United States Department of the Interior

FISH AND WILDLIFE SERVICE
San Francisco Bay-Delta Fish and Wildlife Office
650 Capitol Mall, 5th Floor
Sacramento, California 95814

In reply refer to:
81410-2010-F-0022

SEP - 3 2010

Ms. Kathleen Dadey
Chief, California Delta Branch
Department of the Army
U.S. Army Engineer District, Sacramento
Corps of Engineers
1325 J Street
Sacramento, California 95814-2922

Subject: Engineering Geotechnical Studies for the Bay Delta Conservation Plan (BDCP) and/or the Preliminary Engineering Studies for the Delta Habitat Conservation and Conveyance Program (DHCCP)

Dear Ms. Dadey:

This letter is in response to the U.S. Army Corps of Engineers' (Corps) June 25, 2010, letter requesting initiation of formal consultation with the U.S. Fish and Wildlife Service (Service) on permitting the Engineering Geotechnical Studies for the Bay Delta Conservation Plan (BDCP) and/or the Preliminary Engineering Studies for the Delta Habitat Conservation and Conveyance Program (DHCCP) Project (Project). This project may affect the following species and/or critical habitats:

1. Federally endangered California clapper rail (*Rallus longirostris obsoletus*)
2. Federally endangered least Bell's vireo (*Vireo bellii pusillus*) and its designated critical habitat
3. Federally endangered California least tern (*Sternula antillarum browni*)
4. Federally threatened delta smelt (*Hypomesus transpacificus*) and its designated critical habitat
5. Federally threatened California tiger salamander (*Ambystoma californiense*), central valley population and its designated critical habitat
6. Federally threatened California red-legged frog (*Rana draytonii*) and its designated critical habitat
7. Federally threatened Giant garter snake (*Thamnophis gigas*)
8. Federally threatened Western snowy plover (*Charadrius alexandrines nivosus*) and its designated critical habitat
9. Federally endangered San Joaquin kit fox (*Vulpes macrotis mutica*)

10. Federally endangered vernal pool tadpole shrimp (*Lepidurus packardi*) and Federally threatened vernal pool fairy shrimp (*Branchinecta lynchi*) and its designated critical habitat
11. Federally threatened valley elderberry longhorn beetle (VELB) (*Desmocerus californicus dimorphus*) and its designated critical habitat

You determined that this project may affect the southern distinct population segment of the North American green sturgeon (*Acipenser medirostris*). The sturgeon is under the jurisdiction of National Marine Fisheries Service and consultation for this project for this species should be directed through them. This response is in accordance with Section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*).

This Biological Opinion is based on the following documents and other information provided for this project: (1) The *Biological Assessment for Engineering Geotechnical Studies for the Bay Delta Conservation Plan and/or Preliminary Engineering Studies for the Delta Habitat Conservation and Conveyance Program*; (2) the July 2010, *California Department of Water Resources Delta Habitat Conservation and Conveyance Program Listed Brachiopod Wet-Season Survey 90-day Permit Report*; (3) *Draft Mitigated Negative Declaration and Draft Initial Study: Engineering Geotechnical Studies for the Bay Delta Conservation Plan and/ or Preliminary Engineering Studies for the Delta Habitat Conservation and Conveyance Program*; (4) telephone conversations and electronic mail between Michelle Beachley of California Department of Water Resources (DWR) and the Service; and (5) other information available to the Service.

CONSULTATION HISTORY

June 29, 2010: Sacramento Fish and Wildlife Office received consultation package for this project. SacFWO transferred the package to the Bay Delta FWO for consultation review

July 8, 2010: Bay Delta Office received the consultation package and Brian Hansen of The Service contacted Michelle Beachley of DWR regarding the need for a higher level of detail for boring sites.

July 14, 2010: Brian Hansen met with Crystal Bowles and Jim Watson of DWR to discuss the GIS data layers for a more detailed review of the geotechnical boring sites.

August 4, 2010: Brian Hansen, Michelle Beachley and representatives of the geotechnical drilling team made a site visit to Clifton Court Forebay to discuss minimization and avoidance measures for the project on listed vernal pool species.

August 6, 2010: Conference call between the Service and DWR concerning an expedited timeline. DWR requested an expedited Biological Opinion in order to start in water work by the end of August 2010. The Service also provided DWR with a species list of additional species that may be affected by the project so DWR could determine the appropriate conservation measures for the project.

August 11, 2010: Meeting between the Service and DWR to analyze individual boring sites to determine the potential for DWR to work outside the prescribed work windows for the active period of giant garter snake as prescribed in the *Programmatic Formal Consultation for U.S. Army Corps of Engineers 404 Permitted Projects with Relatively Small Effects on the Giant Garter Snake* (Service File No. 1-1-F-97-149).

BIOLOGICAL OPINION

Project Setting and Background

The project site is located within the legal Delta as defined by DWR's D-1641. The project is a preliminary study to the BDCP and the DHCCP which are intended to enhance and restore the ecosystem processes and functions of the Delta by constructing a through-Delta conveyance structure. DWR proposes to make over 300 geotechnical explorations which include approximately 80 overwater and approximately 220 to 240 land locations from around the Freeport area of the Sacramento River and extending south through the Delta to the immediate southern area of Clifton Court Forebay near Tracy, California. This also includes the excavation of approximately 30 test pits. DWR's geotechnical staff and/or its consultants will investigate the engineering properties of the soils in the Delta along various alignment options. The purpose of the investigation is to gather necessary geotechnical information for proposed intake locations, forebays and conveyance facilities. DWR requires soils and groundwater information for conceptual design and construction cost of conveyance facilities and to identify possible constraints in developing conveyance alternatives.

Project Description

Overwater Exploration

DWR proposes approximately 80 overwater geotechnical borings in the Delta waterways between 2010 and 2012. These include approximately 50 overwater geotechnical borings in the Sacramento River to obtain information for the five proposed intake structures for the water conveyance facilities associated with the BDCP. Approximately 20 overwater borings are planned at the twelve major water crossings along the proposed Pipeline/Tunnel Option conceptual alignment. An additional five to twelve overwater geotechnical borings are proposed to obtain conceptual information for docking facilities. The depths of borings are planned to range between 100 and 200 feet (30 and 61 meters (m)) below the mudline.

DWR plans to conduct overwater drilling only during the time period from August 1 to October 31 between the hours of sunrise to sunset. This period is the recognized window of opportunity to avoid and minimize disturbance for sensitive environmental resources. Duration of drilling at each location will vary depending on the number and depth of the holes at each location, drill rate, and weather conditions, but are not expected to exceed 60 days at any one location.

The overwater geotechnical borings are proposed to be conducted in the following areas:

1. At the anticipated locations of five proposed intake structures located on the Sacramento River between Courtland and the Clarksburg area, approximately nine to twelve borings at each site.

2. Where the Pipeline/Tunnel Option alignment would intersect major waterways including:

   Snodgrass Slough – North of Lambert Road
   Sacramento River between approximate River Mile 29 and 30
   Sacramento River between approximate River Mile 25 and 26
   Georgiana Slough – 3 crossings between approximate River Mile 8.5 and 11
   North Mokelumne River – between approximate River Mile 2 and 3
   South Mokelumne River – between approximate River Mile 5.5 to 6.5
   Potato Slough
   San Joaquin River between River Mile 25 and 26 (Venice Reach and Mandeville Cut)
   Connection Slough (east of Youngs Slough)
   The Santa Fe Cut between Woodward and Bacon Island (if barge access ids possible)
   Woodward Canal, a.k.a. North Victoria Canal
   Confluence of Victoria Canal and Old River ± 0.5 mile

The drilling will be conducted with a rotary drilling rig mounted on a shallow-draft barge or ship. Multiple barges and/or ships may be operated concurrently. The barge or ship will be anchored into the bottom of the channel with two or four spuds to prevent the vessel from drifting while work is being performed. The spuds are steel pipes mechanically lowered into the channel bottom. The barge or ship will be mobilized from an established marina and will be anchored either at the drill sites or at Coast Guard established anchorage points. Personnel will access the barge and/or ship via a support boat from an established marina. When a drill rig remains on a boring location for more than one day, the drill apparatus and casing will remain in the water column and drill hole to minimize sediment disturbance of the river bottom. The drill apparatus consists of a 6 to 8 inch (15 to 20 centimeters (cm)) diameter conductor casing that extends from the barge deck, through the water column, and into the soft sediments of the river bottom. The casing is smaller than most piers and would not impede water flows or migration patterns of fish. All of the drilling rods, samplers, and other down-hole equipment pass through the inside of the casing, which effectively separates them from the water. There are no loose items or netting on the casing that would trap or snag fish.

The borings will be advanced using mud rotary method and will be drilled and sampled to a maximum depth of approximately 200 feet (61 m) below the bottom of the slough or river. In this case, the term “mud” refers to the use of bentonite clay added to the boring to allow removal of the drill cuttings and to stabilize the boring. Initially, the boring will be advanced by pushing and approximate 6 to 8 inch (15 to 20 cm) diameter conductor casing, which will extend from the top of the barge or drill ship deck, an approximate depth of 10 to 15 feet (3 to 4.5 m) or more below the mud line of the slough or river channel. The conductor casing will be used to confine the drill fluid and cuttings within the drill hole and operating deck of the barge or drill ship and prevent any inadvertent spillage into the water. Soil samples will be collected from within the conductor casing. The drill hole below the conductor casing will be approximately 3.5 to 5.5 inches (9 to 14 cm) in diameter.

Only water will be circulated through the pumps and conductor casing when drilling and sampling within 15 to 20 feet (4.5 to 6 m) of the slough or river mud line. For deeper drilling, the drilling fluid, consisting of a mixture of circulating water and bentonite clay, will be introduced into the conductor casing via the drill string to create a more viscous drilling fluid. The drilling fluid will pass down the center of the drill rod to the cutting face in the formation being drilled and will return up the drilled hole with the suspended cuttings. The drilling fluids and cutting will be confined by the borehole walls and the conductor casing. Return drilling fluids will pass through the conductor casing to the barge or ship deck and then through a tee connection at the head of the conductor casing into the drilling recirculation tank.

With the conductor casing in place, the drilling fluids will be kept in the closed system formed by the conductor casing and a tank at the top of the hole on the barge deck and a precautionary provision of a heavy plastic sleeve over the conductor casing which drapes into an external mud tank. This system will provide a reliable seal and prevent significant spillage of the drilling fluid into the water. The drill rod and sample rod connections will be disconnected either directly over the conductor casing or the recirculation tank. Furthermore, positive barriers consisting of hay waddles and/or other suitable types of spill stoppage materials will be placed around the work area on the barge and ship decks.

Drill cuttings that settle out in the recirculation tank will be collected into 55 gallon storage drums. Best Management Practices (BMPs) will be observed and maintained in containing the drilling fluid, including taking care when transferring drill cuttings from the recirculation tanks to the drums. The drums will be placed adjacent to the recirculation tank. If drilling fluid or drill cutting material accidentally spill onto the barge deck outside of the containment area, they will be immediately picked up with a flat blade shovel and placed either into the recirculation tank or a storage drum, and the affected area will then be cleaned and mopped. Discarded soil samples will also be placed in the storage drums.

Samples will be obtained using a combination of split spoon samples, thin-walled tubes (Shelby tubes or piston samplers), and soil coring techniques. Standard penetration tests, a process of conducting split spoon sampling, will be taken in the sandy and clayey soils, and Shelby and piston tube (push) undisturbed soil samples will be taken in soft clay soils. Standard penetration tests are performed by dropping a 140 pound automatic hammer on the drill string to drive a sampler about 1.5 feet (0.5 m). This is a test conducted in short durations (a few minutes for each test) using a relatively small energy source. Vibrations from the test are minimal. The Shelby tube and piston samplers are collected by pushing on the drill string with the weight of the drill rig. No vibrations are produced from pushing tube samples. A punch core or similar soil coring technique will be utilized to retain disturbed soil samples in an inner core barrel within the drill string.

Upon completion of each hole, the borings will be grouted from the bottom of the borehole to within approximately 10 to 15 feet (3 to 4.5 m) of the top with 5 percent (by weight) bentonite and 95 percent (by weight) cement grout. Water will first be introduced inside the drilled hole and circulated within the conductor casing to clear out any remaining drilling mud prior to grouting. Grouting of the drilled hole will be accomplished by the tremie method[1] from the bottom upward to a depth of approximately 10 feet (3 m) below the bottom of the river based on a calculated grout take volume to prevent grout migration into the river water. At the completion of the grouting, the conductor casing will then be pulled out of the channel bottom to complete the overwater boring operation.

An Environmental Scientist stationed on the barge or ship will observe the drilling operation to ensure that all drilling fluid and cuttings are kept and confined within the recirculation tanks and storage drums. The Environmental Scientist will pay special attention to the river water for the presence of colored or increasingly opaque plumes when drilling, grouting, and pulling casing. All personnel on the barge or ship will report any observations of colored plumes in the water or leaking of the drilling fluids to the Environmental Scientist. Colored plumes are an indication that material may be leaking into the water. If an unauthorized discharge is discovered by any of the personnel on board the barge or ship, drilling activities will cease until appropriate corrective measures have been completed. Cuttings and excess drilling fluid will be contained in drums or bins, periodically off-loaded to a land-based staging area, and disposed of at a State-approved landfill site. The overwater borings will be supervised by a licensed drilling contractor under the direction of Department of Water Resources' personnel or its Contractor. An Engineering Geologist or Engineer will be on site at the drill rig to supervise activities at all times during the operation. An Environmental Scientist will be on-site during all active drilling work to monitor activities.

Land Exploration

The geotechnical investigation program on land will consist of approximately 220 to 240 exploration locations (Figure 1), including drilling boreholes and performing cone penetration tests (CPT); as well as conducting approximately 15 shallow test pit excavations (typically 4 feet wide x 12 feet long X 12 feet deep) (1 m x 3.5 m x 3.5 m) in soils to measure soil load-bearing capacity, physical properties of the sediments, location of the groundwater table, and other typical geologic and geotechnical parameters. Cone penetration testing pushes a cone connected to a series of rods into the ground at a constant rate, allowing continuous measurements of resistance to penetration both at the cone tip and the sleeve behind the cone tip. The resulting information allows the nature and sequence of subsurface soil strata, groundwater conditions, and physical and mechanical properties of the soil to be estimated.

Temporary test wells may be installed at some sites to investigate soil permeability and to allow sampling of dissolved gases in the groundwater. Small test pit excavations may be dug to obtain near-surface soil samples for laboratory analysis in limited locations. Drilling will take place on disturbed soils on properties in the Delta readily accessible by vehicles by established roads or paths.

After each site is investigated, the boring, CPT and/or well holes will be backfilled with cement-bentonite grout in accordance with California regulations and industry standards (Water Well Standards, DWR 74-81 and 74-90). Test pits will be backfilled with the excavated material on the same day as they are dug, with the stockpiled topsoil placed at the surface and the area restored as close as possible to its original condition.

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[1] A pipe is lowered to the bottom of the borehole and grout is pumped down to the bottom of the hole. This insures that grout has been placed from the bottom of the hole to the top and prevents bridging.

Site investigation activities may consist of auger and mud-rotary drilling with soils sampling using a standard penetration test (SPT) barrel (split spoon sampler) and Shelby tubes; cone penetrometer testing; temporary well installation; test pits; and electrical resistivity and other geophysical surveys. All exploration methods will require a drill rig and support vehicle for the drillers and vehicles for the Geologists and Environmental Scientists. The Department of Water Resources will implement best management practices that include measures for air quality, noise, greenhouse gases, and water quality. The different investigation methods may last from a few hours to several days and are described in the following paragraphs.

1) Drilling activities will generally be performed using a rotary drill rig with auger capabilities. Auger techniques will drill an approximate 6.5 to 8 inch (16 to 20 cm) diameter boring and will be used only for shallow depths. Mud-rotary drilling and sampling will generate 4 to 6 inch (10 to 15 cm) diameter borings, unless casing is required, which will increase the boring diameter to 6 to 8 inches (15 to 20 cm). Depths of test holes will generally vary from about 5 to 225 feet (1.5 to 68.5 m). At three selected locations, drilling may extend to a depth of approximately 500 feet (152.5 m) to allow for a better understanding of the deeper subsoil formation with the measurements of the geophysical properties such as shear and compression wave velocities. Drilling time required for each drill hole is approximately 3 work days for drill holes less than 100 feet deep (30 m), approximately 5 work days for drill holes to 225 feet deep (68.5 m), and up to 3 weeks or more for deeper drill holes up to 500 feet deep (152.5 m). Upon completion of soil sampling and testing, holes will be sealed using cement-bentonite grout in accordance with California regulations and industry standards (Water Well Standards, DWR 74-81 and 74-90). Drilling boreholes usually requires a truck or track-mounted drill rig typically powered by a 100 to 200 horsepower (hp) diesel engine. A drill rig tender vehicle and tool truck generally accompany the drill rig. Track-mounted rigs will be used only if needed to minimize access impacts over soft ground. Trailers will carry track-mounted equipment to the site. Cuttings and excess drilling fluid will be contained in drums, large containers, or vacuum truck and disposed of offsite at an appropriate landfill.

2) The cone penetrometer test sounding usually requires a truck-mounted, 15 to 30 ton push-capacity cone apparatus. The apparatus is typically powered by a 400 to 500 hp diesel engine. A drill rig tender vehicle and tool truck generally accompany the cone penetrometer test rig.

3) Select geotechnical drill holes may be completed as groundwater monitoring wells. An additional day or two added to the total drilling time may be required for the completion of each groundwater monitoring well. The wells will be completed in accordance with California regulations and industry standards (Water Well Standards, DWR 74-81 and 74-90). After well tests and monitoring are completed, the well material will be drilled out and the hole will be backfilled with cement-bentonite grout using a tremie pipe.

4) Shallow test pits (typically 4 feet wide x 12 feet long X 12 feet deep) (1 m x 3.5 m x 3.5 m) may be dug in limited locations to obtain near-surface soil samples for laboratory analysis. Test pits will not be dug on any levees or in any sensitive habitats. During test pit excavation, any topsoil will be segregated from other material removed from the pit. Test pits will be backfilled with the excavated material on the same day as they are dug, with the stockpiled topsoil placed at the surface and the area restored as close as possible to its original condition.

5) Non-invasive geophysical surveys may be employed to determine the near surface characteristics of the soil. The electrical resistivity surveys consist of driving four steel probes, each one-half inch in diameter, about 12 inches (30.5 cm) into the ground and measuring the resistance between different pairs of electrodes. The electrode spacing may vary depending upon the depth of investigation. The survey method is considered safe because low amperage currents (usually less than 0.5 amp) are involved. Therefore, the method does not present a danger to fauna. In addition, the duration of applied current is extremely short; just long enough to take a voltmeter reading. The process takes about 30 minutes, and at the completion, the probes and equipment are removed. Other methods of geophysical surveys use similar types of non-destructive equipment that measure parameters such as electrical currents, seismic waves, magnetic fields, or radar reflections in the ground.

Conservation Measures

Through site visits and several meetings for the project, DWR has agreed to implement the following conservation measures with regard to the species identified through the consultation. These are measures to avoid and minimize impacts or disturbance to sensitive species and their habitats to the fullest extent possible.

The Department of Water Resources' Environmental Scientists have reviewed potential drill locations through GIS with DFG and CNDDB layers to evaluate the potential impacts, if any, to environmental resources. Drill locations have been moved to avoid any identified sensitive habitats or environmental resources or to reduce impacts to a less than significant level. In addition, DWR has committed to the following general and species-specific conservation measures:

General

1. An environmental scientist will conduct onsite field reviews for drill locations as well as ingress and egress from drill sites before and during drilling operations. A biological monitor will inspect these sites to ensure that potentially sensitive environmental resources are not significantly impacted during operations.

2. An Environmental Scientist will be stationed near the work areas for land drilling and on the barges/boats for water drilling to act as biological monitor and to assist the construction crew with environmental issues as necessary. An Environmental Scientist will approach the site prior to any drilling equipment or drilling activities being conducted. If a sensitive species is encountered by a biological monitor during construction, activities shall cease until appropriate corrective measures have been completed or it has been determined that the species will not be harmed.

3. Biological monitors will conduct a worker awareness program and educate work crews about sensitive habitats and species within the project area, including habitat needs, status of the species and protection under the Endangered Species Act. The biological monitor will include a list of measures being taken to reduce impacts to species during project construction and implementation.

4. All litter, debris, unused materials, rubbish, supplies, or other material will be appropriately stored at the work site until it can be removed and deposited at an appropriate disposal or storage site.

5. Equipment shall be refueled, maintained and serviced at designated staging areas away from the riverbank, levee, or habitat designated as sensitive by an approved environmental monitor.

6. On land locations, vehicles will access the work site following the shortest possible route from the levee road. All site access and staging shall limit disturbance to the riverbank, or levee as much as possible and avoid sensitive habitats. When possible, existing ingress and egress points shall be used.

7. Vehicles will follow a 20 MPH speed limit on paved roads and 15 MPH on unpaved surfaces.

8. Upon completion of the project, all areas subject to temporary ground disturbances, including storage and staging areas, should be returned as close to pre-project conditions as practical.

Species-specific

Delta Smelt

Delta smelt could be affected by activities that degrade water quality and in water work that could cause disturbance in behavior through vibration and noise. All life stages of delta smelt as well as some designated critical habitat can be found in the Project Area. However, the proposed project activities are not likely to have a significant adverse effect on delta smelt as project activities are minor in scope and duration and all project activities will be conducted between August 1 and October 31 when fish are at their lowest abundance in the waterways. These work windows are prescribed in the *Formal Programmatic Consultation on the Issuance of Section 10 and 404 Permits for Projects with Relatively Small Effects on the Delta Smelt* (Service File No. 1-1-04-F-0345). The proposed activities will not cause any changes to delta smelt habitat. The implementation of the best management practices mentioned above, will prevent any water quality degradation that could significantly affect delta smelt. In the core distribution of Delta smelt (Chipps Island-Rio Vista), construction activities on shoals during ebb tides will be minimized. There is some evidence that Delta smelt may move inshore on ebb tides to avoid getting swept downstream by currents. Hence, reducing work during those periods could provide some protection.

Valley Elderberry Longhorn Beetle

DWR will avoid and protect habitat for VELB whenever possible. If suitable habitat for the beetle is found to occur on the project site (including ingress and egress) or within close proximity where beetles may be affected by the project, these areas will be designated as avoidance areas and will be protected from disturbance during the construction and operation of the project. The project will be designed such that avoidance areas are connected with adjacent habitat to prevent fragmentation and isolation of beetle populations. Beetle habitat will be avoided as described below.

1. A 100 foot (30 m) (or wider) buffer will be established around elderberry plants containing stems measuring 1.0 inch (2.5 cm) in diameter or greater at ground level using fencing and flagging. Complete avoidance (i.e., no adverse effects) will be assumed when a 100 foot (30 m) (or wider) buffer is established and maintained around elderberry plants during construction. In buffer areas construction related disturbance will be minimized and any damaged area will be promptly restored following construction. The U.S. Fish and Wildlife Service will be consulted before any disturbances within the buffer area are considered. In addition, the U.S. Fish and Wildlife Service will be provided with a map identifying the avoidance area and written details describing avoidance measures if requested. In areas where encroachment on the 100 foot (30 m) buffer has been approved by the U.S. Fish and Wildlife Service, provide a minimum setback of at least 20 feet (6 m) from the dripline of each elderberry plant.

2. Within the immediate vicinity of drill locations, DWR will place signs every 50 feet (15 m) along the edge of the avoidance area with the following information: "This area is habitat of the valley elderberry longhorn beetle, a threatened species, and must not be disturbed. This species is protected by the Endangered Species Act of 1973, as amended. Violators are subject to prosecution, fines, and imprisonment." The signs should be clearly readable from a distance of 20 feet (6 m), and must be maintained for the duration of construction.

3. DWR will educate work crews about the status of the beetle, the need to avoid damaging its elderberry host plant, and the possible penalties for not complying with these requirements.

4. No insecticides, herbicides, fertilizers, or other chemicals that might harm the beetle or its host plant will be used in the buffer areas, or within 100 feet (30 m) of any elderberry plant with one or more stems measuring 1.0 inch (2.5 cm) or greater in diameter at ground level.

Vernal Pool Invertebrates

Vernal pool fairy shrimp (VPFS, *Branchinecta lynchi*) are found in vernal pools and also sandstone rock outcrop pools. VPFS are known to occur in the southern portion of the project area near Clifton Court Forebay and VPFS have also been found just outside of the northeastern portion of this project area. Along with standard project BMPs, measures will be taken to avoid all vernal pool, ephemeral waterways, and wetland areas. In order to accomplish this, topographic depressions that are most likely to serve as seasonal vernal pools will be flagged and avoided. In addition, work will be done outside the wet season and measures, such as having vehicles follow shortest possible routes from levee road to the drill or CPT sites, will be taken to minimize the overall project footprint.

Vernal pool tadpole shrimp (VPTS, *Lepidurus packardi*) are found in vernal pools containing clear to highly turbid water in a wide range of sizes. Habitat for VPTS does occur within the southern portion of project area near Clifton Court Forebay and VPTS have been found in pools just to the northeast of the project area. Along with standard project BMP's, measures will be taken to avoid all vernal pool, ephemeral waterways, and wetland areas. In order to accomplish this, topographic depressions that are most likely to serve as seasonal vernal pools will be flagged and avoided. In addition, work will be done outside the wet season and measures, such as having vehicles follow shortest possible routes from levee road to the drill or CPT sites, will be taken to minimize the overall project footprint.

Giant Garter Snake

To the extent practicable, all activities in this area will avoid impacts to aquatic and adjacent uplands within 200 feet (61 m). The following avoidance and minimization measures will be used to ensure there are no significant impacts to the giant garter snake.

1. This active period for giant garter snakes is between May 1 and October 1. Direct mortality is lessened during this period because snakes are expected to actively move and avoid danger. If construction takes place outside this window, activities will be confined to more than 200 feet (61 m) from the banks of giant garter snake habitat.

2. Avoid construction activities within 200 feet (61 m) from the banks of giant garter snake aquatic habitat. Confine movement of heavy equipment to outside 200 feet (61 m) of banks of potential giant garter snake habitat to minimize habitat disturbance.

3. Construction personnel should receive Service-approved worker environmental awareness training. This training instructs workers to recognize giant garter snakes and their habitat(s).

California Tiger Salamander

To the extent practicable, all project activities will avoid impacts to grassland habitat within 100 feet (30 m) that possesses cracks or burrows that could be occupied by California tiger salamanders. Pre-construction surveys will be conducted by a qualified biologist. A biological monitor will be present during all drilling activities to ensure there are no significant impacts to CTS. In addition, work will be done outside the wet season and measures, such as having vehicles follow shortest possible routes from levee road to the drill or CPT sites, will be taken to minimize the overall project footprint.

California Red-legged Frog

To the extent practicable, all activities will avoid impacts to aquatic and adjacent uplands within 100 feet (30 m) that possesses cracks or burrows that could be occupied by California red-legged frogs. Pre-construction surveys will be conducted by a qualified biologist. A biological monitor will be present during all drilling activities to ensure there are no significant impacts to CRLF. In addition, work will be done outside the wet season and measures, such as having vehicles follow shortest possible routes from levee road to the drill or CPT sites, will be taken to minimize the overall project footprint.

San Joaquin Kit Fox

1. Vehicles will access the work site following the shortest possible route from the levee road. All site access and staging shall limit disturbance to the riverbank, or levee as much as possible and avoid sensitive habitats. When possible, existing ingress and egress points shall be used. A biological monitor will inspect these sites to ensure that potentially sensitive environmental resources are not significantly impacted during operations.

2. Project activities will not take place at night when kit foxes are most active. Off-road traffic outside of designated project areas should be prohibited.

3. A biological monitor will be stationed near the work areas to act as biological monitor and to assist the construction crew with environmental issues as necessary. If kit foxes are encountered by a biological monitor during construction, activities shall cease until appropriate corrective measures have been completed or it has been determined that the species will not be harmed.

4. To prevent inadvertent entrapment of kit foxes or other animals during the construction phase of a project, all excavated, steep-walled holes or trenches more than 2 feet (0.6 m) deep should be covered at the close of each working day by plywood or similar materials, or provided with one or more escape ramps constructed of earth fill or wooden planks. Before such holes or trenches are filled, they should be thoroughly inspected for trapped animals.

5. All construction pipes, culverts, or similar structures with a diameter of 4 inches (10 cm) or greater that are stored at a construction site for one or more overnight periods should be thoroughly inspected for kit foxes before the pipe is used or moved in any way. If a kit fox is discovered inside a pipe, construction activities will be halted and that section of pipe should not be moved until the biologist monitoring the project construction site has contacted the Service. Once the Service has given the construction monitor instructions on how to proceed or the kit fox has escaped on its own volition, the pipe may be moved.

6. No firearms shall be allowed on the project site.

7. Noise will be minimized to the extent possible at the work site to avoid disturbing kit foxes.

8. To prevent harassment, mortality of kit foxes or destruction of dens by dogs or cats, no pets are permitted on project sites.

9. Rodenticides and herbicides will not be used during this project.

10. If a San Joaquin kit fox is inadvertently injured or killed, the biological monitor shall immediately report the incident to the DWR Lead Environmental Monitor. The Lead Construction Monitor/Biologist shall contact the USFWS and CDFG immediately in the case of a dead, injured or entrapped kit fox. The CDFG contact for immediate assistance

is State Dispatch at (916) 445-0045. They will contact the local warden or biologist. Notification must include the date, time, and location of the incident or of the finding of a dead or injured animal and any other pertinent information.

California Least Tern

California Least Terns are unlikely to be affected by project activities, as the only known nesting site in the BDCP plan area is in Suisun Bay. However, if work takes place during Least Tern nesting season (mid-April to late-August), and nesting Least Terns are observed near work sites, the following measures will be followed to avoid and/or minimize impacts to this species.

1. Preconstruction surveys for nesting birds will be conducted 2 weeks before any construction activities are anticipated during the nesting season.

2. Noise will be minimized at the work site to avoid disturbing nesting Least Terns.

3. To prevent harassment and mortality of Least Terns or their nests by dogs or cats, no pets will be permitted on project sites.

Action Area

The action area is defined in 50 CFR § 402.02, as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." For the Engineering Geotechnical Studies for the Bay Delta Conservation Plan (BDCP) Project, the action area are 300 to 400 point locations within the defined legal “Delta” starting from Herdlyn Road, south of the Clifton Court Forebay, extending along several paths north through the Delta to the Clarksburg region along the Sacramento River just south of West Sacramento.

Determination of not likely to adversely affect for the following species and critical habitats:

The Service has determined that due to the relatively small extent of individual borings and through the implementation of the proposed conservation measures, this project is not likely to adversely affect the endangered San Joaquin kit fox (*Vulpes macrotis mutica*), the endangered California least tern (*Sternula antillarum browni*), the endangered California clapper rail (*Rallus longirostris* obsoletus), the endangered least Bell’s vireo (*Vireo bellii* pusillus) and its critical habitat, the endangered vernal pool tadpole shrimp (*Lepidurus packardi*) and its critical habitat, and the threatened valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) and its critical habitat. Although unlikely, any take would be expected to happen in the form of harassment. Kit foxes, terns, clapper rails and least Bell’s vireos should be able to avoid the limited noise producing activities, vehicles and work crews. Elderberry shrubs where the valley elderberry longhorn beetles may occur will be avoided with the appropriate buffers and no shrubs are expected to be trimmed or removed.

The remainder of the Biological Opinion will address adverse project effects to the endangered vernal pool tadpole shrimp (*Lepidurus packardi*), the threatened vernal pool fairy shrimp

(*Branchinecta lynchi*) and its critical habitat, the threatened delta smelt (*Hypomesus transpacificus*) and its critical habitat, the threatened California tiger salamander (*Amystoma californiense*)- central valley population and its critical habitat, the threatened California red-legged frog (*Rana draytonii*) and its critical habitat, and the threatened giant garter snake (*Thamnophis gigas*).

Status of the Species/Environmental Baseline

Vernal pool tadpole shrimp (VPTS) and vernal pool fairy shrimp (VPFS)

Listing status: The Service proposed to list the vernal pool tadpole shrimp as endangered and the vernal pool fairy shrimp as threatened on May 8, 1992 (57 FR 19856). The Service listed the VPTS and the VPFS on September 19, 1994 (59 FR 48136). Critical habitat was proposed on September 24, 2002 (67 FR 59883), and designated *on* October 10, 2002 (67 FR 63067). The VPTS and VPFS were two of four vernal pool crustaceans addressed in the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (Service 2005). A 5-year review was completed for both the VPTS and the VPFS and no change in status for either species was recommended (Service 2007).

VPTS

The vernal pool tadpole shrimp (*Lepidurus packardi*) is a small crustacean in the Triopsidae family. It has compound eyes, a large shield-like carapace (shell) that covers most of the body, and a pair of long cercopods (appendages) at the end of the last abdominal segment. VPTS adults reach a length of 2 inches (5 cm) in length. They have about 35 pairs of legs and two long cercopods. Species in the genus *Lepidurus* can be distinguished from members of the similar looking genus *Triops* by the presence of a supra-anal plate between their cercopods, which is lacking in *Triops*. Two other species of *Lepidurus* are found in California. One, the cryptic tadpole shrimp (*Lepidurus cryptus*), has recently been described (Rogers 2001).This species cannot be differentiated from the VPTS by appearance, but the two species are genetically distinct (King and Hanner 1998, Rogers 2001). The cryptic tadpole shrimp occurs in the Great Basin and intermountain regions of northern California and southern and eastern Oregon, whereas the VPTS occurs in the Central Valley, Delta, and east San Francisco Bay area (Rogers 2001).

Distribution: Holland (1978) estimated that roughly 4,000,000 acres (1,600,000 hectares) of vernal pool habitat existed in the Central Valley during pre-agricultural times. Historically the VPTS was probably distributed over most of these vernal pool habitats. However, surveys in southern portions of California have never revealed *VPTS* populations, and the species probably did not occur historically outside of the Central Valley and Central Coast regions

The VPTS is currently distributed across the Central Valley of California and in the San Francisco Bay area. The species' distribution has been greatly reduced from historical times as a result of widespread destruction and degradation of its vernal pool habitat. Vernal pool habitats in the Central Valley now represent only about 25 percent of their former area, and remaining habitats are considerably more fragmented and isolated than during historical times (Holland 1998). VPTS are uncommon even where vernal pool habitats occur. Helm (1998) found VPTS in only 17 percent of vernal pools sampled across 27 counties, and Sugnet (1993) found this species at only 11 percent of 3,092 locations. Although there are no current occurrence records around the vernal pools identified at the Clifton Court Forebay, survey data is absent for the immediate area. Therefore, because habitat exists for the VPTS it is possible for the shrimp to be present.

Species account: Although the VPTS is adapted to survive in seasonally available habitat, the species has a relatively long life span compared to other vernal pool crustaceans. VPTS continue growing throughout their lives, periodically molting their shells. These shells can often be found in vernal pools where VPTS occur. Helm (1998) found that VPTS took a minimum of 25 days to mature and the mean age at first reproduction was 54 days. Other researchers have observed that VPTS generally take between 3 and 4 weeks to mature (Ahl 1991, King *et al.*1996). Ahl (1991) found that reproduction did not begin until individuals were larger than 0.4 inch (10 millimeters (mm)) in carapace length. Variation in growth and maturation rates may be a result of differences in water temperature, which strongly influences the growth rates of aquatic invertebrates. VPTS have relatively high reproductive rates. Ahl (1991) *found* that fecundity increases with body size. Large females, greater than 0.8 inch (20 mm) carapace length, could deposit as many as 6 clutches, ranging from 32 to 61 eggs per clutch, in a single wet season. VPTS may be hermaphroditic (Longhurst 1955, Lynch 1966, C. Rogers *in litt.* 2001), and sex ratios can vary (Ahl 1991, Sassaman 1991), perhaps in response to changes in water temperature.

After winter rains fill their vernal pool habitats, dormant VPTS cysts may hatch in as little as 4 days (Ahl 1991, Rogers *in litt*. 2001). Additional cysts produced by adult tadpole shrimp during the wet season may hatch without going through a dormant period (Ahl 1991). VPTS emerge from their cysts as metanauplii, a stage which lasts for 1.5 to 2 hours. Then they molt into a larval form resembling the adult. Multiple hatching within the same wet season allows VPTS to persist within vernal pools as long as these habitats remain inundated, sometimes for 6 months or more (Ahl 1991, Gallagher 1996, Helm 1998). VPTS hatching is temperature dependent. Optimal hatching occurs between 50 to 59 degrees Fahrenheit (^{0} F) (10 to 15 degrees Celsius (^{0} C)), with hatching rates becoming significantly lower at temperatures above 68^0 F (20^0 C) (Ahl 1991).

VPTS occur in a wide variety of ephemeral wetland habitats (Helm 1998). The species has been collected in vernal pools ranging from 6.5 square feet to 88 acres (2 to 356,253 square meters) in surface area (Helm 1998). Some of these vernal pools may be too small to remain inundated for the entire life cycle of the tadpole shrimp, but the VPTS may be able tolerate temporary drying conditions (Helm 1998). VPTS have been found in pools with water temperatures ranging from 50^0 F (10^0 C) to 84^0 F (29^0 C) and pH ranging from 6.2 to 8.5 (Syrdahl 1993, King 1996). However, vernal pools exhibit daily and seasonal fluctuations in pH, temperature, dissolved oxygen, and other water chemistry characteristics (Syrdahl 1993, Scholnick 1995, Wiggins 1995, Keeley 1998). Determining the VPTS's habitat requirements is not possible based on anecdotal evidence, and the tolerances of this species to specific environmental conditions have yet to be determined.

VPFS

Although most species of fairy shrimp look generally similar, VPFS are characterized by the presence and size of several mounds (see identification section below) on the male's second antennae, and by the female's short, pyriform brood pouch. VPFS vary in size, ranging from 0.4 to 1.0 inch (11 to 25 mm) in length (Eng *et al.* 1990).

Distribution: There is little information on the historical range of the species. However, the VPFS is currently known to occur in a wide range of vernal pool habitats in the southern and Central Valley areas of California. The VPFS is currently found in 28 counties across the Central Valley and coast ranges of California, and in Jackson County of southern Oregon. The species occupies a variety of vernal pool habitats, and occurs in 11 of the 17 vernal pool regions identified in California (Keeler-Wolf *et.al*. 1998). It is generally uncommon throughout its range and rarely abundant where it does occur (Eng *et al.* 1990, Eriksen and Belk 1999). Helm (1998) found VPFS in only 16 percent of pools sampled across 27 counties, and Sugnet (1993) found this species in only 5 percent of 3,092 locations sampled. VPFS are known to occur in the southern portion of the project area near Clifton Court Forebay and VPFS have also been found just outside of the northeastern portion of this project area.

Species account: VPFS are highly adapted to the environmental conditions of their ephemeral habitats. One adaptation is the ability of the VPFS eggs, or cysts, to remain dormant in the soil when their vernal pool habitats are dry. Another important adaptation is that the VPFS has a relatively short life span, allowing it to hatch, mature to adulthood, and reproduce during the short time period when vernal pools contain water. The VPFS can reach sexual maturity in as few as 18 days at optimal conditions of 68^0 F (20^0 C), and can complete its life cycle in as little as 9 weeks (Gallagher 1996, Helm 1998). However, maturation and reproduction rates of vernal pool crustaceans are controlled by water temperature and can vary greatly (Eriksen and Brown 1980, Helm 1998). Helm (1998) observed that VPFS did not reach maturity until 41 days at water temperatures of 59^0 F (15^0 C). Helm (1998) observed six separate hatches of VPFS in a single pool within a single wet season, and Gallagher (1996) observed three separate hatches of VPFS in vernal pools in Butte County. Helm (1998) found the mean life span of the VPFS was significantly shorter than the California fairy shrimp, but not significantly different from midvalley, longhorn, or Conservancy fairy shrimp observed under the same conditions. In larger pools that hold water for longer durations, VPFS are capable of hatching multiple times if water temperatures drop to below 50^0 F (10^0 C) a necessary environmental cue for VPFS cyst hatching (Gallagher 1996, Helm 1998). Helm (1998) observed VPFS living for as long as 147 days.

VPFS exist only in vernal pools or vernal pool-like habitats. Individuals have never been found in riverine, marine, or other permanent bodies of water. Vernal pool habitats form in depressions above an impervious soil layer or duripan. Due to local topography and geology, the depressions are part of an undulating landscape, where soil mounds are interspersed with basins, swales, and drainages. Water movement within complexes allows VPFS to move between individual pools. These movement patterns, as well as genetic evidence, indicate that VPFS populations exist within and are defined by entire vernal pool complexes, rather than individual vernal pools (Simovich *et al.* 1992, King, *et al.* 1996).

Threats: Vernal pool species are threatened primarily by loss and fragmentation of existing habitat. Vernal pool complexes, which are mosaics of wetted pools which are hydrologically connected and include the associated upland habitat and local watersheds essential for the function of the pools, must be preserved on a landscape level to ensure the persistence of the species that inhabit them. Although dispersal of vernal pool crustaceans between complexes is and probably always has been relatively low, fragmentation of existing intact complexes could contribute to the loss of genetic diversity of vernal pool species, and reduce the likelihood of recolonization from other populations. Fragmentation by conversion or degradation of habitat may essentially serve as a barrier to dispersal. It is essential that large, contiguous areas of uninterrupted vernal pool habitat, including both wetted and upland components, be preserved across the range of each of the listed species to "buffer" against unforeseen stochastic events.

Vernal pool habitat indirectly affected includes all habitat supported by destroyed or modified upland areas, and all habitat otherwise damaged by changes to the watershed, human intrusion, and disturbance that will be caused by the project. Ground disturbing activities in the watershed of vernal pools are expected to result in siltation when pools fill during the wet season following construction. The proposed project construction activities could result in increased sedimentation transport into vernal pool crustacean habitats during periods of heavy rains. Siltation in pools supporting listed crustaceans may result in decreased cyst viability, decreased hatching success, and decreased survivorship among early life history stages, thereby reducing the number of mature adults in future wet seasons. The hydrologic regime (e.g., change in rates of surface flow, reducing subsurface volumes) of the pools may be altered due to disturbance of the hardpan or changing the slope or groundcover of the surrounding landscape. The biota of vernal pools and swales can change when the hydrologic regime is altered (Bauder 1987). Survival of aquatic organisms such as VPFS and VPTS are directly linked to the water regime of their habitat (Zelder 1987). Therefore, construction near vernal pool areas is likely to result in the decline of local sub-populations of vernal pool organisms, including the vernal pool crustaceans.

Effects of the action: The proposed project will likely adversely affect the listed vernal pool brachiopods. Although DWR proposes to conduct construction activities in the dry season, vernal pool crustacean cysts could be crushed or removed from suitable habitat by vehicle operations or human foot traffic. This would be extremely difficult to detect due to their small size and cryptic nature. In addition to the adverse effects above, the proposed project may contribute to a local and range-wide trend of habitat loss and degradation, the principal reasons that the VPFS and VPTS population numbers have declined. If the hydrology of the area is adversely affected through the improper boring techniques in the vernal pool duripan layer or adverse changes in the top sediment layer due to vehicle operations, the proposed project could contribute to the fragmentation and reduction of the acreage of the remaining listed vernal pool crustacean habitat. The proposed construction activities could result in the introduction of chemical contaminants to the site. Substances used in the boring process could leach out or wash out into the soil and adjacent habitat. Vehicles may leak hazardous substances such as motor oil and antifreeze. A variety of substances could be introduced during accidental spills of materials. Such spills can result from leaks in vehicles, small containers falling off vehicles, or from accidents resulting in whole loads being spilled. Vernal pool brachiopods using these areas could be exposed to any contaminants that are present at the site. Exposure pathways could include respiration, dermal contact, direct ingestion, or ingestion of contaminated soil or plants. Exposure to contaminants could cause short- or long-term morbidity, possibly resulting in reduced productivity or mortality. Carcinogenic substances could cause genetic damage resulting in sterility, reduced productivity, or reduced fitness among progeny. Little information is available on the effects of contaminants on these species and the effects may be difficult to detect. DWR proposes to minimize these risks by implementing BMPs and a Spill Response Plan stated in the Project Description Conservation Measures.

Delta smelt

Listing status: The Service proposed to list the delta smelt as threatened with proposed critical habitat on October 3, 1991 (56 FR 50075). The Service listed the delta smelt as threatened on March 5, 1993 (58 FR 12854), and designated critical habitat for this species on December 19, 1994 (59 FR 65256). The delta smelt was one of eight fish species addressed in the *Recovery Plan for the Sacramento–San Joaquin Delta Native Fishes* (Service 1995). A 5-year status review of the delta smelt was completed on March 31, 2004 (Service 2004); that review affirmed the need to retain the delta smelt as a threatened species. On April 7, 2010, the Service determined that the delta smelt warrants uplisting from threatened to endangered throughout its range, but reclassification at this time is precluded by higher priority listing actions.

Distribution: The delta smelt is a member of the Osmeridae family (northern smelts) (Moyle 2002) and is one of six species currently recognized in the Hypomesus genus (Bennett 2005). The delta smelt is endemic to the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta) in California, and is restricted to the area from San Pablo Bay upstream through the Delta in Contra Costa, Sacramento, San Joaquin, Solano, and Yolo counties (Moyle 2002). Their range extends from San Pablo Bay upstream to Verona on the Sacramento River and Mossdale on the San Joaquin River. The delta smelt was formerly considered to be one of the most common pelagic fish in the upper Sacramento-San Joaquin Estuary.

Species account: The delta smelt is a slender-bodied fish, generally about 2 to 3 inches (60 to 70 mm) long, although they can reach lengths of up to 4.7 inches (120 mm) (Moyle 2002). Live delta smelt are nearly translucent and have a steely blue sheen to their sides. Delta smelt usually aggregate but do not appear to be a strongly schooling species. Genetic analyses have confirmed that H. transpacificus presently exists as a single intermixing population (Stanley et al. 1995; Trenham et al. 1998). The most closely related species is the surf smelt (H. pretiosis), a marine species common along the western coast of North America. Despite its morphological similarity, the delta smelt is less-closely related to wakasagi (H. nipponensis), an anadromous western Pacific species introduced into California Central Valley reservoirs in 1959 and now distributed in the historic range of the delta smelt (Trenham et al. 1998). Genetic introgression among H. transpacificus and H. nipponensis is low.

The following is summarized information for the delta smelt from the *Recovery Plan for the Sacramento-San Joaquin Delta Native Fishes* (Service 1995). For a complete overview of the current monitoring programs, life cycle, biology, life history, foraging ecology, habitat, population dynamics, abundance trends and factors affecting the species please refer to the *Formal Endangered Species Act Consultation on the Proposed Coordinated Operations of the Central Valley Project (CVP) and State Water Project (SWP)* (Service File No. 81420-2008-F-1481-5).

Delta smelt are euryhaline (a species that tolerates a wide range of salinities) fish that rarely occur in water with more than 10 to 12 parts per thousand (ppt) salinity (about 1/3 sea water). In recent history, they have been most abundant in shallow areas where early spring salinities are around 2 ppt. Prior to the 1800's before the construction of levees that created the Delta Islands, a vast fluvial marsh existed in the Delta and the delta smelt probably reared in these upstream areas. During historic droughts delta smelt have been found concentrated in deep areas in the lower Sacramento River near Emmaton, where average salinity ranged from 0.36 to 3.6 ppt for much of the year. During years with wet springs (such as 1993), delta smelt may continue to be abundant in Suisun Bay during summer even after the 2 ppt isohaline has retreated upstream (Sweetnam and Stevens 1993). Fall abundance of delta smelt is generally highest in years when salinities of 2 ppt are in the shallows of Suisun Bay during the preceding spring (Herbold 1994). It should also be noted that the point in the estuary where the 2 ppt isohaline is located (X2) does not necessarily regulate delta smelt distribution in all years. In wet years, when abundance levels are high, their distribution is normally very broad. In late 1993 and early 1994, delta smelt were found in Suisun Bay region despite the fact that X2 was located far upstream. In this case, food availability may have influenced delta smelt distribution, as evidenced by the Eurytemora found in this area by DFG.

Delta smelt inhabit open, surface waters of the Delta and Suisun Bay, where they presumably school. Spawning takes place between January and July, as inferred from larvae collected during this period (Wang 1986; Sweetnam and Stevens 1993; D. Sweetnam, DFG, unpublished data). Timing and length of the spawning season may vary. Spawning usually takes place from late March through mid-May in low outflow years. Most spawning occurs in sloughs and shallow edge-waters of channels in the upper Delta including (1) Barker, (2) Lindsey, (3) Cache, (4) Georgiana, (5) Prospect, (6) Beaver, (7) Hog, and (7) Sycamore sloughs, and in the Sacramento River above Rio Vista. Laboratory observations have indicated that delta smelt are broadcast spawners (DWR and Reclamation 1994) and eggs are demersal (sinks to the bottom) and adhesive, sticking to hard substrates such as: rock, gravel, tree roots or submerged branches, and submerged vegetation (Moyle 1976; Wang 1986). At 14-16 degrees Celsius (57-61 degrees Fahrenheit), embryonic development to hatching takes 9 -14 days and feeding begins 4-5 days later (R. Mager, UCD, unpublished data).

Females between 2.3 to 2.8 inches (59 to 70 mm) standard length lay 1,200 to 2,600 eggs (Moyle et al. 1992). The abrupt change from a single-age, adult cohort during spawning in spring to a population dominated by juveniles in summer suggests strongly that most adults die after they spawn (Radtke 1966). In a near-annual fish like delta smelt, a strong relationship would be expected between number of spawners present in one year and number of recruits to the population the following year. Instead, the stock-recruit relationship for delta smelt is weak, accounting for about a quarter of the variability in recruitment (Sweetnam and Stevens 1993). This relationship does indicate, however, that factors affecting numbers of spawning adults (e.g., entrainment, toxics, and predation) can have an effect on delta smelt numbers the following year.

Delta smelt were once one of the most common pelagic (living in open water away from the bottom) fish in the upper Sacramento-San Joaquin estuary, as indicated by its abundance in DFG trawl catches (Erkkila *et al.* 1950; Radtke 1966; Stevens and Miller 1983). Delta smelt abundance from year to year has fluctuated greatly in the past, but between 1982 and 1992 their population was consistently low. The decline became precipitous in 1982 and 1983 due to extremely high outflows and continued through the drought years 1987-1992 (Moyle *et al.* 1992). In 1993, numbers increased considerably, apparently in response to a wet winter and spring. During the period 1982-1992, most of the population was confined to the Sacramento

River channel between Collinsville and Rio Vista (D. Sweetnam, DFG unpublished data). This was still an area of high abundance in 1993, but delta smelt were also abundant in Suisun Bay. The actual size of the delta smelt population is not known. However, the pelagic life style of delta smelt, short life span, spawning habits, and relatively low fecundity indicate that a fairly substantial population probably is necessary to keep the species from becoming extinct.

Threats: Several factors have led to the decline of the delta smelt. Reduction in outflows due to water consumption for agriculture, industrial and municipal uses is considered to be the largest factor. However, entrainment from water diversions, exceptionally high outflows causing washout (flushing smelt and zooplankton out of the ecosystem), changes in food sources, toxic substances, disease, competition from invasive species, predation, and loss of genetic integrity have all been identified as factors leading to their decline.

Effects of the action: The proposed project will likely adversely affect the delta smelt. Construction noise, vibration, possible night lighting, and increased human activity may interfere with normal behaviors. These behaviors include feeding, sheltering, movement between refugia and foraging grounds, and other essential behaviors of the delta smelt. Intolerable levels of disturbance may force individuals from suitable habitat cover and subject them to predation that otherwise would not occur.

The proposed construction activities could also result in the introduction of chemical contaminants to the water way and adjacent shorelines. Substances used in the boring process could leach out or wash out into the water or the soil along the shoreline. Vehicles may leak hazardous substances such as motor oil and antifreeze. A variety of substances could be introduced during accidental spills of materials. Such spills can result from leaks in vehicles, small containers falling off vehicles, or from accidents resulting in whole loads being spilled. Delta smelt using these areas could be exposed to any contaminants that are present at the site. Exposure pathways could include respiration, dermal contact, direct ingestion, or ingestion of contaminated food source. Exposure to contaminants could cause short- or long-term morbidity, possibly resulting in reduced productivity or mortality. Carcinogenic substances could cause genetic damage resulting in sterility, reduced productivity, or reduced fitness among progeny. Little information is available on the effects of contaminants on these species and the effects may be difficult to detect. DWR proposes to minimize these risks by implementing BMPs and a Spill Response Plan stated in the Project Description Conservation Measures.

Adverse effects are likely to individual smelt in the form of harassment. In order to avoid and minimize adverse impacts to the delta smelt, conservation measures in the form of work windows have been identified in the Corps' *Programmatic Formal Consultation on the Issuance of Section 10 and 404 Permits for Projects with Relatively Small Effects on the delta smelt* (Service File No. 1-1-04-F-0345). These windows are established to allow in water work when the delta smelt are least likely to occupy the area. This project falls within the Central Zone and these windows have been established as the time period starting August 1 and ending November 30. Any adverse effects to delta smelt will be difficult to detect due to their small size and cryptic nature. Because of work restriction windows, overall mortality is expected to be low.

California Tiger Salamander (CTS) – Central Valley Population

Listing status: The Service listed the California tiger salamander as threatened on August 4, 2004 (69 FR 47212) and designated critical habitat in 19 counties for the central population on August 23, 2005 (70 FR 49379). There is currently no Recovery Plan for the CTS.

Distribution: The California tiger salamander is endemic to California and historically inhabited the low-elevation grassland and oak savanna plant communities of the Central Valley, adjacent foothills, and Inner Coast Ranges (Jennings and Hayes 1994; Storer 1925; Shaffer et al. 1993). The species has been recorded from near sea level to approximately 3,900 feet (1,189 m) in the Coast Ranges and to approximately 1,600 feet (488 m) in the Sierra Nevada foothills (Shaffer et al. 2004). Along the Coast Ranges, the species occurred from the Santa Rosa area of Sonoma County, south to the vicinity of Buellton in Santa Barbara County. The historic distribution in the Central Valley and surrounding foothills included northern Yolo County southward to northwestern Kern County and northern Tulare County. Three distinct California tiger salamander populations are recognized and correspond to Santa Maria area within Santa Barbara County, the Santa Rosa Plain in Sonoma County, and vernal pool/grassland habitats throughout the Central Valley. Thirty-one percent (221 of 711 records and occurrences) of all Central Valley DPS California tiger salamander records and occurrences are located in Alameda, Santa Clara, San Benito (excluding the extreme western end of the County), southwestern San Joaquin, western Stanislaus, western Merced, and southeastern San Mateo counties. Of these counties, most of the records are from eastern Alameda and Santa Clara counties (Buckingham in litt. 2003; CDFG 2009; Service 2004). The California Department of Fish and Game (2009) now considers 13 of these records from the Bay Area region as extirpated or likely to be extirpated. Of the 140 reported California tiger salamander localities where wetland habitat was identified, only 7 percent were located in vernal pools (CDFG 2009). The East Bay counties of Alameda and Contra Costa supported the greatest concentrations of CTS (Shaffer et al. 1993). In relation to this project, CTS are known to occur within 1 mile (1.6 kilometers (km)) of the Clifton Court Forebay with CTS larvae detected during recent surveys (AECOM 2010).

Species account: The California tiger salamander is a large, stocky, terrestrial salamander with a broad, rounded snout. Recorded adult measurements have been as much as 8.2 inches (20.8 cm) long (Petranka 1998; Stebbins 2003). CTS exhibit sexual dimorphism (differences in body appearance based on gender) with males tending to be larger than females. Tiger salamander coloration generally consists of random white or yellowish markings against a black body. The markings on adult CTS tend to be more concentrated on the lateral sides of the body, whereas other tiger salamander species tend to have brighter yellow spotting that is heaviest on the dorsal surface.

The tiger salamander has an obligate biphasic life cycle (Shaffer et al. 2004). Although the larvae develop in the vernal pools and ponds in which they were born, CTS are otherwise terrestrial and spend most of their post-metamorphic lives in widely dispersed underground retreats (Shaffer et al. 2004; Trenham et al. 2001). Because they spend most of their lives underground, CTS are rarely encountered even in areas where salamanders are abundant. Subadult and adult CTS typically spend the dry summer and fall months in the burrows of small mammals, such as California ground squirrels (*Spermophilus beecheyi*) and Botta's pocket gopher (*Thomomys bottae*) (Storer 1925; Loredo and Van Vuren 1996; Petranka 1998; Trenham 1998a). Although ground squirrels have been known to eat tiger salamanders, the relationship with their burrowing hosts is primarily commensal (an association that benefits one member while the other is not affected) (Loredo et al. 1996; Semonsen 1998). CTS may also use landscape features such as leaf litter or desiccation cracks in the soil for upland refugia. Burrows often harbor camel crickets and other invertebrates that provide likely prey for tiger salamanders. Underground refugia also provide protection from the sun and wind associated with the dry California climate that can cause excessive drying of amphibian skin. Although CTS are members of a family of "burrowing" salamanders, they are not known to create their own burrows. This may be due to the hardness of soils in the California ecosystems in which they are found. CTS depend on persistent small mammal activity to create, maintain, and sustain sufficient underground refugia for the species. Burrows are short lived without continued small mammal activity and typically collapse within approximately 18 months (Loredo et al. 1996). Upland burrows inhabited by CTS have often been referred to as aestivation sites. However, "aestivation" implies a state of inactivity, while most evidence suggests that tiger salamanders remain active in their underground dwellings. A recent study has found that CTS move, feed, and remain active in their burrows (Van Hattem 2004). Because CTS arrive at breeding ponds in good condition and are heavier when entering the pond than when leaving, inferring that tiger salamanders are feeding while underground. Observations have confirmed this (Trenham 2001; Van Hattem 2004). Thus, "upland habitat" is a more accurate description of the terrestrial areas used by CTS. California tiger salamanders typically emerge from their underground refugia at night during the fall or winter rainy season (November-May) to migrate to their breeding ponds (Stebbins 1989, 2003; Shaffer et al. 1993; Trenham et al. 2000).

The breeding period is closely associated with the rainfall patterns in any given year with less adults migrating and breeding in drought years (Loredo and Van Vuren 1996; Trenham et al. 2000). Male salamander are typically first to arrive and generally remain in the ponds longer than females. Results from a 7-year study in Monterey County suggested that males remained in the breeding ponds for an average of 44.7 days while females remained for an average of only 11.8 days (Trenham et al. 2000). Historically, breeding ponds were likely limited to vernal pools, but now include livestock stock ponds and other depressions that could hold sufficient water to allow for larval development. Ideal breeding ponds are typically fishless, and seasonal or semi-permanent (Barry and Shaffer 1994; Petranka 1998). While in the ponds, adult salamanders mate and then the females lay their eggs in the water (Twitty 1941; Shaffer et al. 1993; Petranka 1998). Egg laying typically reaches a peak in January (Loredo and Van Vuren 1996; Trenham et al. 2000). Females attach their eggs singly, or in rare circumstances, in groups of two to four, to twigs, grass stems, vegetation, or debris (Storer 1925; Twitty 1941). Eggs are often attached to objects, such as rocks and boards in ponds with no or limited vegetation (Jennings and Hayes 1994). Clutch sizes from a Monterey County study had an average of 814 eggs (Trenham et al. 2000). Seasonal pools may not exhibit sufficient depth, persistence, or other necessary parameters for adult breeding during times of drought (Barry and Shaffer 1994). After breeding and egg laying is complete, adults leave the pool and return to their upland refugia (Loredo et al. 1996; Trenham 1998a). Adult salamanders often continue to emerge nightly for approximately the next two weeks to feed in their upland habitat (Shaffer et al. 1993).

CTS larvae typically hatch within 10 to 24 days after eggs are laid (Storer 1925). The peak emergence of these metamorphs is typically between mid-June and mid-July (Loredo and Van Vuren 1996; Trenham et al. 2000). The larvae are totally aquatic and range in length from approximately 0.45 to 0.56 inches (1.14 to 1.42 cm) (Petranka 1998). They have yellowish gray bodies, broad fat heads, large, feathery external gills, and broad dorsal fins that extend well up their back. The larvae feed on zooplankton, small crustaceans, and aquatic insects for about six weeks after hatching, after which they switch to larger prey (J. Anderson 1968). Larger larvae have been known to consume the tadpoles of Pacific treefrogs (*Hyla regilla*), western spadefoot toads (*Spea hammondii*), and California red-legged frogs (J. Anderson 1968; P. Anderson 1968). CTS larvae are among the top aquatic predators in seasonal pool ecosystems. When not feeding, they often rest on the bottom in shallow water but are also found throughout the water column in deeper water. Young salamanders are wary and typically escape into vegetation at the bottom of the pool when approached by potential predators (Storer 1925). The CTS larval stage is typically completed in 3 to 6 months with most metamorphs entering upland habitat during the summer (Petranka 1998). In order to be successful, the aquatic phase of this species' life history must correspond with the persistence of its seasonal aquatic habitat. Most seasonal ponds and pools dry up completely during the summer. Amphibian larvae must grow to a critical minimum body size before they can metamorphose (change into a different physical form) to the terrestrial stage (Wilbur and Collins 1973). Larval development and metamorphosis can vary and is often site-dependent. Larvae collected near Stockton in the Central Valley during April varied between 1.88 to 2.32 inches (4.78 to 5.89 cm) in length (Storer 1925). Feaver (1971) found that larvae metamorphosed and left breeding pools 60 to 94 days after eggs had been laid, with larvae developing faster in smaller, more rapidly drying pools. Longer ponding duration typically results in larger larvae and metamorphosed juveniles that are more likely to survive and reproduce (Pechmann et al. 1989; Semlitsch et al. 1988; Morey 1998; Trenham 1998b). Larvae will perish if a breeding pond dries before metamorphosis is complete (P. Anderson 1968; Feaver 1971). Pechmann et al. (1988) found a strong positive correlation between ponding duration and total number of metamorphosing juveniles in five salamander species. In Madera County, Feaver (1971) found that only 11 of 30 sampled pools supported larval California tiger salamanders, and 5 of these dried before metamorphosis could occur. Therefore, out of the original 30 pools, only 6 (20 percent) provided suitable conditions for successful reproduction that year. Size at metamorphosis is positively correlated with stored body fat and survival of juvenile amphibians, and negatively correlated with age at first reproduction (Semlitsch et al. 1988; Scott 1994; Morey 1998).

Following metamorphosis, juveniles leave their pools and enter upland habitat. This emigration can occur in both wet and dry conditions (Loredo and Van Vuren 1996; Loredo et al. 1996). Wet conditions are more favorable for upland travel but rare summer rain events seldom occur as metamorphosis is completed and ponds begin to dry. As a result, juveniles may be forced to leave their ponds on rainless nights. Under dry conditions, juveniles may be limited to seeking upland refugia in close proximity to their aquatic larval pool. These individuals often wait until the next winter's rains to move further into more suitable upland refugia. Although likely rare, larvae may over-summer in permanent ponds. Juveniles remain active in their upland habitat, emerging from underground refugia during rainfall events to disperse or forage (Trenham and Shaffer 2005). Depending on location and other development factors, metamorphs will not return as adults to aquatic breeding habitat for 2 to 5 years (Loredo and Van Vuren 1996; Trenham et al. 2000). Lifetime reproductive success for tiger salamander species is low. Results from one study suggest that the average female tiger salamander bred 1.4 times and produced 8.5 young per reproductive effort that survived to metamorphosis (Trenham et al. 2000). This resulted in the output of roughly 11 metamorphic offspring over a breeding female's lifetime. The primary reason for low reproductive success may be that this relatively short-lived species requires two or more years to become sexually mature (Shaffer et al. 1993). Some individuals may not breed until they are four to six years old. While California tiger salamanders may survive for more than ten years, many breed only once, and in one study, less than 5 percent of marked juveniles survived to become breeding adults (Trenham 1998b). With such low recruitment, isolated populations are susceptible to unusual, randomly occurring natural events as well human-caused factors that reduce breeding success and individual survival. Factors that repeatedly lower breeding success in isolated pools can quickly extirpate a population.

Dispersal and migration movements made by tiger salamanders can be grouped into two main categories: (1) breeding migration; and (2) interpond dispersal. Breeding migration is the movement of salamanders to and from a pond from the surrounding upland habitat. After metamorphosis, juveniles move away from breeding ponds into the surrounding uplands, where they live continuously for several years. At a study in Monterey County, it was found that upon reaching sexual maturity, most individuals returned to their natal/ birth pond to breed, while 20 percent dispersed to other ponds (Trenham et al. 2001). After breeding, adult tiger salamanders return to upland habitats, where they may live for one or more years before attempting to breed again (Trenham et al. 2000).

CTS are known to travel large distances between breeding ponds and their upland refugia. Generally it is difficult to establish the maximum distances traveled by any species, but tiger salamanders in Santa Barbara County have been recorded dispersing up to 1.3 miles (2.1 km) from their breeding ponds (Sweet 1998). CTS are also known to travel between breeding ponds. One study found that 20 to 25 percent of the individuals captured at one pond were recaptured later at other ponds approximately 1,900 and 2,200 feet (579 to 671 m) away (Trenham et al. 2001). In addition to traveling long distances during juvenile dispersal and adult migration, tiger salamanders may reside in burrows far from their associated breeding ponds. Although previously cited information indicates that tiger salamanders can travel long distances, they typically remain close to their associated breeding ponds. A trapping study conducted in Solano County during the winter of 2002/2003 suggested that juveniles dispersed and used upland habitats further from breeding ponds than adults (Trenham and Shaffer 2005). More juvenile salamanders were captured at traps placed at 328 feet, 656 feet, and 1,312 feet (100 m, 200 m, and 400 m) from a breeding pond than at 164 feet (50 m). Approximately 20 percent of the captured juveniles were found at least 1,312 feet (400 m) from the nearest breeding pond. The associated distribution curve suggested that 95 percent of juvenile salamanders were within 2,099 feet (640 m) of the pond, with the remaining 5 percent being found at even greater distances. Preliminary results from the 2003-04 trapping efforts at the same study site detected juvenile CTS at even further distances, with a large proportion of the captures at 2,297 feet (700 m) from the breeding pond (Trenham et al., unpublished data). Surprisingly, most juveniles captured, even those at 2,100 feet (640 meters), were still moving away from ponds (Ben Fitzpatrick, University of California at Davis, personal communication, 2004). These data show that many CTS travel far while still in the juvenile stage. Post-breeding movements away from breeding ponds by adults appear to be much smaller. During post-breeding emigration from aquatic habitat, radio-equipped adult CTS were tracked to burrows between 62 to 813 feet (19 to

248 m) from their breeding ponds (Trenham 2001). These reduced movements may be due to adult CTS exiting the ponds with depleted physical reserves, or drier weather conditions typically associated with the post-breeding upland migration period. CTS are also known to use several successive burrows at increasing distances from an associated breeding pond. Based on radio-tracked adults, there is no indication that certain habitat types are favored as terrestrial movement corridors (Trenham 2001). In addition, captures of arriving adults and dispersing new metamorphs were evenly distributed around two ponds completely encircled by drift fences and pitfall traps. Thus, it appears that dispersal into the terrestrial habitat occurs randomly with respect to direction and habitat types.

Threats: Documented or potential tiger salamanders predators include coyotes (*Canis latrans*), raccoons (*Procyon lotor*), striped skunks (*Mephitis mephitis*), opossums (*Didelphis virginiana*), egrets (*Egretta species*), great blue herons (*Ardea herodias*), crows (*Corvus brachyrhynchos*), ravens (*Corvus corax*), garter snakes (*Thamnophis species*), bullfrogs, California red-legged frogs, mosquito fish, and crayfish (*Procrambus* spp.). CTS are imperiled throughout their range due to a variety of human activities (Service 2004). Current factors associated with declining tiger salamander populations include continued habitat loss and degradation due to agriculture and urbanization; hybridization with the non-native eastern tiger salamander (*Ambystoma tigrinum*) (Fitzpatrick and Shaffer 2004; Riley et al. 2003); and predation by introduced species. CTS populations are likely threatened by multiple factors but continued habitat fragmentation and colonization of non-native salamanders may represent the most significant current threats. Habitat isolation and fragmentation within many watersheds have precluded dispersal between sub-populations and jeopardized the viability of metapopulations (broadly defined as multiple subpopulations that occasionally exchange individuals through dispersal, and are capable of colonizing or "rescuing" extinct habitat patches). Other threats include disease, predation, interspecific competition, urbanization and population growth, exposure to contaminants, rodent and mosquito control, road-crossing mortality, and hybridization with non-native salamanders. CTS are also prone to chance environmental or demographic events, to which small populations are particularly vulnerable. The necessity of moving between multiple habitats and breeding ponds means that many amphibian species, such as the CTS are especially vulnerable to roads and well-used large paved areas in the landscape. Proposed land conversion continues to target large areas of CTS habitat.

Effects of the action: The proposed project will likely adversely affect the threatened Central Valley DPS of the California tiger salamander by killing, harming and/or harassing juveniles and adults inhabiting grasslands supporting suitable underground refugia within or adjacent to undeveloped lands around the Clifton Court Forebay. Construction noise, vibration, possible night-lighting, and increased human activity may interfere with normal CTS behaviors. These behaviors include feeding, sheltering, movement between refugia and foraging grounds, and other essential behaviors of the CTS. Avoidance of areas that have suitable habitat but intolerable levels of disturbance may force individuals from cover thereby subjecting them to predation that otherwise would not occur. Natural food sources may be reduced as a result of habitat disturbance and loss. Short-term temporal effects will occur when vegetative cover is removed along riparian corridors and within upland habitat during project construction, which may subject these species to an increased risk of predation.

The proposed construction activities could result in the introduction of chemical contaminants to the site. Substances used in the boring process could leach out or wash out into the soil and adjacent habitat. Vehicles may leak hazardous substances such as motor oil and antifreeze. A variety of substances could be introduced during accidental spills of materials. Such spills can result from leaks in vehicles, small containers falling off vehicles, or from accidents resulting in whole loads being spilled. Salamanders using these areas could be exposed to any contaminants that are present at the site. Exposure pathways could include inhalation, dermal contact, direct ingestion, or ingestion of contaminated soil or plants. Exposure to contaminants could cause short- or long-term morbidity, possibly resulting in reduced productivity or mortality. Carcinogenic substances could cause genetic damage resulting in sterility, reduced productivity, or reduced fitness among progeny. Little information is available on the effects of contaminants on these species and the effects may be difficult to detect. Morbidity or mortality likely would occur after the animals had left the contaminated site, and more subtle effects such as genetic damage could only be detected through intensive study and monitoring. DWR proposes to minimize these risks by implementing BMPs and a Spill Response Plan stated in the Project Description Conservation Measures.

Since salamanders use small mammal burrows and soil crevices for shelter and aestivation outside of their breeding season, salamanders in terrestrial habitat may become entombed under soil, crushed or damaged by equipment or personnel, thereby resulting in harm or mortality to individuals. As ground squirrel burrows can be deep and long, drills may come into direct contact with an aestivating salamander and a salamander could be killed or injured from drilling activities. Adverse effects will be partially minimized by preconstruction surveys, educating construction personnel about the presence of CTS, their habitat, species identification, regulatory laws, and avoidance measures, and requiring a Service approved biologist to be present to monitor project activities within or adjacent to suitable habitat.

California Red-legged Frog (CRLF)

Listing status: The California red-legged frog was listed as a threatened species on May 23, 1996 (61 FR 25813). Critical Habitat was designated for this species on April 13, 2006 (71 FR 19244) and revisions to the critical habitat designation were published on March 17, 2010 (75 FR 12816). At this time the Service recognized the taxonomic change from *Rana aurora draytonii* to *Rana draytonii*. A recovery plan was published for the California red-legged frog on September 12, 2002 (Service 2002).

Distribution: The historic range of the California red-legged frog extended from the vicinity of Elk Creek in Mendocino County, California, along the coast inland to the vicinity of Redding, Shasta County, California, and southward to northwestern Baja California, Mexico (Fellers 2005; Jennings and Hayes 1985; Hayes and Krempels 1986). CRLF was historically documented in 46 counties but the taxa now remains in 238 streams or drainages within 23 counties, representing a loss of 70 percent of its former range (Service 2002). CRLF are still locally abundant within portions of the San Francisco Bay area and the Central California Coast. Isolated populations have been documented in the Sierra Nevada, northern Coast, and northern Transverse Ranges. The species is believed to be extirpated from the southern Transverse and Peninsular ranges, but is still present in Baja California, Mexico (California Department of Fish and Game [CDFG]

2010). California red-legged frogs have been documented to occur within 1 mile northwest of the Clifton Court Forebay.

Species account: The California red-legged frog is the largest native frog in the western United States (Wright and Wright 1949), ranging from 1.5 to 5.1 inches (3.81 to 12.95 cm) in length (Stebbins 2003). The abdomen and hind legs of adults are largely red, while the back is characterized by small black flecks and larger irregular dark blotches with indistinct outlines on a brown, gray, olive, or reddish background color. Dorsal spots usually have light centers (Stebbins 2003), and dorsolateral folds are prominent on the back. Larvae (tadpoles) range from 0.6 to 3.1 inches (1.52 to 7.87 cm) in length, and the background color of the body is dark brown and yellow with darker spots (Storer 1925).

California red-legged frogs predominately inhabit permanent water sources such as streams, lakes, marshes, natural and manmade ponds, and ephemeral drainages in valley bottoms and foothills up to 4,921 feet (1,500 m) in elevation (Jennings and Hayes 1994, Bulger et al. 2003, Stebbins 2003). However, CRLF also have been found in ephemeral creeks and drainages and in ponds that minimal riparian and emergent vegetation. CRLF breed between November and April in still or slow-moving water often with emergent vegetation, such as cattails (*Typha* spp.), tules (*Scirpus* spp.) or overhanging willows (*Salix* spp.) (Hayes and Jennings 1988). CRLF have paired vocal sacs and vocalize in air (Hayes and Krempels 1986). Female frogs deposit egg masses on emergent vegetation so that the egg mass floats on or near the surface of the water (Hayes and Miyamoto 1984). CRLF breed from November through March with earlier breeding records occurring in southern localities (Storer 1925). Individuals occurring in coastal drainages are active year-round (Jennings et al. 1992), whereas those found in interior sites are normally less active during the cold season.

During other parts of the year, habitat includes nearly any area within 1 to 2 miles (1.6 to 3.2 km) of a breeding site that stays moist and cool through the summer (Fellers 2005). According to Fellers (2005), this can include vegetated areas with coyote brush (*Baccharis pilularis*), California blackberry thickets (*Rubus ursinus*), and root masses associated with willow and California bay (*Umbellularia californica*) trees. Sometimes the non-breeding habitat used by CRLF is extremely limited in size. For example, non-breeding CRLF have been found in a 6 foot (1.8 m) wide coyote brush thicket growing along a tiny intermittent creek surrounded by heavily grazed grassland (Fellers 2005). Sheltering habitat for CRLF is potentially all aquatic, riparian, and upland areas within the range of the species and includes any landscape features that provide cover, such as existing animal burrows, boulders or rocks, organic debris such as downed trees or logs, and industrial debris. Agricultural features such as drains, watering troughs, spring boxes, abandoned sheds, or hay stacks may also be used. Incised stream channels with portions narrower and depths greater than 18 inches (46 cm) also may provide important summer sheltering habitat. Accessibility to sheltering habitat is essential for the survival of CRLF within a watershed, and can be a factor limiting frog population numbers and survival.

California red-legged frogs do not have a distinct breeding migration (Fellers 2005). Adult frogs are often associated with permanent bodies of water. Some frogs remain at breeding sites year-round, while others disperse to neighboring water features. Dispersal distances are typically less than 0.5 mile (0.8 km), with a few individuals moving up to 1 to 2 miles (1.6 to 3.2 km) (Fellers 2005). Movements are typically along riparian corridors, but some individuals, especially on rainy nights, move directly from one site to another through normally inhospitable habitats, such as heavily grazed pastures or oak-grassland savannas (Fellers 2005). In a study of CRLF terrestrial activity in a xeric environment, Tatarian (2008) noted that a 57 percent majority of frogs fitted with radio transmitters in the Round Valley study area in eastern Contra Costa County stayed at their breeding pools, whereas 43 percent moved into adjacent upland habitat or to other aquatic sites. This study reported a peak seasonal terrestrial movement occurring in the fall months associated with the first 0.2 inch (0.5 cm) of precipitation and tapering off into spring. Upland movement activities ranged from 3 to 233 feet (1 to 71 m), averaging 80 feet (24 m), and were associated with a variety of refugia including grass thatch, crevices, cow hoof prints, ground squirrel burrows at the base of trees or rocks, logs, and man-made structures such as a downed barn door; others were associated with upland sites lacking refugia (Tatarian 2008). The majority of terrestrial movements lasted from 1 to 4 days; however, one adult female was reported to remain in upland habitat for 50 days (Tatarian 2008). Upland refugia closer to aquatic sites were used more often and were more commonly associated with areas exhibiting higher object cover, e.g., woody debris, rocks, and vegetative cover. Subterranean cover was not significantly different between occupied upland habitat and non-occupied upland habitat.

California red-legged frogs are often prolific breeders, laying their eggs during or shortly after large rainfall events in late winter and early spring (Hayes and Miyamoto 1984). Egg masses containing 2,000 to 5,000 eggs are attached to vegetation below the surface and hatch after 6 to 14 days (Storer 1925, Jennings and Hayes 1994). In coastal lagoons, the most significant mortality factor in the pre-hatching stage is water salinity (Jennings et al. 1992). Eggs exposed to salinity levels greater than 4.5 ppt resulted in 100 percent mortality (Jennings and Hayes 1990). Increased siltation during the breeding season can cause asphyxiation of eggs and small larvae. Larvae undergo metamorphosis 3 ½ to 7 months following hatching and reach sexual maturity 2 to 3 years of age (Storer 1925; Wright and Wright 1949; Jennings and Hayes 1985, 1990, 1994). Of the various life stages, larvae probably experience the highest mortality rates, with less than 1 percent of eggs laid reaching metamorphosis (Jennings et al. 1992). CRLF may live 8 to 10 years (Jennings et al. 1992). Populations can fluctuate from year to year; favorable conditions allow California red-legged frogs to experience extremely high rates of reproduction and thus produce large numbers of dispersing young and a concomitant increase in the number of occupied sites. In contrast, California red-legged frogs may temporarily disappear from an area when conditions are stressful (e.g., during periods of drought, disease, etc.).

The diet of California red-legged frogs is highly variable and changes with the life history stage. The diet of larval CRLF is not well studied, but is likely similar to that of other ranid frogs, feeding on algae, diatoms, and detritus by grazing on the surface of rocks and vegetation (Fellers 2005; Kupferberg 1996a, 1996b, 1997). Hayes and Tennant (1985) analyzed the diets of CRLF from Cañada de la Gaviota in Santa Barbara County during the winter of 1981 and found invertebrates (comprising 42 taxa) to be the most common prey item consumed; however, they speculated that this was opportunistic and varied based on prey availability. They ascertained that larger frogs consumed larger prey and were recorded to have preyed on Pacific chorus frogs (*Pseudacris regilla*), three-spined stickleback (*Gasterosteus aculeatus*) and, to a limited extent, California mice (*Peromyscus californicus*), which were abundant at the study site (Hayes and Tennant 1985, Fellers 2005). Although larger vertebrate prey was consumed less frequently, it represented over half of the prey mass eaten by larger frogs suggesting that such prey may play an energetically important role in their diets (Hayes and Tennant 1985). Juvenile and subadult/adult frogs varied in their feeding activity periods; juveniles fed for longer periods throughout the day and night, while subadult/adults fed nocturnally (Hayes and Tennant 1985). Juveniles were significantly less successful at capturing prey and all life history stages exhibited poor prey discrimination, feeding on several inanimate objects that moved through their field of view (Hayes and Tennant 1985).

Threats: Habitat loss, non-native species introduction, and urban encroachment are the primary factors that have adversely affected the CRLF throughout its range. Several researchers in central California have noted the decline and eventual local disappearance of California and northern red-legged frogs in systems supporting bullfrogs (*Rana catesbeiana*) (Jennings and Hayes 1990; Twedt 1993), red swamp crayfish (*Procambarus clarkii*), signal crayfish (*Pacifastacus leniusculus*), and several species of warm water fish including sunfish (*Lepomis* spp.), goldfish (*Carassius auratus*), common carp (*Cyprinus carpio*), and mosquitofish (*Gambusia affinis*) (Moyle 1976, Barry 1992, Hunt 1993, Fisher and Schaffer 1996). This has been attributed to predation, competition, and reproduction interference. Twedt (1993) documented bullfrog predation of juvenile northern red-legged frogs (*Rana aurora*), and suggested that bullfrogs could prey on subadult northern CRLF as well. Bullfrogs may also have a competitive advantage over CRLF. For instance, bullfrogs are larger and possess more generalized food habits (Bury and Whelan 1984). In addition, bullfrogs have an extended breeding season (Storer 1933) during which an individual female can produce as many as 20,000 eggs (Emlen 1977). Furthermore, bullfrog larvae are unpalatable to predatory fish (Kruse and Francis 1977). Bullfrogs also interfere with CRLF reproduction by taking adult male CRLF out of the breeding pool. Both California and northern red-legged frogs have been observed in amplexus (mounted on) with both male and female bullfrogs (Jennings and Hayes 1990; Twedt 1993; Jennings 1993). Thus bullfrogs are able to prey upon and out-compete CRLF, especially in sub-optimal habitat.

The urbanization of land within and adjacent to CRLF habitat has also affected CRLF. These declines are attributed to channelization of riparian areas, enclosure of the channels by urban development that blocks dispersal, and the introduction of predatory fishes and bullfrogs. Diseases may also pose a significant threat, although the specific effects of disease on the California red-legged frog are not known. Pathogens are suspected of causing global amphibian declines (Davidson et al. 2003). Ranaviruses are a potential threat to the red-legged frog because these diseases have been found to adversely affect other amphibians, including the listed species (Davidson et al. 2003; Lips et al. 2006). Mao et al. (1999 cited in Fellers 2005) reported northern red-legged frogs infected with an iridovirus, which was also presented in sympatric threespine sticklebacks in northwestern California. Ingles (1932a, 1932b, and 1933 cited in Fellers 2005) reported four species of trematodes from red-legged frogs, but he later synonymized two of them, *i.e.*found them to be the same as the other two. Non-native species, such as bullfrogs and non-native tiger salamanders that live within the range of the CRLF have been identified as potential carriers of these diseases (Garner et al. 2006). Human activities can facilitate the spread of disease by encouraging the further introduction of non-native carriers and by acting as carriers themselves (i.e., contaminated boots, waders or fishing equipment). Human activities can also introduce stress by other means, such as habitat fragmentation, that results in the listed species being more susceptible to the effects of disease.

Effects of the action: The proposed project will likely adversely affect the threatened California red-legged frog by killing, harming and/or harassing juveniles and adults inhabiting grasslands supporting suitable underground refugia within or adjacent to undeveloped lands around the Clifton Court Forebay. Construction noise, vibration, possible night-lighting, and increased human activity may interfere with normal behaviors. These behaviors include feeding, sheltering, movement between refugia and foraging grounds, and other essential behaviors of the CRLF. Avoidance of areas that have suitable habitat but intolerable levels of disturbance may force individuals from cover thereby subjecting them to predation that otherwise would not occur. Natural food sources may also be reduced as a result of habitat disturbance and loss. Short-term temporal effects will occur when vegetative cover is removed along riparian corridors and within upland habitat during project construction, which may subject these species to an increased risk of predation.

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Since frogs can use small mammal burrows and soil crevices for shelter and aestivation outside of their breeding season, frogs in terrestrial habitat may become entombed under soil, crushed or damaged by equipment or personnel, thereby resulting in harm or mortality to individuals. As ground squirrel burrows can be deep and long, drills may come into direct contact with an aestivating frog and a frog could be killed or injured from drilling activities. Adverse effects will be partially minimized by preconstruction surveys, educating construction personnel about the presence of CRLF, their habitat, species identification, regulatory laws, and avoidance measures, and requiring a Service approved biologist to be present to monitor project activities within or adjacent to suitable habitat.

Giant garter snake

Listing status: The Service published a proposal to list the giant garter snake as an endangered species on December 27, 1991 (56 FR 67046). The Service reevaluated the status of the snake before adopting the final rule, which listed it as a threatened species on October 20, 1993 (58 FR 54053). A Draft Recovery Plan was proposed for the snake on July 2, 1999 (64 FR 36033) and a 5 year review was conducted where no change of status was recommended (72 FR 7064)

Distribution: Giant garter snake formerly occurred throughout the wetlands that were extensive and widely distributed in the Sacramento and San Joaquin Valley floors of California (Fitch, 1940; Hansen and Brode, 1980; Rossman and Stewart, 1987). The historical range of the GGS is thought to have extended from the vicinity of Chico, Butte County, southward to Buena Vista Lake, near Bakersfield, in Kern County (Fitch, 1940; Fox, 1948; Hansen and Brode, 1980; Rossman and Stewart, 1987). Early collecting localities of the GGS coincide with the distribution of large flood basins, particularly riparian marsh or slough habitats and associated tributary streams (Hansen and Brode, 1980). Loss of habitat due to agricultural activities and flood control have extirpated the snake from the southern one third of its range in former wetlands associated with the historic Buena Vista, Tulare, and Kern lake beds (Hansen, 1980; Hansen and Brode, 1980).

Upon Federal listing in 1993, the Service identified 13 separate populations of GGS, with each population representing a cluster of discrete locality records (Service, 1993a). The 13 populations largely coincide with historical flood basins and tributary streams throughout the Central Valley: (1) Butte Basin, (2) Colusa Basin, (3) Sutter Basin, (4) American Basin, (5) Yolo Basin/Willow Slough, (6) Yolo Basin/Liberty Farms, (7) Sacramento Basin, (8) Badger Creek/Willow Creek, (9) Caldoni Marsh/White Slough, (10) East Stockton--Diverting Canal & Duck Creek, (11) North and South Grasslands, (12) Mendota, and (13) Burrel/Lanare. Population clusters 1 through 4 above were associated with rice production areas, especially channels and canals that delivered or drained agricultural irrigation water. These populations were determined to be extant in 1993. Population clusters at Butte, Sutter, and Colusa Basins (1, 2, and 3) were determined to be not imminently threatened with extirpation. Populations 4 through 13 were determined to be imminently threatened with extirpation. The area covered by these populations (4 through 13) included the San Joaquin Valley, portions of the eastern fringes of the Delta, and the southern Sacramento Valley; an area encompassing about 75 percent of the species' known geographic range (Service, 1993a).

The known range of the GGS has changed little since the time of listing. In 2005, GGS were observed at the City of Chico's wastewater treatment facility, approximately ten miles north of what was previously believed to be the northernmost extent of the species' range (D. Kelly, pers. comm., 2006; E. Hansen, pers. comm., 2006). The southernmost known occurrence is at the Mendota Wildlife Area in Fresno County. No sightings of GGS south of Mendota Wildlife Area within the historic range of the species have been made since the time of listing (Hansen, 2002). A recent documented sighting of a dead individual was recorded around Empire Cut in the South Delta (CNDDB 2010).

The current distribution and abundance of the GGS is much reduced from former times (Service, 1999). Prior to reclamation activities beginning in the mid- to late-1800s, about 60 percent of the Sacramento Valley was subject to seasonal overflow flooding providing expansive areas of snake habitat (Hinds, 1952). Now, less than 10 percent, or about 319,000 acres (129,095 hec) of the historic 4.5 million acres (1.8 million hec) of Central Valley wetlands remain (U.S. Department of Interior, 1994), of which very little provides habitat suitable for the GGS. Loss of habitat due to agricultural activities and flood control have extirpated the snake from the southern one-third of its range in former wetlands associated with the historic Buena Vista, Tulare, and Kern lakebeds (Hansen, 1980; Hansen and Brode, 1980).

Recent genetic work on GGS population structure indicates three genetic entities within the species which follow the pattern of subdivision revealed by the snake's mitochondrial DNA and color pattern variants: north, central, and south (Paquin, 2001; Paquin *et al.,* 2006). Evidence of historical gene flow between northern and southern populations exists; however, mitochondrial DNA data reveal that the central population, analogous to the Delta Basin, is genetically isolated from both northern and southern populations. High frequencies of unique mitochondrial DNA haplotypes in the central population increase the conservation value for the Delta Basin, particularly as a source for GGS genetic diversity.

Species account: The giant garter snake is one of the largest garter snake species, reaching a total length of approximately 64 inches (1.6 m). Females tend to be slightly longer and proportionately heavier than males. Generally, the snakes have a dark dorsal background color with pale dorsal and lateral stripes, although coloration and pattern prominence are geographically and individually variable (Hansen, 1980; Rossman *et al.,* 1996). Endemic to wetlands in the Sacramento and San Joaquin valleys, the GGS inhabits marshes, sloughs, ponds, small lakes, low gradient streams, and other waterways and agricultural wetlands, such as irrigation and drainage canals, rice fields and the adjacent uplands (Service, 1999). Essential habitat components consist of wetlands with adequate water during the snake's active season (early-spring through mid-fall) to provide food and cover with emergent, herbaceous wetland vegetation, such as cattails and bulrushes for escape cover and foraging habitat during the active season. The snake also requires upland habitat with grassy banks and openings in waterside vegetation for basking and higher elevation uplands for over-wintering habitat with escape cover (vegetation, burrows) and underground refugia (crevices and small mammal burrows) (Hansen, 1988). Summer aquatic habitat is essential because it supports the frogs, tadpoles, and small fish on which the GGS preys. Rice and natural wetlands adjacent to ditches and canals may serve as vital nursery habitat for young GGS and as temporary stopping stations as GGS make their way through systems of ditches and canals.

GGS breeding season extends through March and April, and females give birth to live young from late July through early September (Hansen and Hansen, 1990). Although growth rates are variable, young typically more than double in size by one year of age, and sexual maturity averages three years in males and five years for females (Service, 1993a). Females will often give birth in rice fields and the newly born snakes will feed on the small prey items that are prevalent in rice fields, but are rare or absent from other permanent aquatic habitat types (E. Hansen, pers. comm., 2008). GGS are typically absent from larger rivers and other bodies of water that support introduced populations of large, predatory fish, and from wetlands with sand, gravel, or rock substrates (Hansen, 1988; Hansen and Brode, 1980; Rossman and Stewart, 1987). Riparian woodlands do not provide suitable habitat because of excessive shade, lack of basking sites, and absence of prey populations (Hansen, 1988). However, snakes have been known to occur along reaches in the delta from washdown events and during juvenile dispersal (Hansen pers. Comm. 2010)

Giant garter snakes are the most aquatic garter snake species and are active foragers, feeding primarily on aquatic prey such as fish and amphibians (Fitch, 1941). Because the species' historic prey is either declining, extirpated, or extinct, the predominant food items are now introduced species such as carp (*Cyprinus carpio*), mosquito-fish (*Gambusia affinis*), and larval and sub-adult bullfrogs (*Rana catesbiana*) (Fitch, 1941; Hansen, 1988; Hansen and Brode, 1980, 1993; Rossman *et al.,* 1996).

GGS is highly aquatic but also occupies a terrestrial niche (Service, 1999; Wylie *et al.,* 2004a). The snake typically inhabits small mammal burrows and other soil and/or rock crevices during the colder months of winter (*i.e.,* October to April) (Hansen and Brode, 1993; Wylie *et al.,* 1995; Wylie *et al.,* 2003a), and also uses burrows as refuge from extreme heat during its active period (Wylie *et al.,* 1997; Wylie *et al.,* 2004a). While individuals usually remain in close proximity to wetland habitats, the Biological Resource Division of the U.S. Geological Survey (BRD) has documented snakes using burrows as much as 165 feet (50.3 m) away from the marsh edge to escape extreme heat, and as far as 820 feet (250 m) from the edge of marsh habitat for over-wintering habitat (Wylie *et al.,* 1997).

In studies of marked snakes in the Natomas Basin, snakes moved about 0.25 to 0.5 mile per day (0.4 to 0.8 km) (Hansen and Brode, 1993). Total activity, however, varies widely between individuals; individual snakes have been documented to move up to five miles (8 km) over a few days in response to dewatering of habitat (Wylie *et al.,* 1997) and to use up to more than eight miles (13 km) of linear aquatic habitat over the course of a few months. Home range (area of daily activity) averages about 61 acres (24.7 hectares (hec)) in both the Natomas Basin and the Colusa National Wildlife Refuge (NWR) (Wylie, 1998a; Wylie *et al.,* 2002a).

Recent studies provide limited information on the use of agricultural wetlands by GGS. Wylie *et al.* (1997) found that GGS densities were highest, and average home range was smallest, in permanent wetlands (Badger Creek, Sacramento County) compared to agricultural wetlands (Gilsizer Slough, Sutter County) or managed marshes (Colusa NWR, Colusa County). However, Wylie *et al.* (2000) reported that in wetlands managed specifically to benefit the GGS, home range estimates were smaller than for those areas lacking comparable management (wetlands managed for waterfowl). Wylie (1998b) also documented 14 captures and recaptures of GGS using natural channels or sloughs in the Grasslands Area in Merced County, compared to four captures and recaptures of snakes using irrigation canals. These observations may indicate that GGS may concentrate in the best habitat when all other surrounding habitat has been eliminated or highly degraded. It also may indicate that habitat in agricultural wetlands and some managed marshes are meeting some of their biological needs, but not to the fullest extent possible.

Threats: Giant garter snakes are killed and/or eaten by a variety of predators, including raccoons (*Procyon lotor*), striped skunks (*Mephitis mephitis*), opossums (*Didelphis virginiansa*), bull frogs (*Rana catesbiana*), hawks (*Buteo* sp.), egrets (*Casmerodius albus, Egretta thula*), river otters (*Ludra canadensis),* and great blue herons (*Ardea herodias*) (Dickert, 2003; Wylie *et al.,* 2003b; G. Wylie, pers. comm., 2006). Many areas supporting snakes have been documented to have abundant predators; however, predation does not seem to be a limiting factor in areas that provide abundant cover, high concentrations of prey items, and connectivity to a permanent water source (Hansen and Brode, 1993; Wylie *et al.,* 1995).

Valley flood wetlands are now subject to cumulative effects of upstream watershed modifications, water storage and diversion projects, as well as urban and agricultural development. The Central Valley Project (CVP), the largest water management system in California, created an ecosystem altered to such an extent that remaining wetlands depend on highly managed water regimes (U.S. Department of Interior, 1994). Further, the implementation of CVP has resulted in conversion of native habitats to agriculture, and has facilitated urban development through the Central Valley (Service, 1999). For instance, it is estimated that residential and commercial growth in the Central Valley will lead to the loss of more than one million acres (404685 hec) by the year 2040 (USGS, 2003). Environmental impacts associated with urbanization include loss of biodiversity and habitat, alteration of natural fire regimes, fragmentation of habitat from road construction, and degradation due to pollutants. Rapidly expanding cities within the snake's range include Chico, Yuba City, the Sacramento area, Galt, Stockton, Gustine, and Los Banos.

The primary threats to the GGS continue to be habitat loss and degradation. Farmland lost to urbanization includes land that is presently cultivated in rice. The relatively abundant populations of GGS in the Sacramento Valley may reflect the expansion of available habitat that is provided from rice cultivation. Dependence of populations on rice cultivation leaves the GGS vulnerable to wide-scale habitat loss in the event of changes in crop type (e.g., grapes, fruit or nut producing orchards, or annual row crops such as wheat, tomatoes or cotton) to those less water intensive or land fallowing (Paquin *et al.,* 2006) and to changes in precipitation patterns and water availability and timing associated with climate change (CDWR, 2008). Unlike flood irrigated rice fields, other agricultural cropping systems do not hold sufficient water for long enough time periods to create artificial, temporary wetlands. GGS in the San Joaquin Valley are threatened by a lack of summer surface water in wetlands and fields, and the age structure of populations in this part of the range has been found to be senescing with very few if any young individual GGS being found during trapping surveys conducted over the last five years (Hansen, 2008a). Availability of clean summer water is especially important for young GGS to survive and grow (E. Hansen, pers. comm., 2008).

Ongoing maintenance of aquatic habitats for flood control and agricultural purposes eliminates or prevents the establishment of habitat characteristics required by GGS (Hansen, 1988). Such practices can fragment and isolate available habitat, prevent dispersal of snakes among habitat units, and adversely affect the availability of the snake's food items (Hansen, 1988; Brode and Hansen, 1992). For example, tilling, grading, harvesting and mowing may kill or injure individuals (Wylie *et al.,* 1997). Biocides applied to control aquatic vegetation reduce cover for the snake and may harm prey species (Wylie *et al.,* 1995). Rodent control threatens the snake's upland aestivation habitat (Wylie *et al.,* 1995; Wylie *et al.,* 2003). Restriction of suitable habitat to water canals bordered by roadways and levee tops renders snakes vulnerable to vehicular mortality (Wylie *et al.,* 1997). Rolled erosion control products, which are frequently used as temporary berms to control and collect soil eroding from constriction sites, can entangle and kill snakes (Stuart *et al.*, 2001; Barton and Kinkead, 2005). Livestock grazing along the edges of water sources degrades water quality and can contribute to the elimination and reduction of available quality snake habitat (Hansen, 1988; E. Hansen, pers. comm., 2006), and GGS have been observed to avoid areas that are grazed (Hansen, 2003). Fluctuation in rice and agricultural production affects stability and availability of habitat (Paquin *et al.,* 2006; Wylie and Casazza, 2001; Wylie *et al.,* 2003c, 2004).

Other land use practices also currently threaten the survival of the snake. Recreational activities, such as fishing, may disturb GGS and disrupt thermoregulation and foraging activities

(E. Hansen, pers. comm., 2006). While large areas of seemingly suitable GGS habitat exist in the form of duck clubs and waterfowl management areas, water management of these areas typically does not provide the summer water needed by the species (Beam and Menges, 1997; Dickert, 2005; Paquin *et al.,* 2006).

Nonnative predators, including introduced predatory game fish, bullfrogs, and domestic cats, can threaten snake populations (Dickert, 2003; Hansen, 1986; Service, 1993a; Wylie *et al.,* 1995; Wylie *et al.,* 2003b). Nonnative competitors, such as the introduced water snake (*Nerodia fasciata*) in the American River and associated tributaries near Folsom, may also threaten the GGS (Stitt *et al.,* 2005). Predation by native species upon the GGS has not been well documented. Anecdotal information includes observations of hawks, herons, and river otters preying upon the GGS. According to Rossman *et al.* (1996), GGS may be important prey for several vertebrate predators including jays (*Cyanocitta cristata*) and crows (*Corvus brachyrhynchos*), carnivorous fish, and small mammals. Small native mammalian predators are likely to include raccoons, skunks, opossums, and foxes. Anthropogenic (human-caused) changes in ecosystem dynamics and reductions in suitable habitat for GGS may favor and subsidize these predator populations. The result may be an increase in predation pressure upon the GGS (Service, 2006).

The disappearance of GGS from much of the west side of the San Joaquin Valley was approximately contemporaneous with the expansion of subsurface drainage systems in this area, providing circumstantial evidence that the resulting contamination of ditches and sloughs with drainwater constituents (principally selenium) may have contributed to the demise of GGS populations. Dietary uptake is the principle route of toxic exposure to selenium in wildlife, including GGS (Beckon *et al.,* 2003). Many open ditches in the northern San Joaquin Valley carry subsurface drainwater with elevated concentrations of selenium, and green sunfish (*Lepomis cyanellus*) have been found to have concentrations of selenium within the range of concentrations associated with adverse effects on predator aquatic reptiles (Hopkins *et al.,* 2002; Saiki, 1998). Studies on the effects of selenium on snakes suggest that snakes with high selenium loads in their internal organs can transfer potentially toxic quantities of selenium to their eggs (Hopkins *et al.,* 2004) and also demonstrate higher rates of metabolic activity than uncontaminated snakes (Hopkins *et al.,* 1999).

Effects of the action: The proposed project will likely adversely affect the threatened giant garter snake by killing, harming and/or harassing juveniles and adults inhabiting wetlands or upland areas supporting suitable underground refugia within or adjacent to undeveloped lands. The aspects of the proposed action most likely to affect the giant garter snake are largely confined to the construction phase of the project. Construction noise, vibration, possible night-lighting, and increased human activity may interfere with normal behaviors. These behaviors include feeding, sheltering, movement between refugia and foraging grounds, and other essential behaviors of the GGS. Avoidance of areas that have suitable habitat but intolerable levels of disturbance may force individuals from cover thereby subjecting them to predation that otherwise would not occur. Natural food sources may also be reduced as a result of habitat disturbance and loss. Short-term temporal effects will occur when vegetative cover is removed within upland habitat during project construction, which may subject these species to an increased risk of predation.

The proposed construction activities could result in the introduction of chemical contaminants to the site. Substances used in the boring process could leach out or wash out into the soil and adjacent habitat. Vehicles may leak hazardous substances such as motor oil and antifreeze. A variety of substances could be introduced during accidental spills of materials. Such spills can result from leaks in vehicles, small containers falling off vehicles, or from accidents resulting in whole loads being spilled. Snakes using these areas could be exposed to any contaminants that are present at the site. Exposure pathways could include inhalation, dermal contact, direct ingestion, or ingestion of contaminated soil or plants. Exposure to contaminants could cause short- or long-term morbidity, possibly resulting in reduced productivity or mortality. Carcinogenic substances could cause genetic damage resulting in sterility, reduced productivity, or reduced fitness among progeny. Little information is available on the effects of contaminants on these species and the effects may be difficult to detect. Morbidity or mortality likely would occur after the animals had left the contaminated site, and more subtle effects such as genetic damage could only be detected through intensive study and monitoring. DWR proposes to minimize these risks by implementing BMPs and a Spill Response Plan stated in the Project Description Conservation Measures.

Since snakes use small mammal burrows, soil crevices, and/or rock crevices for shelter for hibernating during the winter season and aestivating during extremely hot days during their active period, snakes in terrestrial habitat may become entombed under soil, crushed or damaged by equipment or personnel, thereby resulting in harm or mortality to individuals. As ground squirrel burrows can be deep and long, drills may come into direct contact with a hibernating or aestivating snake and a snake could be killed from drilling activities. Adverse effects will be partially minimized by preconstruction surveys, educating construction personnel about the presence of GGS, their habitat, species identification, regulatory laws, and avoidance measures, and requiring a Service approved biologist to be present to monitor project activities within or adjacent to suitable habitat.

Due to time constraints of the project DWR proposes to conduct drilling activities outside of the work window for the snake as recommended in the Corps' *Programmatic Formal Consultation for U.S. Army Corps of Engineers 404 Permitted Projects with Relatively Small Effects on the Giant Garter Snake* (Service file no. 1-1-F-97-149). These work windows are established to coincide with the snake's active period and to minimize adverse effects by allowing snakes the ability to flee or move from an area of construction to avoid injury or death. During consultation and several meetings with biological resource and engineering staff from DWR, Brian Hansen of the Service examined individual drill sites that could be identified as potentially non-habitat and allow for DWR to drill outside of the work windows. The areas were identified based on current and historical occurrence data, proximity to suitable habitat and in developed areas where snakes were least likely to occur or predicted to be hibernating or aestivating. A list of individual bore sites are listed below. These bore sites correspond with GIS data and are currently not for public availability due to property rights issues. For sites determined to be within the snake's range and have suitable aquatic and upland habitat, the Service and DWR has designated these areas as **Priority 1** and will only be drilled during the recommended work windows (active period for snakes) of May 1 to October 1. For those sites which are defined as Priority 1, but if possible, can be moved to a new location more than 200 feet from an existing waterway within a developed site, these locations are designated as **Priority 1.5**. These sites can be drilled outside of the work windows only after further consultation and approval from the Service. Locations determined not to be suitable GGS habitat and not likely to adversely affect GGS are designated as **Priority 2**. Other species restrictions may apply. Bore sites and their corresponding Priority designation are listed below in Table 1.

Environmental Permissibility Definitions:
1.0 – Drill Within Work Window of GGS active season
1.5 – Drill Within Work Window of GGS active season if boring is kept in same location; Drill anytime of year if the boring is moved AWAY from GGS habitat/waterways and with further consultation from FWS
2.0 – Drill anytime of the year

Additional Notes from meeting:
"DCT-CPT-014" & "668": must stay within Ag field to maintain "2" status
"DCI-CPT-010" & "DCI-DH-010" cannot be moved toward river, or will status will change to a "1"

Drill Hole Name	Alternative Drill Hole Name	Environmental Permissibility
	144B	1.00
	147B	1.00
	149B	1.00
	150B	1.00
	152B	1.00
	154B	1.00
	156B	1.00
	162B	1.00
	163B	1.00
	164B	1.00
	166B	1.00
	169B	1.00
	170B	1.00
	171B	1.00
	203B	1.00
	213B	1.00
	238B	1.00
	250B	1.00
	258B	1.00
	262B	1.00
	266B	1.00
	267B	1.00
	356B	1.00
	362B	1.00
	366B	1.00
	405B	1.00

	409B	1.00
	459B	1.00
	461B	1.00
	462B	1.00
	487B	1.00
	491B	1.00
	514B	1.00
	521B	1.00
	539B	1.00
	546B	1.00
	550B	1.00
	564B	1.00
	631B	1.00
	634B	1.00
	636B	1.00
	668B	1.00
	692B	1.00

Drill Hole Name	Alternative Drill Hole Name	Environmental Permissibility
DCB-DH-002	B-DH-002	1.00
DCB-DH-005	B-DH-005	1.00
DCB-DH-009	B-DH-009	1.00
DCB-DH-010	B-DH-010	1.00
DCE-CPT-001	E-CPT-001	1.00
DCE-CPT-003	E-CPT-003	1.00
DCE-CPT-005	E-CPT-005	1.00
DCE-CPT-006	E-CPT-006	1.00
DCE-CPT-017	E-CPT-017	1.00
DCE-CPT-019	E-CPT-019	1.00
DCE-CPT-021	E-CPT-021	1.00
DCE-DH-001	E-DH-001	1.00
DCE-DH-002	E-DH-002	1.00
DCE-DH-007	E-DH-007	1.00
DCE-DH-008	E-DH-008	1.00
DCE-DH-009	E-DH-009	1.00
DCI-CPT-002	I-CPT-002	1.00
DCI-CPT-004	I-CPT-004	1.00
DCI-CPT-005	I-CPT-005	1.00
DCI-CPT-008	I-CPT-008	1.00
DCI-CPT-009	I-CPT-009	1.00
DCI-CPT-011	I-CPT-011	1.00
DCI-DH-002	I-DH-002	1.00
DCI-DH-004	I-DH-004	1.00
DCI-DH-005	I-DH-005	1.00
DCI-DH-008	I-DH-008	1.00
DCI-DH-009	I-DH-009	1.00
DCI-DH-011	I-DH-011	1.00
DCT-CPT-001	T-CPT-001	1.00
DCT-CPT-005	T-CPT-005	1.00
DCT-CPT-008	T-CPT-008	1.00
DCT-CPT-010	T-CPT-010	1.00
DCT-CPT-016	T-CPT-016	1.00
DCT-CPT-017	T-CPT-017	1.00
DCT-CPT-020	T-CPT-020	1.00
DCT-CPT-026	T-CPT-026	1.00
DCT-CPT-027	T-CPT-027	1.00
DCT-CPT-028	T-CPT-028	1.00
DCT-CPT-029	T-CPT-029	1.00
DCT-DH-003	T-DH-003	1.00

DCW-CPT-005	W-CPT-005	1.00
DCW-CPT-006	W-CPT-006	1.00
DCW-CPT-007	W-CPT-007	1.00
DCW-CPT-008	W-CPT-008	1.00
DCW-CPT-009	W-CPT-009	1.00
DCW-CPT-010	W-CPT-010	1.00
DCW-CPT-011	W-CPT-011	1.00
DCW-CPT-013	W-CPT-013	1.00
DCW-CPT-016	W-CPT-016	1.00
DCW-CPT-017	W-CPT-017	1.00
DCW-DH-001	W-DH-001	1.00
DCW-DH-002	W-DH-002	1.00
DCW-DH-003	W-DH-003	1.00
DCW-DH-004	W-DH-004	1.00
DCW-DH-006	W-DH-006	1.00
DCW-DH-009	W-DH-009	1.00
DCW-DH-010	W-DH-010	1.00
DCA-DH-002	A-DH-002	1.00
DCA-DH-001	A-DH-001	1.00
DCA-CPT-005	A-CPT-005	1.00
DCA-DH-002A	A-DH-002A	1.00
DCA-CPT-005A	A-CPT-005A	1.00
	312B	1.50
DCE-CPT-022	E-CPT-022	1.50
DCE-CPT-025	E-CPT-025	1.50
DCE-CPT-027	E-CPT-027	1.50
DCT-CPT-003	T-CPT-003	1.50
DCT-CPT-006	T-CPT-006	1.50
DCA-DH-009	A-DH-009	1.50
DCA-CPT-009	A-CPT-009	1.50
	125B	2.00
	141B	2.00
	145B	2.00
	179B	2.00
	183B	2.00
	208B	2.00
	214B	2.00
	224B	2.00
	227B	2.00
	228B	2.00
	229B	2.00

DCT-DH-005	T-DH-005	1.00
DCT-DH-008	T-DH-008	1.00
DCW-CPT-002	W-CPT-002	1.00

	231B	2.00
	232B	2.00
	234B	2.00
	241B	2.00
	253B	2.00
	257B	2.00
	270B	2.00
	285B	2.00
	299B	2.00
	307B	2.00
	323B	2.00
	350B	2.00
	352B	2.00
	378B	2.00
	381B	2.00
	382B	2.00
	383B	2.00
	386B	2.00
	388B	2.00
	398B	2.00
	413B	2.00
	414B	2.00
	416B	2.00
	421B	2.00
	422B	2.00
	423B	2.00
	424B	2.00
	430B	2.00
	431B	2.00
	436B	2.00
	444B	2.00
	447B	2.00
	457B	2.00
	458B	2.00
	488B	2.00
	473B	2.00
	482B	2.00
	486B	2.00
	493B	2.00
	495B	2.00
	497B	2.00
	499B	2.00
	504B	2.00
	517B	2.00
	518B	2.00

	519B	2.00
	520B	2.00
	522B	2.00
	529B	2.00
	531B	2.00
	534B	2.00
	541B	2.00
	558B	2.00
	560B	2.00
	565B	2.00
	566B	2.00
	568B	2.00
	569B	2.00
	571B	2.00
	579B	2.00
	582B	2.00
	586B	2.00
	593B	2.00
	603B	2.00
	616B	2.00
	617B	2.00
	619B	2.00
	628B	2.00
	637B	2.00
	649B	2.00
	656B	2.00
	660B	2.00
	663B	2.00
	665B	2.00
	669B	2.00
	670B	2.00
	679B	2.00
	704B	2.00
	705B	2.00
	714B	2.00
DCB-DH-003	B-DH-003	2.00
DCB-DH-007	B-DH-007	2.00
DCB-DH-008	B-DH-008	2.00
DCB-DH-011	B-DH-011	2.00
DCE-CPT-002	E-CPT-002	2.00
DCE-CPT-012	E-CPT-012	2.00
DCE-CPT-018	E-CPT-018	2.00
DCE-CPT-028	E-CPT-028	2.00

DCE-CPT-029	E-CPT-029	2.00
DCE-CPT-031	E-CPT-031	2.00

(Table 1.)

DCE-DH-011	E-DH-011	2.00
DCE-DH-012	E-DH-012	2.00
DCE-DH-013	E-DH-013	2.00
DCI-CPT-010	I-CPT-010	2.00
DCI-CPT-012	I-CPT-012	2.00
DCI-DH-010	I-DH-010	2.00
DCT-CPT-012	T-CPT-012	2.00
DCT-CPT-014	T-CPT-014	2.00
DCT-CPT-015	T-CPT-015	2.00
DCT-CPT-019	T-CPT-019	2.00
DCT-CPT-021	T-CPT-021	2.00
DCT-CPT-022	T-CPT-022	2.00
DCT-CPT-023	T-CPT-023	2.00
DCT-CPT-024	T-CPT-024	2.00
DCT-CPT-030	T-CPT-030	2.00
DCT-CPT-031	T-CPT-031	2.00
DCT-CPT-033	T-CPT-033	2.00
DCT-CPT-034	T-CPT-034	2.00
DCT-CPT-035	T-CPT-035	2.00
DCT-CPT-036	T-CPT-036	2.00
DCT-DH-006	T-DH-006	2.00
DCT-DH-007	T-DH-007	2.00
DCT-DH-009	T-DH-009	2.00
DCW-CPT-018	W-CPT-018	2.00
DCW-CPT-020	W-CPT-020	2.00
DCW-CPT-021	W-CPT-021	2.00
DCW-CPT-022	W-CPT-022	2.00
DCW-CPT-023	W-CPT-023	2.00
DCW-CPT-024	W-CPT-024	2.00
DCW-DH-011	W-DH-011	2.00
DCW-DH-012	W-DH-012	2.00
DCA-DH-010	A-DH-010	2.00
DCA-DH-012	A-DH-012	2.00
DCA-CPT-010	A-CPT-010	2.00
DCA-CPT-012	A-CPT-012	2.00

Critical Habitat

Critical habitat is defined in Section 3 of the Act as: (1) The specific areas within the geographical area occupied by a species, at the time it is listed in accordance with the Act, on which are found those physical or biological features (a) essential to the conservation of the species and (b) that may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species. In determining which areas to designate as critical habitat, the Service considers those physical and biological features that are essential to a species' conservation and that may require special management considerations or protection (50 CFR 424.12(b)). The Service is required to list the known primary constituent elements together with the critical habitat description. Such physical and biological features include, but are not limited to, the following:

(1) Space for individual and population growth, and for normal behavior;

(2) Food, water, air, light, minerals, or other nutritional or physiological requirements;

(3) Cover or shelter;

(4) Sites for breeding, reproduction, rearing of offspring, germination, or seed dispersal; and

(5) Generally, habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species.

Status of the Vernal Pool Fairy Shrimp Critical Habitat

The Service designated 111 units as critical habitat for the 15 vernal pool species. Many of the critical habitat units for the 15 vernal pool species overlap in 34 counties in California and 1 county in southern Oregon in a final rule of August 11, 2005 (Service 2005b). In determining which areas to designate as critical habitat, the Service considers those physical and biological features (primary constituent elements) that are essential to the conservation of the species, and that may require special management considerations and protections (50 CFR § 424.14).

The critical habitat units for vernal pool fairy shrimp contain primary constituent elements that support vernal pool crustacean feeding, growth, breeding, reproduction, and dispersal. These primary constituent elements provide for the physiological, behavioral, and ecological requirements of the vernal pool fairy shrimp. The following is a summary of the primary constituent elements for vernal pool fairy shrimp critical habitat:

Primary Constituent Element 1: Topographic features characterized by mounds and swales and depressions within a matrix of surrounding uplands that result in complexes of continuously, or intermittently, flowing surface water in the swales connecting the pools, providing for dispersal and promoting hydroperiods of adequate length in the pools.

Primary Constituent Element 2: Depressional features including isolated vernal pools with underlying restrictive soil layers that become inundated during winter rains and that continuously hold water for a minimum of 18 days, in all but the driest years; thereby providing adequate water for incubation, maturation, and reproduction. As these features are inundated on a seasonal basis, they do not promote the development of obligate wetland vegetation habitats typical of permanently flooded emergent wetlands.

Primary Constituent Element 3: Sources of food, expected to be detritus occurring in the pools, contributed by overland flow from the pools' watershed, or the results of biological processes within the pools themselves, such as single-celled bacteria, algae, and dead organic matter, to provide for feeding.

Primary Constituent Element 4: Structure within the pools consisting of organic and inorganic materials, such as living and dead plants from plant species adapted to seasonally inundated environments, rocks, and other inorganic debris that may be washed, blown, or otherwise transported into the pools, that provide shelter.

With the designation of critical habitat, the Service intends to conserve the physical and biological features that are essential to the conservation of the species, through the identification of the appropriate quantity and spatial arrangement of the primary constituent elements sufficient to support the life-history functions of the species. Because not all life-history functions require all the primary constituent elements, not all areas designated as critical habitat will contain all the primary constituent elements. Please refer to 70 FR 46924 and 71 FR 7118 for additional information on vernal pool fairy shrimp critical habitat.

Environmental Baseline

The proposed project is located within portions of vernal pool fairy shrimp Critical Habitat Units 19A and 19B. Unit 19A encompasses approximately 1,472 acres and Unit 19B is approximately 4,891 acres. Both habitat units are in Contra Costa County on the western most boundary of the legal "Delta." Unit 19A is between Deer Valley Road and Highway 4, on the southeastern foothill of Mount Diablo. Unit 19B is further south surrounded by Vasco Road to the west, Byron Road to the east, and the California Aqueduct Intake Channel to the southeast of the unit.

Effects of the Proposed Action

Implementation of the proposed project may have temporary adverse effects to critical habitat as boring areas will be unusable by vernal pool fairy shrimp during project construction activities. However, it is expected that critical habitat locations that were bored will be returned to pre-project conditions following work activities. Due to the relatively small footprint of the individual borings and temporary nature of the construction activities, the proposed project will not adversely modify vernal pool fairy shrimp critical habitat.

Status of the Delta Smelt Critical Habitat

The action area for this consultation covers the entire range of delta smelt critical habitat. The Status of Critical Habitat and Environmental Baseline sections are combined into one section in this document. The Service designated critical habitat for the delta smelt on December 19, 1994 (Service 1994). The geographic area encompassed by the designation includes all water and all submerged lands below ordinary high water and the entire water column bounded by and contained in Suisun Bay (including the contiguous Grizzly and Honker Bays); the length of

Goodyear, Suisun, Cutoff, First Mallard (Spring Branch), and Montezuma sloughs; and the existing contiguous waters contained within the legal Delta (as defined in section 12220 of the California Water Code) (Service 1994).

Conservation Role of Delta Smelt Critical Habitat

The Service's primary objective in designating critical habitat was to identify the key components of delta smelt habitat that support successful spawning, larval and juvenile transport, rearing, and adult migration. Delta smelt are endemic to the Bay-Delta and the vast majority only live one year. Thus, regardless of annual hydrology, the Delta must provide suitable habitat all year, every year. Different regions of the Delta provide different habitat conditions for different life stages, but those habitat conditions must be present when needed, and have sufficient connectivity to provide migratory pathways and the flow of energy, materials and organisms among the habitat components. The entire Delta and Suisun Bay are designated as critical habitat; over the course of a year, the entire habitat is occupied.

Description of the Primary Constituent Elements

In designating critical habitat for the delta smelt, the Service identified the following primary constituent elements essential to the conservation of the species:

Primary Constituent Element 1: "Physical habitat" is defined as the structural components of habitat. Because delta smelt is a pelagic fish, spawning substrate is the only known important structural component of habitat. It is possible that depth variation is an important structural characteristic of pelagic habitat that helps fish maintain position within the estuary's low-salinity zone ([LSZ]; Bennett et al. 2002).

Primary Constituent Element 2: "Water" is defined as water of suitable quality to support various delta smelt life stages with the abiotic elements that allow for survival and reproduction. Delta smelt inhabit open waters of the Delta and Suisun Bay. Certain conditions of temperature, turbidity, and food availability characterize suitable pelagic habitat for delta smelt and are discussed in detail in the Status of the Species/Environmental Baseline section, above. Factors such as high entrainment risk and contaminant exposure can degrade this PCE even when the basic water quality is consistent with suitable habitat.

Primary Constituent Element 3: "River flow" is defined as transport flow to facilitate spawning migrations and transport of offspring to LSZ rearing habitats. River flow includes both inflow to and outflow from the Delta, both of which influence the movement of migrating adult, larval, and juvenile delta smelt. Inflow, outflow, and Old and Middle Rivers flow influence the vulnerability of delta smelt larvae, juveniles, and adults to entrainment at Banks and Jones (refer to Status of the Species/Environmental Baseline section, above). River flow interacts with the fourth primary constituent element, salinity, by influencing the extent and location of the highly productive LSZ where delta smelt rear.

Primary Constituent Element 4: "Salinity" is defined as the LSZ nursery habitat. The LSZ is where freshwater transitions into brackish water; the LSZ is defined as 0.5-6.0 psu (parts per thousand salinity; Kimmerer 2004). The 2 psu isohaline is a specific point within the LSZ where the average daily salinity at the bottom of the water is 2 psu (Jassby et al. 1995). By

> local convention the location of the LSZ is described in terms of the distance from the 2 psu isohaline to the Golden Gate Bridge (X2); X2 is an indicator of habitat suitability for many San Francisco Estuary organisms and is associated with variance in abundance of diverse components of the ecosystem (Jassby et al. 1995; Kimmerer 2002). The LSZ expands and moves downstream when river flows into the estuary are high. Similarly, it contracts and moves upstream when river flows are low. During the past 40 years, monthly average X2 has varied from as far downstream as San Pablo Bay (45 km) to as far upstream as Rio Vista on the Sacramento River (95 km). At all times of year, the location of X2 influences both the area and quality of habitat available for delta smelt to successfully complete their life cycle (see Biology and Life History in OCAP BO). In general, delta smelt habitat quality and surface area are greater when X2 is located in Suisun Bay. Both habitat quality and quantity diminish the more frequently and further the LSZ moves upstream, toward the confluence.

Overview of Delta Smelt Habitat Requirements and the Primary Constituent Elements

As previously described in the Status of the Species/Environmental Baseline section, delta smelt live their entire lives in the tidally-influenced fresh- and brackish waters of the San Francisco Estuary (Moyle 2002). Delta smelt are an open-water, or pelagic, species. They do not associate strongly with structure. They may use nearshore habitats for spawning (PCE #1), but free-swimming life stages mainly occupy offshore waters (PCE #2). Thus, the distribution of the population is strongly influenced by river flows through the estuary (PCE #3) because the quantity of fresh water flowing through the estuary changes the amount and location of suitable low-salinity, open-water habitat (PCE #4). This is true for all life stages. During periods of high river flow into the estuary, delta smelt distribution can transiently extend as far west as the Napa River and San Pablo Bay. Delta smelt distribution is highly constricted near the Sacramento-San Joaquin river confluence during periods of low river flow into the estuary (Feyrer et al. 2007). In the 1994 designation of critical habitat, the best available science held that the delta smelt population was responding to variation in spring X2. In the intervening 14 years, the scientific understanding of delta smelt habitat has improved. The current understanding is that X2 and the combined water flows of the Old River and Middle River both must be considered to manage entrainment and that X2 indexes important habitat characteristics throughout the year.

Environmental Baseline

The proposed project action area falls within the entire defined legal “Delta” from Herdlyn Road, South of the Clifton Court Forebay, extending along several paths north through the Delta to the Clarksburg region along the Sacramento River just south of West Sacramento. The designated critical habitat for the delta smelt within the legal Delta are areas of all water and all submerged lands below ordinary high water and the entire watercolumn bounded by and contained in Suisun Bay (including the contiguous Grizzly and Honker Bays); the length of Goodyear. Suisun, Cutoff, First Mallard (Spring Branch), and Montezuma sloughs; and the existing contiguous waters contained within the Delta, as defined in section 12220 of the California Water Code.

Effects of the Proposed Action

Implementation of the proposed project may have temporary adverse effects to critical habitat as boring areas will be unusable by delta smelt during project construction activities. However, it is expected that critical habitat locations that were bored will be returned to pre-project conditions following work activities. Due to the relatively small footprint of the individual borings and temporary nature of the construction activities, the proposed project will not adversely modify delta smelt critical habitat.

Status of California Red-legged Frog Critical Habitat

The primary constituent elements defined for the California red-legged frog were derived from its biological needs. The area proposed for designation as critical habitat provides aquatic habitat for breeding and non-breeding activities and upland habitat for shelter, foraging, predator avoidance, and dispersal across the California red-legged frog's range. The primary constituent elements and, therefore, the resulting physical and biological features essential for the conservation of the species were determined from studies of California red-legged frog ecology.

Based on the above needs and our current knowledge of the life history, biology, and ecology of the species, and the habitat requirements for sustaining the essential life-history functions of the species, we have determined that the primary constituent elements essential to the conservation of the California red-legged frog are:

> *Primary Constituent Element 1: Aquatic Breeding Habitat.* Standing bodies of fresh water (with salinities less than 7.0 ppt), including: natural and manmade (e.g., stock) ponds, slow-moving streams or pools within streams, and other ephemeral or permanent water bodies that typically become inundated during winter rains and hold water for a minimum of 20 weeks in all but the driest of years.
>
> *Primary Constituent Element 2: Non-Breeding Aquatic Habitat.* Freshwater and wetted riparian habitats, as described above, that may not hold water long enough for the subspecies to hatch and complete its aquatic life cycle but that do provide for shelter, foraging, predator avoidance, and aquatic dispersal for juvenile and adult California red-legged frogs. Other wetland habitats that would be considered to meet these elements include, but are not limited to: plunge pools within intermittent creeks; seeps; quiet water refugia during high water flows; and springs of sufficient flow to withstand the summer dry period.
>
> *Primary Constituent Element 3: Upland Habitat.* Upland areas adjacent to or surrounding breeding and non-breeding aquatic and riparian habitat up to a distance of 1 mi (1.6 km) in most cases and comprised of various vegetation series such as grasslands, woodlands, wetland, or riparian plant species that provides the frog shelter, forage, and predator avoidance. Upland features are also essential in that they are needed to maintain the hydrologic, geographic, topographic, ecological, and edaphic features that support and surround the wetland or riparian habitat. These upland features contribute to the filling and drying of the wetland or riparian habitat and are responsible for maintaining suitable periods of pool inundation for larval frogs and their food sources, and provide breeding, non-breeding, feeding, and sheltering habitat for juvenile and adult frogs (e.g., shelter, shade, moisture, cooler temperatures, a prey base, foraging opportunities, and areas for predator avoidance). Upland habitat should include structural features such as boulders, rocks and organic debris (e.g., downed trees, logs), as well as small mammal burrows and moist leaf litter.

> *Primary Constituent Element 4: Dispersal Habitat*. Accessible upland or riparian dispersal habitat within designated units and between occupied locations within a minimum of 1 mi (1.6 km) of each other and that allows for movement between such sites. Dispersal habitat includes various natural habitats and altered habitats such as agricultural fields, which do not contain barriers (e.g., heavily traveled road without bridges or culverts) to dispersal. Dispersal habitat does not include moderate- to high-density urban or industrial developments with large expanses of asphalt or concrete, nor does it include large reservoirs over 50 ac (20 ha) in size, or other areas that do not contain those features identified in primary constituent elements 1, 2, or 3 as essential to the conservation of the subspecies.

With the designation of critical habitat, the Service intends to conserve the physical and biological features that are essential to the conservation of the species, through the identification of the appropriate quantity and spatial arrangement of the primary constituent elements sufficient to support the life-history functions of the species. Because not all life-history functions require all the primary constituent elements, not all areas designated as critical habitat will contain all the primary constituent elements. Please refer to 75 FR 12815 for additional information on California red-legged frog critical habitat.

Environmental Baseline

The action area falls within a portion of Contra Costa County critical habitat unit 2B, in the northeastern-most corner of the critical habitat unit, near Clifton Court Forebay, near the California Aqueduct Intake Channel Pumping Stations.

Effects of the Proposed Action

Implementation of the proposed project may have temporary adverse effects to critical habitat as boring areas will be unusable by red-legged frogs during project construction activities. However, it is expected that critical habitat locations that were bored will be returned to pre-project conditions following work activities. Due to the relatively small footprint of the individual borings and temporary nature of the construction activities, the proposed project will not adversely modify red-legged frog critical habitat.

Status of California Tiger Salamander-Central Valley Population Critical Habitat

Critical habitat was designated on August 23, 2005 in 19 counties for the Central Valley population and is divided into four geographic regions: (1) Central Valley Region; (2) Southern San Joaquin Region; (3) East Bay Region; and (4) Central Coast Region (70 FR 49379). The rule identifies approximately 199,109 acres (80,576 hectares) within 32 critical habitat units.

The primary constituent elements for the tiger salamander are based on our current knowledge of the life history, biology, and ecology of the species and the relationship of its essential life history functions to its habitat, we have determined that the Central population of the tiger salamander requires the following primary constituent elements: (1) Standing bodies of fresh water including natural and manmade (e.g., stock) ponds, vernal pools, and other ephemeral or permanent water bodies which typically support inundation during winter rains and hold water for a minimum of 12 weeks in a year of average rainfall; (2) Upland habitats adjacent and accessible to breeding ponds that contain small mammal burrows or other underground habitat that tiger salamanders depend upon for food, shelter, and protection from the elements and predation; and (3) Accessible upland dispersal habitat between occupied locations that allow for movement between such sites.

> *Primary Constituent Element 1:* The requisite aquatic habitat described as the first PCE is essential for the Central population of the tiger salamander for providing space, food, and cover necessary to support reproduction and to sustain early life history stages of larval and juvenile tiger salamander. Aquatic and breeding habitats consist of fresh water bodies, including natural and artificially made (e.g., stock) ponds, vernal pools, and vernal pool complexes. To be considered essential, aquatic and breeding habitats must have the capability to hold water for a minimum of 12 weeks in the winter or spring in a year of average rainfall, the amount of time needed for salamander larvae to metamorphose into juveniles capable of surviving in upland habitats. During periods of drought or less-than-average rainfall, these sites may not hold water long enough for individuals to complete metamorphosis; however, these sites would still be considered essential because they constitute breeding habitat in years of average rainfall.
>
> *Primary Constituent Element 2:* Essential upland habitats containing underground refugia described as the second PCE are essential for the survival of the Central population's adult tiger salamanders and juveniles that have recently undergone metamorphosis. Adult and juvenile tiger salamanders are primarily terrestrial; adult tiger salamanders enter aquatic habitats only for relatively short periods of time to breed. For the majority of their life cycle, tiger salamanders survive within upland habitats containing underground refugia in the form of small mammal burrows. The Central population of the tiger salamander cannot persist without upland underground refugia. These underground refugia provide protection from the hot, dry weather typical of California in the nonbreeding season. The Central population of the tiger salamander also forages in the small mammal burrows and rely on the burrows for protection from predators. The presence of small burrowing mammal populations is essential for constructing and maintaining burrows. Without the continuing presence of small mammal burrows in upland habitats, the tiger salamander would not be able to survive.
>
> *Primary Constituent Element 3:* The dispersal habitats described as the third PCE are essential for the conservation of the Central population of the tiger salamander. Protecting the ability of tiger salamander to move freely across the landscape in search of suitable aquatic and upland habitats is essential in maintaining gene flow, recolonization, and population structure. Movement between areas containing suitable upland and aquatic habitats (i.e., dispersal) is restricted due to inhospitable conditions around and between areas of suitable habitats. Because many of the areas of suitable habitats may be small and support small numbers of salamanders, local extinction of these small units may be common.

Essential dispersal habitats generally consist of upland areas adjacent to essential aquatic habitats that are not isolated from essential aquatic habitats by barriers that tiger salamanders cannot cross. Essential dispersal habitats provide connectivity among suitable aquatic and upland habitats. While the tiger salamanders can bypass many obstacles, and do not require a particular type of habitat for dispersal, the habitats connecting essential aquatic and upland habitats need to be free of barriers (e.g., a physical or biological feature that prevents salamanders from dispersing beyond the feature) to function effectively. Examples of barriers are areas of steep topography devoid of soil or vegetation. Agricultural lands such as row crops, orchards, vineyards, and pastures do not constitute barriers to the dispersal of tiger salamander.

With the designation of critical habitat, the Service intends to conserve the physical and biological features that are essential to the conservation of the species, through the identification of the appropriate quantity and spatial arrangement of the primary constituent elements sufficient to support the life-history functions of the species. Because not all life-history functions require all the primary constituent elements, not all areas designated as critical habitat will contain all the primary constituent elements. Please refer to 70 FR 49379 for additional information on California tiger salamander critical habitat.

Environmental Baseline

The proposed project action area falls within the California Tiger Salamander Central Valley 2 Critical Habitat Unit, which is approximately 9.2 square miles. It is located in Solano County, adjacent to Highway 113 to the east, between Creed (south) and Hastings Island (north) Roads.

Effects of the Proposed Action

Implementation of the proposed project may have temporary adverse effects to critical habitat as boring areas will be unusable by CTS during project construction activities. However, it is expected that critical habitat locations that were bored will be returned to pre-project conditions following work activities. Due to the relatively small footprint of the individual borings and temporary nature of the construction activities, the proposed project will not adversely modify CTS critical habitat.

Cumulative effects: Cumulative effects are those impacts of future State, Tribal, local, or private actions affecting listed species that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section, because they require separate consultations pursuant to section 7 of the Act.

Unauthorized fill of wetlands, riparian habitats and vernal pools, increases in non-native and invasive species, and continued and expanded water diversions for multiple, human-water uses in the legal Delta are likely to continue with concomitant adverse effects to vernal pool fairy shrimp, giant garter snake, valley elderberry long-horn beetle, California tiger salamander (central valley population), and the California red-legged frog. Giant garter snake, elderberry longhorn beetle, red-legged frogs, vernal pool fairy shrimp and tiger salamanders may be affected by dredging and clearing vegetation from irrigation canals and levees; discing, mowing, and ornamental cultivation and grounds maintenance of upland habitats; and use of burrow fumigants on levees and upland refugia. Additionally, actions such as urban construction, flood control, highway and roadway construction, utility activities, chemical contaminants, and conversion of vernal pools to agricultural use will have adverse effects to the threatened and endangered species and/or their associated, designated critical habitats.

People exploring creeks or water channels can harrass, collect and hunt the giant garter snake, red-legged frog, and tiger salamander. Both house cats and dogs prey on aquatic and riparian reptile and amphibian species. Non-native species that prey upon, or compete with threatened and endangered reptiles and amphibians continue to be released or introduced to the legal Delta. Bullfrogs, goldfish (*Carassius auratus*), mosquito fish, and warm water game fish species are all expected to persist in the wild and degrade the quality garter snake, red-legged frog and/or tiger salamander habitat.

Cumulative effects on the delta smelt and its designated critical habitat and giant garter snake include the effects of point and non-point source chemical contaminant discharges into the water ways in the legal Delta. These contaminants include selenium, boron, and numerous pesticides and herbicides associated with discharges related to agricultural and urban activities. Implicated as potential sources of mortality for delta smelt and giant garter snake, these contaminants may adversely affect delta smelt and garter snake reproductive success and survival rates. Spawning habitat for the delta smelt may also be affected if submersed aquatic plants used as substrates for adhesive egg attachment are lost due to toxic substances.

Additional cumulative adverse effects to delta smelt may result from continued or future non-Federal diversions of water that may entrain adult or larval fish or that may decrease outflows incrementally, thus shifting the position of the delta smelt's preferred habitat upstream. Water diversions through intakes serving numerous small, private agricultural lands and duck clubs in the Delta, upstream of the Delta, and in Suisun Bay contribute to these cumulative effects. These diversions also include municipal and industrial uses, as well as providing water for power plants. State or local levee maintenance may also destroy or adversely modify critical habitat by disturbing spawning or rearing habitat and release contaminants into the water.

The introduction of exotic species may occur when levees are breached or when separate creeks or river systems are reconnected during various projects. Several exotic species may adversely affect the smelt, including the Asian clam (*Potamocorbula amurensis*) and three non-native species of euryhaline copepods. The Asian clam could potentially play an important role in affecting the phytoplankton dynamics. The exotic copepods may displace native species and at least one species of copepods (*Sinocalanus doerri*) is difficult for larval fishes to catch because of its fast swimming and effective escape response. Reduced feeding efficiency and ingestion rates weaken and slow the growth of young fish and make them more vulnerable to starvation and predation.

Other cumulative effects to water channels and terrestrial habitat surrounding the waterways in the Delta include: wave action caused by boats may degrade riparian and wetland habitat and erode banks; the dumping of domestic and industrial waste may present hazards to fish and garter snakes because they could become trapped in the debris, injure themselves or ingest the debris; golf courses may reduce habitat and introduce pesticides and herbicides into the environment; oil and gas development and production remove habitat and may introduce pollutants to the Delta; agricultural uses on levees may reduce riparian and wetland habitats; residential or agricultural land use can fragment and reduce wildlife habitat and corridors for giant garter snake and valley elderberry longhorn beetle; unscreened agricultural diversions throughout the Delta divert all life stages of the delta smelt (Service 1995); and grazing activities may degrade or reduce suitable habitat and increase erosion and sedimentation.

The cumulative effects of these combined activities pose a significant threat to the recovery of the giant garter snake, delta smelt, vernal pool fairy shrimp, valley elderberry longhorn beetle, red-legged frog and California tiger salamander. Continued human-uses of terrestrial and aquatic environments in the legal Delta, will lead to the incremental increase in the indirect and direct effects described above and contribute to the disturbance and degradation of the aforementioned species' populations and their associated habitats.

Conclusion: After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's opinion that the Engineering Geotechnical Studies for the Bay Delta Conservation Plan (BDCP) and/or the Preliminary Engineering Studies for the Delta Habitat Conservation and Conveyance Program (DHCCP) project, as proposed, is not likely to jeopardize the continued of the Federally endangered vernal pool tadpole shrimp (*Lepidurus packardi*), the Federally threatened vernal pool fairy shrimp (*Branchinecta lynchi*), delta smelt (*Hypomesus transpacificus*), California tiger salamander (*Ambystoma californiense*), California red-legged frog (*Rana draytonii*), and giant garter snake (*Thamnophis gigas*). Critical Habitat for these species, but the giant garter snake, has been designated; however, this action does not affect the area and no destruction or adverse modification of their critical habitats is expected.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Harass is defined by the Service as an intentional or negligent act or omission that creates the likelihood of injury to a listed species by annoying it to such an extent as to significantly disrupt normal behavioral patterns, which include, but are not limited to, breeding, feeding, or sheltering. Harm is defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by impairing behavioral patterns, including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act, provided that such taking is in compliance with this Incidental Take Statement. The measures described herein are non-discretionary.

Amount or Extent of Take

Incidental take for this project will be addressed for each species.

Vernal pool brachiopods – Take is expected in the form of injury or mortality to the dried cysts of vernal pool brachiopods. Cysts are expected to be crushed or removed from suitable habitat by construction equipment and personnel moving through the surrounding suitable vernal pool habitat around Clifton Court Forebay. Because individual cysts would be extremely difficult to detect due their small size and cryptic nature, take for this project will constitute all individuals within the footprint of the bore sites. DWR is not authorized take in the form of permanent loss of habitat due to borings. DWR proposes to seal the bore holes with cement filler after each boring is complete and thereby attempt to return the site to pre-project condition. Proper sealing of the bore holes is the responsibility of DWR and its engineers. Permanent compromise of the duripan in the vernal pool habitats and any failure of hydrologic function is not authorized.

Delta smelt – The Service anticipates that incidental take of delta smelt will occur. The Service anticipates the take of delta smelt will be difficult to detect and quantify and therefore it is not possible to provide precise numbers of delta smelt that could be injured harassed, harmed or killed from this project, however; low mortality is anticipated because of work restriction windows.

California tiger salamander & California red-legged frog – Take for these species is expected to be directly in the form of harassment or indirectly through temporary modification of habitat. Injury or mortality to individual salamanders or frogs aestivating in animal burrows would be extremely difficult to detect and find due to their small size and cryptic nature. For this reason, incidental take cannot be quantified.

Giant garter snake – Take for this species is expected to be directly in the form of harassment or indirectly through temporary modification of habitat. In the unlikely event that GGS are found above ground outside of the breeding winter season. The Service is not authorizing take in the form of injury or mortality for these individuals. Any GGS seen to be injured or killed through implementation of the project shall be reported to the Service immediately for further consultation. Injury or mortality to individual snakes hibernating or aestivating in animal burrows would be extremely difficult to detect and find due to their cryptic nature. For this reason, incidental take cannot be quantified.

Reasonable and Prudent Measures

1. To avoid and minimize adverse effects to the listed species addressed in this Biological Opinion DWR should implement all the proposed Conservation Measures described in the Project Description.

2. If a listed species is found, work should stop and all personnel should allow the animal to leave the work site on their own. Personnel including the biological monitor should not pick up or try to remove the animal. Personnel including the biological monitor should not harass or in any way attempt to make the animal flee the site. If an animal needs to be removed, DWR should contact the Service immediately for further guidance.

3. All BMPs and Spill Prevention Plans should be in place before, during and after the entire construction process.

Terms and Conditions

In order to be exempt from the prohibitions of Section 9 of the Act, DWR must comply with the reasonable and prudent measures outlined above along with the following.

1. DWR will report any incident of a listed animal found injured or killed immediately to the Service. If a listed animal is found to be injured, but still alive, the animal is to be left alone or tracked as necessary until a Service employee can make a determination as to its condition. Where practical, an attempt should be made to salvage and preserve dead individuals. Individuals shall be collected by the biological monitor and placed in an appropriate sealed bag or container and taken away from the construction site. It is to then be turned over to the Service as soon as reasonably possible for further analysis.

2. With regard to drilling in the vernal pool habitats around the Clifton Court Forebay, DWR will make every attempt to return the habitat to pre-existing conditions after construction is complete. A Service contact will inspect the site during the wet season

following the completion of the last construction phase to ensure the biotic and hydrologic function of the vernal pools was preserved.

3. All other in water and through delta bore sites will be returned, to the full extent possible, to pre-construction conditions.

Unless new information reveals effects of the proposed action may affect listed species to an extent not considered or a new species or critical habitat is designated that may be affected by the proposed action, no further action pursuant to the Act is necessary. Any actions or proposed actions that are modified in a manner that causes an effect to listed species or critical habitat that was not considered in this consultation will require reinitiation.

This letter concludes consultation for the Engineering Geotechnical Studies for the Bay Delta Conservation Plan (BDCP) and/or the Preliminary Engineering Studies for the Delta Habitat Conservation and Conveyance Program (DHCCP). Please address any questions or concerns regarding this response to Brian Hansen, Endangered Species Biologist, at Brian_Hansen@fws.gov or (916) 930-5644.

Sincerely,

Jennifer Norris
Assistant Field Supervisor

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