# United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
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Sacramento, California 95825-1846


IN REPLY REFER TO:
1-1-07-F-0358

OCT -2 2007

Mr. James B. Richards
California Department of Transportation
111 Grand Avenue
P.O. Box 23660
Oakland, California 94623

Subject: Biological Opinion for the Proposed U.S. Interstate 680 Sunol Grade Southbound High Occupancy Vehicle Widening between State Route 237 and Interstate 580 in Alameda and Santa Clara Counties, California (Caltrans EA 04-253751) on the Threatened Alameda Whipsnake, the Threatened California Tiger salamander, and the Threatened California Red-Legged Frog

Dear Mr. Richards:

This is in response to your July 19, 2007, request for formal consultation with the U.S. Fish and Wildlife Service (Service) on the proposed U.S. Interstate 680 (I-680) Sunol Grade Southbound High Occupancy Vehicle (HOV) Widening between State Route 237 (SR 237) and Interstate 580 (I-580) in Alameda and Santa Clara Counties, California. Your letter was received in this office on July 23, 2007. At issue are the effects of this project on the threatened Alameda whipsnake (*Masticophis lateralis euryxanthus*), threatened California tiger salamander (*Ambystoma californiense*), and the threatened California red-legged frog (*Rana aurora draytonii*). Formal consultation for the project was first initiated by the Federal Highway Administration (FHWA) on April 12, 2006. FHWA transferred their Federal nexus for this project to the California Department of Transportation (Caltrans) on July 1, 2007. This document represents the Service's biological opinion on the effects of the proposed action on these three listed species. This document is issued under the authority of the Endangered Species Act of 1973, as amended (16 U.S.C. § 1531 *et seq.*)(Act).

Based on consultation for the I-680 Sunol Grade Northbound HOV Widening Project (1-1-04-F-327) and other information available to the Service, we have determined the proposed action is not likely to affect the threatened vernal pool fairy shrimp (*Branchinecta lynchi*), endangered vernal pool tadpole shrimp (*Lepidurus packardi*), endangered palmate-bracted birds-beak (*Cordylanthus palmatus*), endangered San Joaquin kit fox (*Vulpes macrotis mutica*), and

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endangered callippe silverspot butterfly (*Speyeria callippe callippe*) due to lack of appropriate habitat for these species in the action area.

This biological opinion is based on: (1) the March 2006 Biological Evaluation; (2) a June 6, 2007, project field visit; (3) additional project information provided by the California Department of Transportation (Caltrans) on July 23, 2007 (July 2007 response); (4) telephone discussion, correspondence, and electronic mail concerning the proposed action between the Service, Caltrans, and the Alameda County Congestion Management Agency (ACCMA); and (5) other information available to the Service.

**Consultation History**

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| June 1, 1999 | Caltrans requested concurrence that the proposed widening of I-680 along the Sunol Grade would not adversely affect listed species. |
| June 14, 1999 | The Service issued a concurrence letter (1-1-99-I-1412) to Caltrans stating that based on the available information the proposed project was not likely to result in take of the California red-legged frog or the callippe silverspot butterfly. |
| June 30, 2005 | The Service issued the biological opinion for the I-680 Sunol Grade Northbound HOV Widening Project (1-1-04-F-327). The biological opinion included the Alameda whipsnake, California tiger salamander, and California red-legged frog. The location of this linear project mirrored the proposed I-680 Sunol Grade Southbound HOV Widening between SR 237 and I-580. |
| April 10, 2006 | The Service received the *Interstate 680 Sunol Grade Southbound HOV Widening Project Focused Biological Evaluation for the California Tiger Salamander* from FHWA. The Biological Evaluation was dated March 2006. The accompanying cover letter included a request for concurrence with a determination that the proposed project may affect but is not likely to adversely affect the California tiger salamander. Caltrans had not begun construction on the final phase of the project that was proposed on June 1, 1999. |
| July 19, 2006 | The Service sent an information request required to complete consultation. The Service requested that FHWA reassess the project effects to the Alameda whipsnake, California tiger salamander, and California red-legged frog based on the formal consultation that was completed for the I-680 Sunol Grade Northbound HOV Widening Project (1-1-04-F-327). |

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| June 6, 2007 | The Service met with representatives of Caltrans and ACCMA to review the proposed project in the field. |
| June 19, 2007 | The Service received a request from Caltrans, dated June 18, 2007, to begin geotechnical borings at specific locations within the action area prior to completion of formal consultation. |
| June 30, 2007 | During a telephone conversation with the Service, Caltrans stated that proposed geotechnical borings south of Mission Boulevard would not affect listed species or their habitat. The proposed geotechnical borings north of Mission Boulevard would be included in the formal consultation and would not be initiated until after this biological opinion was issued. |
| July 10, 2007 | The Service received additional project information via an electronic mail message regarding the construction methodology for the proposed geotechnical bores. |
| July 23, 2007 | The Service received *Caltrans Response to the July 19, 2006 Information Request from the United States Fish and Wildlife Service.* The document included a letter from Caltrans requesting formal consultation by Caltrans as the NEPA lead agency provided by *Memorandum of Understanding (MOU) between the Federal Highway Administration and the California Department of Transportation Concerning the State of California's Participation in the Surface Transportation Project Delivery Pilot Program*, which became effective on July 1, 2007. Caltrans requested formal consultation for the California tiger salamander, California red-legged frog, and Alameda whipsnake. |
| August 8, 2007 | The Service received an electronic mail message from Caltrans requesting the I-680 Sunol Grade Southbound HOV Widening project be given priority over other Caltrans projects currently in consultation. |
| August 14, 2007 | The Service received revised habitat compensation language, at the Service's request, from Caltrans via electronic mail that proposed three alternatives: participation in an East Bay Regional Parks District purchase of land on Sunol Ridge; purchase of credits at the Ohlone Preserve Conservation Bank; or purchase of credits at another Service-approved mitigation bank. |
| August 15, 2007 | The Service received a request from Caltrans to include additional avoidance and conservation measures to the project description. |
| August 17, 2007 | The Service sent a draft biological opinion to Caltrans. |

September 18, 2007 The Service received requested revisions to the draft biological opinion from Caltrans via an electronic mail message. Hardcopies of the request were received on September 21, 2007.

September 20, 2007 The Service received additional revision information from Caltrans via an electronic mail message.

## BIOLOGICAL OPINION

### Description of the Proposed Action

Caltrans is proposing construction of a southbound HOV lane, auxiliary lane, ramp metering, and related improvements along a 21.7 mile stretch of I-680. The project includes a pilot Smart lane concept that will be incorporated into the HOV lane and will allow solo drivers to use the HOV lane for a fee along with carpool drivers. The Smart lane is also known as a High Occupancy Toll lane. The overall project area begins at the interchange of I-680 with Calaveras Road/SR 237 in the City of Milpitas in Santa Clara County. It then passes through the City of Fremont in Alameda County, and ends at the Stoneridge Drive Interchange in the City of Pleasanton, also in Alameda County.

*General Scope of Work*

According to the Caltrans July 2007 response to comments, the proposed project involves widening the freeway and slopes to accommodate standard shoulders, construction of three auxiliary lanes, widening eight bridges, installation of retaining walls, drainage systems, new signs including large overhead signs, concrete slab replacement, striping of the roadway, and installation of ramp metering and electrical equipment at select locations. The major work consists of outside shoulder widening (Caltrans 2007). Existing loop ramp and right-of-way areas will be used for staging, access, and supporting facilities such as electrical equipment and signage (Caltrans 2007).

According to Caltrans, for the extent of the modifications, the widening is located in terrain that varies in topography, requiring grading of the existing areas adjacent to the shoulder, and widening will be accomplished by either cutting into the side slope or filling low areas (Caltrans 2007).

According to the July 2007 response, Caltrans describes the proposed widening between Calaveras Road (SR 237) and North Mission Boulevard (SR 238) and the proposed electrical work area surrounding Bernal Road, Sunol Boulevard and Stoneridge Drive as being located in highly developed urban settings with homes and businesses lining both sides of the freeway.

Caltrans also describes the proposed work on Southbound I-680 between the North Mission Boulevard (SR 238) and Bernal Road as passing through a sparsely developed area with sporadic businesses and homes (Caltrans 2007).

Caltrans stated in their July 2007 response that there will be no effect to listed species for proposed activities from North Mission Boulevard (SR 238) to State Route 237 and from south of Bernal Road Interchange to Stoneridge Drive. Caltrans divides the remaining project activities into two segments: (1) North Mission Boulevard to Andrade Road and (2) Andrade Road to Sunol Boulevard. The construction activities in these two segments are further described as follows.

North Mission Boulevard to Andrade Road

Work between North Mission Boulevard and Andrade Road includes all aspects of project improvement including but not limited to pavement slab replacement, bridge and highway widening, pavement striping, installation of permanent signs including large overhead signs, new ramp metering and electrical equipment and construction of retaining walls.

The terrain between these interchanges varies in topography, requiring grading of the existing areas to permit construction of the roadway. Retaining walls will help minimize the overall project footprint where slopes adjacent to the outside shoulder are steep.

Pavement widening is continuous throughout this zone and extends beyond the existing roadway. Pavement slab replacement, striping and installation of new signs will also occur throughout the zone. This work will occur within the limits of the proposed roadway itself or, in the case of some signs, close to the roadway and involves work that causes little disturbance to adjacent areas. For example, foundation excavation and trenching for electrical conduits is incidental to the roadway widening. Drainage work to contain and control water from the roadway will be performed as part of the roadway or retaining wall work and will be incidental to that work.

Andrade Road to Sunol Boulevard

Installation of ramp metering/electrical equipment will occur at interchanges throughout the zone: (1) SR 84/Calaveras Road and (2) Sunol Boulevard. This is the main type of work between the Andrade Road interchange and Stoneridge Drive interchange as no roadway widening is planned north of Andrade Road. The work involves placing electrical conduits under the existing pavement and next to the edge of existing shoulders, placement of loop detectors in the existing pavement and the placement of electrical cabinets adjacent to the roadway. Ramp metering involves placing electrical conduits under the existing pavement and next to the edge of the existing shoulders, placement of loop detectors in the existing pavement and the placement of electrical cabinets. The proposed work consists of incidental excavation and trenching (approximately one foot wide) for the purpose of placing the electrical conduit. Trenching will be covered and compacted following placement of electrical conduits.

Pavement slab replacement, striping and installation of new signs will occur throughout the zone from Andrade Road to north of Paloma Road. The work will happen within the limits of the roadway itself or, in case of some signs, close to the roadway.

*Construction Schedule*

Caltrans proposes to begin utility relocation in 2007 and 2008 and major project construction is expected to begin during the 2008-2009 construction season and construction is expected to last three years (Caltrans 2007). Night work will be necessary for timely construction (Caltrans 2007). Caltrans will begin the final landscaping restoration activities following roadway construction (Caltrans 2007). The major work for landscape contract will take place in one season and then requires three years of plant establishment to monitor and ensure successful plant development (Caltrans 2007). Concurrently, an on-site mitigation contract will take place (Caltrans 2007). The construction contractor will be required by Caltrans to submit a schedule of activities that will be reviewed by Caltrans for consistency with permitting requirements as stated in the contract specifications.

*Pre-Construction Activities*

Geotechnical Exploration.
According to the June 18, 2007, letter, ground water samples must be taken where proposed walls and other structures will be constructed prior to final design and construction. Gathering these samples requires geotechnical exploratory boring at sixty locations. According to June 18, 2007 letter and electronic mail messages from Caltrans, these bores need to begin as soon as possible so that the information can be included in contract specifications. Drilling will occur in areas along the roadway either within the existing pavement or adjacent to the roadway where structural features such as retaining walls will be constructed.

According to information received on July 10, 2007, in a pre-work visit the Contractor's responsible person for the Task Order work, Caltrans' Task Order Manager, and a Caltrans' biologist will determine the exact locations of the borings. Borings shall be done by direct push drilling and hand auguring, with soil and water samples collected in laboratory-supplied containers. Direct push drilling method consists of a dual tube sampling system with continuous small diameter (1 to 2 inch) steel tubes that are pushed or vibrated into the ground and generate minimal drill cutting waste. The length of time on each hole will depend on the total depth of the boring. Hand-auger holes that are 2.5 feet deep take approximately 15-30 minutes. Direct-push or hollow-stem-auger holes can take a whole day, depending on target depth and whether groundwater samples are to be collected. Mobile (i.e., pickup truck mounted) rigs will be needed for aerially deposited lead surveys next to roads. Clear acetate sleeves may be used for sample and core collection where samples will not be compromised by incompatibilities between the acetate and chemical contamination in the soil or ground water. Borings shall be backfilled with grout, neat cement or bentonite grout during the same day. The soil samples from hand auger borings will be retrieved from hand auger bucket and placed in laboratory-supplied glass jars with Teflon coated lids. Completed hand auger borings shall be backfilled to surface grade with soil cutting.

According to the June 18, 2007 letter, Caltrans assessed the proposed exploratory boring activities and their effects within the action area. Caltrans stated that all exploratory drilling scheduled to occur south of Mission Boulevard/State Route 238 is located in areas where activities will have no effect to listed species. Caltrans characterizes these locations as urban/developed landscape and that habitat for listed species is isolated from the action area by the presence of barriers. Geotechnical explorations south of Mission Boulevard may begin as early as July 2007.

According to Caltrans, the remaining thirteen bores will occur between North Mission Boulevard and Sheridan Road. Activities at these bore locations will not begin until after this biological opinion is issued.

Utility Relocation
Existing utilities will be relocated prior to the roadway contracts. Electrical and sanitary sewer lines will be reconstructed within city streets.

*Construction Activities*

The following discusses the major construction activities and the likely construction methods and equipment used for each activity. The actual construction methods and equipment is left to the contractor's discretion. Additionally, highway striping will occur throughout the length of the project area, but within paved areas. New highway signs will be located close to the roadway and involve little disturbance to adjacent areas. Much of these new signs, such as foundation excavation and trenching for electrical conduits will occur in areas that will already be disturbed by shoulder widening activities.

The activities listed below may be conducted sequentially or concurrently.

Earthwork Activities
This section describes grading operations that establish the initial elevation to start building the civil improvements (retaining walls, roadway pavement). Earthwork is the next step in site preparation after clearing and grubbing.

Earthwork for roadway pavement widening requires cutting and removal of the existing shoulder and the cutting and removal of adjacent soil to the limit of the new shoulder. As with clearing and grubbing, this will be accomplished with tracked end loaders and dump trucks. Incidental to this work will be removal of miscellaneous other items that fall to the outer edge of the new shoulder and may include pavement, curbs, dikes, catch basins and culverts. Removal of catch basins and culverts amounts to an interim condition as final design is inclusive of all required drainage measures. Control of drainage during the interim period is covered by the contractor's approved SWPPP plan.

Earthwork for retaining walls extends beyond the edge of the roadway earthwork. This is because a retaining wall's "toe" or meeting point of the wall with the roadway is at the edge of the shoulder. The extent of the additional earthwork depends on the type of wall. Earthwork for "soil nail" walls and "soldier beam and lagging" walls are approximately the thickness of the wall itself. For walls with footings, the extent of earthwork will be roughly half the total width of the footing plus 1.5 feet to allow for installation and removal of concrete formwork.

Where existing conditions are too low for the future roadway and must be built up, the fill itself is called "embankment". Placement of embankment is carried up to the level of aggregate base that lies just beneath the roadway itself. Embankment may be material cut from elsewhere on the project or imported fill and is placed over native soil by dump trucks in thin "lifts" of approximately 6 inches. The lifts are spread by bulldozer or rubber-tired end-loaders and then compacted with wheeled vibratory equipment.

Stockpiling of material, dust control, temporary water pollution control, slope protection and permanent erosion control are associated with earthwork. Material will be stockpiled as it is cut and deposited nearby for use for embankment or backfill. Stockpiles will be limited in scope to generally what will be removed or placed within a matter of days.

All earthwork tasks will be accompanied by dust control as required by the contract specifications. Dust control is implemented as conditions require and is accomplished by water sprayed from tank trucks especially out-fitted for this purpose.

Temporary slope protection is accomplished by draping plastic tarps over exposed cuts until construction and backfilling are completed and proper drainage measures are in place. The same is done for stockpiled material depending on the season.

Permanent erosion control may be accomplished by a number of measures, from placement of stone or concrete riprap culverts to planted material on steep surfaces. This is done at the end of construction to avoid damage to the finished product, but is done as soon as possible to lessen maintenance required for temporary measures. Where materials are inorganic and heavy, rubber tired end loaders are used to place control measures.

<u>Retaining Walls</u>

Retaining walls will be built in several locations in the work zone. Depending on site conditions, construction activities within the footprint of the retaining wall work will include earthwork cutting or filling for the new shoulder paving. Cutting activities will involve primarily excavation and hauling. Filling activities will involve importation of fill material followed by compaction with heavy equipment.

To the extent possible, material from cuts will be used for fill and backfill purposes. For some retaining walls, fill material behind the wall may be a combination of cut material and imported "structural fill". Structural fill is a very stable natural material composed of some combination of sand, gravel, or crushed stone. It has a high degree of uniformity that allows it to be readily compacted without danger of later swelling or shrinking. Compaction of fill material, whether cut from the site or imported structural fill, is accomplished by mechanical means with a combination of "jumping jacks" for narrow areas and wheeled, vibratory compactors for the remainder.

It is expected that there will be more cut material than fill sites can accommodate. Excess cut material will be disposed off-site at a location approved by the Resident Engineer.

Those areas that require retaining walls may need the wall to either retain a cut slope or fill beneath the new roadway. This project will use three different types of retaining walls, all constructed using steel reinforced concrete. Each type of wall to be used for each application is described as follows:

1. Cast-in-place concrete wall (with footings and on piles);
2. Soil Nail Walls; and
3. Soldier Pile Walls with tie backs.

Lane closures will be required for work to proceed and or for safety purposes. The closures may be conducted overnight and on weekends when traffic is lighter than daytime weekday traffic to minimize interference with periods of high traffic volume. This is expected to be true for nearly all aspects of retaining wall construction, striping and slab replacement activities. The contractor will access work sites via the roadway.

Cast-In-Place with Spread Footings

For this project, cast-in-place with spread footing retaining walls are used for cut and fill slopes. Wall construction uses conventional steel reinforced concrete walls placed on a flat base called "spread footings."

The spread footings on this type of wall prevent the walls from tipping due to pressure of the soil they are retaining. Construction requires that the slope be cut slightly wider than the footing width to accommodate footing formwork. Rubber-tired excavators will be used to excavate the slope. Semi-trailer dump trucks will haul material on and off site.

Footings are relatively narrow, therefore the excavation behind the wall tends to be less than 6.5 feet. A certain amount of excavated material will be stockpiled at the work site for backfill once wall construction is completed. Excess material will be hauled as described above for use in fills or disposed of properly.

Footing formwork will be installed by hand. Concrete for the footings will be poured directly from the ready mix truck whenever possible. The trucks will be located either on the freeway or within the designated work area outside the Environmentally Sensitive Areas or, where possible, from local streets. When any of these locations are impractical for some reason, then concrete will be pumped from a truck staged along or adjacent to the roadway.

After the footing is poured, wall reinforcing steel and framework will be erected. Depending on the size of the wall, erection of reinforcing steel and formwork may be entirely by hand. Where additional lifting capacity is needed, light, rubber-tired cranes may be used.

Walls will also be poured directly from the truck whenever possible. If the wall is too high to pour from the truck, concrete will either be pumped (most likely) or bucketed with the use of a light crane.

In instances where the wall is retaining a cut slope, backfilling of the slope behind the wall will be accomplished with rubber-tired excavators (end-loaders) and will be mechanically compacted with a combination of "jumping jacks" and wheeled compactors.

In instances where the wall is retaining an embankment, after the wall is in place, embankment material will be placed as described in the Earthwork Activities section. Once backfilling is completed, aggregate base, the roadway and shoulder will be constructed on top of the embankment material.

Fill will be placed and compacted over the spread footing on the side of the wall away from the road, in the same manner as embankment material and will be followed by permanent erosion control or planting as required.

All concrete must be "cured" after it is poured to prevent moisture loss until completion of the initial curing period. Footings will be cured by use of either a spray-on curing compound or by covering with burlap that is kept wet for seven days. Keeping the formwork in place for seven days will cure the faces of retaining walls that will be visible. The non-visible face may be cured by any of the methods mentioned. Concrete bridge decks may be cured by use of curing compounds or wetted burlap. Other structure faces will be cured in the same manner as for retaining walls, depending on whether the face is visible or not.

<u>Soil Nail Retaining Wall</u>
Soil nail retaining walls retain cut slopes by means of a steel reinforced concrete wall held in place with "soil nails."

"Soil nails" are rods that are inserted into pre-drilled holes into the hillside. The holes are slightly larger than the diameter of the rods, the empty cavity is then pumped with grout. The purpose of the nails is to take the place of spread footings and enable the wall to hold the retained soil in place. This technique, while more expensive than spread footings, eliminates the portion of excavation behind the wall associated with spread footings.

The progression of construction is top down; meaning that cutting of the slope starts at the top with each row of soil nails being installed before the next cut down is made. In this method, all construction activities are on the side facing the road. Holes for the nails are drilled from a three-axle truck mounted rig. A pump will be used for grouting and pouring of concrete.

Each nail projects slightly out of the cut slope, allowing the steel reinforcing for the wall to attach to the nails. When the wall is poured, the concrete completes the mechanical fastening of the wall to the nails.

Cutting of the slope will be with rubber-tired excavators. The cut extends approximately two feet in below the final surface level of the roadway. This "toeing in" not only accommodates the base material for the roadway but also firmly fixes the bottom of the wall to prevent slipping.

Soldier Pile and Lagging Retaining Wall

A soldier pile and lagging wall retains cut slopes and somewhat resembles a landscaping retaining wall, with the vertical posts being the soldier piles and the horizontal boards between the posts being the lagging.

The soldier piles eliminate the need for spread footings. In the installation technique specified for this project, pre-drilled holes for piles also eliminate the sound and vibrations associated with conventional pile driving.

Similarly to soil nail construction, work is performed from the top down. First a drill rig drills holes for the piles after with steel "I" shaped piles are inserted into the holes. To fix the piles in place, the holes are then pumped full of lean concrete, moderately low strength cement grout. After placement of the lean concrete, slope excavation starts down the slope and extends back into the slope about one half the width of the pile. As excavation proceeds downward, pre-cast concrete lagging planks are inserted in between the piles. This proceeds to a depth equal to the bottom of the roadway base. Once lagging is in place, steel reinforcement is placed against the face of the wall followed by formwork. Once the formwork is ready, concrete is placed for the full height of the wall, providing the ultimate strength and a uniform appearance.

Due to the steep nature of slopes within the project footprint, the contractor may create a ramp on the roadway side of the slope to facilitate movement of the drilling rig. The ramp will be created with a rubber-tired excavator. Either a tracked or a rubber-tired crane will be used to pace the piles. The lean concrete will be pumped around the piles. Lagging will be placed with a rubber-tired crane as will steel reinforcement and concrete forms for the facing. As there is no spread footing excavation with this type of installation, compaction is not required. Excavated material will be hauled off either for use as fill or disposed of properly.

At certain locations along the wall, stabilizing tie-backs will be installed. These tie-backs are long, rod-like anchors that are installed in pre-drilled holes that are perpendicular to the face of the wall and with a slight downward slope. Tie-backs provide additional holding strength and eliminate the need to drill piles deeper. The tie-back holes are drilled with a truck-mounted rig. After the tie-back is place in hole, the holes are grouted.

Roadway and Drainage

Roadway work follows earthwork and proceeds once cutting or filling, as appropriate, are completed. The first step is placement of new granular base material. This material will be imported by semi-trailer dump trucks and placed in layers for compaction by lifts, similar to the process described for embankment fill. This new base material will be compacted most likely using wheeled vibratory compactors.

Pavement work will proceed once a sufficient amount of base is ready to allow continuous paving. Paving machines are usually automated, string-guided machines on crawler treads. Asphalt will be transferred into paving machines by hauling trucks. This work is not likely to extend beyond the limits of the new roadway.

Drainage work consists of built up asphalt curbs intended to direct flow to drainage systems. Drainage inlets and culverts will be extended and modified to match the widening. This work closely follows asphalt paving and is also performed by a continuous forming machine that forms the curb as it moves. This type of machine generally runs on rubber tires. The outside wheels of this machine ride on the soil next to the shoulder.

*Roadway Appurtenances*

Roadway appurtenances include installation of:

1. New and relocated roadways signs;
2. New sign structures;
3. Highway lighting;
4. Installation of guard rails and/or concrete barriers;
5. Installation of electrical equipment; and
6. Pavement markings, pavement delineation, roadway markers and other traffic control devices.

*Roadway Rehabilitation*

Roadway rehabilitation includes:

1. Concrete slab removal and replacement with rapid strength concrete pavement;
2. Pavement surface grinding; and
3. Cold-planting and overlay of asphalt concrete pavement.

*<u>Structures North of Mission Boulevard/SR 238</u>*
Work associated with the bridges north of North Mission Boulevard/SR 238 will occur at Vargas Road and Andrade Road. At Vargas Road, the bridge will be widened to accommodate the new roadway off ramp. At Andrade Road the existing soil shoulder next to the west abutment is being removed to accommodate the widening work and will be replaced with a concrete barrier.

*Vargas Road Structure*
Work will occur along the shoulder and includes demolition of the existing concrete barrier, construction of new support columns with associated footings, demolition and expansion of wing walls, additional fill behind the wing walls and installation of new girders to establish the new lane.

Nearly all work at the bridge deck level will require lane closures and night work for access and safety. Otherwise, to the extent possible, all other work will be performed during daytime work hours.

Concrete demolition will likely be accomplished by hydraulic "hoe ram" devices mounted on tracked backhoes. Hoisting and loading for disposal will likely be by rubber-tired excavators and semi-dump trucks. Earthwork associated with footings and wing walls is likely to be accomplished by rubber-tired excavators and semi-dump trucks. Fill material under the roadway approaches as well as granular roadway base will be placed in layers and compacted by wheeled vibratory machines. Outside the wing walls on embankment slopes, the soil material will be placed by rubber-tired excavators and compacted to landscape requirements by steel wheeled compactors appropriate for working on steep grades.

Construction of the Vargas Road box girders starts once the wing walls are in place. The new box girder is poured in place, meaning that it is constructed entirely on-site. This involves installation of falsework to support the concrete forms. Both the falsework and forms will be installed by means of cranes, most likely tracked cranes that will not require frequent repositioning. Steel reinforcement will be installed during the formwork. Once formwork and steel are in place, the box girder will be poured by means of concrete pumps. After concrete has reached design strength the falsework will be removed. Deck paving will utilize a motor driven device called a "mechanical screed" that levels and strikes-to-grade concrete poured in front of it by ready mix trucks.

Rubber-tired excavators and semi-dump trucks will remove the earth embankment against the west abutment. This material will be used for fill if suitable or hauled to an approved dump site. After removal of the fill, new pavement will be placed as part of the general paving work. This will be followed by installation of a new concrete barrier against the abutment. It will be similar in size and form to K-rails.

*Ramp Metering*

Ramp metering will occur throughout the entire project footprint. However, it is the only activity occurring north of Andrade Road off-ramp to Stoneridge Drive and will require minimal work outside the paved areas. Ramp metering involves placing electrical conduits under the existing pavement and next to the edge of the existing shoulders, placement of loop detectors in the existing pavement and the placement of electrical cabinets. The proposed work consists of incidental excavation and trenching (approximately one foot wide) for the purpose of placing the electrical conduit.

*Site Preparation Activities*

Installation of Environmentally Sensitive Area Fencing

Caltrans will designate all appropriate areas around the boundary of the project footprint from North Mission Boulevard/SR 238 to Andrade Road and within ramp metering areas north of Andrade Road to Bernal Road, as Environmentally Sensitive Areas. These areas will be delineated using high visibility orange plastic fencing staked every eight feet. The fencing is intended to prohibit the contractor from entering, storing or conducting any construction activities within the Caltrans right-of-way that is designated as an Environmentally Sensitive Area. The construction footprint, bound by the fencing, will include construction work areas, access routes and staging areas. Clearing and grubbing of the project footprint will discourage use by dispersing and wandering listed species that may use the project action area.

Additionally, areas throughout the entire project area will have Environmentally Sensitive Areas. Environmentally Sensitive Areas south of Mission Boulevard/SR 238 may be installed to prevent contractors from removing certain trees, or to prohibit contractors from entering California Department of Fish and Game and United States Army Corps of Engineers jurisdictional areas.

Once the project footprint has been delineated by the fencing, portions of the footprint where construction activities will occur will then be cleared of vegetation. Prior to vegetation clearing, a Service-approved biologist will conduct pre-construction surveys of all areas the contractor may use and those areas scheduled for clearing and grubbing. Removal of vegetation will help discourage wildlife from entering the project footprint.

Installation of Preliminary Water Pollution Control Measures

As required by the SWPPP, the contractor must install required water pollution mitigation and control measures. Caltrans must approve these measures before work starts. Ordinarily, this is accomplished by hand and involves minor equipment, often limited to a delivery truck.

Installation of Temporary Fences
Similar to implementation of the SWPPP measures, all temporary fences must be installed and approved before work can start. Fencing of this sort is installed by hand on hand-driven posts.

Roadway Preparation
As required, K-rail will be installed before work begins. Typically the rail will be delivered on semi-trailer flat beds and off-loaded by rubber tire cranes or forklifts. K-rail placement is done at night to allow freedom of movement for placement accuracy.

Since k-rail often delineates new traffic lanes or boundaries, it will be accompanied by changes to lane striping. Depending on job requirements, existing striping in conflict with the new lane configuration will be removed by grinding or painted over with an opaque paint. New temporary striping is then installed either by truck or by hand depending on the quality and nature of the striping required.

Clearing and Grubbing
The term "clearing and grubbing" refers to removal of organic material from beneath the roadway to eliminate possible future subsidence from decomposition. While the actual construction methods and equipment for clearing and grubbing activities are left to the contractor's discretion, clearing and grubbing typically involves the use of tracked end loaders and dump trucks. Clearing and grubbing will not occur until a Service-approved biologist, or their designee, has conducted pre-construction surveys for listed species and general wildlife. Tree removal will be accomplished in accordance with the Migratory Bird Treaty Act.

*Permanent vs. Temporary Effects*

Caltrans described the permanent effects on listed species habitat as those that are converted to hardscape or otherwise modified as to never again support vegetation or wildlife. Temporary effects were considered to be areas that might be subject to vegetation removal and extensive soil disturbance due to excavation, grading or placement of dirt fill, or to lesser degrees of disturbance due to creation of temporary access roads, use of staging areas with storage of construction materials and parking heavy equipment. Areas subject to temporary disturbance will be restored so that they once again support vegetation and provide wildlife habitat.

*Onsite Restoration*

Permanent Erosion Control Planting
All areas subject to temporary disturbance, whether from construction access or temporary ground disturbance, will be restored with vegetative cover within three to six months after hydroseeding. Small mammals are expected to re-occupy these temporary impact areas to the extent that the existing degraded, roadside impact areas are currently occupied by these species. Temporary impact areas are expected to obtain baseline habitat values within three to six months following completion of the contract.

Riparian Replacement Planting at Station 77+45

There is one location (station 77+45) where a retaining wall will require removal of riparian vegetation along unnamed creek #16. In this location, Caltrans will prepare an erosion control and planting plan to replace riparian vegetation and provide slope stability in accordance with California Department of Fish and Game requirements under Fish and Game Code §1600-1616. Caltrans will provide replacement plantings at 1:1 at this location. Due to the potential shading effect of the proposed retaining wall, Caltrans is also providing replacement plantings at 1:1 at the on-site mitigation at Sabercat Creek, for a total replacement ratio of 2:1. This on-site mitigation is described in further detail below.

Landscaping Contract

Following construction of the roadway features, a landscaping contract will replace plantings that were removed as part of the roadway contract. The landscaping contract will open immediately after the construction contract is closed, at which point planting and installation of irrigation facilities will begin. This contract will remain open for approximately three years after plant installation to accommodate a plant establishment period. During the plant establishment period, the contractor is responsible for maintaining irrigation facilities and providing replacement plantings.

Onsite Mitigation at Sabercat Creek

On-site mitigation for impacts to U.S. Army Corps of Engineers waters and wetlands and California Department of Fish and Game riparian habitat will be conducted at Sabercat Creek. Additionally, oak trees within the project limits will be removed. Oak woodlands are protected under Senate Concurrent Resolution No. 17. Caltrans will provide replacement plantings for these oak trees. This mitigation site is intended to mitigate for impacts to the above mentioned habitats for both the Sunol Grade Southbound and Sunol Grade Northbound Projects.

The proposed roadway project will result in small impacts to U.S. Army Corps of Engineers waters and wetlands located south of Mission Boulevard/SR 238. Caltrans will obtain a Nationwide Permit #14 from the U.S. Army Corps of Engineers to fill one wetland that is approximately 0.17 acres.

Impacts to California Department of Fish and Game riparian habitat will occur from construction of retaining wall at Station 77+45. In addition to providing replacement plantings on-site at 1:1, additional riparian vegetation will be planted at Sabercat Creek at 2:1.

Conceptual Design and Location

The on-site mitigation at Sabercat Creek is still in the preliminary planning phase and actual design is forthcoming. At this location, Sabercat creek and unnamed creek #22, come within close proximity of each other and then are connected under I-680 and emerge as one drainage along the southbound side of I-680.

The mitigation site is located along northbound I-680. Caltrans proposes to daylight a small section of each drainage and create a wetland within the Caltrans right-of-way. An overflow berm will be created within the wetland that will then connect to the existing box culvert. The berm is designed to maintain water levels, but allow for flows above the berm's grade to drain into a box culvert that leads back into Sabercat Creek.

Daylighting portions of each creek allow for the extensions of waters of the U.S. and, combined with creation of a wetland, provide an opportunity for restoration and creation of riparian habitat. Upland oak woodland habitat will be enhanced around the wetland and riparian habitats.

The existing slopes along Sabrecat Creek are severly eroded and sac concrete has broken away from the creek banks and has fallen within Sabrecat Creek. This project will remove all such concrete and recontour the creek banks to provide stability. Significant bioengineering is required to ensure that the creek banks are stable. Exact erosion control mechanisms are still being explored, but one option is the use of willow mats as suggested to Caltrans by Marcia Grefsrud of the California Department of Fish and Game. Willow mats are basically woven willows that are secured to creek banks. The willows take root and form a stable and vegetated bank. The feasibility and appropriateness of this option is being explored along with other bioengineering mechanisms.

Construction Considerations

Sabercat Creek is intended as a mitigation project. Accordingly, Caltrans will ensure that the contractor minimizes the earthwork and ground disturbances to that necessary to complete the work. This will be accomplished by delineating the work areas using Environmentally Sensitive Area fencing. The contractor will be prohibited from entering, storing or conducting any construction activities within the Caltrans right-of-way that are designated as an Environmentally Sensitive Area.

Both Sabercat Creek and unnamed creek #22 are perennial creeks. In an effort to minimize downstream impacts from silt and sediment, a temporary creek diversion will be required for both creeks. Work within these creeks will be limited to the dry season defined as May 15 to October 15.

Construction Schedule

Caltrans anticipates including the grading and drainage requirements within the roadway contract. As part of the roadway contract, the grading and drainage will be a first order to work for the contractor (permitting the seasonal requirement). Once the drainage and grading is complete, a separate contractor will implement the remaining bioengineering designs and install the native wetland, riparian and upland oak vegetation according to the contract planting plans, still to be developed. Under this schedule, installation of the mitigation will be completed prior to the roadway contract completion.

Monitoring and Maintenance Activities
The Sabercat Creek mitigation site will be monitored and maintained for approximately three years, or until the site meets the success criteria developed in the Comprehensive Mitigation and Monitoring Plan that is currently being developed. Details of success criteria, site maintenance and monitoring activities will be further refined in this report. The report is anticipated to be completed at the district level by August 2007. Following district approval, the Comprehensive Mitigation and Monitoring Plan will be distributed to the U.S. Army Corps of Engineers, California Department of Fish and Game, and the Regional Water Quality Control Board.

*Proposed Conservation Measures*

According to their July 2007 response, Caltrans proposes to avoid, minimize, and compensate for effects to listed species by implementing the following measures:

1. Caltrans will compensate for effects to the Alameda whipsnake, California red-legged frog, and California tiger salamander through one of the options listed below:

    a. Contribute to the purchase of habitat acquisition which must comply with FHWA policy. Caltrans would contribute the equivalent of 22.41 acres of the total acquisition and the location of the acreage would be determined later in cooperation with the Service and the purchasing entity; or

    b. An in lieu fee agreement, which must comply with FHWA policy for Federal aid participation. Caltrans would contribute the equivalent of 22.41 acres of the total acquisition and the location of the acreage would be determined later in cooperation with the Service and the purchasing entity; or

    c. Caltrans will purchase 10.92 acres (credits) of habitat for all three species and 11.49 acres (credits) for the California tiger salamander and the California red-legged frog from a Service-approved mitigation bank.

2. Environmentally Sensitive Area fencing will be used to delineate the road widening work area between Mission Boulevard (SR 238) and just north of Andrade Road, and for trenching for ramp metering at the SR 84/Calaveras Road and Sunol interchanges.

3. A Service-approved biologist or their designee will conduct pre-construction surveys for listed species within the project footprint between North Mission Boulevard/SR 238 and Bernal Road. In the event that a listed species is discovered during pre-construction

surveys, a Service-approved biologist will relocate the species outside of the project footprint.

4. A Service-approved biological monitor will be on-site for all ground disturbing activities that may result in take of listed species in the area between Mission Boulevard (SR 238) and just north of Andrade Road, and for trenching for ramp metering at the SR 84/Calveras Road and Sunol interchanges.

5. A qualified biologist will conduct employee education training for construction employees working on ground disturbing activities that may result in the take of listed species in the area between Mission Boulevard (SR 238) and just north of Andrade Road, and for trenching for metering on ramps at the SR 84/Calaveras Road and Sunol interchanges. All construction crews will be required to attend a presentation that addresses listed species that have the potential to occur within the project limits, avoidance and minimization measures, terms of the biological opinion, and other related matters. The program will consist of a brief presentation by persons knowledgeable about the California tiger salamander, California red-legged frog, and Alameda whipsnake. The program will included the following: a description of the species and their habitat needs; photographs of these species; an explanation of the legal status of these species and their protection under the Act; and a list of measures taken to reduce effects to these species during project construction.

6. Temporary impacted areas will be re-contoured and reseeded following construction to provide habitat consistent with that existing.

7. Best management practices (BMPs), as indentified by the Regional Water Quality Control Board and the Storm Water Pollution Prevention Plan (SWPPP), will be implemented to control erosion during and after project implementation.

8. Prior to commencing construction, the contractor is required to submit to Caltrans, for review and approval, a SWPPP. This plan will address all aspects of water and pollution control during the period of construction up until the point that the permanent work is functional and accepted.

9. A Service-approved biologist will be designated for the project. This qualified biologist(s) will be on-site during all activities that may result in the take of the Alameda whipsnake, California tiger salamander, and/or California red-legged frog. The qualifications of the biologist(s) will be presented to the Service for review and written approval prior to ground-breaking at the project site. The biologist(s) will be given the authority, through the Resident Engineere to stop any work that may result in take of these listed animal species. If the biologist(s) exercises this authority, the Service and the California Department of Fish and Game will be notified by telephone and electronic mail within one working day. The Service contact will be Chris Nagano, Deputy

Assistant Field Supervisor, Endangered Species Program at the Sacramento Fish and Wildlife Office at telephone 916/414-6600 or electronic mail at Chris_Nagano@fws.gov.

10. The resident engineer will halt work and immediately contact the Service-approved, project biologist and the Service in the event that an Alameda whipsnake, California tiger salamander, or California red-legged frog gain access to a construction zone. The resident engineer will suspend all construction activities in the immediate construction zone until the animal leaves the site voluntarily or is removed by the biologist to a release site using Service-approved transportation techniques.

11. To minimize temporary disturbances, all project-related vehicle traffic will be restricted to established roads, construction areas, and other designated areas. These areas also should be included in pre-construction surveys and, to the maximum extent possible, should be established in locations disturbed by previous activities to prevent further adverse effects. Project-related vehicles will observe a 20-mile per hour speed limit within construction areas, except on County roads, city streets, and State and Federal highways; this is particularly important at night when the California tiger salamander and California red-legged frog are most active. To the maximum extent possible, night-time construction will be minimized. Off-road traffic outside of designated project areas will be prohibited.

12. Project employees will be provided with written guidance governing vehicle use, speed limits on unpaved roads, fire prevention, and other hazards.

13. To eliminate an attraction to predators of the Alameda whipsnake, California tiger salamander, and/or California red-legged frog, all food-related trash items such as wrappers, cans, bottles, and food scraps will be disposed of in closed containers and removed at least once a working day from the construction areas.

14. To avoid injury or death of the Alameda whipsnake, California tiger salamander, and/or California red-legged frog, no firearms will be allowed on the project site except for those carried by authorized security personnel, or local, State, or Federal law enforcement officials.

15. To prevent harassment, injury or mortality of Alameda whipsnake, California tiger salamander, and/or California red-legged frog or destruction of their dens or burrows by dogs or cats, no canine or feline pets will be permitted in the action area.

16. All fueling and maintenance of vehicles and other equipment will occur at least 65 feet from any riparian habitat or aquatic habitat or if not feasible, appropriate water pollution control measures will be implemented as approved by the Service-approved biologist.

17. All grindings and asphaltic-concrete waste will be stored within previously disturbed areas absent of habitat and at a minimum of 150 feet from any culvert, or drainage feature or if not feasible, appropriate water pollution control measures will be implemented as approved by the Service-approved biologist.

18. For seasonal avoidance of the California red-legged frog, construction will not occur from November 1 through March 31 to the extent practicable. If any work remains to be completed after November 1, exclusion fencing will be placed in those areas where construction needs to be completed.

19. Caltrans will install exclusion fencing for the California tiger salamander around any work area if necessary to continue construction activities outside the working window of April 16 to October 14. Exclusionary fencing will consist of taut silt fabric; 24 inches in height, tacked at 10-foot intervals, with the bottom buried 6 inches below grade. Exclusion fencing will be maintained so that it is intact during rain events and 24 hours after any rain event.

20. The construction area will be delineated with high visibility temporary fencing at least four feet in height, flagging, or other barrier to prevent encroachment of construction personnel and equipment onto any sensitive areas during project work activities. Such fencing will be inspected and maintained daily until completion of the project. The fencing will be removed only when all construction equipment is removed from the site. No project activities will occur outside the delineated project construction area.

21. If requested, before, during, or upon completion of ground breaking and construction activities, Caltrans will allow access by Service and/or California Department of Fish and Game personnel to the project site to inspect project effects to the Alameda whipsnake, California tiger salamander, and California red-legged frog, and their habitats.

22. Prior to any ground disturbance, pre-construction surveys will be conducted by a Service-approved biologist for the Alameda whipsnake, California tiger salamander, and California red-legged frog. These surveys will consist of walking surveys of the project limits and adjacent areas accessible to the public to determine presence of the species.

23. Only Service-approved biologist(s) who are familiar with the biology and ecology of the Alameda whipsnake, California tiger salamander, and California red-legged frog will capture or handle these species.

24. Biologists will take precautions to prevent introduction of amphibian diseases to the action area by disinfecting equipment and clothing as directed in the October 2003 California tiger salamander survey protocol titled, Interim Guidance on Site Assessment and Field Surveys for Determining Presence or a Negative Finding of the California

Tiger Salamander and the recommended equipment decontamination procedures within the Service's California Red-Legged Frog Survey Guidance. Both items are available at the Service's Sacramento office website (http://www.fws.gov/sacramento/es/protocol.htm). Disinfecting equipment and clothing is especially important when biologists are coming to the action area to handle salamanders or frogs after working in other aquatic habitats.

25. To prevent inadvertent entrapment of Alameda whipsnake, California tiger salamanders, and California red-legged frogs during construction, all excavated, steep-walled holes or trenches more than 2 feet deep will 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 must be thoroughly inspected for trapped animals. If at any time a trapped listed animal is discovered, the on-site biologist will immediately place escape ramps or other appropriate structures to allow the animal to escape, or the Service and/or California Department of Fish and Game will be contacted by telephone for guidance. The Service will be notified of the incident by telephone and electronic mail within one working day.

26. Plastic mono-filament netting (erosion control matting) or similar material will not be used at the project site because Alameda whipsnakes, California tiger salamander, or California red-legged frog may become entangled or trapped in it. Acceptable substitutes include coconut coir matting or tackified hydroseeding compounds.

27. Injured Alameda whipsnakes, California tiger salamanders, and/or California red-legged frogs will be cared for by a licensed veterinarian or other qualified person such as the on-site biologist; dead individuals of any of these three listed species will be preserved according to standard museum techniques and held in a secure location. The Service and the California Department of Fish and Game will be notified within one (1) working day of the discovery of death or injury to an Alameda whipsnake, California tiger salamander, and/or California red-legged frog that occurs due to project related activities or is observed at the project site. Notification will include the date, time, and location of the incident or of the finding of a dead or injured animal clearly indicated on a USGS 7.5 minute quadrangle and other maps at a finer scale, as requested by the Service, and any other pertinent information. The Service contacts are Chris Nagano, Deputy Assistance Field Supervisor, Endangered Species Program at the Sacramento Fish and Wildlife Office (916/414-6600), and Scott Heard, Resident Agent-in-Charge of the Service's Law Enforcement Division at 916/414-6660. The California Department of Fish and Game contact is Mr. Ron Schlorff at 1416 9th Street, Sacramento, California 95814, (916) 654-4262.

28. Caltrans will submit a post-construction compliance report prepared by the on-site biologist to the Sacramento Fish and Wildlife Office within forty (40) working days following project completion or within sixty calendar days of any break in construction

activity lasting more than forty (40) working days. This report will detail (i) dates that construction occurred; (ii) pertinent information concerning the success of the project in meeting compensation and other conservation measures; (iii) an explanation of failure to meet such measures, if any; (iv) known project effects on the Alameda whipsnake, California tiger salamander, and California red-legged frog, if any; (v) occurrences of incidental take of any of these three species; (vi) documentation of employee environmental education; and (vii) other pertinent information. The reports will be addressed to the Deputy Assistant Field Supervisor of the Endangered Species Program, Sacramento Fish and Wildlife Office.

## Status of the Species and Environmental Baseline

### Alameda Whipsnake

The Alameda whipsnake was federally listed as threatened on December 5, 1997, (Service 1997). The animal was listed as threatened by the State of California in 1971. Approximately 406,598 acres of critical habitat was designated for the Alameda whipsnake within Contra Costa, Alameda, Santa Clara, and San Joaquin counties on October 3, 2000 (Service 2000). The critical habitat was vacated and remanded on May 9, 2003; proposed again on October 18, 2005; and designated on October 2, 2006 (Service 2006). A draft Alameda whipsnake recovery plan was included in the Draft Recovery Plan for Chaparral and Scrub Community Species East of San Francisco Bay, California, issued in November 2002 (Service 2002a).

The Alameda whipsnake is a slender, fast-moving, diurnal snake with a narrow neck and a relatively broad head with large eyes. The snake's dorsal surface is sooty black with distinct yellow-orange stripes along each side. The coloration of the snake's ventral surface varies along its length: the anterior portion is orange-rufous; the midsection is cream colored; and the posterior and tail are pinkish. Adults range in length from 3 to 4 feet (Service 1997).

The Alameda whipsnake is one of two subspecies of California whipsnake (*Masticophis lateralis*). The Alameda whipsnake is distinguished from the other subspecies, the chaparral whipsnake (*M. l. lateralis*), by its sooty black dorsum; wider lateral yellow-orange stripes; the lack of a dark line across the rostral; an uninterrupted light stripe between the rostral and eye; and the virtual absence of spotting on the venter of the head and neck.

The Alameda whipsnake inhabits the inner Coast Ranges in western and central Contra Costa and Alameda counties (Jennings 1988; McGinnis 1992; Swaim 1994) where it is found in a variety of vegetation communities including chamise-redshank chaparral, mixed chaparral, coastal scrub, annual grassland, blue oak-foothill pine, blue oak woodland, coastal oak woodland, valley oak woodland, eucalyptus, redwood, and riparian (CDFG 2006).

Scrub and chaparral communities are the primary habitat types essential for providing space, food, and cover necessary to sustain all life stages of the Alameda whipsnake. Associated scrub habitat typically consists of Diablan sage scrub, coyote bush scrub, and chamise chaparral (Swaim 1994), and is also classified as coastal scrub, mixed chaparral, and chamise-redshank chaparral (CDFG 2006). Swaim (1994) found that core scrub habitat areas (areas of concentrated use by Alameda whipsnakes, based on telemetry and trapping data) tended to occur on east, southeast, south or southwest facing slopes and were within 500 feet of open or partially-open canopy or grassland habitat. Alameda whipsnakes have also been found in open chaparral stands with a northern exposure (K. Swaim, Swaim Biological Consulting, personal communication with the Service 2004). As a result of incidental observations and trapping surveys, Alameda whipsnakes have been discovered greater than 600 feet and as much as 21,600 feet from primary scrub and chaparral habitat (K. Swaim, Swaim Biological Consulting, personal communication with the Service 2004).

Alameda whipsnakes are also known to use other habitat types adjacent to their primary scrub and chaparral habitat. McGinnis (1992) has documented Alameda whipsnakes using oak woodland/grassland habitat as a corridor between stands of northern coastal scrub. Grassland habitats appear to be used extensively by male Alameda whipsnakes during the spring mating season (Swaim 1994). Females appear to use these grassland areas more extensively after mating (Swaim 1994), possibly looking for suitable egg-laying sites or for dispersing to other scrub habitat (K. Swaim, Swaim Biological Consulting, personal communication with the Service, 2002). Egg-laying sites have been found close to scrub communities in grasslands with scattered shrubs (Swaim 1994) and in true scrub communities (K. Swaim, Swaim Biological Consulting, personal communication with the Service, 2002). These other habitat areas may be important in the early life history stages of hatchling whipsnakes (Swaim 1994). Rock outcrops, talus, and burrows (mating habitats) need to be within dispersal range of scrub and grassland habitat (egg-laying habitats). Swaim (1994) also observed Alameda whipsnakes mating in rock outcrops.

Alameda whipsnakes require plant canopy covers that supply a suitable range of temperatures, corridors of plant cover and retreats (including rock outcrops) sufficient to provide dispersal pathways between areas of habitat, and plant community patches of sufficient size to prevent the deleterious effects of isolation, such as inbreeding or the loss of a subpopulation due to a catastrophic event. Specific habitat features used by Alameda whipsnakes include, but are not limited to, small mammal burrows, rock outcrops, talus, soil crevices, debris piles, and other forms of cover to provide temperature regulation, shelter from predators, egg-laying sites, and winter hibernaculum (Swaim 1994). Adequate insect populations are also necessary to sustain their primary lizard prey populations.

Survey data suggests that the Alameda whipsnake exhibits a bimodal season activity pattern with peak activity in the spring and late summer/early fall (Swaim 1994). Male Alameda whipsnakes appear to be more active than females in the spring, which is likely attributed to breeding season behavior (Swaim 1994). The breeding season is thought to be between March and June, and mating appears to typically occur near the female's hibernacula (Swaim 1994). During the mating season, females likely remain near their retreat sites while males disperse throughout their home ranges. In one study, Swaim (1994) estimated a mean individual home range size for four males was 13.6 acres, and 8.4 acres for two females. Gravid female Alameda whipsnakes likely lay eggs between May and July (Stebbins 2003). Clutch sizes are typically between 6 to 11 eggs and the young hatch and emerge in the late-summer to early-fall (Swaim 1994). Male and female snakes appear to exhibit similar movement and activity patterns following the breeding season (Swaim 1994). Increases in late summer/early fall activity may be attributed to emergence of hatchling whipsnakes and the increased availability of hatchling lizard prey (Swaim 1994). Alameda whipsnakes typically retreat into winter hibernacula in November and emerge in March.

Alameda whipsnake above-ground activity cycles appear to be highly temperature dependent. Alameda whipsnakes have the highest documented mean active body temperature (92.1 degrees Fahrenheit) and degree of body temperature stability (stenothermy) than other snake species under natural conditions (Swaim 1994). Maintenance of such a high body temperature likely enables the snake to capture its characteristically fast-moving prey (Swaim 1994). Open and partially open and/or low growing shrub communities provide a mosaic of sunny and shady areas that apparently allow the snake to effectively maintain sufficient body temperature while providing cover from potential predators (Swaim 1994).

The Alameda whipsnake is an active diurnal predator and hunts by holding its head high off the ground to peer over vegetation or rocks for potential prey. This foraging strategy corresponds with the open habitat with which this species is typically associated with (Swaim 1994). Its diet includes lizards, skinks, frogs, small mammals, snakes, nesting birds, and insects. Features such as small mammal burrows, rock outcrops, and talus provide important habitat components such as shelter from predators, egg-laying sites, over-night retreats, and winter hibernacula (Swaim 1994). Their lizard prey is often abundant in these areas as well. Lizards, especially the western fence lizard, appear to be the Alameda whipsnake's primary prey item (Stebbins 2003; Swaim 1994).

Urban development has fragmented the once contiguous range of the Alameda whipsnake into the following five population centers: (1) the Tilden-Briones population (Sobrante Ridge, Tilden/Wildcat Regional Parks to the Briones Hills, in Contra Costa County); (2) the Oakland-Las Trampas population (Oakland Hills, Anthony Chabot area to Las Trampas Ridge, in Contra Costa County); (3) the Hayward-Pleasanton Ridge population (Hayward Hills, Palomares area to Pleasanton Ridge, in Alameda County); (4) the Mount Diablo-Black Hills population (Mount Diablo vicinity and the Black Hills, in Contra Costa County); and (5) the Sunol-Cedar Mountain population, (Wauhab Ridge, Del Valle area to the Cedar Mountain Ridge) (Service 1997).

Habitat fragmentation appears to have resulted in little to no gene flow or interchange between the five populations. Interchange between the Tilden-Briones, Oakland-Las Trampas, and Hayward-Pleasanton Ridge populations appears to depend on dispersal over the Caldecott Tunnel in Contra Costa County; under State Route 580 in Alameda County (at the Eden Canyon interchange); under the Dublin Boulevard undercrossing; or where San Lorenzo Creek passes under the highway (Service 1997). Interchange between the Hayward-Pleasanton Ridge and Sunol-Cedar Mountain populations depends on dispersal along Alameda Creek in Alameda

County; crossing under I-680 (where the creek passes under the highway); or crossing under the highway at Scott's Corner along Vallecitos Creek, or where two unnamed tributaries to Arroyo de la Laguna cross under I-680 north of Scott's Corner (Service 1997). The Mount Diablo-Black Hills population appears to be completely isolated from the other populations (Service 1997).

Habitat fragmentation makes some Alameda whipsnake populations more vulnerable to extinction. Habitat patches with high edge to interior ratios are known to provide less value for some species than round or square patches (Jimerson and Hoover 1991; Saunders et al. 1991). In general, the species most prone to extinction in fragmented habitats are those that depend on native vegetation; require combinations of different habitat types; require large territories; and exist at low densities (Saunders et al. 1991). Alameda whipsnakes have been associated with a variety of habitats for different natural history functions. They are primarily associated with native Diablan sage scrub, but are known to forage in adjacent grasslands, and migrate along riparian corridors. Consistent low trap success and high recapture rates suggests Alameda whipsnakes may be sparse, even in suitable habitat (Swaim 1994). The combination of these factors may cause the Alameda whipsnake to be more vulnerable to extinction in small habitat patches resulting from habitat fragmentation.

Small populations with limited breeding partners are prone to inbreeding which often results in problems associated with the lack of genetic diversity (Frankham and Ralls 1998). Populations with less genetic variability or more deleterious genetic material are typically less able to successfully respond to environmental stresses or adapt to even relatively minor changes in environmental conditions. These factors influence the survivability of smaller, genetically isolated populations.

The Alameda whipsnake has a variety of potential native and exotic predators including California kingsnake (*Lampropeltis getula californiae*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), opossum (*Didelphis virginianus*), coyote (*Canis latrans*), gray fox (*Vulpes cinereoargenteus*), red fox (*V. vulpes*), and red-tailed hawk (*Buteo jamaicensis*). Urbanization often facilitates the introduction or spread of non-native predators (Goodrich and Buskirk 1995). Increased predatory pressure may become excessive in situations where Alameda whipsnake habitat is fragmented, isolated, and otherwise degraded by human activities. This may be especially true where alien species, such as rats, feral pigs (*Sus scrofa*), and feral and domestic cats (*Felis domesticus*) and dogs (*Canis familiaris*) are present. These additional threats become particularly acute where urban development immediately adjacent to Alameda whipsnake habitat. A growing movement to maintain feral cats in parklands, such as those managed by East Bay Regional Park District, is a potential threat to a variety of wildlife species (Coleman et al. in litt. 1997; Roberto 1995; DelVecchio 1997). Little is known about the predation of Alameda whipsnakes, but feral cats are known to prey on reptiles, including the yellow racer (*Coluber mormon*), a fast, diurnal snake similar to the Alameda whipsnake (Hubbs 1951; Stebbins 2003). The threat of predation and harassment from domestic and feral cats and other non-native species increases as human disturbance from recreational use on regional and state parks, and urban development encroaches into the current open space buffers between existing developments and Alameda whipsnake habitat on public lands (Coleman et al. in litt. 1997).

McGinnis (1992) has suggested that grazing has impacted Alameda whipsnake habitat in many areas east of the Coast Range. Livestock grazing that significantly reduces or eliminates shrub and grass cover can be detrimental to this snake. Many snake species, including the Alameda whipsnake, likely avoid such open areas due to increased danger from predators and lack of prey (McGinnis 1992). Removed native vegetation is often replaced by non-native plant species that significantly degrade habitat values or even replace entire plant communities such that it no longer provides appropriate habitat for the Alameda whipsnake. For instance, radio telemetry data indicates that Alameda whipsnakes tend to avoid dense stands of eucalyptus (Swaim 1994).

The Alameda whipsnake is directly and indirectly threatened by the effects of fire suppression. Fire suppression results in a buildup of fuel (underbrush, thatch, and woody debris). This exacerbates the effects of wildfires by creating conditions for hot, slow-moving fires. The development of a closed scrub canopy also results in a buildup of flammable fuels over time (Parker 1987; Rundel et al. 1987). Fire suppression can also result in the spread and proliferation of non-native vegetation, further increasing flammable fuel loads in and around Alameda whipsnake habitat. The threat of wildfire is typically highest in the summer and early fall when accumulated fuel is abundant and dry. This "fire season" coincides with the primary above-ground activity period for hatchling and adult Alameda whipsnakes (Swaim 1994). Therefore, populations are likely to sustain heavy losses from fires during this period.

Changes in the vegetation structure typically results in changes to the micro-climate temperature regime important in maintaining the Alameda whipsnake's high optimal body temperature. For instance, fire suppression may result in increased canopy closure and shading (Parker 1987) from plant species such as poison oak (*Toxicodendron diversilobum*) and coyote brush (*Baccharis pilularis*). Increased vegetative cover can result in ground temperatures that are less than optimal for the Alameda whipsnake. Survey data suggests that Alameda whipsnakes are less likely to be found in areas of scrub habitat with a closed canopy (Swaim 1994).

Encroaching urban development has lead to the implementation of rigorous fire suppression practices in and around adjacent suitable Alameda whipsnake habitat. Frequent fire events are important in maintaining the scrub habitat associated with the Alameda whipsnake. Many native coastal scrub and chaparral plant species require periodic fires to stimulate new sprouting, seedling recruitment, and seed dispersal (Parker 1987; Keeley 1987; Keeley 1992). The optimal frequency of fire events is often disputed but likely ranges from every 10 to 30 years (Keeley 1987; Rundel et al. 1987). Depending on the rate of fuel accumulation, any prescribed burn program should take place every 10 to 30 years (J. Ferreira, California Department of Parks and Recreation, personal communication with the Service 1996).

All five remaining populations of the Alameda whipsnake are threatened by a variety of factors. Each of these populations consists of several to numerous subpopulations with varying degrees of connectivity between them. In the western portion of the species' range, the Tilden-Briones population is threatened by a high potential for catastrophic wildfire and urban development. However, the remaining habitat, regional parklands, and municipal watersheds within this area overlap to the extent that a regional preserve may be possible. The Oakland-Las Trampas population is threatened by a high potential for catastrophic wildfire and the negative effects associated with habitat fragmentation and urban development. The Hayward-Pleasanton Ridge population may be the most susceptible to extirpation. This population is scattered in distribution and is, therefore, more vulnerable to the effects of development and subsequent habitat fragmentation. The Mount Diablo-Black Hills population, in the eastern portion of the species' range, is threatened by a high potential for catastrophic wildfire, development and its associated impacts, and inappropriate grazing practices. If threats associated with urbanization can be controlled, this population is a good candidate for recovery, due to the inclusion of public lands and the potential for improved fire and grazing management on parklands. The Sunol-Cedar Mountain population is threatened by development and inappropriate grazing practices. Overall, the Oakland-Las Trampas and Hayward-Pleasanton Ridge populations are the most immediately imperiled with habitat fragmentation becoming prevalent enough to compromise its long-term viability.

Seven recovery units have been identified for the Alameda whipsnake (Service 2002a). The the proposed I-680 Sunol Grade Southbound HOV Widening Project is located within the Hayward-Pleasanton Ridge Unit (Unit 3), the Sunol-Cedar Mountain Unit (Unit 5), and the Niles Canyon/Sunol Corridor Unit (Unit 7).

The Hayward Pleasanton Ridge Unit has the least contiguous lands in open space or conservation, and is under intense development pressure. According to the recovery plan, recovery of this unit will require: (1) immediate minimization of habitat fragmentation and isolation; (2) strategic protection of habitat; and (3) land management actions that promote Alameda whipsnake distribution, abundance, and dispersal.

The Sunol-Cedar Mountain Unit is the most southern recovery unit and is important because it is the interface between chaparral whipsnake (*Masticophis lateralis lateralis*) and the Alameda whipsnake. Although this unit has not had the same degree of habitat loss and fragmentation experienced by other units, the pressure for housing is increasing, particularly in the Pleasanton/Livermore area as is vehicular traffic through Corral Hollow. According to the recovery plan, in this unit: (1) long-term protection should be sought for all open space lands; (2) there should be focus on connecting the Sunol Regional Park population center with the Niles Canyon-Sunol Corrodor, and other populations; and (3) more survey and research data is needed.

The Niles Canyon/Sunol Corridor Unit includes open space or public trust lands but not all the land is habitat that would promote connectivity with other units and populations. According to the recovery plan: (1) land management plans for this unit need to address health and possible restoration of chaparral/scrub habitats, fire management, grazing, and incompatible land uses such as mining and agriculture; (2) there should be habitat enhancement within the Alameda

Creek floodplain; and (3) additional safe passage should be established across Niles Canyon Road.

The action area is not within critical habitat but the southbound lanes are immediately adjacent to the Hayward-Pleasanton Ridge critical habitat unit (Unit 3).

The California Natural Diversity Database includes records for Alameda whipsnakes at approximately 1 mile and 2.1 miles from the action area (CDFG 2007b). Pleasanton Ridge, immediately west of the action area is within Alameda whipsnake critical habitat and is managed for the species in large part by EBRPD. The action area is crossed by Alameda Creek and Vallecitos Creeks and other drainages that are critical movement corridors for interchange between the Hayward Pleasanton Ridge and Sunol-Cedar Mountain Alameda whipsnake populations (Service 1997). Based on the habitat located within and adjacent to the action area, the proximity of critical habitat, the inclusion within three recovery units, the biology and ecology of the Alameda whipsnake, including its dispersal behavior, and the nearby records of the listed species, the Service has concluded it is likely this listed animal utilizes the action area for foraging, resting, mating, and other essential behaviors.

*California Tiger Salamander*

The final rule listing the California tiger salamander as a threatened species was published on August 4, 2004 (Service 2004a).

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 in the coast ranges and to approximately 1,600 feet 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.

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 long (Petranka 1998; Stebbins 2003). Tiger salamanders 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 adults California tiger salamanders 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, tiger salamanders 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, tiger salamanders are rarely encountered even in areas where salamanders are abundant. Subadult and adult tiger salamanders typically spend the dry summer and fall months in the burrows of small mammals, such as California ground squirrels 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).

Tiger salamanders 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 California tiger salamanders 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. Tiger salamanders 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 tiger salamanders 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 tiger salamanders move, feed, and remain active in their burrows (Van Hattem 2004). Because tiger salamanders arrive at breeding ponds in good condition and are heavier when entering the pond than when leaving, researchers have long inferred that tiger salamanders are feeding while underground. Recent direct observations have confirmed this (Trenham 2001; Van Hattem 2004). Thus, "upland habitat" is a more accurate description of the terrestrial areas used by tiger salamanders.

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 1985, 1989; 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 stockponds and other artificial aquatic habitat. 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 averaged 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 amongst their upland habitat (Shaffer *et al.* 1993).

Tiger salamander 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 to 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 (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 (*Pseudacris regilla*), Western spadefoot toads (*Spea hammondii*), and California red-legged frogs (J. Anderson 1968; P. Anderson 1968; University of California 2005). Tiger salamander 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 tiger salamander 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. In one study, larvae collected near Stockton in the Central Valley during April varied between 1.88 to 2.32 inches 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 (University of California 2005). 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).

Tiger salamanders are known to travel large distances between breeding ponds and their upland refugia (Orloff 2007; Trenham and Chaffer 2005). 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 kilometers) from their breeding ponds (Sweet 1998). Tiger salamanders 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 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 sited 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 2002-03 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, 656, and 1,312 feet from a breeding pond than at 164 feet. Approximately 20 percent of the captured juveniles were found at least 1,312 feet from the nearest breeding pond. The associated distribution curve suggested that 95 percent of juvenile salamanders were within 2,099 feet 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 tiger salamanders at even further distances, with a large proportion of the captures at 2,297 feet from the breeding pond (Trenham *et al.*, unpublished data). Surprisingly, most juveniles captured, even those at 2,100 feet, were still moving away from ponds (Ben Fitzpatrick, University of California at Davis, personal communication, 2004). In Santa Barbara County, juvenile California tiger salamanders have been trapped approximately 1,200 feet away while dispersing from their natal pond (Science Applications International Corporation, unpublished data). These data show that many California tiger salamanders 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 tiger salamanders were tracked to burrows between 62 to 813 feet from their breeding ponds (Trenham 2001). These reduced movements may be due to adult California tiger salamanders exiting the ponds with depleted physical reserves, or drier weather conditions typically associated with the post-breeding upland migration period.

California tiger salamanders are also known to use several successive burrows at increasing distances from an associated breeding pond. Although previously sited studies provide information regarding linear movement from breeding ponds, upland habitat features appear to have some influence on movement. Trenham (2001) found that radio-tracked adults were more abundant in grasslands with scattered large oaks (*Quercus* species), than in more densely wooded areas. 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.

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 (*Gambusia affinis*), and crayfish (*Procrambus* species). Domestic dogs have been observed eating California tiger salamanders at Lake Lagunitas at Stanford University (Sean Barry, University of California, Davis, personal communication to C. Nagano, July 2004).

The California tiger salamander is imperiled throughout its 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. California tiger salamander 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 predation and competition from introduced exotic species; possible commercial over-utilization; diseases; various chemical contaminants; road kill; illegal collection; and certain unrestrictive mosquito and rodent control operations. Currently, these various primary and secondary threats are largely not being offset by existing federal, state, or local regulatory mechanisms. The tiger salamander is also prone to chance environmental or demographic events, to which small populations are particularly vulnerable.

The specific effects of disease on the Central California tiger salamander are not known. Pathogens, fungi, water mold, bacteria, and viruses have been known to adversely affect other tiger salamander species or other amphibians. Pathogens are suspected of causing global amphibian declines (Davidson *et al.* 2003). Pathogen outbreaks have not been documented in the Central California tiger salamander, but Chytrid fungus infections (chytridiomycosis) have been detected in Central California tiger salamanders (Padgett-Flohr and Longcore 2004). Chytridiomycosis and ranaviruses are a potential threat to the California tiger salamander because these diseases have been found to adversely affect other amphibians, including tiger salamanders (Longcore in litt. 2003; Lips in litt. 2003). Nonnative species, such as bullfrogs and nonnative tiger salamanders, are both located within the range of the Central California tiger salamander and have been identified as potential carriers of these diseases. 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 or fishing equipment). Human activities can also introduce stress by other means, such as habitat fragmentation, that results in tiger salamanders being more susceptible to the effects of disease. Disease will likely become a growing threat because of the relatively small, fragmented remaining Central California tiger salamander breeding sites, the many stresses on these sites due to habitat losses and alterations, and the many other potential disease-enhancing anthropogenic changes which have occurred both inside and outside the species' range.

Thirty-one percent (221 of 711 records and occurrences) of all Central California tiger salamander records and occurrences are 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 2007a; Service 2004b). The California Department of Fish and Game (2003) now considers 13 of these records from the Bay Area region as extirpated or likely to be extirpated.

The East Bay and Livermore Valley areas have undergone intensive urban development in recent years (California Department of Conservation 1996, 1998, 2000, 2002). The total human population of the counties in the Bay Area region increased by approximately 17 percent between 1990 and 2000 (4.5 million to 5.3 million people) (California Department of Forestry 1998). Most of the California tiger salamander natural historic habitat (vernal pool grasslands) available in this region has been lost due to urbanization and conversion to intensive agriculture (Keeler-Wolf and Elaml 1998). California tiger salamanders are now primarily restricted to artificial breeding ponds, such as bermed ponds or stock ponds which are typically located at higher elevations (California Department of Fish and Game 2003).

Of the 140 California tiger salamander localities where wetland habitat was identified, only 7 percent were located in vernal pools (California Department of Fish and Game 2003). The Bay Area region occurs within the Central Coast and Livermore vernal pool regions (Keeler-Wolf *et al.* 1998). Vernal pools within the Coast Range are more sporadically distributed than vernal pools in the Central Valley (Holland 2003). In San Benito and Santa Clara counties, Central Coast vernal pools have been destroyed and degraded due to agriculture. The vernal pools at Stanford in Santa Clara County have been destroyed and degraded due to recreation and development (Keeler-Wolf *et al.* 1998). The annual loss of vernal pools from 1994 to 2000 in Monterey, San Benito, San Luis Obispo, Santa Barbara, and Ventura counties was 2 to 3 percent. This rate of loss suggests that vernal pools in these counties are disappearing faster than previously reported (Holland 2003). Most of the vernal pools in the Livermore Region in Alameda County have been destroyed or degraded by urban development, agriculture, water diversions, poor water quality, and long-term overgrazing (Keeler-Wolf *et al.* 1998). During the 1980s and 1990s, vernal pools were lost at a 1.1 percent annual rate in Alameda County (Holland 1998).

Due to the extensive losses of vernal pool complexes and their limited distribution in the Bay Area region, many California tiger salamander breeding sites consist of artificial water bodies. Overall, 89 percent (124) of the identified water bodies are stock, farm, or berm ponds used for cattle and/or as a temporary water source for small farm irrigation (California Department of Fish and Game 2003). This possibly places the California tiger salamander at great risk of hybridization with non-native tiger salamanders, especially in Santa Clara and San Benito counties. Without long-term maintenance, the longevity of artificial breeding habitats is uncertain relative to naturally occurring vernal pools that are dependent on the continuation of seasonal weather patterns (Shaffer in litt. 2003).

Shaffer *et al.* (1993) found that the East Bay counties of Alameda and Contra Costa supported the greatest concentrations of California tiger salamander. California tiger salamander populations in the Livermore Valley are severely threatened by the ongoing conversion of grazing land to subdivisions and vineyards (Stebbins 1989; East Bay Regional Park District 1999). Proposed land conversion continues to target large areas of California tiger salamander habitat. One such project in Alameda County totals 700 acres (East Bay Regional Parks District 2003). Other proposed projects located within the California tiger salamander's distribution include another 310-acre project in Alameda County, two in San Joaquin County totaling 12,427 acres, and a 19-acre project in Santa Clara County.

There are fourteen California Natural Diversity Database records for California tiger salamanders within 1.3 miles of the action area (CDFG 2007b). Of those fourteen, all but one was recorded as a breeding location and the closest record is approximately 0.3 miles from the action area (CDFG 2007b). Sam McGinnis is also believed to have observed a California tiger salamander in a stockpond immediately adjacent to the intersection of I-680 and Vargas Road (Caltrans 2006). EBRPD describes its property on Pleasanton Ridge, immediately west of the action area as occupied by the California tiger salamander (EBRPD 2007). The California tiger salamander is particularly likely to occupy grassland habitat within the action area between Mission Boulevard and Bernal Road. Based on the habitat located within and adjacent to the action area, the biology and ecology of the California tiger salamander, including its dispersal behavior, and local observations of the listed species, the Service has concluded it is likely this listed animal utilizes the action area for foraging, resting, mating, and other essential behaviors.

*California Red-legged Frog*

The red-legged frog was listed as a threatened species on May 23, 1996 (Service 1996). Please refer to the final rule and the Recovery Plan for the California Red-Legged Frog (*Rana aurora draytonii*) (Service 2002) for additional information on this species.

This species is the largest native frog in the western United States (Wright and Wright 1949), ranging from 1.5 to 5.1 inches 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 lighter centers (Stebbins 2003) and dorsolateral folds are prominent on the back. Larvae (tadpoles) range from 0.6 to 3.1 inches in length, and the background color of the body is dark brown and yellow with darker spots (Storer 1925).

Red-legged frogs have paired vocal sacs and vocalize in air (Hayes and Krempels 1986). Female frogs deposit egg masses on emergent vegetation, allowing the egg mass floats on the surface of the water (Hayes and Miyamoto 1984). Red-legged frogs 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.

The historic range of the red-legged frog extended coastally from the vicinity of Elk Creek in Mendocino County, California, and inland from the vicinity of Redding, Shasta County, California, southward to northwestern Baja California, Mexico (Fellers 2005; Jennings and Hayes 1985; Hayes and Krempels 1986). The red-legged frog was historically documented in 46 counties but the taxa now remains in 238 streams or drainages within 23 counties. This represents a loss of 70 percent of its former range (Service 2002). Red-legged frogs are still locally abundant within portions of the San Francisco Bay area and the central coast. Within the remaining distribution of the species, only 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 (CDFG 2007a).

Adult red-legged frogs prefer dense, shrubby or emergent riparian vegetation closely associated with deep (>2.3 feet), still, or slow-moving water (Hayes and Jennings 1988). However, frogs also have been found in ephemeral creeks and drainages and in ponds that may or may not have riparian vegetation. The largest densities of red-legged frogs currently are associated with deep pools with dense stands of overhanging willows (*Salix* species) and an intermixed fringe of cattails (*Typha latifolia*) (Jennings 1988). Red-legged frogs disperse upstream and downstream of their breeding habitat to forage and seek sheltering habitat.

According to Feller and Kleeman (2007), non-breeding dry season habitat includes several characteristics: 1) sufficient moisture to allow the frogs to survive throughout the non-breeding season that may be up to 11 months long ; 2) sufficient cover to moderate temperatures during the warmest and coldest times of the year; and 3) protection (e.g., deep pools in a stream, or complex cover such as root masses or thick vegetation) from predators such as hawks and owls, herons, and small carnivores.

During other parts of the year, habitat includes nearly any area within 1-2 miles 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 bush (*Baccharis pilularis*), California blackberry thickets (*Rubus ursinus*), and root masses associated with willow (*Salix* species) and California bay trees (*Umbellularis californica*). Sometimes the non-breeding habitat used by red-legged frogs is extremely limited in size. For example, non-breeding red-legged frogs have been found in a 6-foot (1.8-meter) wide coyote bush thicket growing along a tiny intermittent creek surrounded by heavily grazed grassland (Fellers 2005). Sheltering habitat for red-legged frogs 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 also may provide important summer sheltering habitat. Accessibility to sheltering habitat is essential for the survival of red-legged frogs within a watershed, and can be a factor limiting frog population numbers and survival.

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 all year while others disperse. Dispersal distances are typically less than 0.5 mile, with a few individuals moving up to 1-2 miles (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). Dispersing frogs in northern Santa Cruz County traveled distances from 0.25 miles to more than 2 miles without apparent regard to topography, vegetation type, or riparian corridors (Bulger *et al.* 2003). Fellers and Kleeman (2007) and Bulger et al. (2003) found that California red-legged frog migration corridors can be less "pristine" (e.g., closely grazed fields, plowed agricultural lands) than breeding or non-breeding habitats. Bulger et al. (2003) observed that this listed ranid did not avoid or prefer any landscape feature or vegetation type. They tracked individuals that crossed agricultural land, including recently tilled fields and areas with mature crops. The threats facing migrating California red-legged frogs during their movements include being run over by vehicles on roads (Gibbs 1998; Vos and Chardon 1998), degradation of habitat (Vos and Stumpel 1995; Findlay and Houlahan 1997; Gibbs 1998), predation (Gibbs 1998), and dessication (Rothermel and Semlistch 2002; Mazerolle and Desrochers 2003).

Egg masses contain about 2,000 to 5,000 moderate sized (0.08 to 0.11 inches in diameter), dark reddish brown eggs and are typically attached to vertical emergent vegetation, such as bulrushes (*Scirpus* species) or cattails (Jennings *et al.* 1992). 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). Eggs hatch in 6 to 14 days (Jennings 1988). 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 parts per thousand results 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 3.5 to 7 months after hatching (Storer 1925; Wright and Wright 1949; Jennings and Hayes 1990). 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). Sexual maturity normally is reached at 3 to 4 years of age (Storer 1925; Jennings and Hayes 1985). Red-legged frogs may live 8 to 10 years (Jennings *et al.* 1992). Populations of red-legged frogs fluctuate from year to year. When conditions are favorable red-legged frogs can 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, red-legged frogs may temporarily disappear from an area when conditions are stressful (e.g., drought).

The diet of red-legged frogs is highly variable. Hayes and Tennant (1985) found invertebrates to be the most common food items. According to their data, vertebrates, such as Pacific tree frogs and California mice (*Peromyscus californicus*) represent over half the prey mass eaten by larger frogs (Hayes and Tennant 1985). Hayes and Tennant (1985) found juvenile frogs to be active diurnally and nocturnally, whereas adult frogs were largely nocturnal. Feeding activity probably occurs primarily along the shoreline and on the surface of the water (Hayes and Tennant 1985). The diet of red-legged frogs is not well studied, but their diet is likely similar to other ranid frogs that feed on algae, diatoms, and detritus by grazing on the surface of rocks and vegetation (Fellers 2005; Kupferberg 1996a, 1996b).

Several researchers in central California have noted the decline and eventual local disappearance of California and northern red-legged frogs in systems supporting bullfrogs (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* species), goldfish (*Carassius auratus*), common carp (*Cyprinus carpio*), and mosquitofish (L. Hunt, in litt. 1993; S. Barry, in litt. 1992; S. Sweet, in litt. 1993). Habitat loss, non-native species introduction, and urban encroachment are the primary factors that have adversely affected the red-legged frog throughout its range.

Several researchers in central California have noted the decline and eventual disappearance of red-legged frog populations once bullfrogs became established at the same site (L. Hunt, in litt. 1993; S. Barry, in litt. 1992; S. Sweet, in litt. 1993). This has been attributed to predation, competition, and reproduction interference. Twedt (1993) documented bullfrog predation of juvenile northern red-legged frogs (*Rana aurora aurora*), and suggested that bullfrogs could prey on subadult northern red-legged frogs as well. Bullfrogs may also have a competitive advantage over red-legged frogs. 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). Further more, bullfrog larvae are unpalatable to predatory fish (Kruse and Francis 1977). Bullfrogs also interfere with red-legged frog reproduction. 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; M. Jennings, in litt.1993; R. Stebbins in litt. 1993). Thus bullfrogs are able to prey upon and out-compete red-legged frogs, especially in sub-optimal habitat.

The urbanization of land within and adjacent to red-legged frog habitat has also adversely affected red-legged frogs. These declines are attributed to channelization of riparian areas, enclosure of the channels by urban development that blocks red-legged frog dispersal, and the introduction of predatory fishes and bullfrogs. The conversion and isolation of perennial pool habitats resulting from urbanization is an ongoing impact to red-legged frogs.

The California red-legged frog may be susceptible to many of the same pathogens, fungi, water mold, bacteria, and viruses have been known to adversely affect tiger salamander species or other amphibians. As with the California tiger salamander, Chytridiomycosis and ranaviruses may be a particular developing concern for California red-legged frog populations. Mao *et al.* (1999 cited in Fellers 2005) reported northern red-legged frogs infected with an iridovirus, which was also presented in sympatric three-spined sticklebacks (*Gasterosteus aculeatus*) 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 (found them to be the same as the other two). As mentioned for the California tiger salamander, nonnative species, such as bullfrogs and nonnative tiger salamanders, are both located within the range of the California red-legged frog and have been identified as potential carriers of these diseases. 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 or fishing equipment). Human activities can also introduce stress by other means, such as habitat fragmentation, that results in red-legged frogs being more susceptible to the effects of disease. Disease will likely become a growing threat because of the relatively small, fragmented remaining California red-legged frog breeding sites, the many stresses on these sites due to habitat losses and alterations, and the many other potential disease-enhancing anthropogenic changes which have occurred both inside and outside the species' range.

The recovery plan for red-legged frogs identifies eight Recovery Units (Service 2002). The establishment of these Recovery Units is based on the Recovery Team's determination that various regional areas of the species' range are essential to its survival and recovery. The status of the red-legged frog will be considered within the smaller scale of Recovery Units as opposed to the overall range. These Recovery Units are delineated by major watershed boundaries as defined by U.S. Geological Survey hydrologic units and the limits of the range of the California red-legged frog. The goal of the draft recovery plan is to protect the long-term viability of all extant populations within each Recovery Unit. Within each Recovery Unit, core areas have been delineated and represent contiguous areas of moderate to high red-legged frog densities that are relatively free of exotic species such as bullfrogs. The goal of designating core areas is to protect metapopulations that, combined with suitable dispersal habitat, will allow for the long term viability within existing populations. This management strategy will allow for the recolonization of habitat within and adjacent to core areas that are naturally subjected to periodic localized extinctions, thus assuring the long-term survival and recovery of red-legged frogs.

This project is located within the East San Francisco Bay Recovery Unit, which extends from the northernmost portion of Contra Costa County, includes a portion of San Joaquin County south to Santa Clara County, includes the eastern portion of San Mateo County, and all of San Francisco County (Service 2002). Contra Costa and Alameda counties contain the majority of known California red-legged frog localities within the eastern San Francisco Bay area. Within this recovery unit, the listed amphibian seem to have been nearly eliminated from the western lowland areas near urbanization, they still occur in isolated populations in the East Bay Foothills (between Interstate 580 and Interstate 680), and are abundant in several areas in the eastern portions of Alameda and Contra Costa counties. This recovery unit is essential to the survival and recovery of California red-legged frogs, as it contains the largest number of occupied drainages in the northern portion of its range. The eastern and western edges of this area are heavily urbanized and the northern and southern edges are bounded by major highways. However, there are numerous small drainages flowing underneath both I-580 and Route 84 that California red-legged frogs could disperse through. Therefore, this area is connected to other populations of California red-legged frogs in the foothills of central Alameda and Contra Costa Counties and the populations found in eastern Alameda County. Within this area, the species historically bred in several ponds and drainages within the proposed project area, Garin/Dry Creek Regional Park, Pleasanton Ridge Regional Park, and Sinbad Creek.

There are five historical records of the California red-legged frog from the California Natural Diversity Database within 2 miles of the action area (CDFG 2007a). All but one of these records was associated with a breeding pond and the closest record is less than 0.1 miles from the action area (CDFG 2007b). The listed frog is also known to occupy drainages that cross through the action area including Aqua Fria Creek and Alameda Creek (CDFG 2007b) and it is the Service's opinion that the frog likely occupies the other drainages in the action area. The California red-legged frog is also likely to occupy upland grassland habitat within the action area adjacent to drainages and between Mission Boulevard and Bernal Road. EBRPD describes its property on Pleasanton Ridge, immediately west of the action area as occupied by the California red-legged frog (EBRPD 2007). Therefore, the Service has concluded that the California red-legged frog inhabits the action area based on nearby records of this animal, the crossings of occupied aquatic features, the presence of suitable upland habitat, the biology and ecology of the species, and the recent records of the animal.

**Effects of the Proposed Action**

The proposed I-680 Sunol Grade Southbound HOV Widening Project likely will result in a number of adverse effects to the Alameda whipsnake, California tiger salamander, and California red-legged frog. There is a likelihood that the animals may be affected by being crushed; entombed in their burrows or cover sites; hit and injured or killed by vehicle strikes; shot; chased and injured or killed by domestic animals; poisoned by chemical agents; trapped in erosion control netting; or harassed by noise and vibration. The proposed project may also adversely affect the Alameda whipsnake, California tiger salamander, and California red-legged frog by blocking movement corridors; interfering with foraging, mating, and/or movement; or by subjecting them to predation that otherwise would not occur. They also are likely to be subject to indirect effects including loss of habitat, pesticide or chemical poisoning, an influx of exotic predators, increased competition, the intrusion of non-native plants, disease, and a reduction in natural food sources as a result of habitat disturbance and loss.

The Alameda whipsnake would be affected by the loss of woodland, scrub, rocky outcrop, and grassland habitat as well as the drainage crossing under I-680 within the action area. The California tiger salamander and California red-legged frog would be affected by loss of grassland and wooded habitats within the action area. All three species may use a wide variety of habitat types for activities such as foraging and dispersal. Furthermore, either species may seek retreat in other areas when displaced by activity or disturbance within their more traditionally associated habitat. Therefore, the proposed action could affect all three species in the action area from Mission Boulevard north to Bernal Road and at all drainage crossings the action area where work will be occurring in the open channels.

The proposed temporary effects described in the July 2007 response that include the described access, workspace, and staging areas will be unavailable for use by the three listed species as foraging, breeding, resting, and other essential behaviors for approximately three years, and are therefore, permanent effects. Thus, there are permanent effects to 3.64 acres as described in the above paragraph that provide habitat for the Alameda whipsnake and 7.47 acres for the California red-legged frog and California tiger salamander, using the Service's definition of permanent effects.

Temporary effects are project activities that temporarily remove one or more essential components of a listed species habitat, but can be restored to pre-project conditions of equal or greater habitat value. In order for the effects to be considered temporary, the affected habitat of the listed species must be totally restored within one season. Ground disturbance resulting from the proposed I-680 Sunol Grade Southbound HOV Widening Project includes grading, excavating, fill, and equipment staging. Caltrans proposed temporary effects are permanent effects because the described access, workspace, and staging areas will be unavailable as listed species habitat for three years. Any ground disturbing work between Mission Boulevard and Bernal Road has potential to cause injury and mortality to individual Alameda whipsnakes, California red-legged frogs, and California tiger salamanders occupying the action area, and these areas likely will not be suitable for use as habitat for foraging, breeding, resting and other essential behaviors by these animals for a significant period of time, almost certainly longer than one season after the construction of the project is completed. Additional harm could be sustained by entanglement with erosion control features, capture or intentional harm by project personnel, or falling or entrapment in trenches or other project-related excavations. As part of the project description, Caltrans has stated upon completion of the project, they will re-contour temporally affected habitat areas if necessary, and revegetate them to promote restoration of the area to pre-project conditions. These areas may be occupied by the Alameda whipsnake, California red-legged frog, and California tiger salamander following restoration.

Alameda Whipsnake

Individual Alameda whipsnakes may be directly injured or killed by activities that disturb feeding, sheltering, and dispersal habitat. Based on information provided by Caltrans, the proposed project will result in the permanent loss of approximately 3.64 acres of habitat for this listed species using the Service's definition of permanent effects. The proposed project could result in (1) result in the injury and death of an unknown number of Alameda whipsnakes; (2) result in construction-related harassment to the surviving Alameda whipsnakes in the area; (3) partially impede the dispersal of Alameda whipsnakes through the area while the action is in progress; (4) increase the likelihood of predation on Alameda whipsnakes; and (5) fragment and reduce the amount of Alameda whipsnake habitat.

Construction related activities may cause disruption of foraging, harassment from increased human activity, and permanent and temporary loss of shelter. Because Alameda whipsnakes are diurnal, they will be active while construction is performed. Individuals that avoid construction activities may become displaced into adjacent areas where they may be vulnerable to increased predation, exposure, starvation, or stress through disorientation, loss of shelter, and intraspecific and inter-specific aggression (Grigione 2002).

The proposed construction may temporarily affect Alameda whipsnake dispersal due to activities that produce high levels of noise and vibration. The proposed I-680 Sunol Grade Southbound HOV Widening Project includes activities that cause barriers or deterrents to dispersal activities.

The addition of impermeable surfaces resulting from the widened roadway and realignment will likely be accompanied by an increase in chemical runoff, higher road-kill, and the introduced of non-native and/or introduction of non-native species. These factors may affect the Alameda whipsnake in ways similar to those discussed for the California tiger salamander and California red-legged frog.

California Tiger Salamander and California Red-legged Frog

The proposed project could have direct effects to the California tiger salamanders and the California red-legged frogs through direct mortality, injury, or harassment of individual animals. Based on information provided by Caltrans, the proposed project will result in the permanent loss of approximately 7.47 acres of upland habitat for California tiger salamander and California red-legged frog using the Service's definition of permanent effects.

Mortality, injury, or harassment of the California tiger salamander and the California red-legged frog could occur from being crushed by project related equipment or vehicles, construction debris, and worker foot traffic within the action area. Individuals of these two listed species also could fall into trenches, pits, or other excavations, and then be directly killed or unable to escape and be killed due to desiccation, entombment, or starvation. Work activities, including vibration, may cause red-legged frogs and tiger salamanders to leave the work site and surrounding areas. Individuals also may become trapped by plastic mono-filament netting used for erosion control or other purposes where they could be subject to death by predation, starvation, or desiccation (Stuart *et al.* 2001). This disturbance and displacement may increase the potential for predation, desiccation, competition for food and shelter, or strike by vehicles on roadways.

Various conservation measures such as minimizing the total area disturbed by project activities, and properly constructing exclusionary fencing may reduce mortality, injury, or harassment. Preconstruction surveys and the relocation of individual red-legged frogs or tiger salamanders may reduce injury or mortality. However, the capturing and handling of red-legged frogs and tiger salamanders to remove them from a work area may result in the harassment, mortality or injury of individuals. Stress, injury, and mortality may occur as a result of improper handling, containment, and transport of individuals. Death and injury of individual red-legged frogs or tiger salamanders could occur at the time of relocation or later in time subsequent to their release. Although survivorship for translocated red-legged frogs and tiger salamanders has not been estimated, survivorship of translocated wildlife, in general, is lower because of intraspecific competition, lack of familiarity with the location of potential breeding, feeding, and sheltering habitats, and increased risk of predation. Improper handling, containment, or transport of individuals would be reduced or prevented by use of a Service-approved biologist, by limiting the duration of handling, and requiring the proper transport of these species.

Various other work activities associated with the proposed project also may adversely affect California tiger salamanders and California red-legged frogs. Trash left during or after project activities could attract predators to work sites, which could subsequently harass or prey on the animals. For example, raccoons, crows, and ravens are attracted to trash and also prey opportunistically on amphibians. Accidental spills of hazardous materials or careless fueling or oiling of vehicles or equipment could degrade water quality or habitat to a degree where salamanders and frogs are adversely affected. Some potential also exists for disturbance of habitat which could result in the spread or establishment on non-native invasive plant species.

Biologists working in different areas and with different species may transmit diseases by introducing contaminated equipment. The chance of a disease being introduced into a new area is greater today than in the past due to the increasing occurrences of disease throughout amphibian populations in California and the United States. It is possible that chytrid fungus may exacerbate the effects of other diseases on amphibians or increase the sensitivity of the amphibian to environmental changes (e.g., water pH) that reduce normal immune response capabilities (Bosch *et al.* 2000). Implementation of the Declining Amphibian Populations Task Force Fieldwork Code of Practice" during any aquatic survey activity will likely prevent transfer of diseases through contaminated equipment or clothing.

**Cumulative Effects**

Cumulative effects include the effects of future State, Tribal, local or private actions 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 consultation pursuant to section 7 of the Act.

Numerous non-Federal activities continue to negatively affect the Alameda whipsnake, California tiger salamander, and California red-legged frog in Alameda and Santa Clara

Counties. Habitats are lost or degraded as a result of road and utility construction and maintenance, overgrazing, agricultural expansion, and water irrigation and storage projects that may not be funded, permitted, or constructed by a Federal agency. Other threats include contamination, poisoning, increased predation, and competition from non-native species associated with human development. Small private actions that may impact listed species, such as conversion of land, small mammal population control, mosquito control, and residential development, may occur without consultation with or authorization by the Service or the California Department of Fish and Game pursuant to their respectively Endangered Species Act.

It is anticipated that population increases and development pressures will continue to affect land use and growth in Alameda and Santa Clara Counties for the foreseeable future. Population growth in Alameda County was 10.7% between 1990 and 2000 (U.S. Census Bureau 2006). The population in Santa Clara County doubled between 1950 and 1960 and nearly double again by 1970 (Santa Clara County 1994). The population in Santa Clara County is expected to continue growth by more than 206,000 people between 1995 and 2010 for a total of almost 1.8 million (Santa Clara County 1994). Increased demand for housing will likely result in loss of suitable habitat for all listed species discussed in this opinion as housing developments replace agricultural and ranch lands. Increased urbanization in the region will contribute to the degradation of water quality in streams, altered flow regimes, increased contaminated road runoff, loss of upland habitat, and increased human presence in natural areas.

There is a continued demand for new housing and commercial development in Alameda County and Santa Clara County and other road and development projects have been recently completed or are planned along the I-580 and I-680 corridors. These large developments and further infill will eliminate the habitat connectivity between listed species habitat remaining habitat north and east of the action area. Development of adjacent wildlife habitat will continue to result in the loss of not only breeding, resting, and foraging habitat, but the loss of dispersal corridors between breeding populations, thereby further isolating and fragmenting wildlife populations. Additionally, development of small reservoirs or water bodies, such as golf course hazards, and water diversions may occur which may pose further threats such as disruption of dispersal corridors for terrestrial species, and competition or predation from with non-native species such as bullfrogs for aquatic species.

Cattle-grazing is a common land use practice in rural Alameda and Santa Clara Counties. Overgrazing results in degradation and loss of riparian vegetation, increased water temperatures, streambank and upland erosion, and decreased water quality in streams. Livestock operations may also degrade water quality with pesticides and nutrient contamination. However, light to moderate livestock grazing is generally thought to be compatible with continued successful use of rangelands by the Alameda whipsnake, tiger salamander, red-legged frog, and other listed species, provided the grazed areas do not also have intensive burrowing rodent control efforts (T. Jones, in litt. 1993; Shaffer et al. 1993). The shorter vegetation associated with grazed areas may make the habitat more suitable for ground squirrels whose burrows are utilized by both red-legged frogs and tiger salamanders. Rodent control in rural areas in Alameda and Santa Clara

Counties could contribute to the decline of Alameda whipsnakes, tiger salamanders, and red-legged frogs in the region, as well as other sensitive species that utilize burrows created by burrowing rodents.

Agricultural development, impoundments, and irrigation can reduce stream flows, resulting in the loss of aquatic habitat during the summer for red-legged frogs. Discing is a common practice on agricultural lands which can result in substantial losses of upland habitat for Alameda whipsnakes, red-legged frogs, and tiger salamanders. Significant conversion of rural, undeveloped land to agricultural land, particularly vineyards, is currently occurring in Alameda and Santa Clara Counties, resulting in loss of upland habitat for listed species.

Increased levels of vehicles and increased vehicle speeds on the three roads could lead to an increased mortality level for the Alameda whipsnake, California tiger salamander, and the California red-legged frog. The cumulative local development will result in temporary and permanent habitat fragmentation. The results of fragmentation are inhibition of genetic exchange between populations and impediments to recolonization of habitats from which populations have been extirpated. Small, isolated populations are substantially more vulnerable to stochastic events (e.g., aberrant weather patterns, fluctuations in availability of food) and may exhibit reduced adaptability to environmental (natural or anthropogenic) changes.

California tiger salamanders and California red-legged frogs likely are exposed to a variety of pesticides and other chemicals throughout their ranges. These two amphibian species could also die from starvation due to the loss of their prey base. Hydrocarbon and other contamination from oil production and road runoff; the application of numerous chemicals for roadside maintenance; urban/suburban landscape maintenance; and rodent and vector control programs may all have negative effects on tiger salamander populations. In addition, tiger salamanders and red-legged frogs may be harmed through increased road kill due to the construction and use of new roads and increased traffic in the overall region and collection by amphibian enthusiast and others.

Further habitat fragmentation, additional non-native species introduction, and increased access to aquatic habitat could facilitate or increase the spread of amphibian diseases within the range of the California tiger salamander and the California red-legged frog. The global mass extinction of amphibians primarily due to chytrid fungus continues to be of significant concern (Norris 2007; Skerratt *et al* 2007).

The global average temperature has risen by approximately 0.6 degrees Celsius during the 20th Century (IFPC 2001, 2007; Collins *et al.* 2007; Adger *et al* 2007). There is an international scientific consensus that most of the warming observed has been caused by human activities (IFPC 2001, 2007; Collins *et al.* 2007; Adger *et al.* 2007), and that it is "very likely" that it is largely due to manmade emissions of carbon dioxide and other greenhouse gases (Adger *et al.* 2007). Ongoing climate change (Anonymous 2007; Inkley *et al.* 2004; Adger *et al.* 2007; Kanter 2007) likely imperils the California tiger salamander, California red-legged frog, and the San Joaquin kit fox, and the resources necessary for their survival. Since climate change threatens to disrupt annual weather patterns, it may result in a loss of their habitats and/or prey, and/or increased numbers of their predators, parasites, and diseases. Where populations are isolated, a changing climate may result in local extinction, with range shifts precluded by lack of habitat.

**Conclusion**

After reviewing the current status of the Alameda whipsnake, California tiger salamander, and California red-legged frog the environmental baseline for the action area; the effects of the proposed I-680 Sunol Grade Southbound HOV Widening Project and the cumulative effects; it is the Service's biological opinion that the project, as proposed, is not likely to jeopardize the continued existence of these three listed species. Critical habitat for the Alameda whipsnake, California red-legged frog, and California tiger salamander have been designated, however none is located in the action area, and therefore none will be affected by the proposed project.

## INCIDENTAL TAKE STATEMENT

Section 9(a)(1) of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened fish and wildlife species 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 which 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 below are non-discretionary, and must be implemented by Caltrans so that they become binding conditions of project authorization for the exemption in section 7(o)(2) to apply. Caltrans has a continuing duty to regulate the activity covered by this Incidental Take Statement. If Caltrans (1) fails to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

**Amount or Extent of Take**

The Service expects that incidental take of the Alameda whipsnake will be difficult to detect or quantify because this animal may range over a large territory and the finding of an injured or dead individual is unlikely because of their relatively small body size. Therefore, the Service is estimating that all of the Alameda whipsnakes inhabiting the identified 3.64 acres of habitat between Mission Boulevard and Bernal Road and all drainage crossings of I-680 may be subject to incidental take. Upon implementation of the proposed conservation measures and Reasonable and Prudent Measures, incidental take associated with the I-680 Sunol Grade Southbound HOV Widening Project in the form of harm, harassment, capture, injury, and death of the Alameda whipsnake caused by habitat loss and construction activities will become exempt from the prohibitions described under section 9 of the Act.

The Service anticipates that incidental take of the California tiger salamander will be difficult to detect because when this amphibian is not in their breeding ponds, or foraging, migrating, or conducting other surface activity, they inhabit the burrows of ground squirrels or other rodents; the burrows may be located a distance from the breeding ponds; the migrations occur during rainy nights in the fall, winter, or spring; and the finding of an injured or dead individual is unlikely because of their relatively small body size. Losses of this species may also be difficult to quantify due to seasonal fluctuations in their numbers, random environmental events, changes in the water regime at their breeding ponds, or additional environmental disturbances. Due to the difficulty in accurately estimating the number of California tiger salamander that will be taken as a result of the proposed action, the Service is quantifying take incidental to the project as all of the California tiger salamanders inhabiting or utilizing the identified 7.47 acres of habitat between Mission Boulevard and Bernal Road. The incidental take is expected to be in the form of harm, harassment, capture, trap, collect, injury, and mortality to adult California tiger salamanders from habitat loss/degradation, construction-related disturbance, and capture and relocation.

The Service anticipates that incidental take of the California red-legged frog will be difficult to detect because when California red-legged frogs are not in their breeding ponds, they inhabit the burrows of ground squirrels or other rodents; they may be difficult to locate due to their cryptic appearance and behavior; the sub-adult and adult animals may be located a distance from the breeding ponds; the migrations occur on a limited period during rainy nights in the fall, winter, or spring; and the finding of an injured or dead individual is unlikely because of their relatively small body size. Losses of California red-legged frogs may also be difficult to quantify due to seasonal fluctuations in their numbers, random environmental events, changes in water regime at their breeding ponds, or additional environmental disturbances. Due to the difficulty in quantifying the number of California red-legged frogs that will be taken as a result of the proposed action, the Service is quantifying take incidental to the project as all of the California red-legged frogs inhabiting or utilizing identified 7.47 acres of habitat between Mission Boulevard and Bernal Road and all drainage crossing of I-680. The incidental take is expected to be in the form of harm, harassment, capture, trap, collect, injury, and mortality to adult California red-legged frogs from habitat loss/degradation, construction-related disturbance, and capture and relocation.

Upon implementation of the following reasonable and prudent measures incidental take associated with the proposed action described above for the Alameda whipsnake, California tiger salamander, and California re-legged frog will become exempt from the prohibitions described under section 9 of the Act.

**Effect of the Take**

The Service has determined that this level of anticipated take for the Alameda whipsnake, California tiger salamander, and California red-legged frog is not likely to jeopardize the continued existence of these three species. Critical habitat for the Alameda whipsnake, California red-legged frog, and California tiger salamander have been designated, however none is located in the action area, and therefore none will be affected by the proposed project.

**Reasonable and Prudent Measures**

The following reasonable and prudent measures are necessary and appropriate to minimize the effect of the proposed action on the Alameda whipsnake, California tiger salamander, and California red-legged frog:

1. Caltrans will implement the conservation measures in the project description as described in the July 2007 response, and this biological opinion.

2. Caltrans shall reduce adverse effects to the Alameda whipsnake, California tiger salamander, and California red-legged frog.

3. Caltrans shall ensure compliance with this biological opinion.

**Terms and Conditions**

In order to be exempt from the prohibitions of section 9 of the Act, Caltrans shall ensure compliance with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are nondiscretionary.

1. The following Terms and Conditions implement Reasonable and Prudent Measure one (1):

   a. Caltrans shall minimize the potential for harm, harassment, or killing of federally listed wildlife species resulting from project related activities by implementation of the conservation measures as described in the July 2007 response, and appearing in the *Project Description* of this biological opinion.

   b. Caltrans shall include Special Provisions that include the *Conservation Measures* from the *Project Description* of this biological opinion and the *Terms and Conditions* of this biological opinion in the solicitation for bid information. In addition, Caltrans shall educate and inform contractors involved in the project as to the requirements of the biological opinion.

2. The following Terms and Conditions implement Reasonable and Prudent Measure two (2):

   a. No more than twenty (20) working days prior to any ground disturbance, pre-construction surveys shall be conducted by a Service-approved biologist for the Alameda whipsnake, California tiger salamander, and California red-legged frog. These surveys shall consist of walking surveys of the project limits and adjacent areas accessible to the public to determine presence of the species. The Service-approved biologist(s) must investigate all potential Alameda whipsnake, California tiger salamander, and California red-legged frog cover sites. This includes full investigation of mammal burrows. The entrances shall be collapsed following investigation.

   b. A Service-approved biologist shall be onsite to monitor the initial ground disturbance activities for the road construction and restoration projects. The biologist shall perform a clearance survey immediately prior to the initial ground disturbance. Safety permitting, the Service-approved biologist(s) must investigate areas of disturbed soil for signs of listed species within the same day following the initial disturbance of that given area.

   c. All Alameda whipsnakes, California red-legged frogs, and California tiger salamanders encountered in the action area shall be relocated to a Service-approved location. Caltrans shall submit a written plan for translocating Alameda whipsnakes, California red-legged frogs, and California tiger salamanders and submitted by the California department of Transportation to the Service for review and approval prior to the date of initial groundbreaking at the proposed project.

3. The following Terms and Conditions implement Reasonable and Prudent Measure three (3):

   a. Caltrans shall report to the Service any information about take or suspected take of listed wildlife species not authorized by this biological opinion. Caltrans must notify the Service via electronic mail and telephone within twenty-four (24) hours of receiving such information. Notification must include the date, time, location of the incident or of the finding of a dead or injured animal, and photographs of the specific animal. Dead individual animals shall be placed in a zip-lock® plastic bag with a piece of paper containing information on where and when the animal was found along with the name of the person who found it, the bag shall be frozen in a freezer located in a secure location until instructions are received from the Service regarding the disposition of the specimen or the Service takes custody of the specimen. The Service contacts are Chris Nagano, Deputy Assistant Field Supervisor, Endangered Species Program, Sacramento Fish and Wildlife Office at (916) 414-6600, and Special Agent Scott Heard of the Service's Law Enforcement Division at (916) 414-6660.

**Reporting Requirements**

Injured Alameda whipsnakes, California tiger salamanders, and/or California red-legged frogs must be cared for by a licensed veterinarian or other qualified person such as the on-site biologist. Dead individuals of any of these three listed species must be placed in a sealed plastic bag with the date, time, location of discovery, and the name of the person who found the animal; the carcass should be kept in a freezer; and held in a secure location. The Service and the California Department of Fish and Game must be notified within twenty-four (24) hours of the discovery of death or injury to an Alameda whipsnake, California tiger salamander, and/or California red-legged frog that occurs due to project related activities or is observed at the project site. Notification must include the date, time, and location of the incident or of the finding of a dead or injured animal clearly indicated on a U.S. Geological Survey 7.5 minute quadrangle and other maps at a finer scale, as requested by the Service, and any other pertinent information. The Service contacts are Chris Nagano, Deputy Assistant Field Supervisor, Endangered Species Program at the Sacramento Fish and Wildlife Office (916/414-6600), and Scott Heard, Resident Agent-in-Charge of the Service's Law Enforcement Division at 916/414-6660. The California Department of Fish and Game contact is Mr. Ron Schlorff at 1416 9th Street, Sacramento, California 95814, (916) 654-4262.

Sightings of any listed or sensitive animal species shall be reported to the California Natural Diversity Database of the California Department of Fish and Game and a copy of the report shall also be sent to Chris Nagano, Deputy Assistant Field Supervisor, Endangered Species Program at the Sacramento Fish and Wildlife Office.

Caltrans shall submit a post-construction compliance report prepared by the on-site biologist to the Sacramento Fish and Wildlife Office within forty (40) working days of the date of the completion of construction activity. This report shall detail (i) dates that construction occurred; (ii) pertinent information concerning the success of the project in meeting compensation and other conservation measures; (iii) an explanation of failure to meet such measures, if any; (iv) known project effects on the Alameda whipsnake, California tiger salamander, and California red-legged frog, if any; (v) occurrences of incidental take of any of these three listed species, if any; (vi) documentation of employee environmental education; and (vii) other pertinent information.

## CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities that can be implemented to further the purposes of the Act, such as preservation of endangered species habitat, implementation of recovery actions, or development of information and data bases.

The Service requests notification of the implementation of any conservation recommendations in order to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats. We propose the following conservation recommendations:

1. Caltrans should assist the Service in implementing recovery actions identified in the *Recovery Plan for the California red-legged Frog* (Service 2002b) and the *Draft Recovery Plan for Chaparral and Scrub Community Species East of San Francisco Bay, California* (Service 2002a)

2. Caltrans should consider establishing functioning preservation and creation conservation banking systems to further the conservation of the Alameda whipsnake, California tiger salamander, California red-legged frog, and other appropriate species. Such banking systems also could possibly be utilized for other required mitigation (i.e., seasonal wetlands, riparian habitats, etc.) where appropriate.

3. Caltrans should incorporate culverts, tunnels, or bridges on highways and other roadways that allow safe passage by the Alameda whipsnake, California red-legged frog, California tiger salamander, other listed animals, and wildlife. Caltrans should include photographs, plans, and other information in their biological assessments if they incorporate "wildlife friendly" crossings into their projects.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed and/or proposed species or their habitats, the Service requests notification of the implementation of these recommendations.

## REINITIATION--CLOSING STATEMENT

This concludes formal consultation on the proposed I-680 Sunol Grade Southbound HOV Widening Project, in Alameda and Santa Clara Counties, California. As provided in 50 CFR §402.16 and in the terms and conditions of this biological opinion, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Please contact John Cleckler or Chris Nagano at the letterhead address or at telephone 916/414-6600 if you have questions concerning this biological opinion on the proposed I-680 Sunol Grade Southbound HOV Widening Project, Alameda and Santa Clara Counties, California.

Sincerely,

Chris Nagano

fn Cay C. Goude
Acting Field Supervisor

cc:
Scott Wilson, California Department of Fish and Game, Yountville, California
Janice Gan, California Department of Fish and Game, Tracy, California
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**Literature Cited**

N. Adger, P.Aggarwal, S. Agrawala, J.Alcamo, A. Allali, O. Anisimov, N. Arnell, M. Boko, O.Canziani, T. Carter, G. Cassa, U. Confalonieri, R. Cruz, E.de Alba Alcaraz, W. Eastreling, C. Field, A. Fischlin, B. Fitzharris, C.G. Garcia, C. Hanson, H. Harasawa, K. Hennessy, S.Huq, R. Jones, L. K. Bogataj, D. Karoly, R. Kliein, Z. Kundzewicz, M. Lal, R. Lasco, G. Love, X. Lu, G. Magrin, L.J. Mata, R. McLean, B. Menne, G. Midgley, N. Mimura, M.Q. Mirza, J. Moreno, L. Mortsch, I. Niang-Diop, R. Nichols, B. Novaky, L. Nurse, A. Nyon, M. Oppenheimer, J. Palutikof, M. Parry, A. Patwardhan, P. R. Lankao, C. Rosenzweig, S. Schneider, S. Semenov, J. Smith, J. Stone, J van Ypersele, D. Vaughan, C. Vogel, T. Wilbanks, P.Wong, S. Wu, and G. Yohe. 2007. Working Group II Contribution to the Intergovernmental Panel on Climate Change Fourth Assessment Report. Climate Change 2007: Climate change impacts, adaptation and vulnerability. Brussels, Belgium.

Anderson, J. D. 1968. Comparison of the food habits of *Ambystoma macrodactylum sigillatum*, *Ambystoma macrodactylum croceum*, and *Ambystoma tigrinum californiense*. Herpetologica 24(4): 273-284.

Anderson, P. R. 1968. The reproductive and developmental history of the California tiger salamander. Masters thesis, Department of Biology, Fresno State College, Fresno, California. 82 pages.

Anonymous. 2007. Global warming is changing the World. Science 316:188-190.

Barry, S. J. and H. B. Shaffer. 1994. The status of the California tiger salamander (*Ambystoma californiense*) at Lagunita: A 50-year update. Journal of Herpetology 28(2): 159-164.

Bobzien, S. and J. DiDonato. 2007. The status of the California tiger salamander (*Ambystoma californiense*), California red-legged frog (*Rana aurora draytonii*), foothill yellow-legged frog (*Rana boylii*), and other aquatic herptofauna in the East Bay Regional Park District, California. East Bay Regional Parks District, Oakland, California

Bosch, J., I. Martinez-Solano, and M. Garciaparis. 2001. Evidence of a chytrid fungus infection involved in the decline of the common midwife toad (*Alytes obstetricans*) in protected areas of central Spain. Biological Conservation 97: 331–337.

Bulger, J. B., N. J. Scott Jr., and R. B. Seymour. 2003. Terrestrial activity and conservation of adult California red-legged frogs *Rana aurora draytonii* in coastal forests and grasslands. Biological Conservation 110:85-95.

California Department of Conservation. 1994. Farmland Conversion Report 1990-1992. Sacramento, California.

_____ 1996. Farmland Conversion Report 1992-1994. Sacramento, California.

_____ 1998. Farmland Conversion Report 1994-1996. Sacramento, California.

California Department of Fish and Game (CDFG). 2006. California wildlife habitat relationships. Wildlife and Habitat Data Analysis Branch. California Department of Fish and Game, State of California. Website: http://www.dfg.ca.gov/whdab/html/wildlife_habitats.html. Sacramento, California.

_____ 2007a. RAREFIND. Natural Heritage Division, Sacramento, California.

_____ 2007b. BIOSIS. Natural Heritage Division, Sacramento, California.

California Department of Transportation. 2006. Interstate 680 Sunol Grade Southbound HOV Widening Project Focused Biological Evaluation for the California Tiger Salamander. March 2006. Oakland, California.

_____ 2007. Caltrans Response to July 19, 2006 Information Request from the United States Fish and Wildlife Service for the I-680 Sunol Grade Southbound HOV Widening Project. July 2007. Oakland, California.

Coleman, J.S., S.A. Temple, and S.R. Craven. 1997. cats and wildlife: a conservation dilemma. Cooperative Extension Publication. Madison, Wisconsin.

Collins, W., R. Coleman, J. Haywood, M.R. Manning, and P. Mote. 2007. The physical science behind climate change. Scientific America 297: 64-71.

Davidson, E. W.., M. Parris, J. Collins, J. Longcore, A. P. Pessier, and J. Brunner. 2003. Pathogenicity and Transmission of Chytridiomycosis in Tiger Salamanders (*Ambystoma tigrinum*). Copeia, 2003(3): 601-607.

DelVecchio, R. 1997. Truce in fight over feral cats. San Francisco Chronicle, April 2, 1997, Page A15.

Emlen, S. T. 1977. "Double clutching" and its possible significance in the bullfrog. Copeia 1977(4):749-751.

Feaver, P. E. 1971. Breeding pool selection and larval mortality of three California amphibians: *Ambystoma tigrinum californiense* Gray, *Hyla regilla* Baird and Girard and *Scaphiopus hammondi hammondi* Girard. Master's thesis, Department of Biology, Fresno State College, Fresno California. 58 pages.

Fellers, G. 2005. *Rana draytonii* Baird and Girard, 1852b California red-legged frog. Pages 552-554 *in* M. Lannoo (editor). Amphibian declines the conservation status of United States species. University of California Press. Berkeley, California.

Fellers, G. M. and P. M. Kleeman. 2007. California Red-Legged Frog (*Rana draytonii*) Movement and Habitat Use: Implications for Conservation. Journal of Herpetology. 41(2): 271-281

Findlay, C.S. and J. Houlahan. 1997. Anthropogenic correlates of species richness in southeastern Ontario wetlands. Conservation Biology 11: 1000-1009.

Fitzpatrick, B. M. an H. B. Shaffer. 2004. Environmental-dependent admixture dynamics in a tiger salamander hybrid zone. Evolution 58(6): 1282-1293.

Frankham, R., and K. Ralls. 1998. Inbreeding leads to extinction. Nature 241:441-442.

Gibbs, J.P. 1998. Amphibian movements in response to forest edges, roads, and streambeds in southern New England. Journal of Wildlife Management 62: 584-589.

Goodrich, J.M. and S.W. Buskirk. 1995. Control of abundant native vertebrates for conservation of endangered species. Conservation Biology 9:1357-1364.

Grigione, M.M. 2002. Turning night into day: the artificial effects of artificial night lighting on endangered and other mammal species. Paper presented at the Urban Wildlands Group's Ecological Consequences of Artificial Night Lighting. February 23-24, 2002. University of California, Los Angeles, California.

Hayes, M. P., and M. R. Jennings. 1988. Habitat correlates of distribution of the California red-legged frog (*Rana aurora draytonii*) and the foothill yellow-legged frog (*Rana boylii*): implications for management. Pages 144-158 *in* R. Sarzo, K. E. Severson, and D. R. Patton (technical coordinators). Proceedings of the symposium on the management of amphibians, reptiles, and small mammals in North America. United States Department of Agriculture, Forest Service, Rocky Mountain Range and Experiment Station, Fort Collins, Colorado. General Technical Report (RM-166): 1-458.

Hayes, M. P. and D. M. Krempels. 1986. Vocal sac variation among frogs of the genus Rana from western North America. Copeia 1986(4):927-936.

Hayes, M. P. and M. M. Miyamoto. 1984. Biochemical, behavioral and body size differences between *Rana aurora aurora* and *R. a. draytonii*. Copeia 1984(4):1018-1022.

Hayes, M. P., and M. R. Tennant. 1985. Diet and feeding behavior of the California red-legged frog, *Rana aurora draytonii* (Ranidae). Southwestern Naturalist 30(4): 601-605.

Holland, R.F. 1998. No Net Loss? Changes in great valley vernal pool distribution from 1989 to 1997. California Department of Fish and Game, Sacramento, California.

_____ 2003. Distribution of vernal pool habitats in five counties of California's southern coast ranges. Report to U. S. Fish and Wildlife Service. Ventura, California. 23 pages.

Hubbs, E. L. 1951. Food habits of feral house cats in the Sacramento Valley. California Department of Fish and Game 37:177-189.

IFPC. 2001. Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change (Houghton, J.T., Y. Ding, D.J. Griggs, M. Noguer, P.J. van der Linden, X. Dai, K. Maskell, and C.A. Johnson [editors]). Cambridge University Press, Cambridge, United Kingdom and New York, New York. 881 pp. Available at http://www.ipcc.ch/.

_____ 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Alley, R., T. Berntsen, N.L. Bindoff, Z. Chen, A. Chidthaisong, P. Friedlingstein, J. Gregory, G. Hegerl, M. Heimann, B. Hewitson, B. Hoskins, F. Joos, J. Jouzel, V. Kattsov, U. Lohmann, M. Manning, T. Matsuno, M. Molina, N. Nicholls, J. Overpeck, D. Qin, G. Raga, V. Ramaswamy, J. Ren, M. Rusticucci, S. Solomon, R. Somerville, T.F. Stocker, P. Stott, R.F. Stouffer, P. Whetton, R.A. Wood, D. Wratt. 21 pp. Available at http://www.ipcc.ch/.

Ingles, L.G. 1932a. Four new species of *Heamatoloechus* (Trematoda) from California. University of California Publications in Zoology 37: 189-201.

_____ 1932b. *Cephalogonimus brevicirrus*, a new species of trematoda from the intestine of *Rana aurora* from California. University of California Publications in Zoology 37:203-210.

_____ 1933. Studies on the structure and life history of *Ostiolum oxyorchis* (Ingles) from the California red-legged frog *Rana aurora draytonii*. University of California Publication in Zoology 39:135-162.

Inkley, D.B., M.G. Anderson, A.R. Blaustein, V.R. Burkett, B. Felzer, B. Griffin, J. Price, and T.L. Root. 2004. Global climate change and wildlife in North America. Wildlife Society Technical Review 04-2.

Jennings, M. R. 1988. Natural history and decline of native ranids in California. Pages 61-72 *in* H. F. De Lisle, P. R. Brown, B. Kaufman, and B. McGurty (editors). Proceedings of the Conference On California Herpetology. Southwestern Herpetologists Society, Special Publication 4:1-143.

Jennings, M. R., and M. P. Hayes. 1985. Pre-1900 overharvest of California red-legged frogs (*Rana aurora draytonii*): The inducement for bullfrog (*Rana catesbeiana*) introduction. Herpetological Review 31(1):94-103.

_____ 1990. Final report of the status of the California red-legged frog (*Rana aurora draytonii*) in the Pescadero Marsh Natural Preserve. Final report prepared for the California Department of Parks and Recreation, Sacramento, California, through Agreement (4-823-9018). Department of Herpetology, California Academy of Sciences, Golden Gate Park, San Francisco, California. 30 pages.

_____ 1994. Amphibian and reptile species of special concern in California. Report prepared for the California Department of Fish and Game, Inland Fisheries Division, Rancho Cordova, California. 255 pages.

Jennings, M. R., M. P. Hayes, and D. C. Holland. 1992. A petition to the U.S. Fish and Wildlife Service to place the California red-legged frog (*Rana aurora draytonii*) and the western pond turtle (*Clemmys marmorata*) on the list of endangered and threatened wildlife and plants. 21 pages.

Jimerson, T. and L. Hoover. 1991. Old-growth forest fragmentation: Changes in amount, patch size and edge as a result of logging. Pages 168-174 *in*: Proceedings of the symposium on biodiversity of northwestern California. October 28-30, 1991, Santa Rosa, California.

Kanter, J. 2007. Scientists detail climate changes, Poles to Tropics. New York Times. April 10, 2007.

Keeley, J.E. 1987. Role of fire in seed germination of woody taxa in California chaparral. Ecology 68(2):434-443.

Keeley, J.E. 1992. Demographic structure of California chaparral in the long-term absence of fire. Journal of Vegetation Science 3: 79–90.

Keeler-Wolf T., D. R. Elam, K. Lewis, S. A. Flint. 1998. California vernal pool assessment. Preliminary Report. State of California, The Resources Agency, Department of Fish and Game, Sacramento, California.

Kruse, K. C. and M. G. Francis. 1977. A predation deterrent in larvae of the bullfrog, *Rana catesbeiana*. Transactions of the American Fisheries Society 106(3):248-252.

Kupferberg, S. J. 1996a. Hydrologic and geomorphic factors affecting conservation of a river-breeding frog (*Rana boylii*). Ecological Applications 6: 1322-1344.

_____ 1996b. The ecology of native tadpoles (*Rana boylii* and *Hyla regilla*) and the impacts of invading bullfrogs (*Rana catesbeiana*) in a northern California river. PhD dissertation. University of California, Berkeley, California.

Lips, K. R. 2003. Letter to the Sacramento office of the U.S. Fish and Wildlife Service. Subject: Peer Review of the proposal to list the Central California DPS of the California tiger salamander as threatened and to reclassify the status of the Santa Barbara and Sonoma county DPSs of the same species from endangered to threatened. Dated September 15, 2003. 4 pages.

Longcore, J. E. 2003. Letter to the Sacramento office of the U.S. Fish and Wildlife Service. Subject: peer review of notice of proposed rule to list the California tiger salamander as a threatened species. University of Maine, Orono, Maine. July 1, 2003. 2 pages.

Loredo, I., and D. Van Vuren. 1996. Reproductive ecology of a population of the California tiger salamander. Copeia 1996(4):895-901.

Loredo, I., D. Van Vuren and M. L. Morrison. 1996. Habitat use and migration behavior of the California tiger salamander. Journal of Herpetology 30(2): 282-285.

Mao, J., D. E. Green, G. M. Fellers, and V. G. Chincar. 1999. Molecular characterization of iridoviruses isolated from sympatric amphibians and fish. Virus Research 6: 45-52.

Mazzerolle, M.J. and A. Desrochers. 2005. Landscape resistance to frog movements. Canadian Journal of Zoology 83: 455-464.

McGinnis, S.M. 1992. Habitat requirements, distribution, and current status of the Alameda whipsnake (*Masticophis lateralis euryxanthus*). California State University, Hayward, California. 27 pages.

Morey, S. R. 1998. Pool duration influences age and body mass at metamorphosis in the western spadefoot toad: implications for vernal pool conservation. Pages 86-91 *in* Witham, C.W., E.T. Bauder, D. Belk, W.R. Ferren Jr., and R. Ornduff (editor). Ecology, Conservation, and Management of Vernal Pool Ecosystems - Proceedings from a 1996 Conference. California Native Plant Society. Sacramento, California. 1998.

Morin, P.J. 1987. Salamander predation, prey facilitation, and seasonal succession in microcrustacean communities. Pages 174-188 *in* W.C. Kerfoot and A. Sih (editors) Predation Direct and indirect impacts on aquatic communities. University Press of New England, Hanover, New Hampshire.

Norris, S. 2007. Ghosts in our midst: coming to terms with amphibian extinctions. Bioscience 57(4): 311-316.

Orloff, S. 2003. Comments on the Central California DPS of the California tiger salamander (CTS) proposed rule. Ibis Environmental. San Rafel, California.

_____ 2007. Migratory movements of California tiger salamander in upland habitat – a five-year study Pittsburg, California. Ibis Environmental, San Rafael, California.

Padgett-Flohr, G. E., and J. E. Longcore. In press. *Ambystoma californiense* (California tiger salamander) fungal infection. Herpetological Review.

Parker, V.T. 1987. Can native flora survive prescribed burns? Fremontia 14(4):3-6.

Pechmann, J. H. K., D. E. Scott, J. W. Gibbons, and R. D. Semlitsch. 1989. Influence of wetland hydroperiod on diversity and abundance of metamorphosing juvenile amphibians. Wetlands Ecology and Management 1(1):3-11.

Petranka, J. W. 1998. Salamanders of the United States and Canada. Smithsonian Institution Press, Washington, D.C.

Riley, S. P. D., H. B. Shaffer, S. R. Voss, and B. M. Fitzpatrick. 2003. Hybridization between a rare, native tiger salamander (*Ambystoma californiense*) and its introduced congener. Biological Applications 13(5): 1263-1275.

Roberto, P. 1995. The cat rescue movement vs. wildlife defenders. California Coast and Ocean 11(2):31-40.

Rothermel, R.B. and R. D. Semlitsch. 2002. An experimental investigation of landscape resistance of forest versus old-field habitats to emigrating juvenile amphibians. Conservation Biology 16: 1324-1332.

Rundel, P. W., G. A. Baker, D. J. Parsons, and T. J. Stohlgren. 1987. Postfire demography of resprouting and seedling establishment by Adenostoma fasciculatum in the California chaparral pages 575–596 in J. D. Tenhunen, F. M. Catarino, P. L. Lange, and W. C. Oechel, W.C. [eds.]. Plant response to stress. Springer-Verlag, Berlin.

Santa Clara County. 1994. Santa Clara County General Plan, 1995-2010. Adopted December 20, 1994. San Jose, California.

Saunders, D.A., R.J. Hobbs, and C.R. Margules. 1991. Biological consequences of ecosystem fragmentation: a review. Conservation Biology 5:18-32.

Scott, D. E. 1994. The effect of larval density on adult demographic traits in *Ambystoma opacum*. Ecology 75:1383-1396.

Semlitsch, R. D., D. E. Scott, and J. H. K. Pechmann. 1988. Time and size at metamorphosis related to adult fitness in *Ambystoma talpoideum*. Ecology 69: 184-192.

Shaffer, H. B., G. B. Pauly, J. C. Oliver, and P. C. Trenham. 2004. The molecular phylogenitics of endangerment: cryptic variation and historic phylogeography of the California tiger salamander, *Ambystoma californiense*. Molecular Ecology 13: 3033-3049.

Shaffer, H. B., R. N. Fisher, and S. E. Stanley. 1993. Status report: the California tiger salamander (*Ambystoma californiense*). Final report for the California Department of Fish and Game. 36 pages plus figures and tables.

Skerratt, L.F., L. Berger, R. Speare, S. Cashins, K.R. McDonald, A.D. Phillott, H.B.Hines, and N. Kensyon. 2007. Spread of chytridiomycosis has caused the rapid global decline and extinction of frogs. EcoHealth.

Stebbins, R. C. 1985. A field guide to western reptiles and amphibians. Houghton Mifflin Company, Boston, Massachusetts.

_____ 1989. Declaration of R. C. Stebbins in support of petition of writ of mandate. Sierra Club and Richard Pontuis v. Gilroy City Council, Shappell Industries *et al.* Santa Clara County Superior Court. March 16, 1989. 11 pages plus exhibits.

_____ 2003. A field guide to western reptiles and amphibians. Houghton Mifflin Company, Boston, Massachusetts.

Storer, T. I. 1925. A synopsis of the amphibia of California. University of California Publications in Zoology 27:1-1-342.

_____ 1933. Frogs and their commercial use. California Department of Fish and Game 19(3)203-213.

Stuart, J. M., M. L. Watson, T. L. Brown, and C. Eustice. 2001. Plastic netting: an entanglement hazard to snakes and other wildlife. Herpetological Review 32(3): 162-164.

Swaim, K.E. 1994. Aspects of the ecology of the Alameda whipsnake, *Masticophis lateralis euryxanthus*. Masters Thesis, California State University, Hayward, California. 140 pages.

_______ 2005a. 2004 Annual report results of baseline and post-burn trapping surveys for the California Whipsnake (*Masticophis lateralis*) at Lawrence Livermore National Laboratory, Site 300 Experimental Test Facility, Alameda and San Joaquin Counties, California. 25 pages.

______ 2005b. Results of baseline trapping survey for the Alameda whipsnake (*Masticophis lateralis euryxanthus*) Mount. Diablo State Park, Contra Costa County, California. 29 pages.

______ 2005c. Results of 2004 baseline trapping survey (Pre-burn) for the Alameda whipsnake (*Masticophis lateralis euryxanthus*) at Mallory Ridge, Los Vaqueros Reservior Watershed, Contra Costa county, California. 35 pages.

Sweet, S. 1998. Letter to Dwight Harvey, U.S. Fish and Wildlife Service with a report titled "Vineyard development posing an imminent threat to *Ambystoma californiense* in Santa Barbara County, California." University of California, Santa Barbara, California.

Trenham, P. 1998a. Radio tracking information. University of California, Davis, California.

_____ 1998b. Demography, migration, and metapopulation structure of pond breeding salamanders. Ph.D. dissertation. University of California, Davis, California.

Trenham, P. C., and H. B. Shaffer. 2005. Amphibian upland habitat use and its consequences for population viability. Ecological Applications 15:1158–1168.

Trenham, P. C., H. B. Shaffer, W. D. Koening and M. R. Stromberg. 2000. Life History and Demographic variation in the California Tiger Salamander (*Ambystoma californiense*). Copeia 2000(2): 365-377.

Trenham, P. C., W. D. Koenig, and H. B. Shaffer. 2001. Spatially autocorrelated demography and interpond dispersal in the salamander *Ambystoma californiense*. Ecology 82: 3519-3530.

Trombulak, S. C., and C. A. Frissell. 2000. The ecological effects of roads on terrestrial and aquatic communities: a review. Conservation Biology 14:18-30.

Twedt, B. 1993. A comparative ecology of *Rana aurora* Baird and Girard and *Rana catesbeiana* Shaw at Freshwater Lagoon, Humboldt County, California. Unpublished. Master of Science thesis. Humboldt State University, Arcata, California. 53 pages plus appendix.

Twitty, V. C. 1941. Data on the life history of *Ambystoma tigrinum californiense* Gray. Copeia 1941 (1):1-4.

U. S. Census Bureau. 2006. State and county quick facts for Alameda County, California. http://quickfacts.census.gov/qfd/states/06/06001 1k.html.

U. S. Fish and Wildlife Service. 1996. Endangered and threatened wildlife and plants; determination of threatened status for the California Red-Legged Frog. **Federal Register** 61:25813-25833.

_____ 1997. Endangered and threatened wildlife and plants; determination of endangered status for the callippe silverspot butterfly and the Behren's silverspot butterfly and threatened status for the Alameda whipsnake. **Federal Register** 62(234):64306-64320.

_____ 2000. Endangered and threatened wildlife and plants; final determination of critical habitat for the Alameda whipsnake (Masticophis lateralis euryxanthus). Federal Register 62(192):58933-58962.

_____ 2001a. Endangered and threatened wildlife and plants; final determinations of critical habitat for the California Red-legged Frog; Final Rule. **Federal Register** 66:14626-14758.

_____ 2002a. Draft Recovery Plan for Chaparral and Scrub Community Species East of San Francisco Bay, California. Region 1, Portland, Oregon. xvi + 306 pages.

_____ 2002b. Recovery Plan for the California red-legged frog (*Rana aurora draytonii*). Portland, Oregon. May 28, 2002. 173 pages.

_____ 2004a. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the California tiger salamander (*Ambystoma californiense*) in Santa Barbara County. **Federal Register** 69:68567-68609.

_____ 2004b. Endangered and threatened wildlife and plants; determination of threatened status for the California tiger salamander; and special rule exemption for existing routine ranching activities; final rule. **Federal Register** 69: 47212-47248.

_____ 2004c. Endangered and threatened wildlife and plants; proposed designation of critical habitat for the California Tiger Salamander, Central Population; Proposed Rule. **Federal Register** 69:19620-19642.

_____ 2004d. Endangered and threatened wildlife and plants; proposed designation of critical habitat for the California Red-legged Frog (*Rana aurora draytonii*), Proposed Rule. **Federal Register** 69:19620-19642.

_____ 2005a. Endangered and threatened wildlife and plants; designation of critical habitat for the California Tiger Salamander, Central Population; Final Rule. **Federal Register** 70:49379-49458.

_____ 2005b. Endangered and threatened wildlife and plants; revised proposed designation of critical habitat for the California red-legged frog (*Rana aurora draytonii*); Proposed Rule. **Federal Register** 70:66905-67064.

_____ 2006. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Alameda Whipsnake; Final Rule. Federal Register 71:58176-58231.

Van Hattem, M. G. 2004. Underground ecology and natural history of the California tiger salamander. Master of Science thesis. San Jose State University, San Jose, California.

Vos, C.C. and J.P. Chardon. 1998. Effects of habitat fragmentation and road density on the distribution pattern of the moor frog, *Rana arvalis*. Journal of Applied Ecology 35: 44-56.

Vos, C.C. and A.H.P. Stumpel. 1995. Comparasion of habitat-isolation parameters in relation to fragmentation distribution patterns in the tree frog (*Hyla arborea*). Landscape Ecology 11: 203-214.

Wilbur, H. M. and J. P. Collins. 1973. Ecological aspects of amphibian metamorphosis. Science 182(4119): 1305-1314.

Wright, A. H. and A. A. Wright. 1949. Handbook of frogs and toads of the United States and Canada. Comstock Publishing Company, Inc., Ithaca, New York. 640 pages.