacramento/es/spp_concern.htm) for more information and links to these sensitive species lists.

**Red-Legged Frog Critical Habitat** - The Service has designated final critical habitat for the California red-legged frog. The designation became final on May 15, 2006. See our [map index](#).

## Species

### Listed Species

#### Invertebrates

Branchinecta conservatio

Conservancy fairy shrimp (E)

Branchinecta lynchi

vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus

valley elderberry longhorn beetle (T)

Lepidurus packardii

vernal pool tadpole shrimp (E)

#### Fish

Hypomesus transpacificus

delta smelt (T)

*Oncorhynchus mykiss*

Central Valley steelhead (T) (NMFS)

Critical habitat, Central Valley steelhead (X) (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 aurora draytonii*

California red-legged frog (T)

#### Reptiles

*Thamnophis gigas*

giant garter snake (T)

#### Birds

*Haliaeetus leucocephalus*

bald eagle (T)

#### Plants

*Calystegia stebbinsii*

Stebbins's morning-glory (E)

*Ceanothus roderickii*

Pine Hill ceanothus (E)

*Fremontodendron californicum* ssp. *decumbens*

Pine Hill flannelbush (E)

*Galium californicum* ssp. *sierrae*

El Dorado bedstraw (E)

*Orcuttia viscida*

Critical habitat, Sacramento Orcutt grass (X)

Sacramento Orcutt grass (E)

*Senecio layneae*

Layne's butterweed (=ragwort) (T)

#### Candidate Species

Fish

*Oncorhynchus tshawytscha*

Central Valley fall/late fall-run chinook salmon (C) (NMFS)

Critical habitat, Central Valley fall/late fall-run chinook (C) (NMFS)

#### Selected Quads

CLARKSVILLE (511A) FOLSOM (511B) ROCKLIN (527C) PILOT HILL (527D)

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#### County Lists

*No county species lists requested.*

#### 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 li

- Fish and other aquatic species appear on your list if they are in the same watershed as your quad or if water use in you 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 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 nine 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 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.

For plant surveys, we recommend using the Guidelines for Conducting and Reporting Botanical Inventories. The results of yr 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 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 th 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 addres the anticipated effect of the project on listed and proposed species. The opinion may authorize a limited level of incide take.
- If no Federal agency is involved with the project, and federally listed species may be taken as part of the project, then the applicant, should apply for an incidental take permit. The Service may issue such a permit if you submit a satisfact 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 b the project, we recommend that you work with this office and the California Department of Fish and Game to develop plan that minimizes the project's direct and indirect impacts to listed species and compensates for project-related loss i 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 designat 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 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 critical habitat page for maps.

#### 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.

#### 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 your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be February 08, 2007.

APPENDIX D. MERCURY WHITE PAPER

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**WHITE PAPER**  
**A BRIEF SYNTHESIS ON MERCURY IN THE ENVIRONMENT**

February 6, 2006

Prepared by.  
ENTRIX, Inc.  
590 Ygnacio Valley Road, Suite 200  
Walnut Creek, CA 94596

For:  
USDI, Bureau of Reclamation

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### Mercury in the Environment

Mercury is a heavy metal that comes from natural and anthropogenic sources. It is toxic to human and wildlife in extremely low concentrations, and has been considered as an environmental pollutant for several decades (Jones and Slotton 1996, EPA 1997). Because of the tremendous increase of mercury production and use in this century, mercury contamination is now virtually world-wide. Mercury travels easily through different environmental media, it can be transported atmospherically, hydraulically, and biologically in a variety of forms. Mercury may be present in the environment as elemental mercury, inorganic mercury, or organic mercury (methyl mercury) (Beckvar et al. 1996). Most mercury is released into the environment as inorganic mercury, which is primarily bound to particulates and organic substances and may not be available for direct uptake by aquatic organisms.

Under anaerobic conditions, bacteria convert inorganic mercury into methyl mercury which is then available for uptake into the food web (Beckvar et al. 1996, EPA 1997). Rates of methyl mercury production depend not only on the abundance of inorganic mercury but also on a complex assortment of environmental variables which affect the activities and species composition of the bacteria and the availability of the inorganic mercury for methylation (HSDB 2003, Beckvar et al. 1996, EPA 1997). These factors include temperature, dissolved organic carbon, salinity, acidity (pH), oxidation-reduction conditions, and the form and concentration of sulfur in water and sediments (Beckvar et al. 1996, EPA 1997).

Methyl mercury normally occurs in the environment at extremely low concentrations; however, it is taken up easily by aquatic organisms and bioaccumulated. The food web is the main pathway for bioaccumulation. The concentration of methyl mercury generally increases by a factor of ten or less with each step up the food chain, a process known as biomagnification (Alpers et al. 2005). Therefore, even though the concentrations of elemental or oxidized mercury in water may be very low and deemed safe for human consumption in drinking water, methyl mercury concentration levels in fish, especially predatory species such as bass and catfish, may reach levels that are considered potentially harmful to humans and fish-eating wildlife (Alpers et al. 2005). Fish at the top of the food web can harbor mercury concentrations in their tissues over one million times the mercury concentration in the water in which they swim (Jones and Slotton 1996). Methyl mercury may comprise more than 95% of the mercury in fish tissue while only 5-15% of the total mercury burden in sediments and water of contaminated lakes is methyl mercury (Saroff 1990, as cited in Beckvar et al. 1996, EPA 1997, and Jones and Slotton 1996)

### Mercury in California

While most areas of the world receive most of their mercury input through atmospheric deposition, most mercury in California stems from historic mining

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operations. The Coast Ranges have large quantities of mercury ores that were historically mined. These areas are a continuing source of mercury to the waters of the state from unreclaimed mines and tailings and from natural deposits. These Coast Range sources are estimated to contribute large quantities of mercury to west side Central Valley streams and the Sacramento River (May et al. 1999 and Jones and Slotton 1996). Mercury was mined in the Coast Ranges in the form of mercury sulfide, and then transported to the Sierra Nevada Gold mining regions (as elemental Hg) where it was used in gold recovery operations (Bradley 1918 as cited in Domagalski 2001, Alpers et al. 2005, May et al. 1999, and Jones and Slotton 1996). In Sierra Nevada foothill streams and rivers, the most important sources of mercury are from historic gold mining operations, where elemental mercury was used to extract gold from either placer or primary ore deposits (Domagalski 2001). While elemental mercury is not biologically available, it poses a threat to wildlife and humans through its potential conversion to methyl mercury. Elemental mercury can be converted to inorganic mercury, which can, in turn, be methylated to form methyl mercury (Beckvar et al 1996, Domagalski et al. 2001).

In the American River watershed, extensive hydraulic mining of placer gold deposits took place between the 1850s and 1884, resulting in the release of 750,000 kg of elemental mercury into the environment (DTMC and SRWP 2002, Saiki et al., 2004). Hardrock mining of lode gold deposits in the American River watershed occurred from the 1880s until 1942. Dredging of placer gold deposits in the lower American River watershed took place from 1898 to 1956, the year that Folsom Dam and Nimbus Dam were completed (Saiki et al., 2004).

### **Mercury Transport in Rivers**

Mercury can be transported in air with subsequent wet or dry deposition to water bodies; by river systems, dissolved in water or attached to sediment or biological particles; and in the tissues of aquatic organisms (Domagalski et al. 2004). Elemental mercury from gold mining operations was transported directly into rivers and other water bodies during sluicing or deposited in mine tailings in upland areas. From these deposits it travels via surface transport, erosion, and pore water to aquatic environments. Once in the aquatic environment, mercury is transported downstream through normal fluvial processes. While total mercury concentrations are correlated with total suspended solid concentrations in the water column, the concentration of methyl mercury is not (Domagalski 2001).

Mercury in sediments occurs primarily in the form of inorganic mercury. Studies in California rivers suggest that less than 8 percent of the total mercury (elemental, ionic, inorganic and methylated) is available in an ionic form that is available for conversion to either elemental or methylated forms. In the American River, below Nimbus Dam, the amount of reactive mercury in sediments ranged from 0.8 to 2.5 percent (Domagalski 2001, Domagalski et al. 2001). Other

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studies have found that the amount of total mercury in sediments is not correlated with the amount of methyl mercury available to fish (Beckvar et al. 1996).

Reservoirs act as depositional sinks for mercury (Slotton 2000). Studies in the American River watershed have found reduced concentrations of mercury in biota below reservoirs, as compared to above them (Slotton 2000). Reservoirs trap mercury because suspended sediments, the principal means by which mercury is transported, tend to settle to the bottom (Domagalski et al. 2000). Through a series of chemical and biological processes, elemental and inorganic mercury can be converted to methyl mercury, which is the primary compound of concern to wildlife and humans (Beckvar, et al. 1996). Bioavailability studies confirm that the reservoir acts as an interceptor of not only inorganic, sediment-based mercury, but of bioavailable methyl mercury as well (Jones and Slotton, 1996).

### **Mercury Standards and Levels Affecting Salmonids**

The U.S. Environmental Protection Agency (EPA) has recommended criteria for mercury to protect aquatic life and human health. The recommended water-quality criterion is 50 ng/L (EPA1999). For fish tissue, EPA recommends a target of an average of no more than 0.3 mg/kg of methyl mercury (Slotton 2000, CSWRCB 2006, Domagalski 2001).

The California State Regional Water Quality Control Board recommends a limit of 1.06 mg/kg of dry weight in sediment concentrations (CSWRCB 2006). The National Oceanographic and Atmospheric Administration (NOAA) established a screening level of 0.486 mg/kg for sediments in freshwater.

Table 1 summarizes mercury and methyl mercury criteria for the U.S. and California. It also summarizes the mercury concentrations found in water, sediments and fish tissues in the project area and downstream waters. Note that criteria and measured values for mercury are total mercury concentrations including methyl mercury. In water and sediment samples, only a small portion of the total mercury is methyl mercury. Fish samples also reflect total mercury, but nearly all of this mercury is methyl mercury.

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**Table 1- Water Quality, Sediments, and Salmonid Tissue Mercury and Methyl mercury Concentrations at different locations on the American River and criteria.**

*Values are geometric means (ranges in parenthesis)*

| Parameters                          | Criteria   | Unit  | Folsom Reservoir  | Lake Natomas                  | American River below Nimbus Dam                     | American River near mouth  |
|-------------------------------------|--|-------|---|-------------------------------|---|--|
| Water quality<br>(Unfiltered water) | <b>Total mercury</b>   |       |   |                               |   |  |
|                                     | EPA Drinking Water <sup>1</sup> : 50   | ng/L  |   | 1.35 <sup>6</sup>             | <0.65 <sup>6</sup><br>-1.5 (0.3-15.4) <sup>6</sup>  | -2 (0.5-13.3) <sup>7</sup><br>-1.7 (1.1-4.2) <sup>9</sup> 2.5 <sup>10</sup><br>(0.8-18.5) <sup>11</sup><br>3.9 <sup>11</sup> |
|                                     | Freshwater CCC <sup>2,13</sup> : 770   |       |   |                               |   |  |
|                                     | <b>Methyl mercury</b>  | ng/L  |   | <0.04 <sup>6</sup>            | <0.04 <sup>6</sup><br>-0.03 (0.02-0.1) <sup>6</sup> | (0.02-0.18) <sup>6</sup>   |
| Sediments                           | <b>Total Mercury</b>   |       |   |                               |   |  |
|                                     | CSRWQCB <sup>3</sup> : 1.06<br>NOAA <sup>4</sup> PEL: 0.486<br>CVRWQCB 0.2 <sup>14</sup> | mg/kg | 0.16 (0.12-0.20) <sup>4</sup>   |                               | 0.15 <sup>6</sup>                                   | 0.16, 0.15 <sup>6,5</sup>  |
| Salmonid Tissue (wet weight)        | <b>Total Mercury</b>   |       |   |                               |   |  |
|                                     | EPA <sup>1,3</sup> : 0.3   | mg/kg | Trout: 0.2 (0.0-0.9) <sup>5</sup><br>Chinook Salmon: 0.8 (0.5-1.0) <sup>5</sup> | 0.04 (0.02-0.10) <sup>7</sup> |   |  |

<sup>1</sup> EPA 2001

<sup>2</sup> EPA 1999

CCC (Criterion Continuous Concentration) is an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect.

<sup>3</sup> CSRWQCB 2006

<sup>4</sup> Reclamation 2006

<sup>5</sup> Reclamation unpublished data

<sup>6</sup> USGS NWISWeb database for stations 384122121095801 AMERICAN R 1.4 MI DS FOLSOM DAM NR FOLSOM CA (Lake Natomas), 11446500 AMERICAN R A FAIR OAKS CA (Below Nimbus Dam), and 1447000 AMERICAN R A SACRAMENTO CA (near mouth).

<sup>7</sup> Saiki et al. 2004

<sup>8</sup> Values derived from logarithmic plot in SRWP 2005. Central tendency is the median.

<sup>9</sup> Domagalski et al. 2001

<sup>10</sup> USGS NAWQA.

<sup>11</sup> BOAT Database.

<sup>12</sup> Values derived from logarithmic plot in Domagalski and Olanis 2000. Central tendency is the median.

<sup>13</sup> Buchman 1999. PEL: Probable Effects Levels

<sup>14</sup> CVRWQCB as cited by Reclamation (2006)

The no effect level for methyl mercury in brook and rainbow trout ranges from 0.2 to 3 mg/kg (Beckvar et al. 1996). Effects were observed at tissue concentrations ranging from 10 to 52 mg/kg for a single generation, but effects were noted at a concentration of 2.2 mg/kg in brook trout continuously exposed to mercury for three generations. The level reported for brook trout would not apply in the Lower American River, because steelhead and spring-run Chinook salmon would not be continuously exposed, as they migrate to the ocean. One mitigating factor to these exposure levels in salmonids may be that they can eliminate mercury from their bodies (Rucker and Amend 1969, as cited by Hartman 1978), but the mechanism by which it occurs is not clear. From this, the EPA criterion (which is

intended to protect human health) is more than ten times lower than the level known to cause effects in salmonids.

## **Mercury Studies in the American River**

### ***Folsom Reservoir***

Reclamation has conducted various studies in Folsom Reservoir, including the measurement of fish muscle tissue mercury concentrations for various fish species collected in 2004 and 2006 (unpublished data). Sampling included a variety of species at different trophic levels. The most pertinent results to evaluate impacts to salmonids come from fish at a similar trophic level to salmonids juveniles. This includes rainbow trout and sunfish. The results above include results for Chinook salmon, but these results may not be indicative of the levels which would occur in juveniles, as the Chinook salmon sampled were larger than 440 mm and had reared in Folsom Reservoir. Results for trout and Chinook salmon are summarized in Table 1. The values for sunfish range from 0.1 to 0.3 mg/kg. These data indicate that some individual fish exceed the U.S. EPA criterion, but the average values for rainbow trout and sunfish are less than this criterion.

Reclamation also conducted a study of trace metals concentrations including mercury in the area where the JFP spillway would be constructed. The study identified the magnitude and spatial distribution of sedimentary metals contamination in the excavation area. Total mercury concentrations in sediments were observed to range from 0.12 to 0.20 mg/kg with an average of 0.16 mg/kg, and did not exceed the RWQCB criterion (Reclamation 2006).

### ***Lake Natomas***

In Lake Natomas, the USGS measured total mercury concentrations in filets of sport fishes collected during 2000-2003, and found elevated levels in some fish species (Saiki et al. 2004). Mercury concentrations in trout were among the lowest of any species (0.02-0.10 mg/kg), although only two trout were sampled. Sunfish values ranged from 0.03 to 0.39 mg/kg, but only one fish exceeded the EPA criterion. All other sunfish (n=121) had concentrations of less than 0.2 mg/kg. Fish at higher trophic levels had higher mercury concentrations, with means ranging from 0.13 to 1.50 mg/kg. The highest mercury concentration observed was 1.89 mg/kg in a channel catfish.

This information resulted in the Office of Environment Health Hazard Assessment (OEHA) developing a health advisory for consumption of fish from Lake Natomas and the lower American River in 2004 (Klasing 2004).

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### ***Lower American River***

Mercury studies performed in the Lower American River have focused primarily on mercury in sediment and the water column. The Sacramento Coordinated Water Quality Monitoring Program (CMP) monitors mercury in the water at two stations in the Lower American River. These studies have found that mercury concentrations meet regulatory criteria proposed in the August 1997 California Toxics Rule (SFEI 1999).

Domagalski (2001, also reported in Domagalski and Deleanis 2000) determined mercury and methyl mercury concentrations in water and sediments of the Sacramento River basin, including a station in the American River near the mouth. Higher amounts of mercury tended to be measured at sites downstream of the gold mining areas in the Sierra Nevada, compared to other sites within the basin. The mercury concentrations in the American river water and sediment samples were the lowest of all Sierra Nevada drainage sites. This was attributed to the possible entrapment of mercury in the upstream reservoirs.

The Sacramento River Watershed Program (SRWP 2005) reported annual monitoring results for total mercury (1994-2003) and methyl mercury (2000-2003) concentration in water at two stations of the lower American River. The concentrations were among the lowest of the Sacramento watershed and well below the EPA criterion. Fish tissue samples were also collected as part of this program. All except two of the fish sampled were from higher trophic levels. The two sunfish sampled had mercury concentration of 0.08 and 0.3 mg/kg.

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