APPENDIX D: United States Fish and Wildlife Service Consultation

Biological Assessment

Erosion Protection System Maintenance at the San Antonio Road West Bridge

Vandenberg Air Force Base, Santa Barbara County, California

NOVEMBER 2015

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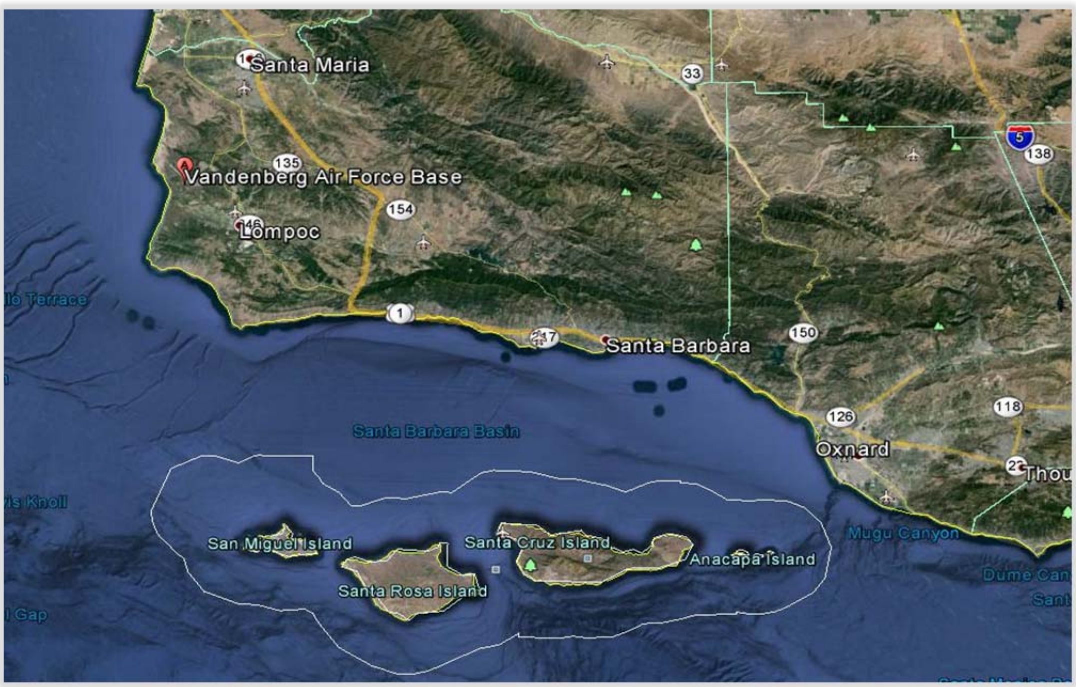
1.0 Introduction

The 30th Space Wing at Vandenberg Air Force Base (VAFB) (Figure 1) is the Air Force Space Command organization responsible for commercial and Department of Defense space and missile launch activities on the west coast of the United States. The Wing supports West Coast launch activities for the U.S. Air Force (USAF), Department of Defense, Missile Defense Agency, National Aeronautics and Space Administration, foreign nations, and various private industry contractors. Satellite launches and ballistic missile testing occurs at VAFB. Reliable transportation corridors are critical to these missions. San Antonio Road West crosses San Antonio Creek near its intersection with Richmond Avenue and serves as an access route into North VAFB. The San Antonio West Bridge was constructed in 1969 and repaired in 1983 to include the installation of riprap and gabions under the bridge (Appendix A and B).

The 30th Space Wing, Installation Management Flight (30 CES/CEI), has prepared this Biological Assessment (BA), per Section 7 of the Endangered Species Act (ESA) (16 USC § 1536(c)) and its implementing regulations (50 CFR Part 402), to evaluate the potential effects of the Proposed Action on ESA-listed species. The Proposed Action consists of repairing gabions, removing vegetation and applying herbicides in the San Antonio Creek channel and its hydrologic floodplain, and installing a berm in an adjacent agricultural field to curb bank erosion (see Section 2.0). These maintenance activities would ensure that creek flow, under normal and flood conditions, does not undermine the stability of the bridge.

Based on the content of this BA, the USAF has determined that formal consultation under the ESA is required because the project *may affect* and is *likely to adversely affect* the following ESA-listed species: California red-legged frog, unarmored threespine stickleback, and tidewater goby.



Source: Google Earth (May 4, 2015)

Figure 1 – Regional Location of Action Area

2.0 Description of the Proposed Action

The Proposed Action involves maintenance activities at the San Antonio Road West Bridge (see Figure 2-3). This area includes some pre-disturbed areas, depicted on Photos 1-12 below (dated July 28, 2015). Specific aspects of the Proposed Action are as follows:

- San Antonio Creek Diversion. The USAF would develop a plan to divert the flow of San Antonio Creek to facilitate the inspection, repair and/or replacement of the gabions. Creek diversion may affect a 0.03-mile (175-foot) stretch of San Antonio Creek. The USAF anticipates diverting the creek to the bay opposite from construction activities in the Main Construction Area. The specific details of the plan would be determined during the National Environmental Policy Act (NEPA) process. It is likely that the USAF will design a plan based on the San Antonio Creek Restoration Project and/or the 13th Street Bridge Replacement Project (Appendix C), but modified to the conditions at the Main Construction Area, a smaller scope of work, and incorporating lessons learned from past projects.
- Repair/Replacement of Gabion Mattresses and Baskets. The USAF would inspect and replace/repair gabions in the San Antonio Creek and its hydrologic floodplain. Not all gabions were visible in the 2012 inspection due to sediment build-up (Appendix B).
  - Sediment Removal. The USAF would remove sediment from an approximate 0.1-acre area under the bridge deck to facilitate the inspection and/or replacement and repair of gabions. The gabions where originally installed 3 feet below ground surface (Appendix A, Sheet 1), but depth of gabions is not presently known and likely varies throughout the Main Construction Area since some gabions are presently visible.
  - Replacement. After sediment removal, the USAF would inspect and replace any failed or excessively worn wire fabric. The replacement of wire fabric should be of the same or better quality as the original and be galvanized to slow soil-water-metal interaction that wears the wire fabric.
  - Repair. Repair will consist of adding additional rock-fill and securely attaching wire fabric over the damaged sections. Fastening methods would follow Caltrans Standard Plans D100A and D100B (Appendix D).
- Vegetation Removal and Herbicide Treatment. The USAF would first perform mechanical/manual removal of vegetation followed by the application of herbicides to prevent regrowth, as listed below. Vegetation could undermine the erosion control structures by growing into the gabions and breaking them open in addition to placing stress on the bridge structure from the resulting ponding/pooling water (Appendix B).
  - Manual or mechanical removal of riparian vegetation would occur within an approximate 0.3-acre area under the bridge, extending outward approximately 60 and 80-feet to the northeast and southwest of the creek, respectively, and up to 16 to 18 feet in width (see Figure 4 and Section 3.1).
  - All woody vegetative material with stems greater than or equal to 2 inches in diameter will be trimmed to within 3 inches of the ground and/or water surface. Vegetation less than 2 inches will remain.
  - The USAF would then hand apply the herbicide Aquamaster® on the cut stumps, using a sponge or other wipe applicator, eliminating the need for spraying (see Appendix E).

  Vegetation removal and herbicide treatment would not require the diversion of San Antonio Creek. The USAF would carry out this work in and around San Antonio Creek and personnel may need to enter San Antonio Creek.

- Bank Erosion Control Measure. The USAF would construct an earthen berm adjacent to the agricultural field depression to retain existing surface water runoff (stormwater) on the field, which would in effect redirect flow away from San Antonio Creek (see Figures 5 - 6). The berm would be located along the edge of the agricultural field, centered on the 0.3-acre depression, and approximately 33-feet wide and 4-feet tall (see Figure 7). The berm would include a spillway to ensure structural integrity of the berm in the event of a major rain or flood event. If additional soil is required for construction, the USAF would use soil from existing borrow pits on VAFB (see Figure 8). The USAF has previously consulted with the U.S. Fish and Wildlife Service on the use of these borrow pits resulting in a biological opinion (*Biological Opinion for the Expansion of Four Soil Borrow Pits at Vandenberg Air Force Base, Santa Barbara County, California (8-8-10-F-5)*), which is incorporated by reference into this BA.

  The existing flow direction is responsible for the bank erosion that is occurring near the bridge and this measure would reduce existing bank erosion adjacent to the bridge and reduce additional pollutants (i.e., suspended solids, heavy metals, and pathogens) from entering San Antonio Creek (Appendix B).

- Staging Areas. Two staging areas would be required to implement the Proposed Action and are located on opposite sides of San Antonio Road West (see Figure 3 and Photos 2-3). The southern staging area is approximately 0.4-acre and the northern area is approximately 0.12-acre. These areas would be cleared and grubbed prior to implementing the Proposed Action.
- Maintenance requirements. After the completion of the Proposed Action, the USAF would conduct annual inspections to maintain the erosion protection system in good condition. It is possible that additional vegetation clearing and/or herbicide application will be required on an annual basis, depending on the rate of regrowth.
- Equipment. The Proposed Action would require the use of a front loader (i.e., bobcat), crane, dump truck, soil container/bin, and shovels. The USAF would use a crane, located in one of the staging areas, to place the bobcat and container/bin under the bridge deck, within the San Antonio Creek hydrologic floodplain. The bobcat would loosen and load sediment from large patches of sediment under the bridge deck and place it into the container. In addition, personnel with shovels would loosen and remove sediment from smaller patches. The crane would then raise the container, as filled, and transfer the sediment to a dump truck waiting in the staging area. This process will continue until the all the sediment covering the gabions is removed and all gabions are exposed.
- Schedule. The USAF anticipated that the Proposed Action would take approximately 90 days, be limited to daytime hours, and commence upon completion of the NEPA process.

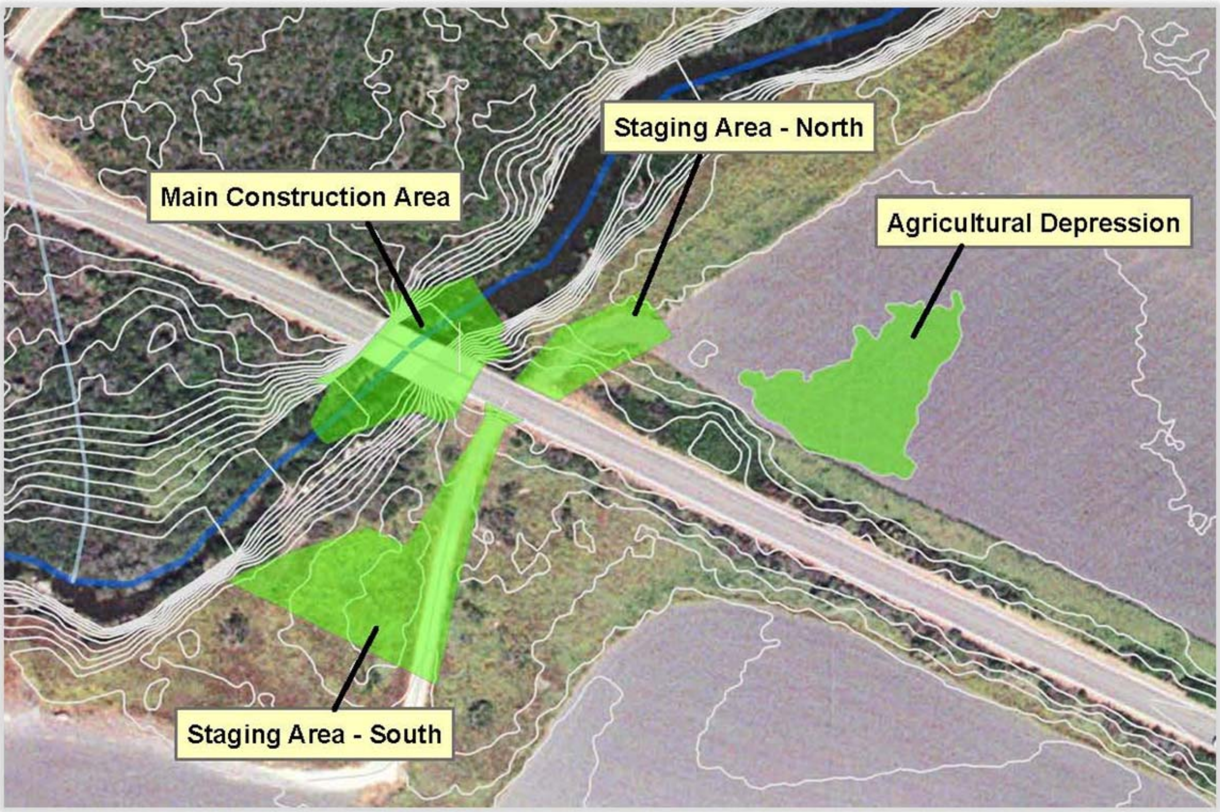
In total, the Proposed Action would affect approximately 1.12 acres with annual maintenance affecting some or all of the same areas (Table 1). Ground disturbing activities would occur in the Main Construction Area, staging areas, and near the agricultural depression.

Table 1 – Proposed Action Acreage

Proposed Action Areas	Acres	Square Feet
Main Construction Area (gabions, vegetation, and a portion of San Antonio Creek)	0.3	13,068
Staging Area – North	0.12	5,227
Staging Area – South	0.4	17,424
Agricultural Depression	0.3	13,068
Total	**1.12**	**48,787**

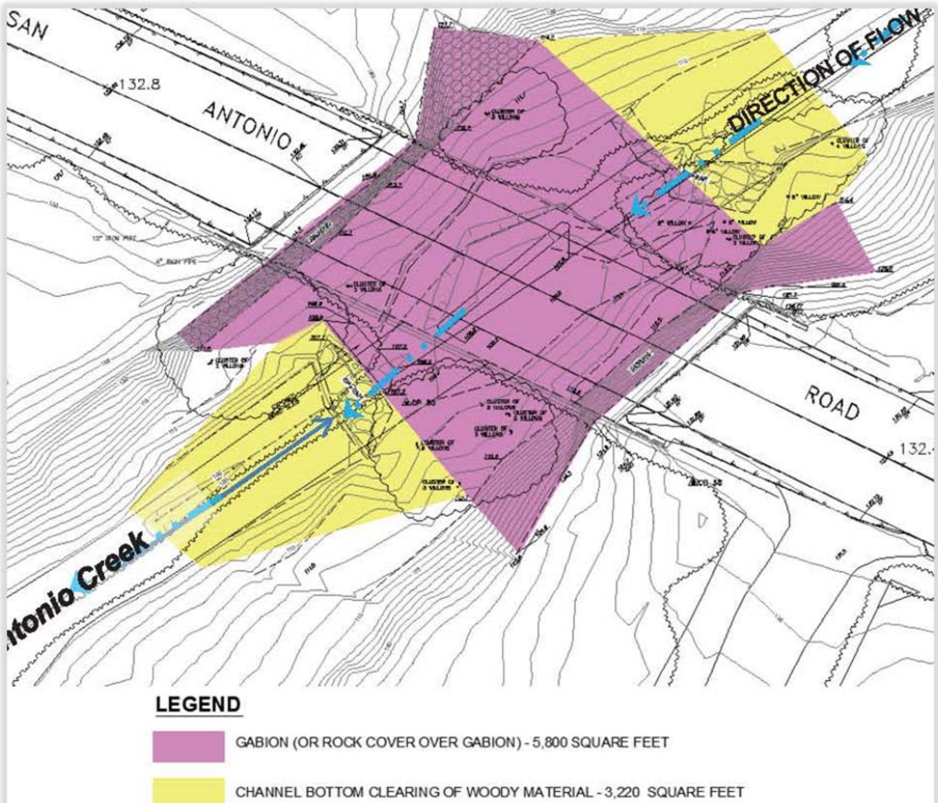
Source: VAFB GIS (October 22, 2015).

Figure 2 – Vicinity Map of the Proposed Action



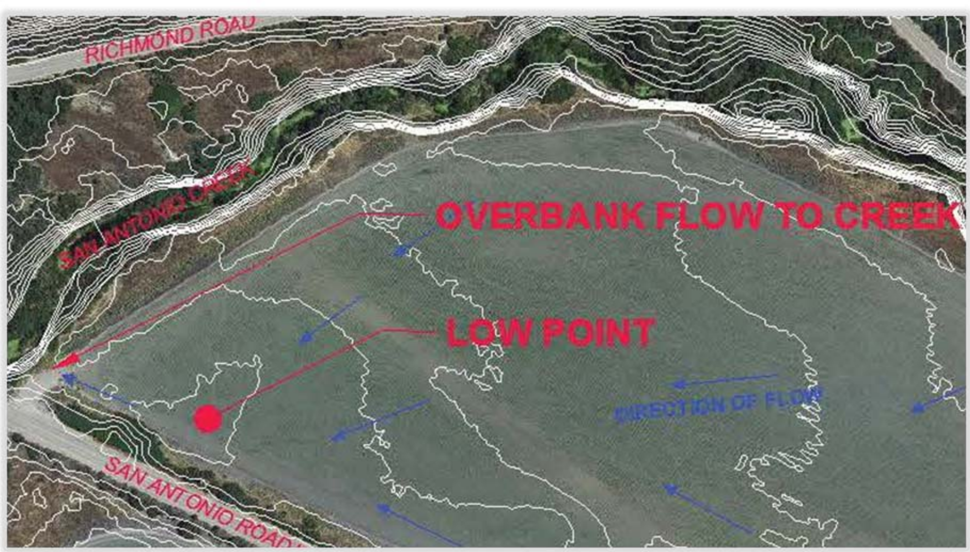
Source: VAFB GIS and 30 CES/CEN (November 5, 2015).

Figure 3 – Location of the Proposed Action



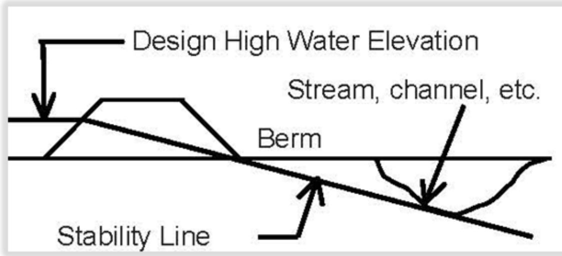
Source: Appendix B (note: woody vegetation exists in the gabion and channel bottom areas).

Figure 4 – Proposed Vegetation Removal



Source: Appendix B.

Figure 5 – Runoff Flow Direction

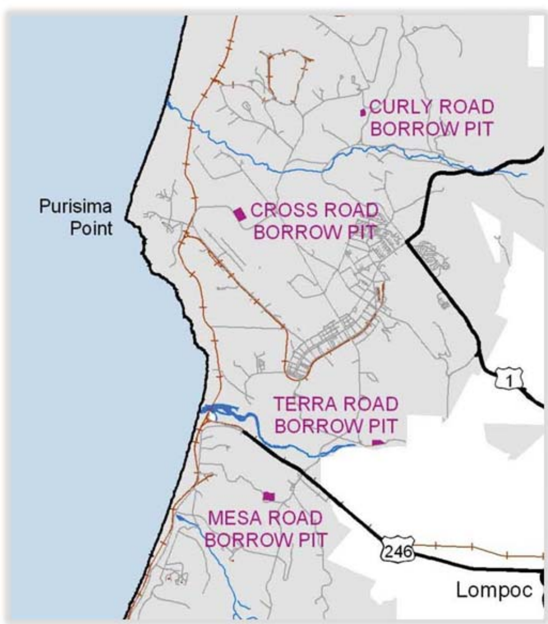


Source: USDA NRCS 2005.

Figure 6 – Typical Berm (for illustrative purposes)

Source: VAFB Engineering Department (November 19, 2015)

Figure 7 - Tentative Location of Berm



Source: Final EA, Borrow Pits Expansion and Reactivation (2010).

Figure 8 – Location of Borrow Pits on VAFB

Photo 1 – Bridge (northwest view)

Photo 2 – Agricultural Field/
Northeast Staging Area

Photo 3 – Southwest Staging Area

Photo 4 – East Bay of Bridge (upstream view)

Photo 5 – Upstream Riprap or Gabion

Photo 6 – Sediment (east bay under bridge**)**

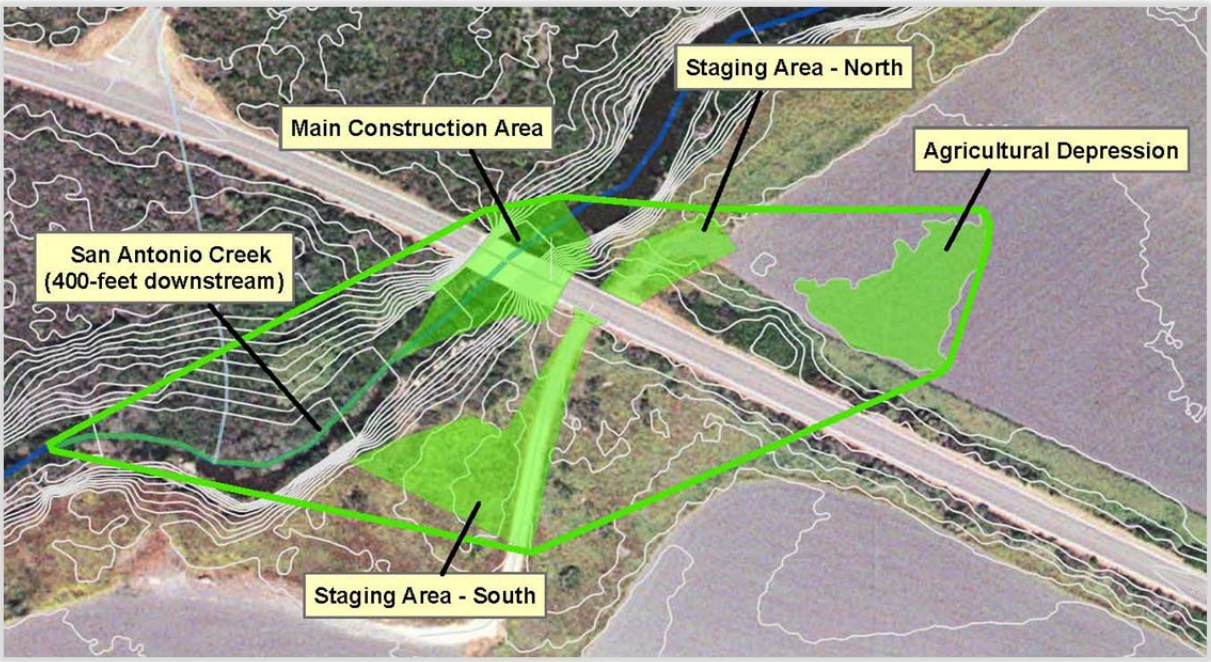
Photo 7 – Gabion Baskets (east bay under bridge) Photo 8 – West Bay of Bridge (upstream view**)**

Photo 9 – Gabion baskets (west bay under bridge) Photo 10 – San Antonio Creek (west bay under bridge)

Photo 11– Upstream Vegetation Photo 12 – Downstream Vegetation

3.0 Action Area

The Action Area includes: (1) the Main Construction Area (gabions under the bridge and the extent of vegetation removal and herbicide application); (2) staging areas; (3) the agricultural field depression; and (4) a downstream portion of San Antonio Creek, approximately 400 feet from the bridge (Figure 9). The USAF applied a 400-foot downstream distance, from the Main Construction Area, as the limit of potential effects from sedimentation and/or increased turbidity. This distance is the farthest downstream sampling point required by the Central Coast Regional Water Quality Control Board in a past project at San Antonio Creek.[1] Since the USAF would hand apply herbicides onto the cut stumps, an expanded Action Area, to account for spray drift, is not required. In total, the Action Area covers approximately 3.88 acres, but the majority of this area would not being disturbed under the Proposed Action (Table 2).



Source: VAFB GIS (November 5, 2015).

Figure 9 – Action Area

Table 2 – Action Area Acreage

Action Area	Acres	San Antonio Creek (Linear Feet)	Square Feet
Proposed Action	1.12	172	48,787
San Antonio Creek (south of Main Construction Area)	-	400	-
San Antonio Creek (north of Main Construction Area)	-	25	-
San Antonio Road West (including portion over creek)	0.3	-	13,068
Undisturbed/Natural Areas (remainder of Action Area)	2.46	-	107,157
Total	3.88	597	169,012

1 Tara Wiskowski, 30 CES/CEIEC, Water Program Manager, email message to author, October 7, 2015.

3.1 Topography

The Action Area covers an approximate 0.1-mile (530-foot) stretch of San Antonio Creek. The San Antonio Creek hydrologic floodplain is narrow, approximately 40 feet wide, and bounded by steep banks (Figure 10). As depicted, San Antonio Creek is located between 110 to 114 feet above sea level (ASL), with the top of bank located at 128 to 130 feet ASL; a 16 to 18-foot differential. Overall, the Action Area appears incised by San Antonio Creek.

Source: VAFB GIS (November 5, 2015).

Figure 10 – Action Area Topography

3.2 Waterbodies and Drainages

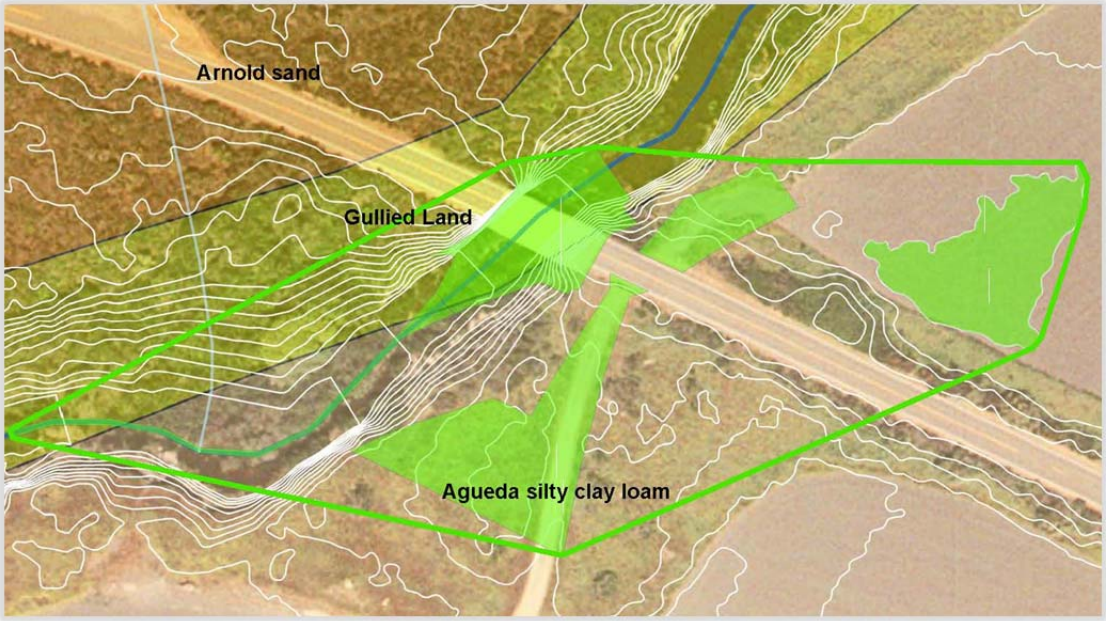
The Action Area includes a portion of San Antonio Creek and a drainage (classified as dry), which only flows during storms (see light blue drainage feature on Figure 3). The portion of San Antonio Creek under the bridge is shallow and flows under the west side of the bridge (see Photos 7 and 9). The USAF is in the process of mapping floodplains on VAFB; however, for this BA, the USAF assumes that the hydrologic floodplain of San Antonio Creek extends to the top of the bank. Storm drains and culverts do not exist within the Action Area.

3.3 Soils

The Action Area is comprised of the following soil types: gullied land, Arnold sands and Agueda silty clay loam (Figure 11). As depicted, San Antonio Creek is located within gullied land, but VAFB GIS data may depict a past creek configuration because the soil boundaries are offset from San Antonio Creek. The soils in the Action Area have the following characteristics:

- Agueda silty clay loam: characterized by moderate permeability, slow surface runoff, and a low erosion hazard (none to slight). Absent vegetative cover, soils are susceptible to wind erosion and easily gullied by surface water runoff.
- Arnold sands: characterized by rapid permeability, rapid surface runoff, and a high erosion hazard (soil is easily gullied).
- Gullied land: characterized by deep gullies, some areas actively eroding, and areas with nearly vertical banks.

(USDA NRCS 1972).

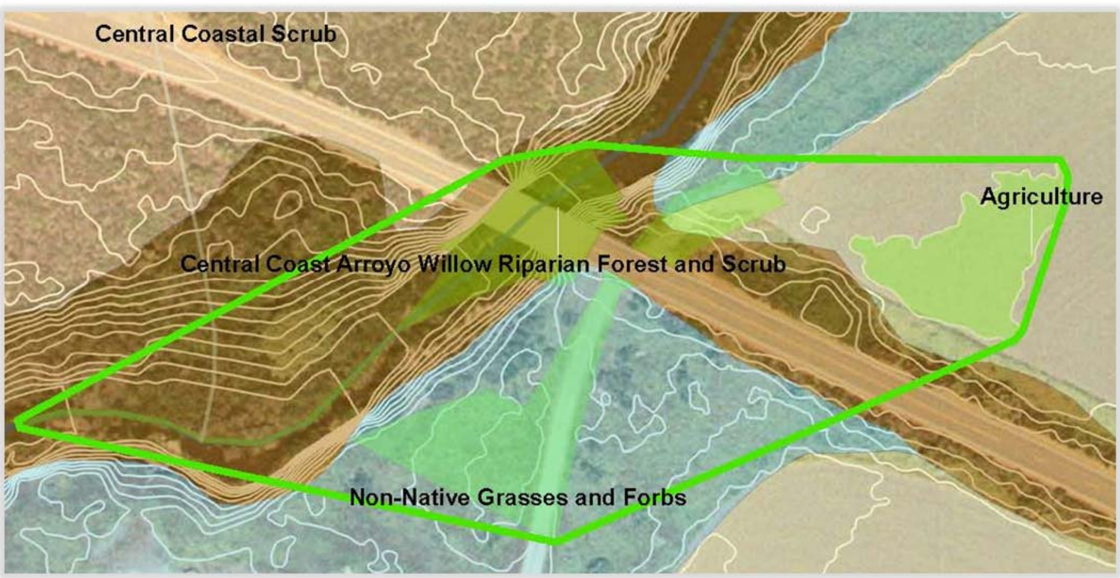


Source: VAFB GIS (November 4, 2015).

Figure 11 – Action Area Soils

3.4 Vegetation Types

The Action Area is comprised of the following vegetation types: central coast arroyo willow riparian forest and scrub, central coastal scrub, non-native grasses and forbs, and agriculture (Figure 12). Wetland plant species may exist within the riparian forest vegetation-type. The USAF is conducting a wetland delineation of the Action Area as part of the NEPA process, to ensure compliance with Clean Water Act (CWA) requirements.



Source: VAFB GIS (November 4, 2015).

Figure 12 – Action Area Vegetation Types

4.0 Status of the Species

4.1 California Red-legged Frog

4.1.1 Status

The California red-legged frog (CRLF), *Rana draytonii*, was listed as threatened in 1996, critical habitat was designated in 2001 (revised in 2010), a recovery plan was issued in 2002, and a 5-Year Review was initiated in 2011 (USFWS 1996, USFWS 2001, USFWS 2010, USFWS 2002a; USFWS 2011). The USFWS ultimately excluded VAFB lands from designated critical habitat under ESA Section 4(b) (2) (USFWS 2001, USFWS 2010).

4.1.2 Habitat Requirements

CRLF habitat requirements include: (1) aquatic breeding habitat; (2) aquatic non-breeding habitat; (3) upland habitat; and (4) dispersal habitat (USFWS 2010).

<u>Aquatic breeding habitat</u> generally consists of:

> [S]tanding bodies of fresh water (with salinities less than 4.5 ppt), including natural and manmade (e.g., stock) ponds, slow-moving streams or pools within streams, and other ephemeral or permanent water bodies that typically become inundated during winter rains and hold water for a minimum of 20 weeks in all but the driest of years (USFWS 2010).

<u>Aquatic non-breeding habitat</u> generally consists of:

> [F]reshwater pond and stream habitats, as described above, that may not hold water long enough for the species to complete its aquatic life cycle but which provide for shelter, foraging, predator avoidance, and aquatic dispersal of juvenile and adult CRLFs [but also includes other wetland habitats (i.e., intermittent creeks, seeps, quiet water refugia within streams, springs] (USFWS 2010).

<u>Upland habitat</u> generally consists of:

> [A]reas adjacent to or surrounding breeding and non-breeding aquatic and riparian habitat up to a distance of 1 mi (1.6 km) in most cases (i.e., depending on surrounding landscape and dispersal barriers) …. Upland features … are needed to maintain the … aquatic, wetland, or riparian habitat…. Upland habitat should include structural features such as boulders, rocks and organic debris (e.g., downed trees, logs), small mammal burrows, or moist leaf litter (USFWS 2010).

<u>Dispersal habitat</u> generally consists of:

> [A]ccessible upland or riparian habitat within and between occupied or previously occupied sites that are located within 1 mi (1.6 km) of each other, and that support movement between such sites. Dispersal habitat includes various natural habitats, and altered habitats such as agricultural fields, that do not contain barriers (e.g., heavily traveled roads without bridges or culverts) to dispersal. Dispersal habitat does not include … urban or industrial developments … large lakes or reservoirs over 50 ac (20 ha) in size, or other areas that do not contain those features identified in [the above] … (USFWS 2010).

CRLFs may complete their entire life cycle in a particular habitat or may use multiple habitat types (USFWS 2002a). The most secure aggregations of CRLFs are in aquatic sites that support substantial riparian and aquatic vegetation (USFWS 1996). Riparian areas may provide good foraging habitat and facilitate dispersal in addition to providing pools and backwater aquatic areas for breeding (USFWS 2002a). If aquatic habitat is not available, CRLFs will seek suitable riparian and upland habitat (USFWS 2010, USFWS 2002a).

CRLF dispersal distances vary widely and are dependent on habitat availability and environmental conditions (USFWS 2002a). In Northern Santa Cruz County, CRLFs traveled more than 2.0 miles without apparent regard to topography, vegetation type, or riparian corridors (USFWS 2010, USFWS 2002a). In studies where habitat appeared ideal, movement varied greatly. In Ventura County, the maximum distance traveled was 48 feet (USFWS 2010). In Santa Cruz County, typical dispersal distances were 9 to 16 feet (USFWS 2010). In Marin County (Point Reyes National Seashore and Golden Gate National Recreation Area), the farthest distance traveled from breeding habitat was 1.7 miles (USFWS 2010).

During periods of wet weather, CRLFs may make overland excursions through upland habitats; however, during dry periods, the CRLF is rarely far from water (USFWS 2002a).

4.1.3 Distribution, Population, and Relevant Aspects of Life History

Distribution & Population. The CRLF is endemic to California and Baja California, Mexico (USFWS 2001, USFWS 2002a). CRLFs are found in wetlands and streams in coastal drainages of Central California (USFWS 1996, USFWS 2001).

On VAFB, CRLFs exist in San Antonio Creek, San Antonio Lagoon, Honda Creek, and Santa Ynez River (Christopher 1996, USFWS 2002a). Subsequent surveys have confirmed CRLFs exist in other areas on VAFB (i.e., Shuman Creek, Bear Creek, Honda Creek) (ManTech 2009a, ManTech 2014). It is noted that San Antonio Creek, its lagoon, and nearby habitat (including dune swales) may be the most important habitat on VAFB (Christopher 1996, USFWS 2002a).

Population estimates, in terms of individual CRLFs, are not readily available. Documents discuss populations of CRLFs in terms of locations where they are known to exist, rather than the sum total of CRLFs at any one location (see e.g., USFWS 2002a).

Relevant Aspects of Life History. CRLFs generally breed from November to April, with most adults laying their eggs in March and depositing them on emergent vegetation and/or in the willows (Christopher 1996, USFWS 1996, USFWS 2002a). Embryos hatch 10 to 14 days after fertilization depending on water temperature, and tadpoles require 11 to 28 weeks to metamorphose into juveniles (terrestrial-phase), typically between May and September, but tadpoles have been observed to delay metamorphosis until the following year (over-winter) (USEPA 2008).

Generally, juvenile CRLFs are active during the day and night, whereas adult CRLFs are active during the night (USFWS 1996, USFWS 2002a). As to habitat requirements, adult CRLFs have more specific requirements than juvenile CRLF (i.e., water depth, stream width, and emergent vegetation) (Christopher 1996).

Although the diet of CRLF aquatic-phase larvae (tadpoles) has not been studied specifically, it is assumed that their diet is similar to that of other frog species, with the aquatic phase feeding exclusively in water and consuming diatoms, algae, and detritus (USEPA 2008). Juvenile and adult CRLFs forage in aquatic and terrestrial habitats, and their diet differs greatly from that of larvae. The main food source for juvenile aquatic- and terrestrial-phase CRLFs is thought to be aquatic and terrestrial invertebrates found along the shoreline and on the water surface (USEPA 2008). CRLFs may be prey of bullfrogs and mosquitofish (*Gambusia affinis*) and CRLF larvae may be predated upon by fish (USFWS 2002a).

4.2 Tidewater Goby

4.2.1 Status

The tidewater goby (TWG), *Eucyclogobius newberryi,* was listed as endangered in 1994 and was twice proposed to be reclassified as threatened; however, a decision has not yet been made (USFWS 1994; USFWS 2002; USFWS 2014). The USFWS designated critical habitat on three separate occasions in 2000, 2008, and 2013 (USFWS 2000, USFWS 2008, USFWS 2013). VAFB lands are exempt from designated critical habitat under ESA, Section 4(a)(3) for having an approved Integrated Natural Resources Management Plan (INRMP) that was founded to provide a conservation benefit to the species (USFWS 2013). The USFWS issued a recovery plan in 2005 (USFWS 2005). The USFWS has not published a 5-Year Review; however, recommendations set forth in the TWG Recovery Plan include continued monitoring, research, habitat restoration, and education (USFWS 2005).

4.2.2 Habitat Requirements

The TWG has adapted to a broad range of environmental conditions (i.e., salinity, oxygen levels, sediment) that exist in estuary environments (USFWS 2005).

The habitat requirements of TWG consist of:

(1) Persistent, shallow (in the range of approximately 0.3 to 6.6 ft (0.1 to 2 m), still-to-slow-moving lagoons, estuaries, and coastal streams with salinity up to 12 ppt, which provide adequate space for normal behavior and individual and population growth that contain one or more of the following:

(a) Substrates (e.g., sand, silt, mud) suitable for the construction of burrows for reproduction,

(b) Submerged and emergent aquatic vegetation … that provides protection from predators and high flow events; or

(c) Presence of a sandbar(s) across the mouth of a lagoon or estuary during the late spring, summer, and fall that closes or partially closes the lagoon or estuary, thereby providing relatively stable water levels and salinity.

(USFWS 2013). TWGs generally select habitat in the upper estuary, usually within the fresh-saltwater interface and are absent from areas where the coastline is steep and streams that do not form lagoons or estuaries (USFWS 2005). TWG prefer a sandy substrate for breeding, but they can be found on rocky, mud, and silt substrates as well (USFWS 2005).

4.2.3 Distribution, Population, and Relevant Aspects of Life History

Distribution & Population. Historically, TWGs ranged from Northern California to northern San Diego County (USFWS 2005).

On VAFB, TWGs exist in Shuman Creek, San Antonio Creek, Santa Ynez River, Canada Honda (Honda Creek), and Jalama Creek (USFWS 2005). TWG localities closely correspond to major stream drainages; sediments provided by major drainages produce sandy beaches with low-lying coastal areas conducive to formation of coastal lagoons (USFWS 2005).

Population estimates are not readily available for TWG, but the USAF evaluated populations on VAFB on a project-by-project basis, since the populations fluctuate yearly. Researchers have identified San Antonio Creek and Santa Ynez lagoons as the most important habitats supporting the TWG, with the Santa Ynez lagoon supporting the largest population (Swift et al. 1997, Swift 1999). In 1999, researchers documented TWG as being concentrated in the San Antonio Creek lagoon as compare to its channel (Swift 1999).

Since TWG appear to spend all life stages in lagoons, estuaries, and river mouths, their population may experience a decline if flushed out by the breaching of sandbars following storm events (USFWS 2005). However, population decline in one area may lead to colonization of others areas up and down the coast, as is suspected to be the case with Honda Creek (Swift et al. 1997, USFWS 2005).

Relevant Aspects of Life History. TWG is a small fish rarely exceeding 2 inches (USFWS 2005). Reproduction occurs year-round although distinct peaks in spawning often occur in early spring and late summer (USFWS 2005). Male tidewater gobies begin digging breeding burrows in April or May after lagoons close to the ocean with evidence showing that reproduction occurs in upstream tributaries (USFWS 2005). In San Antonio Creek, TWG have been collected 3 to 5 miles upstream of the tidal lagoons (USFWS 2005). TWGs feed on invertebrates (i.e., shrimp, amphipods) and aquatic insects (USFWS 2005). Juvenile TWGs are generally day-feeders and adults mainly feed at night (USFWS 2005). TWG predators include fish (i.e., bullhead), birds and snakes (USFWS 2005).

4.3 Unarmored Threespine Stickleback

4.3.1 Status

The unarmored threespine stickleback (UTS), *Gasterosteus aculeatus williamsoni*, was listed as endangered in 1970, critical habitat was proposed in 1980 (not designated), and a recovery plan was issued in 1985 (USFWS 1970, USFWS 1980, USFWS 1985, USFWS 2002). The USFWS has not yet published a 5-Year Review, but recommendations in the recovery plan include the need to restore and maintain habitat at optimum conditions (i.e., water quality) (USFWS 1985).

4.3.2 Habitat Requirements

San Antonio Creek (VAFB), from its mouth to Barka Slough, including the lateral areas of its hydrologic floodplain up to 10 feet out from the main streambed is essential habitat for the UTS (USFWS 1980, USFWS 1985).

Suitable habitat in San Antonio Creek consists of shallow areas of moderate current with copious amounts of aquatic vegetation (USFWS 1985). The hydrologic floodplain supports seasonal marshes used for feeding and reproduction by the UTS (USFWS 1980). In addition, UTS are more abundant in pools (with some flow) and shallow backwaters than in stream channels (USFWS 1985). Stream channelization increases water velocity in pools, eliminates shallow backwaters, and reduces aquatic vegetation (USFWS 1985). Past studies have found UTS to be absent from rapid and high gradient flows (see ManTech 2009a). Although UTS in San Antonio Creek are adapted to life in a turbulent/dynamic environment (i.e., floods), they appear to be intolerant to turbidity as they are not found in muddy water (USFWS 1980).

Observation of the UTS population in the Santa Clara River may be useful due to lack of information regarding how UTS utilize habitats in San Antonio Creek. In the Santa Clara River, young UTS were found at the shallow edge of the stream in areas of dense/protective vegetation, in slow moving or standing water (USFWS 1985). Adult UTS were found in all portions of the stream, but also gathering in areas of slow-moving or standing water in addition to occurring in ponds isolated from the main stream (USFWS 1985).

4.3.3 Distribution, Population, and Relevant Aspects of Life History

Distribution & Population. UTS was abundant throughout the Los Angeles basin, but was reported to be extirpated by 1942. As of 1985, UTS was generally restricted to the Santa Clara River drainage in Los Angeles County and the San Antonio Creek drainage in Santa Barbara County (USFWS 1985).

On VAFB, UTS exists in lower San Antonio Creek and found mostly in the creek channel rather than the lagoon (ManTech 2009b, Swift 1999). UTSs were previously documented as being most concentrated near the El Rancho Road bridge (Swift 1999). In a recent 2009 survey, UTSs were most confined to the stretch of San Antonio Creek from its mouth to just south of Lee Road (ManTech 2009a). Very small to no populations of UTSs were found upstream of the Lee Road bridge (ManTech 2009a). The creek habitat north of Lee Road has a narrow and incised channel (ManTech 2009a).

Population estimates are not readily available for UTSs, but the USAF evaluated populations on VAFB on a project-by-project basis, since the populations fluctuate yearly. For example, the USAF captured 3,454 UTSs in a survey of San Antonio Creek in 2009 (ManTech 2009a). In addition, flood events in San Antonio Creek may result in population decreases if the lagoon breaches and UTSs disperse into the ocean (USFWS 1985).

Relevant Aspects of Life History. UTSs are small fish (approximately 6 centimeters) that are short-lived (i.e., rarely surviving 2-3 years) (USFWS 1985, ManTech 2009a). UTSs reproduce throughout the year with highest recruitment noted from May to September (USFWS 1985). UTSs are opportunistic feeders and primarily feed on invertebrates and aquatic insects (USFWS 1985). In San Antonio Creek, UTSs coexist with other native and introduced species, namely: tidewater goby, prickly sculpin, arroyo chub, carp, and mosquitofish (USFWS 1985). Some species may feed on UTSs. In 2009, bullfrogs, crayfish, brown bullhead, and possibly black bullhead exist where documented in San Antonio Creek with brown bullheads preying on UTSs (see ManTech SRS 2009a).

4.4 Other Species Considered

The following other species have been considered in preparing this BA: El Segundo blue butterfly (*Euphilotes battoides allyni*) (Endangered); Least Bell's vireo (*Vireo bellii pusillus*) (Endangered); Southwestern willow flycatcher (*Empidonax traillii extimus*) (Endangered); Western yellow-billed cuckoo (*Coccyzus americanus*) (Threatened); and Gambel's watercress (*Rorippa gambelif)* (Endangered). The USAF has determined that the Proposed Action would not affect these species because repeated surveys have failed to detect presence of these species in the Action Area. A no effect determination is on file with the USAF.

5.0 Other Considerations

5.1 Environmental Baseline

No other past or present federal, state, and/or private actions are located within the Action Area.

5.2 Interrelated and Interdependent Actions

The Proposed Action is not part of a larger action. There is no comprehensive bridge replacement program on VAFB. Furthermore, all bridge projects on VAFB have independent utility in preventing failure at specific locations. This is the case even though these independent projects result in upgrades to the overall transportation system. The USAF repairs/replaces bridges, based on priority and available funding, which varies from year to year. Bridges have an approximate 50- to 75-year lifespan (Appendix B) and since the base was in place in the 1940s, many or all of the existing bridges are in some need of repair. Aside from USAF actions on VAFB, the Union Pacific Railroad (UPRR) repairs its railroad infrastructure that crosses the Santa Ynez River, Honda Creek and San Antonio Creek on VAFB. UPRR owns various widths along the railroad that crosses through VAFB. The USAF conducted the ESA Section 7 consultation on the Narlon Replacement Bridge Project because the project required access/use of federal lands on VAFB (#8-8-12-F-52). This project crosses San Antonio Creek, but is not within the Action Area.

5.3 Cumulative Effects

No future state or private activities are located within the Action Area.

6.0 Site Survey

The USAF conducted a site survey of the Main Construction Area on May 27, 2015 to determine if Gambel's watercress is present in the Action Area; it was not present.[2] Subsequently, the USAF conducted a site survey of the Action Area on July 23, 2015 to determine if the El Segundo blue butterfly host plant, seacliff buckwheat, is present in the Action Area (see Photos 1-12, above). No seacliff buckwheat was present; mustard (i.e., *Brassica nigra*) generally dominates the area.[3] These survey dates coincided with the blooming season for these species (CalFlora 2015, CNPS 2015).

7.0 Effects Analysis

The following analyses evaluate the potential effects on the species identified in Section 4.0, focusing on aspects of the Proposed Action having the potential for the most significant effects.

7.1 California Red-legged Frog

CRLF sightings have been documented throughout San Antonio Creek, with the majority of sightings centered around waterbodies (i.e., wetlands, tributaries and San Antonio Creek). Since 2009, the USAF has released many CRLFs into the Action Area in support of a separate projects such as the Installation Restoration Program Site 13-C ABRES Complex Artifical Basins (ManTech 2013). The USAF is currently conducting CRLF surveys with San Antonio Creek scheduled in 2016. Despite past or future documented locations, CRLFs may be present whereever there is suitable habitat. As previsouly explained, CRLF may travel more than two miles between locations and not deterred by obstacles (i.e., steep slopes in the Main Construction Area) (Section 4.1.2). As a result, the concentration of CRLFs may vary in locations where they are previously known to be present.

7.1.1 Physical Effects

The Proposed Action would involve intrusive activities within the Main Construction Area (i.e., removal of sediment covering gabions, repair/replacement of gabions, riparian vegetation removal, and application of herbicides) (Section 2.0), which could result in physical injury to or death of CRLFs.

Under the Proposed Action, CRLFs could be inadvertently crushed by vehicles, equipment and/or people if CRLF enter the Main Construction Area (creek and riparian areas) during construction activities. In addition, the Proposed Action would occur in the daytime, but during anytime of the year, including breeding season. CRLFs generally breed from November to April, and metamorphosis from tadpoles into juveniles (terrestrial phase) may take up to 28 weeks (5 months), but could be delayed up to 1 year (Section 4.1.3). Based on this information,

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[2] Lum, Luanne, USAF (30 CES/CEIEA), Botanist, interviewed by author regarding results of site survey for Gambel's watercress (July 30, 2015).

[3] Miller, Katherine, Colorado State University, Center for Environmental Management of Military Lands, Biologist, interviewed by author regarding results of site survey for seacliff buckwheat (July 23, 2015).

the Proposed Action would tend to affect juvenile CRLFs to a greater extent than adults because juveniles are active during both the day and night. Further, the potential loss of eggs during vegetation removal (discussed below) could prevent an increase in population of the CRLF population in San Antonio Creek.

In response to these potential effects, the USAF would relocate CRLFs and install temporary exclusionary fencing prior to work. Temporary exclusionary fencing would prevent CRLFs from entering the Main Construction Area and it would be monitored daily. Relocation has the potential to result in injury and transmission of the chytrid infection, recently documented in San Antonio Creek (see ManTech 2014). To prevent inadvertent adverse effects, only a USFWS-approved biologist will relocate CRLFs. In addition, the USAF would temporarily divert San Antonio Creek's flow into the Main Construction Area, which would reduce the potential for CRLFs to congregate in the aquatic habitat of San Antonio Creek that runs through the Main Construction Area. Finally, all personnel working in the Main Construction Area will adhere to the requirements stated in *The Declining Amphibian Populations Task Force Fieldwork Code of Practice* (USFWS 2002a), which includes a list of sanitation practices for the protection of species, such as the CRLF (see Appendix F). Since CRLF eggs and/or junveniles may be present throughout the year in San Antonio Creek, additional Conservation Measures regarding time of day or duration of construction activitiesare not feasible in order the implement the Proposed Action.

Therefore, the Proposed Action could result in adverse effects to CRLF from accidental physical injury, but it would be implemented in a way to avoid and/or minimize the potential adverse effects to the maximum extent practicable. A summary of the Conservation Measures discussed above, which are part of the Proposed Action, are located in Section 8.0.

7.1.2 Habitat Effects

7.1.2.1. Vegetation Removal

The Proposed Action would involve intrusive work, including vegetation removal, within CRLF habitat (see Tables 3 and 4). Within the Action Area, San Antonio Creek constitutes CRLF aquatic breeding and/or non-breeding habitat because it has standing water that is shallow and slow moving (Section 4.1.2). Aquatic habitat may overlap with upland habitat, as both may contain riparian habitat or wetlands. Although upland habitat generally extends up to 1 mile from aquatic habitats (Section 4.1.2), upland areas within 200 feet of the edge of riparian areas or its drip line may constitute the outer limit of terrestrial-phase CRLF habitat (USEPA 2008, USEPA, 2015b). As a result, the USAF uses a 200-foot buffer, from the edge of aquatic features (i.e., creek, wetland), to delimit the outer extent of upland habitat since those features represent the potential location of riparian habitat (see Figure 13). Finally, CRLF dispersal habitat is the remainder of the land outside of upland habitat, which can be up to 2 miles away (Section 4.1.2).

Under the Proposed Action, the USAF would mechanically or manually remove vegetation within the 0.3-acre Main Construction Area, which includes aquatic and riparian vegetation (see Figures 3 and 4; Photos 11-12). Vegetation removal would primarily affect riparian vegetation, but effects to aquatic vegetation could result since some vegetation is present in the creek (see Photos 9-10). Within the Main Construction Area there is 0.25 and 0.05 acres of aquatic/riparian and upland CRLF-habitat, respectively. In addition, clearing and grubbing of vegetation in the staging areas would affect 0.03 and 0.49 acres of aquatic/riparian and upland habitat, respectively. Installation of the berm near the agricultural field is not anticipated to require removal of vegetation, it would occur in CRLF upland and dispersal habitat, respectively. Therefore, approximately 0.82 acres CRLF habitat could be affected by vegetation removal under the Proposed Action.

Both adult and juvenile CRLFs could be affected by vegetation removal, if it causes a change in habitat structure/function. However, since juvenile CRLFs are less discriminatory in habitat type than adults (Section 4.1.2), any change to the habitat structure in the Main Construction Area may affect adult CRLFs to a greater degree than juveniles. On the other hand, aquatic-phase larvae (tadpoles) and juvenile CRLFs rely on food sources that are linked with the presence of riparian vegetation (i.e., diatoms, algae, detritus, and terrestrial invertebrates) (Section 4.1.3). Finally, CRLF egg masses tend to be located on emergent vegetation and bordering riparian areas (Section 4.1.3). As a result, the removal of vegetation may affect the use of this area by CRLF for breeding, foraging and/or refuge, but since CLRF are not detered by obstacles, this area without vegetation would likely still be used for dispersal/transit by some phases of CRLF to upstream/downstream locations (Sections 4.1.2 and 4.1.3).

In addition, the potential effects of the Proposed Action from vegetation removal may contribute to the existing habitat degradation issues within the watershed already affecting CRLF. For example, San Antonio Creek is incised in the upstream reaches and impervious surfaces border the creek (Figures 2 and 10). Channel incision occurs when long-term erosion exceeds sedimentation (Fischenich and Morrow 2000). Impervious surfaces (i.e., roads and roofs) lead to increased overland flow, resulting in storm flows that are of greater magnitude and frequency than in areas with less impervious surfaces (see Barrett et al. 2010; Novotny 2003). Vegetated buffers can store floodwaters and reduce flood peaks resulting in decreaseed overland flow velocity and sediment transport (Kenwick et al. 2009, Larose et al. 2011). In addition, soil compaction could reduce soil permeability (infiltration) (Novotny 2003). As a result, high runoff velocities resulting from these existing conditions may adversely affect CRLFs that prefer areas of slow moving water within San Antonio Creek. A study on stream breeding amphibians (salamander) found that higher water velocities in urban streams resulted in decreased larval retention in streams (Barrett et al. 2010). The Proposed Action would result in the removal of vegetated buffers along San Antonio Creek in the Main Construction Area, contributing to increased flow velocity in San Antonio Creek. In addition, the use of heavy equipment in undeveloped areas may cause soil compaction, which would further increase flow velocity (see e.g., Photo 2 and 6). Because of the prolonged drought in California, the soils in the Action Area may already be somewhat compacted and impermeable. Therefore, the Proposed Action would occur in an area where CRLF habitat is somewhat degraded and/or undergoing constant changes due because of urbanization.

Therefore, the Proposed Action could result in adverse effects to CRLF habitat; however, no additional Conservation Measures are proposed since this is an unavoidable consequence of the Proposed Action.

Table 3 – CRLF Habitat in Action Area

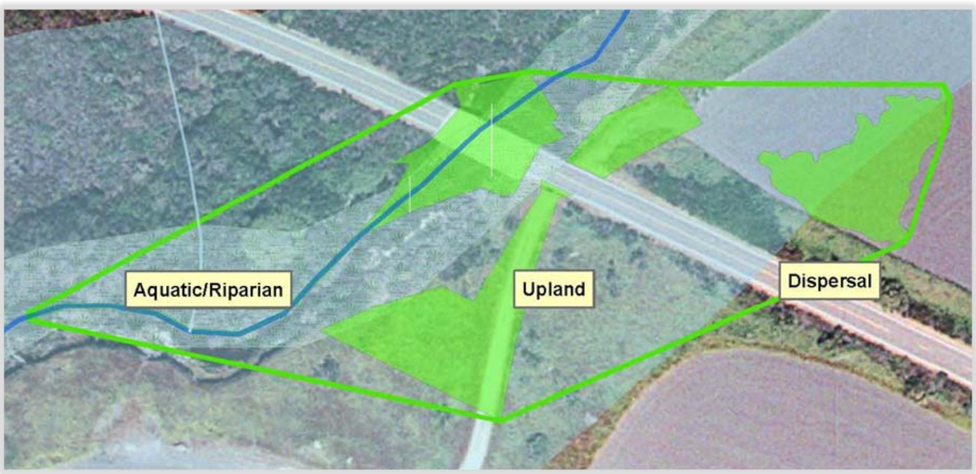
CRLF Habitat	Acres
Aquatic/Riparian Habitat	1.21
Upland Habitat	2.36
Dispersal Habitat	0.31

Source: VAFB GIS (accessed November 5, 2015).

Table 4 – CRLF Habitat in Proposed Action Areas

CRLF Habitat	Acres
Main Construction Area	
Aquatic/Riparian Habitat	0.25
Upland Habitat	0.05
Dispersal Habitat	0
Staging Area - North	
Aquatic/Riparian Habitat	0.01
Upland Habitat	0.11
Dispersal Habitat	0
Staging Area – South	
Aquatic/Riparian Habitat	0.02
Upland Habitat	0.38
Dispersal Habitat	0
Agricultural Depression	
Aquatic/Riparian Habitat	0
Upland Habitat	0.13
Dispersal Habitat	0.17

Source: VAFB GIS (accessed November 5, 2015).



Source: VAFB GIS (accessed November 20, 2015).

Figure 13 – CRLF Habitat in the Action Area

7.1.2.2. Herbicides

The Proposed Action could result in adverse effects to CRLFs due to exposure to the herbicide Aquamaster®, whether applied in or near water because CRLFs exists in both aquatic and terrestrial environments (Section 4.1.2).

Under the Proposed Action, the USAF would hand apply (wipe applicator or sponge) Aquamaster® to the newly cut vegetation (aquatic and riparian), existing inside and outside of the creek, to prevent regrowth. The USAF would use a 50 percent Aquamaster® solution (mixed with water) for treatment of the cut vegetation (cut stumps). Repeated annual applications may be required based on future bridge inspections (Section 2.0). Application of

Aquamaster® would be limited to the Main Construction Area, which includes CRLF aquatic/riparian and upland habitat.

The active ingredient (a.i.) in Aquamaster® is glyphosate (53.8% isopropylamine salt of glyphosate (Monsanto 2009), which in pure form, is practically non-toxic to wildlife (i.e., birds, fish and aquatic invertebrates) (see generally, Bowman 1991,[4] see also, USEPA 1993a, Howe et al. 2004,[5] USEPA 2008[6]). In a recent U.S. Environmental Protection Agency (USEPA) analysis of the effects of glyphosate to CRLFs, *direct and indirect effects* were noted to terrestrial-phase CRLF (i.e., consumption of prey, reduction in prey and habitat effects) and only *indirect effects* to aquatic-phase CRLFs (i.e., reduction in prey) (USEPA 2008).[7] These findings were based on an application range of 3.75 to 7.95 pounds per acre of glyphosate with the exception that any application rate would affect small insects and aquatic plants (USEPA 2008).[8]

Findings from the USEPA analysis are summarized below, in relevant part:

- Terrestrial-phase CRLFs may be directly affected by eating broadleaf plants, small insects and small herbivorous mammals that were chronically exposure [sic] to glyphosate at application rates of 7.5 lb a.e./A and above.
- Terrestrial-phase CRLF may be indirectly affected by a reduction in prey where prey where exposed to any amount (small insects), 3.84 lbs a.e./A and above (small mammals), and 7.5 lb a.e./A and above (large insects).
- Aquatic-phase CRLF may be indirectly affected by a reduction in prey as a result of using glyphosate to target aquatic nonvascular plants (i.e., algae) with aquatic weeds at an application rate of 3.75 lb a.e./A.
- Both aquatic and terrestrial phase CRLFs may be indirectly affected by habitat effects that may occur with aquatic non-vascular plants following aquatic weed management use; aquatic emergent plants and terrestrial plants exposed via spray drift with aerial application at rates of 3.75 lbs/A and above; and with ground applications on impervious surface at a rate of 7.95 lbs/A.

(USEPA 2008). The above findings distinguish between glyphosate and formulations of glyphosate. Findings pertaining to glyphosate are presented in terms of pounds acid equivalents per acre (lb a.e./A)[9] and formulations of glyphosate are presented in terms of

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4 This study determined that AMPA, the glyphosate degradate, is practically nontoxic to Rainbow trout *(Oncorhynchus mykiss)*.

5 This study evaluated glyphosate, the polyethoxylated tallow amine (POEA; MONO818) surfactant, and six glyphosate-based formulations and determined that glyphosate alone is practically nontoxic to the amphibian larvae, but that the POEA surfactant (MONO818) alone or in combination with glyphosate is toxic to amphibians (i.e., affected gonadal development, decreased size at metamorphosis and increased time to metamorphosis).

6 In this report and cited studies, acute and chronic levels of concern for *freshwater* invertebrates are not exceeded for glyphosate, its salts or formulations.

7 For purposes of this BA, the USAF considers the effects identified in the 2008 USEPA analysis as direct effects even though restatement of the findings retain the USEPA distinction of indirect versus direct effects.

8 Lower application rates apply for a specific glyphosate formulation (EPA Registration No. 524-424), but that formulation would not be used under the Proposed Action (USEPA 2008).

9 Toxicity endpoint values for the isopropylamine salt of glyphosate (IPA) were converted to acid equivalents by multiplying by 0.74, the ratio of the molecular weight of glyphosate to the IPA salt (USEPA 2008).

pounds formulated product per acre (lbs/A).[10] Herbicide labels tend to show application rates in units of volume rather than mass applied, which was needed to estimate exposure concentrations for the effects analysis discussed above (USEPA 2008). As a result, the application rates analyzed where calculated based on label information and reasonable assumptions (USEPA 2008). Therefore, it is reasonable to assume that the effects of the Aquamaster® formulation would be within the scope of the foregoing effects analysis of its parent material glyphosate.

Although the USEPA analysis of effects did not evaluate the Aquamaster® formulation, the findings of its study are still useful in shedding light on the potential toxicity of Aquamaster® since formulations of glyphosate are generally more toxic than pure glyphosate (USEPA 2008). For example, Aquamaster® may be less toxic than the formulations analyzed because it contains a greater percent of the less toxic parent material glyphosate. The formulations analyzed[11] contained up to 43.5 percent glyphosate, whereas Aquamaster® contains 53.8 percent glyphosate (USEPA 2008, Monsanto 2009). However, the effects analysis does not show whether toxicity decreases as the active ingredient increases. Nevertheless, the USEPA study did cover a wide array of common uses (e.g., aquatic uses, non-crop uses, residential, farming), with these various uses having similar standard application rates (USEPA 2008). Therefore, it is likely that the standard Aquamaster® application rate is within the scope of the USEPA analysis of effects to CRLFs because the use proposed in this BA is within the scope of its analysis (i.e., aquatic uses).

The ingredients of Aquamaster® are proprietary information and not listed on its label; however, since Aquamaster® is not specifically prohibited on any state or federal list (CDPR 2015, USEPA 2015a), it may be assumed to not contain any prohibited or notably toxic ingredient(s). The Department of Defense (DoD) lists Aquamaster® as a conditionally approved pesticide; use of pesticides on the list are subject to pre-approval by a professional pest management consultant, which is normally done during the approval process of the installation’s pest management plan (PMP) (AFPMB 2015). VAFB has a PMP, but this BA has been prepared to specifically obtain coverage for the use of Aquamaster®. Therefore, the USAF has determined that Aquamaster® is permissible for use in Californa and on federal lands at VAFB.

Since the effects analysis conducted by the USEPA is based on label instructions and reasonsable assumption, as noted above, the concentration limitations discussed in the USEPA study (2008) are not necessarily applicable to this Proposed Action since the USAF method of application would avoid typical adverse effects of using the herbicide. A review of the Aquamaster® label indicates that spraying is the typical method of application, with other methods including injection and direct application to cut stumps (Monsanto 2009). Under the Proposed Action, Aquamaster® will be hand applied onto the stumps directly, resulting is a lesser risk of adverse effects to CRLFs than traditional means of application (i.e., overspraying, spray drift, wind transport of soil particles with adsorbed glyphosate residues). In this way only small quantities of Aquamaster® would be applied directly onto specifically identified vegetation

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[10] [A]pplication rates for formulations were back-calculated based on application rates for glyphosate and the fraction of active ingredient in the formulation. To calculate an application rate for the formulated product, the seasonal application rate of glyphosate acid was converted from acid equivalents [a.e.] to active ingredient [a.i.], and this rate was then divided by the fraction of active ingredient in the formulated product, according to the following equation:

Seasonal application rate (lb formulated product/A) = $\frac{[\textit{Seasonal application rate (lb ae/A)} \div \textit{acid equivalence ratio}]}{[\textit{fraction of a.i. in formulated product}]}$

(USEPA 2008).

[11] The formulations analyzed include the following brands: Touchdown, Sequence, Ortho, Standout, ETK-2301, Chemsico, Nufarm, and Recoil (USEPA 2008).

of 2-inch diameter or more. Finally, the qualified DoD applicator would implement appropriate spill prevention measures, which may be adapted from VAFB standard Spill Prevention Countermeasure Control Plan (SPCC Plan), making it unlikely there would be any spillage into the San Antonio Creek ecosystem. Therefore, the USAF would hand-apply Aquamaster® to specifically identified stumps at rates within the scope of its label (i.e., 50 percent solution) to ensure effective treatment of vegetation.

Once applied, glyphosate would degrade into aminomethyl phosphonic acid (AMPA), which is noted to be less toxic than glyphosate (USEPA 2008). Glyphosate strongly adsorbs to soil/sediments (USEPA 2008). Under *aerobic* conditions, glyphosate has a 1- to 6-day half-life in soil and a 7-day half-life in water-sediment environments (USEPA 2008).[12] The soil degradation rate is consistent with the Aquamaster® label regarding waiting time (i.e., wait 7 days or more after a treatment before reintroducing water; product applied 1 day after drawdown of water) (Monsanto 2009). Under *anaerobic conditions*, degradation takes longer (8 to 200 days), with the potential that it may not breakdown in water (USEPA 2008). Despite lower toxicity, AMPA may persist in the environment (i.e., over 200 days) (USEPA 2008). As explained in Section 2.0, the USAF would cut vegetation to 3 inches above the ground and water surface and apply Aquamaster® to cut stumps by hand (i.e., wipe applicator/sponge). As a result, Aquamaster® should not enter the water. However, the USAF would ensure that Aquamaster® is applied when rain is not in the immediate forecast (i.e., 0.5 inches within a 24-hour period). Therefore, additional contaminant loading into San Antonio Creek and/or a prolonged anaerobic degradation would not be an effect of the Proposed Action because the USAF would ensure Aquamaster® does not enter any waterbody or be used during a rain event.

Finally, the Aquamaster® label instructs the user to add a non-ionic surfactant prior to use (USEPA 2008, Monsanto 2009). Surfactants (to allow easier spreading of the herbicide solution) have been shown to be more toxic that the active ingredient alone [glyphosate] (USEPA 2008).[13] One class of surfactants not allowed in California is polyethoxylated tallow amine (POEA)-containing products (USEPA 2008, Howe et al. 2004). Therefore, the USAF and its DoD-approved applicator would ensure that any non-ionic surfactant added to the Aquamaster® concentrate is not prohibited or toxic to CRLFs; a non-ionic surfactant approved for wetland use.

Therefore, the Proposed Action could result in adverse effects to CRLF from use of Aquamaster® in CRLF habitat, but the method of application would avoid and/or minimize the potential adverse effects. A summary of the Conservation Measures discussed above, which are part of the Proposed Action, are located in Section 8.0.

Note: The foregoing analysis relies upon the USEPA effects analysis prepared in response to the CRLF injunction, requiring the USEPA to evaluate the effects of pesticides (including herbicides) on the CRLF (USEPA 2015b). The evaluation process is still underway (USEPA 2015c). If new information becomes available, the USAF would re-evaluate the content of this BA. In addition, the foregoing analysis is based on studies of glyphosate; no studies were available on the Aquamaster® formulation. However, for further reference, an additional study exists on the herbicide Rodeo®, which has the same percent glyphosate as Aquamaster® (see generally, CDFG 1997).

[12] But see USEPA 1993b (stating that "[t]he half-life in soil is as high as 90.2 days).

[13] One formulation of glyphosate, MON-14420 (Registration No. 524-424), has the potential to result in direct and indirect effects to amphibians at application rates of 1.1 pounds per acre and above (USEPA 2008).

7.1.2.3. Water Quality

The Proposed Action may contribute to additional water quality impairment because all actions would take place within San Antonio Creek's hydrologic floodplain. Water quality is a factor affecting recovery of the species; it is an aspect of suitable habitat (USFWS 2002).

Under the Proposed Action, the USAF would remove riparian vegetation within the following buffers along the banks of the creek: 60 feet and 80 feet to the southeast and northwest of the bridge, respectively, approximately 16- to 18-foot wide (Section 2.0 and 3.1). During the initial vegetation removal, the use of equipment in the creek and/or its hydrologic floodplain may result in contaminant residue (i.e., diesel particulates) entering the watershed.

The soils in the Action Area have moderate to rapid permeability (Section 3.3), capable of attenuating pollutants to some degree (see generally Novotny 2003); however, removing riparian vegetation may result in increased soil erosion due to the loss of the soil stabilizing vegetation in the Action Area (see Kenwick et al. 2009). The Action Area has steep banks (up to a 20-foot drop from top of bank) (Section 3.1, Figure 10) and is comprised of soils that are susceptible to erosion. The soils to the northwest of the bridge (Arnold sand) have a high erosion hazard and the soils to the southeast of the bridge (Agueda silty clay loam) are susceptible to wind erosion, easily gullied and eroded (Section 3.3). In addition, the use of heavy equipment in undeveloped areas within the Action Area may cause soil compaction (see e.g., Photo 2 and 6), reducing soil permeability (infiltration) (Novotny 2003). This could be the issue in the staging areas and under the bridge, where heavy machinery would be located. Therefore, the Proposed Action could result in some increased soil erosion in the Action Area.

Soil erosion may lead to sedimentation, nutrient loading and increased turbidity in San Antonio Creek. Currently, San Antonio Creek is not impaired for turbidity (CCRWQCB 2010). Riparian vegetation is known to filter out pollutants, nutrients and sediments (see Kenwick et al. 2009, Larose et al. 2011, Li et al. 2009; see generally, Orlinskiy et al. 2015), and the loss of riparian vegetative buffers would impair existing processes to some degree in the Action Area. In one study, riparian vegetation measuring only 10-feet wide was effective at reducing a pollutant in surface water runoff (Kenwick et al. 2009). Loss of a riparian buffer, up to 15 feet wide, in the Main Construction Area could result in the loss of these ecosystem services and/or effectiveness of the processes to some degree. Although the benefits of vegetation as a soil stabilizer would be lost within the Action Area, the processes would continue within the larger watershed, as the Action Area constitutes only a small portion of the watershed. These potential effects could ultimately lead to physical and/or chemical changes to the existing CRLF habitat in or near the Main Construction Area (i.e., loss of habitats, change in water temperature) (see Novotny 2003). Therefore, the Proposed Action would likely result in some increased pollutants into San Antonio Creek, within the Action Area. However, the USAF anticipates that any additional effects from erosion due to removal of riparian vegetation would be offset, to some degree, when the USAF re-directs stormwater flow away from San Antonio Creek.

The USAF has modified the initial project design (installing a drain) to diverting stormwater runoff away from San Antonio Creek, which is presently contributing to bankside erosion and scour of the bridge abutment (Appendix B). Urban runoff (storm water) contains high concentrations of pollutants (i.e., suspended solids, heavy metals, and pathogens) and is a main cause of polluted waterways (see generally, Novotny 2003, Barałkiewicz et al. 2014). Within the Action Area, San Antonio Creek is located near and downstream of agricultural fields and generally bound by impervious roads, which likely contributes to the existing pollutant load. Based on available information, San Antonio Creek water quality is impaired for several pollutants, including boron, chloride, chlorpyrifos, *Escherichia coli* (*E. coli*), low dissolved oxygen, nitrogen/nitrate, and sodium (CCRWQCB 2010). Despite the removal of riparian vegetation, the last line of defense for filtering out pollutants before stormwater enters San Antonio Creek, the beneficial effect of re-directing some storm water flow away from San Antonio Creek may reduce the pollutant load in San Antonio Creek as compared to existing conditions. Therefore, this modification to the Proposed Action would result in a beneficial effect to species inhabiting the waterbody, including CRLF, by reducing effects under baseline conditions.

After vegetation removal, the USAF would subsequently apply herbicides to prevent regrowth of cut vegetation. Generally, the use of herbicides could contribute to the water quality issues (i.e., overspray). Glyphosate binds to soils/sediment that could be transported into the water by erosion, resulting in longer degradation times and potential increased exposure to species in the water (see Section 7.1.2.2). In San Antonio Creek, legacy pesticides (organochlorine) remain in the sediments (i.e., DDT) (SWRCB 2007) and any additional contribution could increase the chemical burden on species such as the CRLF (see generally, Johnson et al. 2011). However, under the Proposed Action, the USAF would hand-apply Aquamaster® directly onto cut stumps in the Action Area and not be conducted during rain events. In this way, the USAF would avoid further contamination of San Antonio Creek. The potential for inadvertent spills remains when working with herbicides in and/or near San Antonio Creek, but the USAF would minimize this risk by requiring the DoD applicator to adopt appropriate spill prevention measures when working in the San Antonio Creek hydrologic floodplain. Therefore, it is unlikely that herbicides or residue would enter San Antonio Creek to exacerbate the existing water quality conditions because of method of application and implementation of spill prevention measures.

To implement the Proposed Action, the USAF would use manual and/or mechanical methods resulting in vehicles and personnel present within the San Antonio Creek riparian area/ hydrologic floodplain. As a result, standard VAFB spill prevention and control measures would be required to implement the Proposed Action. For example, the USAF would conduct vehicle maintenance outside of the hydrologic floodplain and store vehicles in the staging areas to avoid the potential for inadvertent spills into the creek and riparian areas. However, since work will occur within the hydrologic floodplain/riparian areas it is likely that residue from vehicles (i.e., particulates from diesel engines) would enter the watershed despite compliance with any prevention and control measures. Therefore, minor water quality effects may be an unavoidable effect of using heavy equipment in the San Antonio Creek, its hydrologic floodplain/riparian area.

Finally, the USAF would comply with requirements imposed through the NEPA process, including compliance with the Clean Water Act (CWA) for effects to wetlands and/or water quality, to ensure effects are within acceptable levels.[14]

Therefore, the Proposed Action could result in adverse effects to CRLF due to potential impacts to water quality from the incidental effects of vegetation removal and construction equipment operating in the hydrologic floodplain; however, adverse effects would be offset by diverting stormwater runoff away from San Antonio Creek.

7.1.2.4. Reduction in Prey

The Proposed Action may contribute to reduction in CRLF prey, aquatic and terrestrial invertebrates (Section 4.1.3), because of the loss of riparian vegetation and potential water quality effects.

Under the Proposed Action, the USAF would remove vegetation (2-inch diameter of larger) within an approximate 0.3-acre area (Section 2.0). This area is presumed to contain both aquatic and non-aquatic riparian vegetation (see Photos 10-12). After removing vegetation, the USAF would hand-apply herbicides to the cut areas to prevent regrowth.

Removal of riparian vegetation may result in a reduction of litter input in the Main Construction Area, which could lead to a reduction in invertebrates, prey for CRLFs. Although the actual scope of vegetation removal in the Main Construction Area has not been determined (i.e., quantity of 2-inch or more diameter vegetation), it is likely that the existing vegetation contributes some leaf litter input into the creek. The riparian canopy provides litter input, which is a major energy source for aquatic communities (Inoue et al. 2012). It is estimated that more than 50 percent of net primary production directly enters food webs as detritus (i.e., dead organic matter), which is broken down by invertebrates (see Bottollier-Curtet 2015; Inoue et al. 2012, Ferreira 2015 et al.). One study documented that headwater streams with herbaceous riparian buffers had greater invertebrate diversity than those with no buffers (Smiley et al. 2011). Another study documented that the presence/diversity of aquatic plants and littoral aquatic vegetation was positively correlated with the abundance of littoral macro-invertebrates (Jurca et al. 2012). San Antonio Creek may presently have high invertebrate diversity because it is a perennial stream that has persisted through droughts, it high quality riparian habitat, and likely support aquatic vegetation as shown in Photos 10-12 (see Ferreira 2015 et al., ManTech 2014, ManTech 2015). The removal of riparian vegetation could cause some change in the invertebrate community in the Action Area. However, the removal may not be detrimental to the persistence of invertebrate communities if they are able to move into adjacent and better habitats until conditions become favorable again (see D'Ambrosio et al. 2014). Dense riparian vegetation exists both upstream and downstream of the Main Construction Area (see Photos 11 and 12) and any detritus or broken down organic matter would pass through the Main Construction Area and be available for CRLFs. As a result, invertebrates in the Main Construction Area could remain present or at worst, relocate into adjacent habitats until condition in the Main Construction Area become favorable again. Finally, the Proposed Action would not directly change any of the features of San Antonio Creek (i.e., stream size, gradient and connectivity to a floodplain) that could further affect invertebrate communities (see D'Ambrosio et al. 2014). Therefore, the USAF anticipates that the Proposed Action could adversely affect CRLF prey by causing temporary displacement or reduction in leaf litter within the Action Area.

Generally, using herbicides in CRLF habitat could lead to a reduction in CRLF-prey, aquatic and terrestrial invertebrates. In one study, it was found that the effects on freshwater invertebrates from exposure to glyphosate formulations ranged from practically non-toxic to moderately toxic (Patterson 2004).[15] In the 2008 USEPA effects analysis for CRLFs, it was determined that herbicide exposure could indirectly affect terrestrial-CRLFs due to reduction in prey base for small insects, which is noted to be possible at any application rate (USEPA 2008). In addition, reduction in prey base could affect to aquatic-phase CRLFs at an application rate of 3.75 lb a.e./A (USEPA 2008). Finally, repeated applications may increase the risk of adverse effects (USEPA 1993a, USEPA 2008, USEPA 1993b). However, under the Proposed Action, reduction of prey for CRLF from herbicides would be avoided by applying small quantities of Aquamaster® by hand to the cut vegetation and outside of any rain event; avoiding Aquamaster® from entering the water column (see Section 7.1.2.2). Further, the application of Aquamaster® would be on an annual basis, minimizing the cumulative effects from repeated applications. Therefore, the USAF does not anticipate any reduction in prey because of the method and frequency of herbicide application.

[15] This study evaluated the effects of glyphosate on endangered and threatened salmon and steelhead.

Therefore, the Proposed Action could result in adverse effects to CRLF prey from removal of vegetation; however, no additional Conservation Measures are proposed because this is an unavoidable effect of the Proposed Action.

7.1.2.5. Construction Noise

The Proposed Action would result in short term noise effects during construction activities, which could adversely affect CRLFs because it may cause avoidance of or result in exposure to noise from the Main Construction Area. The CRLF recovery plan indicates that increased noise in an area can degrade CRLF habitat (USFWS 2002).

The Main Construction Area is located in a rural and undeveloped area. Ambient noise in rural areas ranges between 35 to 40 dBA (WSDOT 2015) and background noise levels in an area with low population density (1 – 100 people per square mile) is estimated at 35 L_{eq} dBA (daytime noise levels exclusive of traffic) (WSDOT 2015). Although the Main Construction Area is undeveloped, farming activities occur at the top of the bank and vehicles use the bridge crossing San Antonio Creek on a daily basis (see Photos 1 and 2). As discussed below, ambient and/or background noise at the Main Construction Area may be higher than generally documented in the literature.

The calculated traffic noise level in the Main Construction Area is approximately 73.9 dbA L_{eq} (hour) at 50-feet.[16] This is based on an average number of 2000 vehicles per hour at a speed of 55 miles per hour for a two lane undivided highway (CalTrans 2014,[17] DMV 2015, WSDOT 2015). However, this is an overestimate of traffic volume on San Antonio Road West. A maximum of 1,937 vehicles travel northbound on VAFB (from traffic counting station), but not all continue onto San Antonio Road West (CalTrans 2014). An impromptu vehicle count at the Main Construction Area provided a more accurate estimate of 246 cars per hour using San Antonio Road West; based on a 10-minute vehicle count.[18] Therefore, it is likely that traffic noise in the Main Construction Area is lesser than initially calculated, approximately 64.9 dbA L_{eq} (hour) at 50-feet (WSDOT 2015).

Due to lack of noise data, VAFB Personnel collected impromptu noise measurements in the Main Construction Area using a handheld mobile device.[19] In-air noise levels under the bridge (no vehicles passing) is approximately 43.9 L_{eq} / 45.7 L_{max} dBA and 41.6 L_{eq} / 55.7 L_{max} dBA (with vehicles passing). In-air noise levels on top of the bridge (vehicle passing) was greater – approximately 56 L_{eq} / 78 L_{max} dBA. Noise levels with vehicles passing would represent background levels at the Main Construction Area. In addition, this data suggests a potential 14.4 L_{eq} / 22.3 L_{max} dBA buffering effect from topography in the Main Construction Area due to the approximate 16 to 18-foot elevation differential (Section 3.1). Therefore, noise generated under the bridge may have a lesser effect on receptors on the top of the bank and vice versa.

Under the Proposed Action, the USAF would need to remove accumulated sediment requiring the use of a crane, front loader, and dump truck. The potential construction noise from the equipment, combined, is approximately 84 L_{max} dBA (crane L_{max} = 81 dBA, front loader L_{max} = 79 dBA, and dump truck L_{max} = 76 dBA at 50-feet from the noise source (FHWA 2006, WSDOT

[16] For line source noise (i.e., highway/road traffic), the equivalent continuous sound level (Leq) is the preferred unit of measure with a noise reduction of 3 dB per doubling of distance from the noise source (WSDOT 2015).

[17] Cindy Pribyl, California Department of Transportation, Research Analyst II, interview with author regarding VAFB traffic volume and peak hour volume data for 2014, September 15, 2015.

[18] Kate Miller, CSU: CEMML, Biologist, interview with author regarding 10-minute car count, September 15, 2015.

[19] Kate Miller, CSU: CEMML, Biologist, interview with author regarding measured noise levels, September 15, 2015.

2015).[20] Based on these values, Table 5 shows the potential in-air noise levels from the Proposed Action considering potential attenuation over distance. Regarding noise attenuation, the Proposed Action would constitute a point noise source and therefore a 6 dB reduction factor applies per doubling of distance from the Main Construction Area (WSDOT 2015). An additional 1.5 dBA reduction is applied for a "soft site" because the Main Construction Area is near water and the majority of the area is not paved (WSDOT 2015).

Table 5 – Noise Attenuation at the Main Construction Area

Distance from noise source (feet/mile)	Construction Noise (L_{max} dBA at 50 feet) (using 7.5 dBA reduction factor)	Background Noise (L_{max} dBA) (includes vehicle noise)	
		Top of Bridge	Under Bridge
0 / MCA*	N/A	78	55.7
50 (0.01)	84	78	55.7
100 (0.02)	76.5	78	55.7
200 (0.04)	69	78	55.7
400 (0.08)	61.5	78	55.7
800 (0.15)	54	78	55.7

Source: WSDOT 2015. Note: N/A = not available, MCA = Main Construction Area.

Based on the information presented in Table 5, CRLFs would be expected to perceive noise generated from the Proposed Action approximately 100-feet and 800-feet from the Main Construction Area for CRLFs located on the top of the bank and under the bridge, respectively. This assumes CRLF have adapted to background noise (noise typical traffic flow over the San Antonio Road West Bridge) and anything in excess would be perceptible to CRLFs. This does not necessarily indicate the threshold of adverse effects to CRLF. Using the 7.5 dBA reduction factor in reverse, the potential noise at the Main Construction Area would be 91.5 dBA. No information exists on what noise levels would adversely affect the CRLF physiologically or behaviorally, based on a review of available information. However, since wildlife may adapt to increased noise in the environment, it is possible that the noise generated in excess of background noise would still not have any adverse effect on CRLFs. Since San Antonio Creek has adjacent suitable habitat for CRLF, if noise did cause any interference with CRLF activities/behavior, CRLFs would be able to retreat to areas further away from the Main Construction Area. This may be the case under the Proposed Action where noise disturbance would be temporary, within a 90-day schedule. Therefore, the USAF has determined that noise generated from the Proposed Action could adversely affect the CRLF due to lack of data to prove otherwise; however, the USAF anticipates that the overall potential effects to CRLFs from noise are minimal, which may be supported by the following analysis of vibration incidental to noise.

In addition to noise, the use of construction equipment may have associated vibratory effects. Since frogs may use vibration in communicating (see generally, Lewis and Narins 1985, Hill 2001), it follows that they would be able to perceive and potentially be affected by vibrations caused by construction equipment used within the Main Construction Area. However, since the Proposed Action would not generate impulse noise (from equipment considered an impact

[20] The maximum decibel level (L_{max}) is a common unit of measure for construction point sources (WSDOT 2015).

device, i.e., pile driver); it is unlikely that vibratory impacts would be a major concern under the Proposed Action, as indicated below.

Caltrans has calculated reference peak particle velocity (PPVs), presented in inches per second (in/sec) from a construction project (Figure 14), which can be used to estimate vibration from construction equipment for the Proposed Action by using the provided equation. Note, however, that PPVs are typically used for evaluating effects to buildings and to assess human responses to vibration (Caltrans 2014). Nevertheless, the calculated PPVs for the Proposed Action presented in Table 6 and based on reference PPVs for similar equipment at 25 feet.

Equipment	Reference PPV at 25 ft. (in/sec)
Vibratory roller	0.210
Large bulldozer	0.089
Caisson drilling	0.089
Loaded trucks	0.076
Jackhammer	0.035
Small bulldozer	0.003
Crack-and-seat operations	2.4

Sources: Federal Transit Administration 1995 (except Hanson 2001 for vibratory rollers) and Caltrans 2000 for crack-and seat-operations.

Using these source levels, vibration from this equipment can be estimated by the following formula:

$$PPV_{Equipment} = PPV_{Ref}\,(25/D)^{n} \quad (in/sec) \qquad (Eq.\ 12)$$

Where:

PPV_{Ref} = reference PPV at 25 ft.
D = distance from equipment to the receiver in ft.
$n = 1.1$ (the value related to the attenuation rate through ground)

Source: Caltrans 2014.

Figure 14 – Caltrans Reference PPVs

Table 6 – Estimated PPVs (in/sec) for the Proposed Action

Equipment	Distances (feet)				
	0	10	20	200	1600
Loaded Trucks	2.62	0.208	0.097	0.008	0.001
Small Bulldozer	0.103	0.008	0.004	0.000	0.000

Based on the values in Table 6, the Proposed Action, overall, would likely result in vibration levels that are barely perceptible to humans and/or have the potential to only cause vibration damage in very fragile to fragile buildings/historic sites (see numeric criteria in Caltrans 2014). Despite these seeming low levels, frogs appear to be able to detect vibration at levels that may not be perceptible to humans. Recorded frog chirping/thumping, showed peak accelerations in the neighborhood of 2 cm/sec^2 (1 meter from the frog) at frequencies below 150 Hz, but confined predominantly between 20 and 70 Hz (Lewis and Narins 1985). The peak acceleration appears based on a recording logged at 0.002 cm/sec over a millisecond, which is approximately 0.00079 inches per second (conversion factor of 0.394); lower than PPVs barely perceptible to humans as shown on Table 6.

Since CRLFs have some life phases that are similar to fish (i.e., egg masses, tadpoles), it is useful to compare thresholds that have been developed for the protection of fish embryos as a proxy for the aquatic-phase CRLF, the more sensitive phase of the CRLFs lifecycle. Blasting standards for the protection of anadromous fish (fish that spawn in rivers/streams) are set to not exceed 2.0 in/sec (re: PPV/vibration) during the early stages of embryo incubation and/or 7.3 pounds per square inch (psi) (re: instantaneous pressure rise) when fish are present (ADFG 2013). Although this Proposed Action does not involve explosive blasting, these thresholds are relevant because it provides a threshold below which the effects of vibration would not physically affect aquatic phase CRLFs.

As shown in Table 6, the estimated PPVs are less than the 2.0 PPV at all distances except for loaded trucks; however, under the Proposed Action, only be one dump truck would be used and it would be 16 to 18 feet above San Antonio Creek. As discussed above, there is a buffering effect for noise between the top of bank and the bed of San Antonio Creek and the front loader, similar to a bulldozer, which would be doing work in the San Antonio Creek hydrologic floodplain/riparian area has a low PPV. The same buffering effect likely exists for the incidental effects of noise, i.e., vibration, to some degree. Since pressure is more relevant to the effects to a fish's swim bladder (see generally, ADFG 1991), the psi threshold is not relevant to the CRLF, but where PPV is acceptable as to a fish embryo, than the associated psi would necessarily be within acceptable limits to mature fish.[21] Therefore, the Proposed Action would not adversely affect CRLFs from vibration, an incidental effect of noise generating equipment, because the potential noise levels would result in a PPV less than 2.0 in/sec, which is the level that is protective of anadromous fish embryos – a proxy for CRLF. However, vibrations could still interfere or be perceived by CRLFs.

Therefore, the Proposed Action could result in adverse effects to CRLF if noise and/or vibration results in interference with CRLF activities/behavior, to the detriment of the CRLF. However, no additional Conservation Measures are proposed because this is an unavoidable effect of the Proposed Action.

7.1.2.6. Predation

The Proposed Action may contribute to increased predation because of the loss of potential refuge habitat used to avoid predators and the potential interference caused by noise generating activities within the Main Construction Area.

Under the Proposed Action , the USAF would remove riparian vegetation (including aquatic vegetation), which may include refuge habitat (see Section 7.1.2.1). In San Antonio Creek, CRLF predators include bullfrogs and fish; fish tend to prey upon CRLF-larvae (Section 4.1.3). In one study, it was found that bullfrogs and mosquito fish adversly affected CRLF tadpoles with bullfrogs more strongly associated with predation on CRLF tadpoles, preventing population recruitment (Lawler et al. 1999). Even if the Proposed Action remove some refuge habitat, CRLFs would be able to find suitable adjacent habitat in the watershed and since some vegetation will presumably remain (vegetation less than 2-inches), it is possible that the Main Construction Area could still retain some refuge habitat.

Based on the discussion in Section 7.1.2.5, CRLF may percieve noise and vibrations associated with the Proposed Action, which would potentially interferes with their activities/behavior in such as way so as to increase their risk of exposure to predators.

As a normal practice, the USAF would continue to remove non-native invasive species during VAFB species surveys in San Antonio Creek, which would tend to reduce predation of CRLFs to some degree.

Therefore, the Proposed Action could result in adverse effects to CRLF from increased exposure to predators due to vegetation loss and noise disturbance; however, no additional

[21] Jackie Timothy, Southeast Regional Supervisor, Alaska Department of Fish and Game, Division of Habitat, interviewed by author regarding use of the ADFG threshold in relation to the Proposed Action, October 6, 2015.

Conservation Measures are proposed because this is an unavoidable effect of the Proposed Action.

7.1.3 Conclusion

Based on the foregoing analysis of effects and considering Conservation Measures, the Proposed Action *may affect*, and is *likely to adversely affect* the CRLF.

A summary of Conservation Measures that would be implemented as part of the Proposed Action are presented in Section 8.0.

Because it cannot be guaranteed that there will be no accidental take of CRLF, the USAF requests incidental take coverage consistent with past consultations for similar projects, in the unlikely event a CRLF is found dead within the Action Area. In a recent biological opinion for the San Antonio Creek Restoration Project (USFWS 2009), the USAF was granted the take of two adult, subadult or tadpole CRLFs before re-initation would be required.

7.2 Unarmored Threespine Stickleback

UTS are present throughout the Action Area within the main channel, concentrated upstream and downstream of the Main Construction Area between El Rancho Road and Lee Road (Sections 4.3.3).

7.2.1 Physical Effects

The Proposed Action may result in potential physical effects on UTS for reasons similar those discussed in Section 7.1.1.

Namely, the Proposed Action could adversely affect UTS during relocation efforts and/or inadvertently crushed during intrusive activities in the Main Construction Area. The USAF would divert San Antonio Creek from flowing through the Main Construction Area during the gabion work, but not the vegetation removal and/or herbicide application (Section 2.0). Since UTS are confined to San Antonio Creek, they are not able to avoid potential impacts of the Proposed Action to the same extent as discussed in Section 7.1.1 for CRLF's; however, the relocation of UTS and diversion of San Antonio Creek would avoid most effects to UTS (i.e., adults and juveniles that are visible).

Conservation Measures for UTS are the same as those discussed in Section 7.1.1 except that the requirements in *The Declining Amphibian Populations Task Force Fieldwork Code of Practice* are not applicable to UTS. A USFWS-approved biologist would relocate and oversee construction activities having the potential to adversely affect UTS in addition to being present during subsequent annual inspection/maintenance activities, since San Antonio Creek would not thereafter be diverted. Since UTS reproduce throughout the year (Section 4.3.2 and 4.3.3), additional Conservation Measures regarding time of day or duration of construction activities are not feasible in order to implement the Proposed Action.

Therefore, the Proposed Action could result in adverse effects to UTS from accidental physical injury, but it would be implemented in a way to avoid and/or minimize the potential adverse effects by relocating and excluding them from the Main Construction Area, to the maximum extent practicable. A summary of the Conservation Measures discussed above, which are part of the Proposed Action, are located in Section 8.0.

7.2.2 Habitat Effects

7.2.2.1. Vegetation Removal

The Proposed Action may result in potential habitat-related effects on UTS for reasons similar those discussed in Section 7.1.2.1.

Under the Proposed Action, the USAF would remove riparian vegetation, which could adversely affect UTS by removing up to 0.27 acres of refuge, breeding, and/or feeding habitat within the Main Construction Area. Within the Main Construction Area, San Antonio Creek is shallow and slow flowing and the area has dense riparian vegetation with some apparent aquatic vegetation (see Photos 6, 9, 10-12). San Antonio Creek including the lateral areas of its floodplain up to 10 feet out from the creek is essential habitat for the UTS, providing refuge, breeding and feeding habitat (Section 4.3.2). Although there is a lack of information about UTS's specific use of habitat in San Antonio Creek (i.e. breeding locations), the USAF assumes that vegetation removal may affect some aspect of UTS habitat. However, the USAF anticipates that UTS habitat would not completely lost since some vegetation would remain (less than 2-inches diameter).

In addition, the loss of riparian vegetation could eventually adversely affect stream flow, temperature and chemistry of UTS habitat (see Water Quality discussion in Section 7.2.2.3), which affects suitability of habitat. Riparian vegetation provides temperature control for fish populations (see Kenwick et al. 2009). By removing riparian vegetation, the Proposed Action may contribute to increased temperature in San Antonio Creek. In addition, when long- term erosion exceeds sedimentation, channel incision occurs (Fischenich and Morrow 2000). Channelization eliminates shallow backwaters and reduces aquatic vegetation important to UTS, which affects UTS populations since they are more abundant in pools versus stream channels (Section 4.3.2 and 4.3.3). Although San Antonio Creek is not channelized (i.e., concrete lined), it is largely bound by roads, which may be contributing to channel incision; potentially resulting similar effects (see generally, Simon and Rinaldi 2006). Based on a review of VAFB GIS, the area north of Lee Road is incised to a greater degree than the Main Construction Area. The size of the hydrologic floodplain in the Main Construction Area is about 40 feet in width whereas the area north of Lee Road is approximately 35-feet and narrower in some areas. Available data indicates that UTS are not located north of Lee Road, but documented near the El Rancho Road Bridge (Section 4.3.3). The Main Construction Area may be a transitional zone between a large wetland area/floodplain to the south (near El Rancho Road) and the north (Barka Slough), where the incised channel north of Lee Road may act as a barrier to UTS from entering Barka Slough. It is possible that removal of riparian vegetation could lead to further incision of the creek because there would be no vegetation present to slow the flow of floodwaters or minimize erosion in the Main Construction Area as discussed in Section 7.1.2.1. As a result, the Proposed Action could contribute to the degradation of UTS habitat that is already occurring under existing conditions. However, since the Proposed Action would divert storm water runoff away from San Antonio Creek, the Proposed Action may curb continued erosion, to some extent, including its incidental effects, as previously discussed.

Therefore, the Proposed Action could result in adverse effects to UTS habitat from vegetation removal; however, no additional Conservation Measures are proposed since this is an unavoidable consequence of the Proposed Action.

Table 7 – UTS Habitat in Action Area

UTS Habitat	
San Antonio Creek	597 linear feet
Lateral Areas (10-feet from creek)	0.27 acres

7.2.2.2. Herbicides

The Proposed Action may result in potential effects on UTS from herbicides for reasons similar those discussed in Section 7.1.2.2.

Under the Proposed Action, the USAF would use the herbicide Aquamaster® to prevent re-growth of riparian vegetation within the 0.3-acre Main Construction Area, which includes vegetation both upstream and downstream of the bridge and vegetation inside San Antonio Creek. Since the USEPA used toxicity information for freshwater fish as a surrogate for aquatic-phase amphibians, in their CRLF effects analysis (USEPA 2008), this same information is relevant for evaluating effects to UTS from glyphosate.

Based on available information, Aquamaster's® main ingredient glyphosate (53.8% isopropylamine salt of glyphosate) has a low tendency to accumulate in fish (Monsanto 2005, USEPA 1993b) and pure glyphosate is less toxic than formulations. Acute toxicity of glyphosate (83% to 96.5% glyphosate) ranges from slightly non-toxic to practically non-toxic to freshwater fish (USEPA 1993b). The glyphosate degradate AMPA was determined to be non-toxic in exposure studies on rainbow trout (see generally, Bowman 1991). However, the toxicity of certain glyphosate formulations (41.8% to 62.4% glyphosate) was higher, ranging from practically non-toxic to moderately toxic in freshwater fish (USEPA 1993b). Finally, surfactants mixed into some formulations of glyphosate may be toxic to fish (i.e., "MON0818") (USEPA 1993b). As previsouly explained, the ingredients of Aquamaster® are proprietary and not listed on its label, but the label indicates that the treatment of aquatic weeds can result in oxygen depletion that could cause fish suffocation (Monsanto 2005).

Based on the foregoing information, Aquamaster's® toxicity to fish may be at most moderately toxic based on containing a 53.8% glyphosate formulation (see Patterson 2004).

Available information indicates that safe application rates for glyphosate containing products as to fish are 5 lb ai/A (Patterson 2004).[22] In contrast, the safe rate identified for CRLF rate is between 3.75 to 7.95 pounds per acre, generally (Section 7.1.2.2). The difference is consistent with the finding that freshwater fish are more sensitive to glyphosate than amphibians (USEPA 2008).

Conservation Measures for UTS are the same as those discussed in Section 7.1.2.2. In sum, the USAF plans to apply herbicides in a very controlled and limited manner, which would prevent Aquamaster® from entering the water and thus avoiding any real effects on UTS or water quality in San Antonio Creek, leading to effects on UTS. Further, the USAF has confirmed that Aquamaster® is not prohibited on any state or federal list and would ensure that the DoD applicator would only use a non-toxic surfactant approved for wetland use, if required for foliar application.

Therefore, the Proposed Action could result in adverse effects to UTS from use of Aquamaster® in UTS habitat, but the method of application would avoid the potential adverse effects. Conservation Measures for use of Aquamaster® are summarized in Section 8.0.

7.2.2.3. Water Quality

The Proposed Action may result in potential water quality effects on UTS for reasons similar those discussed in Section 7.1.2.3.

Under the Proposed Action, the removal of riparian vegetation, a critical component of the ecosystem preserving water quality, could result in increased pollutant loads entering San Antonio Creek at the Action Area because of the associated loss of soil stabilizing vegetation and riparian buffers that filter out pollutants. Since UTS are confined to San Antonio Creek they cannot seek better habitat as San Antonio Creek water quality becomes further impaired overtime. For example, removing riparian vegetation may result in increased sedimentation and/or turbidity in San Antonio Creek. Since San Antonio Creek is shallow and slow flowing and

22 This study evaluated both pure glyphosate and glyphosate formulations on steelhead and salmon species.

any increase in sedimentation could have greater short-term effects on UTS than may be the case in a larger and faster flowing river where sediments could settle out more quickly. Increased turbidity is an adverse effect to UTS, who may be intolerant to turbidity (Section 4.3.2). This may not be a major concern, however, because San Antonio Creek is not currently impaired for turbidity (CCRWQCB 2010). In addition, since the USAF would only remove vegetation more than 2-inches in diameter, some soil stabilizing/filtering capacity may remain in the Action Area. However, since the USAF plans to re-direct stormwater flow coming from the agricultural depression away from San Antonio Creek, the Proposed Action may have an overall beneficial effect on water quality.

The USAF would use/operate construction equipment and vehicles in the hydrologic floodplain of San Antonio Creek. Although the USAF would implement standard spill prevention measures, vehicles and equipment generate pollutants that would enter the watershed. This represents an unavoidable adverse effect.

The USAF does not anticipate adverse effects to water quality from the application of the herbicide Aquamaster® because the USAF's method of application and incorporation of spill prevention measures would ensure use of Aquamaster® does not enter San Antonio Creek.

Therefore, the Proposed Action could result in adverse effects to UTS due to potential impacts to water quality from the incidental effects of vegetation removal and construction equipment operating in the hydrologic floodplain; however, the USAF would offset adverse effects by diverting stormwater runoff away from San Antonio Creek.

7.2.2.4. Reduction in Prey

The Proposed Action may contribute to reduction in UTS prey for the same reasons discussed in Section 7.1.2.4. Namely, the Proposed Action could adversely affect UTS prey by causing a reduction in leaf litter within the Action Area and/or temporary displacement into adjacent habitat. The USAF does not anticipate any reduction in prey because of the method of application and incorporation of spill prevention measures that would ensure Aquamaster® does not enter San Antonio Creek.

Therefore, the Proposed Action could result in adverse effects to UTS prey from removal of vegetation; however, no additional Conservation Measures are proposed because this is an unavoidable effect of the Proposed Action.

7.2.2.5. Construction Noise

Note: This section relies on the best available information, as it currently exists in the literature. However, in addition to data gaps, the literature warns against extrapolating the results of fish-specific studies onto other fish species in addition to relying on data lacking proper unit/metric documentation even though most studies unit/metric documentation issues (see Carlson and Popper 1997, Hastings and Popper 2005, Popper and Hastings 2009, Hawkins et al, 2015). Thus, the USAF cautiously uses existing studies in evaluating the Proposed Action while noting potential limitations.

The Proposed Action would involve noise-generating activities within the San Antonio Creek riparian area/ hydrologic floodplain. There would be no in-water work, because the USAF would divert San Antonio Creek, but the noise generated near the creek may still result in effects to fish that may be located near the Main Construction Area.

An underwater acoustic stimulus has two components, particle motion and sound pressure; however, fish primarily respond to particle motion whether in the near or far field (Popper and Fay 2011, Radford et al., 2012). The near field is the area close to the noise source where particle motion is dominant whereas the far field is the region outside the near field where the propagating pressure wave dominates (Hastings and Popper 2005, Radford et al., 2012). As discussed below, particle motion due to changes in sound pressure are detectable by fish depending on their anatomy.

Fish hear noise, or rather, detect sound (i.e., particle motion and/or sound pressure) with their ear (semicircular canals, sensory cristae and otolith organs) and/or their body (Hastings and Popper 2005, Popper and Fay 2011).[23] The otolith organs contain sensory hair cells that allow the fish to detect water motion; these sensory hair cells also exist along the lateral line, along the outside of a fish's body, which allow the fish to detect particle motion in the water column (Hastings and Popper 2005, Popper and Fay 2011). Particle motion stimulates the otolith because of the differential motion between the fish and the otolith, due to differing densities, which causes the sensory hair cells embedded in the epithelium to move, resulting in the detection of sound (Carlson and Popper 1997, Hastings and Popper 2005, Popper and Fay 2011). In addition, some fish have specialized anatomical structures (i.e., swim bladder, air bubble, gas bladder) that may be coupled with the ear (i.e., an otophysic connection) or located in close proximity to the ear, which results in the ability to detect sound pressure and thus a higher sensitivity to sound (Hastings and Popper 2005, Popper and Hastings 2009). The specialized anatomical structures serves as a small transducer converting the change in sound pressure detected into particle motion heard by its ear; this is in addition to particle motion it already senses via the sensory hair cells (Hastings and Popper 2005, Radford et al., 2012). Therefore, the otolith is stimulated *directly* by particle motion and *indirectly* by particle motion when specialized anatomical structures transform sound pressure fluctuations into particle motion (Hastings and Popper 2005).

Depending on the anatomy of the fish, hearing/sound detection varies along a continuum (Figure 15). To better illustrate the difference between the two extremes, Figure 16 presents audiograms[24] showing the difference in sensitivity between fish species with (solid lines) and without (dotted lines) specialized anatomical structures. Fish with specialized anatomical structures can detect sound at lower levels and higher frequencies than fish without such structures. In the past, the terms used were "hearing generalist" (particle motion detectors) and "hearing specialist" (particle motion and sound pressure detectors), but new information indicates that some hearing generalists are also able to detect pressure (Popper and Fay 2011). Although the distinction between generalist and specialist may no longer be accurate, this BA retains those terms because past-cited studies use those terms.

Fishes are able to discriminate between sounds of different magnitudes or frequencies, detect a sound in the presence of other signals, and determine the direction of a sound source (sound source localization) (Hastings and Popper 2005). As depicted on Figure 16, the majority of fish species detect sounds from below 50 Hz up to 500–1500 hertz (Hz), but hearing specialists will detect signals up to 3,000 – 4,000 Hz, with thresholds that are 20 decibels (dB) or more lower than hearing generalists (Hastings and Popper 2005, Popper and Hastings 2009). To illustrate this difference, Figure 17 shows the range of hearing for a salmon (generalist) versus a goldfish (specialist). Fish also use sounds in a wide variety of behaviors (i.e., defense and reproduction) and these sounds are typically pulsed or tonal and low frequency (50-1000 Hz) and likely used for communication over short distances (Carlson and Popper 1997, Hastings and Popper 2005).

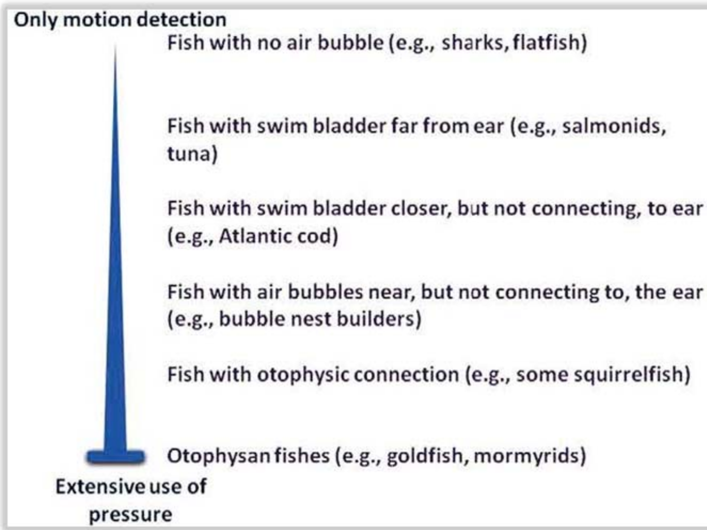
[23] Consider the terms noise and sound interchangeably in this BA since sources varied in usage; however, noise generally means unwanted sound.

[24] An audiogram is a graphic representation of the range of frequencies (or bandwidth) that a fish can detect and showing the lowest levels of the sound detected at each frequency (the 'threshold' (Popper and Hastings 2009). Fish audiograms are generally U-shaped, with higher thresholds at low and high frequencies and lower thresholds at intermediate frequencies (Fay, 1988) (Smith et al. 2004).

Sounds produced by fish for communication have a relatively low frequency with most energy below 500 Hz (Popper and Carlson 1998).

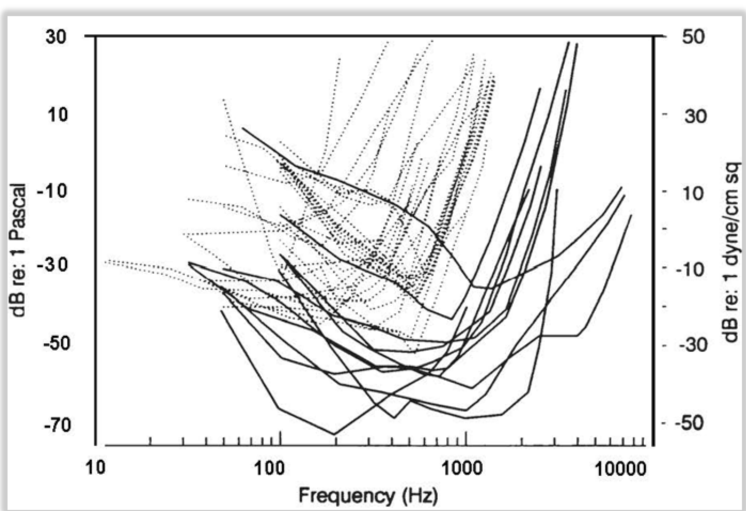
No specific information is available on UTS in the literature (see Popper and Hastings 2009), but it is explained that the majority of fishes do not have specializations and further that the majority of the native fishes on the Pacific Coast likely do not have anatomical specializations (Hastings and Popper 2005). The USAF contacted a local research biologist who confirmed that UTS have a gas bladder, although not connected to the ear.[25]

Therefore, UTS detect both particle motion and sound pressure, to some degree (depends on closeness of gas bladder to the ear).



Source: Popper and Fay 2011.

Figure 15 – Continuum of Pressure Detection Mechanisms



Source: Carlson and Popper 1997.

Figure 16 – Audiograms for All Fish Species Published in the Literature

25 Brenton Spies, University of California Los Angeles, Research Biologist, email message to author, October 6, 2015.

The critical issue for understanding whether an anthropogenic sound affects hearing is whether it is within the hearing frequency range of a fish and loud enough to be detectable above threshold and the intensity of the sound (i.e., received level, duration, repetition rate, sound pressure level, frequency, health of the organisms) (Hastings and Popper 2005, Popper and Hastings 2009). Adverse effects from anthropogenic sound may include potential death, injury, hearing loss, change in behavior, and population level effects (fitness and survival) (Popper et al. 2014). A common adverse effect in fish is temporary or permanent hearing loss, which may result from high intensity sounds resulting in damage or loss of the otolith's sensory hair cells and/or a tear or rupture of the specialized anatomical structure (Hastings and Popper 2005, Popper and Hastings 2009, Larkin et al. 1996). Less apparent are adverse effects from stress, which may result in reduced growth, increase susceptibility to disease and impaired reproduction (Popper and Carlson 1998).

Based on a literature review, no audiograms are available for UTS hearing capabilities, but NMFS uses the following sound pressure thresholds for assessing adverse effects to fish, generally:

- Physical injury (dual criteria): cumulative sound exposure level (SEL) of 187 dB re 1 μPa^2-second or peak sound pressure level (SPL) of 206 dB re: $1 \mu Pa.^{PEAK}$
- Behavioral response: 150 dB re 1 µPa (metric not specified).

(Popper et al. 2006, Popper et al. 2014, WSDOT 2015).

The effects of sound may be attenuated to some degree, resulting in either lesser or greater received levels; sound does not necessarily decrease proportionally to distance. In water, sound travels at a high rate of speed (five times faster than in air) (Popper and Carlson 1998, Smith et al. 2006). However, underwater sound propagation is affected by absorption, surface and bottom reflections, refraction (due to the sound speed profile and objects), and water depth (Carlson and Popper 1997). In addition, the literature indicates weather and background noise may mask received sound levels in fish; received noise levels may vary up to 50dB because of meteorological conditions and that noise needed to be at least 10 dB more intense than background noise to be detected (Popper and Carlson 1998).

In relevant part, low frequency sound propagates very poorly in shallow water because the wavelength is larger than the water depth required for noise propagation (Popper, et al., 2005). As a result, fish are likely only able to detect lower-frequency sounds from sources that are extremely close to them (Popper, et al., 2005). Low frequency sound ranges from 20 to 300 Hz, but could extend up to 500 Hz, as discussed above (Popper and Carlson 1998, Berglund et al. 1996). Noise at these frequencies would generally be within the hearing range of fish (see Figure 16). Table 8 shows minimum water depths needed for low frequency sound to propagate in water (up to 500 Hz).

Construction vehicles/equipment would generate low frequency noise (see e.g., Berglund et al. 1996, Larkin et al. 1996), but pile driving, the focus of noise studies on fish, would occur at even lower frequencies than typical construction vehicles/equipment. As a result, pile-driving activities may affect fish to a greater degree than typical construction activities. In this BA, the USAF conducts a comparative analysis based on the measured effects of a pile-driving project as the upper limit of potential effects that the Proposed Action would not exceed.

Despite the caveats discussed above pertaining to noise propagation, as a default, this BA assumes attenuation would occur via cylindrical spreading (noise bounded by sediment and water), also referred to as the practical spreading model by NMFS, resulting in a 4.5 dB transmission loss per doubling of distance (WSDOT 2015, DOSITS 2015, NOAA 2015).

Table 8 – Minimum Water Depth for Sound Propagation

Frequency (Hz)	Wavelength (velocity/ frequency)*	Minimum Water Depth for Noise Propagation (feet)**
35	42.86	35.14
50	30.00	24.60
100	15.00	12.30
150	10.00	8.20
200	7.50	6.15
250	6.00	4.92
300	5.00	4.10
350	4.29	3.51
400	3.75	3.08
450	3.33	2.73
500	3.00	2.46

* velocity of sound in water is 1,500 meters per second (m/s).

** propagation of a sound requires a water depth of 1/4th the wavelength.

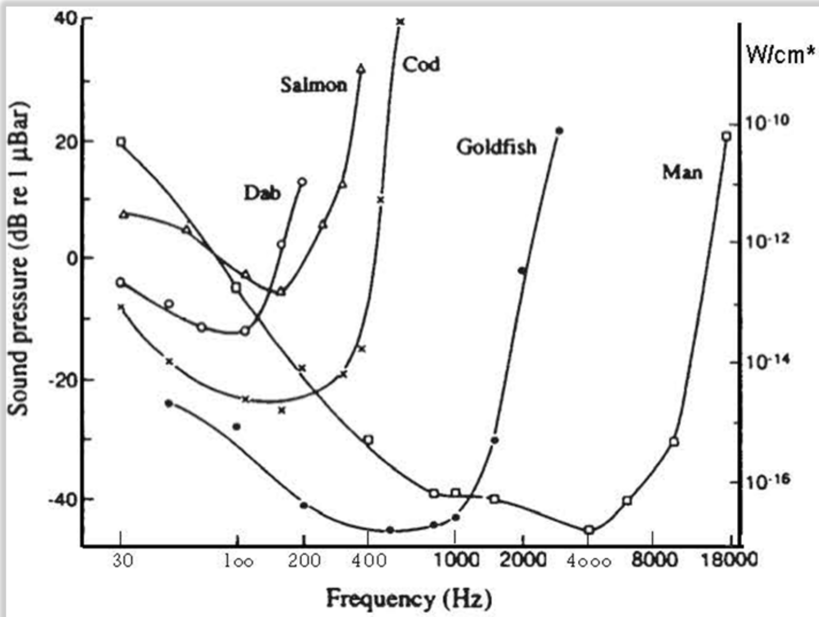
Source: Popper and Carlson 1998, Urick et al. 1996.

The Proposed Action would involve noise-generating activities within the creek channel and its hydrologic floodplain. In relevant part, the USAF anticipates using a crane, front loader, and dump truck to implement the Proposed Action. The combined-average in-air noise levels (A-weighted for human hearing)[26] for this equipment is approximately 84 L_{max} dBA (WSDOT 2015).

Because A-weighting deemphasizes low frequency noise (approximates human hearing) (see generally, St. Pierre and Maguire 2004, see also Finfer et al. 2008), it is not proper metric for evaluating effects to fish because fish hear at low frequencies. Figure 17 shows the general difference between human and fish hearing capabilities. Another limitation of dBA noise levels is that the USAF cannot estimate underwater noise levels because the conversion requires un-weighted dB levels tied to an in-air reference pressure (see Hastings and Popper 2005, Finfer et al. 2008, OCR 2015).[27] Even if the conversion were possible, no information is available regarding frequency. As discussed above, frequency and a species-specific audiogram is critical to evaluating potential effects to a specific species. Finally, in-air noise would not have the same noise signature as in-water noise and/or noise transmitted from air into the water, which is why studies on fish measure received in-water noise levels generated from noise sources outside of water. Therefore, in lieu of actual measurements and species-specific studies, this BA relies on existing studies as proxies for evaluating the potential effects of the Proposed Action, while referencing dBA levels only as an aid to comparisons.

[26] A-weighting deemphasizes low frequency noise, which is the frequency relevant to fish (see Hastings and Popper 2005, see generally, St. Pierre and Maguire 2004).

[27] The common conversion from air (dB referenced to 20 micropascals (μPa)) to water (dB referenced to 1 μPa) is to add 26 dB with an additional 36 dB recommended to account for the acoustic difference between the mediums (Finfer et al. 2008, DOSITS 2015, OCR 2015).



Source: Carlson 1997.

Figure 17 – Audiograms of Selected Species of Fish Compared with the Human Hearing

A review of the literature on effects to fish from noise focuses on large construction projects normally involving pile drivers (an impact device that results in impulse noise). A recent study evaluated noise effects from pile driving on fish in Northern California – *Mad River Bridges Replacement Project Effects of Pile Driving Sound on Juvenile Steelhead* ("Mad River"). Although the Proposed Action will not involve a pile driver, this study provides real time data that is useful to support a conclusion of no adverse effects from the Proposed Action where the primary noise effects would be from non-impact devices, theoretically resulting in less intense effects from noise and/or vibrations.

In Mad River, Caltrans documented noise effects to caged juvenile steelhead from pile driving conducted next to an active river channel that ranged in depth from 0 to 10 feet with piles installed outside of, but adjacent to the river (see Photos 13 and 14) (Caltrans 2010). Similarly, the Proposed Action would occur next to an active and shallow creek. Further, the Mad River results are useful because they provide information on received noise levels measured from equipment with greater average noise levels, as compared to the Proposed Action, in addition to evaluating effects of noise on a fish species that is somewhat similar to UTS. Finally, the Mad River report discusses the data in relation to the NMFS thresholds and shows how attenuation affects received noise levels even where work is not conducted in-water (see Photo 14 for fish cage locations).

Photo 13 – Mad River Pile Driving

Photo 14 – Pile Location in Relation to the Mad River and Fish Cages

In sum, the Mad River project involved the extensive use of a pile driver resulting in fish being exposed to underwater peak SPLs (loudest instantaneous noise measurement) ranging from 69 to 188 decibels (dB) re 1 μPa and cumulative SELs (average of total pile driving noise in one day) ranging from 179 to 194 dB re 1 μPa^2-sec (CalTrans 2010).

As to the potential for physical effects, only on one of the four days of pile driving did noise levels exceed the NFMS cumulative SEL level of 187 dB re 1 μPa^2 –second (CalTrans 2010). The data shows that the project noise levels exceeded the NMFS cumulative SEL threshold on the day with the most strikes from the impact hammer (4,306 strikes), but not on the days when less strikes occurred (1,100 and 1,164) (Caltrans 2010). Despite this exceedance, there was no exceedance of the NMFS peak threshold. Despite this intensive use of the pile driver, there were no immediate physical injuries, although it was not possible to assess the possibility of delayed effects due to project constraints (CalTrans 2010). However, citing a separate study in support of no delayed effects, no immediate or latent (10 to 19 days) mortality in fish occurred after exposure to 207 dB cumulative SEL from pile driving (CalTrans 2010). Therefore, it is possible that even with the intensive use of a pile driver, noise levels may have not exceeded any of the NMFS noise thresholds for adverse effects to fish if its use was limited to a reduced number of strikes per day.

As to the potential for behavioral effects, peak noise levels exceeded the NMFS threshold of 150 dB re 1 μPa (Caltrans 2010). Caltrans documented potential physiological effects based on an analysis of blood variables, hematocrit and plasma cortisol, although the effects could not be tied exclusively to pile driving (e.g., handling fish, bacterial infection). However, one effect noted for all fish with pile driving identified as a potential cause was elevated plasma cortisol levels (indicator of stress) (CalTrans 2010). Therefore, Mad River shows that juvenile steelhead exposed to noise levels from a large impact device, used as close as 115 feet to the fish, only resulted in behaviorally effects in the form of stress.

In comparison, the Proposed Action would use construction equipment with a lesser average dBA values (combined maximum is 84 dBA) than a pile driver (96 to 101 dBA) (FHWA 2006) used in Mad River, which would theoretically result in lesser, actual received noise levels. In Mad River, Caltrans used a large impact hammer to drive eleven piles to a depth of 65 to 85-feet over a four-day period taking 16 hours and involving 9,966 impact hammer strokes (Caltrans 2010). Here, the Proposed Action would use a front loader (not an impact device) to loosen top soil/sediment to access gabions placed 3-feet below the original ground surface (Appendix A, Sheet 1). A front loader would not be capable of being used to the same extent and/or resulting in similar effects as the large pile driver used by Caltrans in Mad River. The impact hammer used was the largest in the United States at that time (Caltrans 2010). Therefore, it is likely that the Proposed Action would result in noise levels less than documented in Mad River, resulting in lesser potential effects to UTS from noise.

Therefore, based on Mad River data, the USAF does not anticipated physical injury to UTS under the Proposed Action, but it cannot rule out the potential for behavioral effects. Fish are able to detect small changes in their environment (see Popper and Fay 2011) (acceleration sensitivity measured at 0.1 nanometer for fish species; diameter of hydrogen atom), but it is not certain at what point (i.e., distance or noise level) effects would be considered adverse without more information on UTS. As a result, the USAF reviewed additional studies to determine the potential behavioral effects documented to hearing specialists versus generalists because of noise.

As discussed above, UTS is more of a specialist (has gas bladder). In a study evaluating the potential effect of noise as a fish deterrent, noise was generally not a deterrent to fish without a swim bladder whereas it was mostly a deterrent to fish with a swim bladder and/or other accessory structures increasing hearing abilities (Maes et al., 2004). This study evaluated forty-one fish species, including some gobies and armored stickleback, exposed to sound within the range of 20 to 600 Hz (Maes et al., 2004). The avoidance response in fish species ranged from no effect to deflection (Maes et al., 2004). The gobies[28] and the armored stickleback had swim bladders, but only the armored stickleback (*Gasterosteus aculeatus*) did not have a significant avoidance response from the noise, which may have been due to its body armor, providing some insulation against sound, and/or having a slower maximum swimming speed as compared to the water current (Maes et al., 2004).

Based on the results of this study, noise generated by the Proposed Action may cause an avoidance response in UTS, if the noise generated is within their hearing capabilities. As previously discussed, UTS has a swim bladder; however, the UTS is not the same species as the armored stickleback, although it is in the same genus. Extrapolating between species advised against even within the same genus. For example, in one study, a brown trout was used as a proxy for evaluating effects to salmon (both in the genus *salmo*), but it was later determined that the brown trout did not have the same hearing sensitivity as salmon (Nedwell et al. (2007). Although Figure 15 generally groups salmonid species together, *Nedwell* demonstrates that not all species are the same despite having a swim bladder. Nevertheless, the value of *Maes* is that it evaluated many species of fish over a range of different frequencies and confirmed that noise, generally, does not bother fish without anatomical specializations, but may trigger an avoidance response in fish with anatomical specializations.

Therefore, since UTS are able to detect sound, there may be some behavioral response to the noise generated under the Proposed Action even if it is just be an avoidance response.

As to the potential for noise propagation within the Action Area, not enough information is available to determine the approximate distance and whether such effects are adverse; however, available information indicates adverse effects to UTS in San Antonio Creek may not result under the Proposed Action, as discussed below.

First, the minimum water depth for noise to propagate and be perceptible to UTS and/or adversely affect UTS does not exist in the Main Construction Area. As discussed above and shown on Table 8, a minimum of 2 feet of water is needed for low frequency sound to propagate and potentially affect fish below 500 Hz, assuming the sound levels (i.e., dB) are within their hearing capabilities (see e.g., Figure 16). The depth of San Antonio Creek, in the Main Construction Area where ground-disturbing activities would occur, is less than 1 foot in depth (several inches) (see Photo 10). As a result, it is unlikely that sound will propagate in water where it may adversely affect UTS in or near the Main Construction Area, since fish in shallow water would only perceive sound in close distance.

Second, the USAF is not able to estimate potential noise attenuation that may result in-water due to lack of estimated noise levels, but some attenuation is likely. Even if possible, projecting attenuation based on available dBA values, using the 4.5 dB reduction factor per doubling of distance, would not lead to a meaningful result since dBA approximates human hearing and noise does not always attenuate in proportion to distance. For example, the Mad River data shows that noise does not attenuate simply in proportion to distance; data exceeded the NFMS behavioral threshold at varied distances with some received levels greater further from the noise source (Caltrans 2010; see also, Hastings and Popper 2005). In addition, the USAF cannot state the potential noise attenuation from the Proposed Action based on the literature because noise propagation and attenuation is highly depending on the specific environment within which the sound originates. However, the USAF is able to conclude that distance does result in some attenuation based on Mad River and therefore distance from the noise source under the Proposed Action would likely result in some noise attenuation.

[28] *Pomatoschistus minutus* (Pallas), *Pomatoschistus lozanoi* (de Buen), and the estuarine resident *Pomatoschistus microps* (Krøyer).

Third, the USAF would divert San Antonio Creek from the area where ground-disturbing work would occur, within the Main Construction Area, protecting UTS to the maximum extent practicable. The USAF anticipates diverting the creek from one bay to the other as work occurs in the opposite bay, under the bridge.

In a recent USAF noise-study, it was determined that an appropriate buffer distance, for the protection of anadromous fish, from in-air noise resulting from the use of approximately 1 pound of explosives, was 14.1-feet.[29] In the same study, an increased buffer of 39-feet was recommended for the protection of all early phases of anadromous fish; however, this was based on the largest potential quantity of explosives to be used – approximately 6.5 lbs. Although this Proposed Action would not utilize explosives or otherwise generate impulse noise of the type likely to adversely affect fish (i.e., pile driving), these buffer distances provides an upper limit distance that would be protective of UTS. Essentially, if these buffers are effective to avoid adverse effects to anadromous fish from impulse noise, then it would also minimize effects to fish from non-impulse noise under the Proposed Action.

As discussed above, UTS are sensitive to particle motion and pressure change and thus impulse noise would have the greater potential to affect UTS than non-impulse noise because of the greater potential to generate changes in water pressure (see Larkin et al. 1996) (discussing effects of impulse versus continuous noise). However, the mass of a fish affects the extent to which it may experience adverse effects with smaller fish more likely to feel the impacts of pressure changes in-water (see generally, Yelverton et al. 1975) (study involved effects of in-water blasting on fish). Although adult UTS are very small in comparison to an adult anadromous fish, their eggs and juveniles are similar in regards to size and dependence on the in-stream habitat. As a result, the 39-foot buffer would be the most protective of UTS in San Antonio Creek. However, the Proposed Action would not actually generate impulsive noise and the ability of the USAF to divert San Antonio Creek is constrained by site conditions. As a result, the most protective distance is not feasible laterally in the Main Construction Area.

Therefore, the USAF would divert San Antonio Creek at least 14.1 feet away from construction activities, if feasible based on site conditions. This would minimize impacts to UTS from noise (and vibrations) to the maximum extent practicable. Existing site conditions do not allow a diversion up to 39-feet away because the floodplain is only 40-feet wide.

Finally, the Proposed Action would not result in effects from vibration that would adversely affect fish embryos or mature fish as previously discussed in Section 7.1.2.5. However, UTS may still be able to perceive vibrations associated with noise generating equipment/vehicles. The setback discussed above is also protective of UTS from the impacts of vibration.

Therefore, the Proposed Action could result in adverse effects to UTS if noise and/or vibration results in interference with UTS activities/behavior, to the detriment of the UTS. However, the USAF would avoid or minimize effects by diverting San Antonio Creek at least 14.1 feet away from construction activities, if feasible based on site conditions.

7.2.2.6. Predation

The Proposed Action may contribute to an increased risk of predation on UTS for the same reasons discussed in Section 7.1.2.6.

Vegetation removal and noise/vibration from construction activities could increase predation on UTS by causing UTS to find other refuge habitat and/or interfering with UTS activities/behavior, making them more susceptible to predation. As further discussed in Section 7.2.2.5, UTS may perceive noise/sound generated by the Proposed Action, which at the least could interfere with

[29] Chris Garner, USAF (673 CES/CEIEC), Wildlife Biologist, email message to author, September 23, 2015.

UTS activities/behavior. UTS predators in San Antonio Creek include the brown bullhead (Section 4.3.3). As a normal practice, the USAF would continue to remove non-native invasive species during VAFB species surveys in San Antonio Creek, which would tend to reduce predation of UTS to some degree.

Therefore, the Proposed Action could result in adverse effects to UTS from increased predations incidental to vegetation removal and noise/vibration disturbance; however, no additional Conservation Measures are proposed because this is an unavoidable effect of the Proposed Action.

7.2.3 Conclusion

Based on the foregoing analysis of effects and considering Conservation Measures, the Proposed Action *may affect*, and is *likely to adversely affect* the UTS.

A summary of Conservation Measures that would be implemented as part of the Proposed Action are presented in Section 8.0.

Because it cannot be guaranteed that there will be no accidental takes of UTS, the USAF requests incidental take coverage for the UTS, consistent with past consultations for similar projects in the unlikely event a UTS is found dead within the Action Area. In a recent biological opinion for the San Antonio Creek Restoration Project (USFWS 2009), the USAF was granted the take of two adult or fry UTS before re-initation would be required.

7.3 Tidewater Goby

TWG exist throughout the Action Area, but largely occur within the lagoon approximately 6 miles downstream of the Main Construction Area (Sections 4.3.3). However, TWG habitat requirements do include coastal streams (Section 4.2.2). The USAF has documented TWG in the creek channel in small numbers and approximately 1 mile upstream of the lagoon at El Rancho Road Bridge, which is downstream of the Main Construction Area (Swift 1999). Since TWG are able to move upstream during wet years, it is possible that they could travel upstream to the Main Construction Area given the right conditions (Swift 1999).

7.3.1 Physical Effects

The Proposed Action may result in similar yet lesser potential physical effects on TWG than discussed in Section 7.2.1.

Under the Proposed Action, TWG could be physically injured during relocation and construction activities because TWG is a small fish and its presence may not be so apparent within the Action Area (Section 4.2.3). However, since TWG mostly exist in the downstream lagoon, there would be a lesser potential for physical injury in the Main Construction Area, located approximately six miles upstream from the lagoon. In addition, TWG peak breeding/spawning season is spring to summer (Section 4.2.3), but reproduction would not likely occur in the Main Construction Area (no tributaries) (Section 4.2.3). Conservation Measures for the protection of TWG are the same as those discussed in Section 7.2.1.

Therefore, the Proposed Action could adversely affect TWG by inadvertent physical injury associated with relocation and/or exclusion if they are present in the Action Area. Conservation Measures are summarized in Section 8.0.

7.3.2 Habitat Effects

7.3.2.1. Vegetation Removal

The Proposed Action may result in lesser potential habitat-related effects on TWG than discussed in Section 7.2.2.1.

Under the Proposed Action, the Proposed Action will affect approximately 597 linear feet of San Antonio Creek. The removal of riparian vegetation is not likely to affect TWG, present in the Action Area, because TWG are more dependent on submerged aquatic vegetation for shelter and are not dependent on riparian habitat (Section 4.2.2). Further, the habitat important to TWG is likely not in the Action Area, but downstream in the lagoon and/or tributaries to San Antonio Creek (Sections 4.2.2, 4.2.3).

Therefore, the Proposed Action will not cause the loss of TWG habitat in the Action Area because TWG habitat is largely in lower San Antonio Creek, but the potential for adverse effects cannot be ruled out based on existing information since vegetation removal is anticipated under the Proposed Action and TWG may be present in the Action Area. However, no additional Conservation Measures are proposed since these potential impacts are unavoidable consequences of the Proposed Action.

Table 9 - TWG Habitat in Action Area

TWG Habitat	
San Antonio Creek	597 linear feet

7.3.2.2. Herbicides

The Proposed Action may result in potential effects on UTS from herbicides to the same extent as discussed in Section 7.2.2.2.

Under the Proposed Action, adverse effects to TWG from use of Aquamaster® are not anticipated despite use in TWG habitat. This is based on the method of application and incorporation of applicable spill prevention measures to ensure that Aquamaster® does not enter San Antonio Creek. Even though TWG are generally located downstream of the Action Area, any increased pollutant load (i.e., herbicides) in San Antonio Creek would have the potential to affect species in the creek to the same degree. Conservation Measures for the use of Aquamaster® are the same as discussed in Setion 7.2.2.2.

Therefore, the Proposed Action could result in adverse effects to TWG from use of Aquamaster® in TWG habitat, but the method of application would avoid the potential adverse effects. Conservation Measures for use of Aquamaster® are summarized in Section 8.0.

7.3.2.3. Water Quality

The Proposed Action may result in lesser potential water quality effects on TWG than discussed in Section 7.2.2.3.

Under the Proposed Action, increased erosion and sedimentation in the creek from ground disturbing activities may occur in the Main Construction Area. However, the potential effects from sedimentation/ increased turbidity would not likely affect TWG that tend to congregate further down the Creek (approximately 6 miles) and sediments will have time to settle out of the main water column. In addition, TWG may not be sensitive to sedimentation/increased turbidity. TWG habitat includes a variety of substrates including silt (Section 4.2.2).

Therefore, the Proposed Action will not cause water quality effects to TWG in the Action Area because TWG habitat is largely in lower San Antonio Creek, but the potential for adverse effects cannot be ruled out based on existing information since effects to water quality are anticipated under the Proposed Action and TWG may be present in the Action Area. However, no additional Conservation Measures are proposed since these potential impacts are unavoidable consequences of the Proposed Action.

7.3.2.4. Reduction in Prey

The Proposed Action may result in lesser potential effects to prey than as discussed in Section 7.2.2.4.

Under the Proposed Action, removal of riparian vegetation and use of herbicides in the Action Area would not tend to adversely affect TWG by causing a reduction in prey. TWG prey includes invertebrates, which are dependent on riparian vegetation (see Sections 4.2.3 and 7.1.2.4). However, since TWG are largely confined to the downstream lagoon, loss of a small patch of riparian vegetation six miles upstream would not appreciably affect the prey of TWG that exist in the lagoon due to reduction in leaf litter/temporary displacement in the Action Area. In addition, the potential for reduction of prey because of using Aquamaster® is the same as discussed in Section 7.2.2.2. Essentially, there is no reduction in prey anticipated from the use of Aquamaster® due to the method of application and incorporation of spill prevention measure, ensuring that Aquamaster® does not enter San Antonio Creek.

Therefore, the Proposed Action will not cause a reduction in TWG prey in the Action Area because TWG habitat is largely in lower San Antonio Creek, but the potential for adverse effects cannot be ruled out based on existing information since reduction in prey is anticipated under the Proposed Action and TWG may be present in the Action Area. However, no additional Conservation Measures are proposed since these potential impacts are unavoidable consequences of the Proposed Action.

7.3.2.5. Construction Noise

The Proposed Action may result in lesser potential effects to TWG from noise than as discussed in Section 7.2.2.5.

Under the Proposed Action, construction equipment used in the Main Construction Area may generate noise/sound that is perceptible to TWG, if they are present in the Action Area.

TWG hear the same way as discussed in Section 7.2.2.5, but are less sensitive to the effects of sound because they do not have a specialized anatomical feature such as a gas/swim bladder; it is lost after their larval phase.[30] Based on this information, TWG only detect particle motion via their sensory hair cells ("hearing generalist"). Nevertheless, the NMFS sound pressure thresholds, assessing adverse effects to fish, are applicable to TWG because they address fish generally.

Considering the comparative analysis of the Mad River versus the Proposed Action, the potential effects on TWG would be lesser than the fish analyzed in Mad River, or UTS under the Proposed Action, because TWG are less sensitive than steelhead and UTS; lacking a gas bladder. This theory was confirmed in a study where it was documented that noise was not a deterrent to fish without a swim bladder, a hearing generalist (see Maes et al., 2004). This study supports a finding of no adverse effects to TWG because it is a hearing generalist. This finding remains even though fish are able to detect small changes in their environment (see Popper and Fay 2011) because the ability to detect motion does not necessarily represent the threshold of adverse effects. Since TWG may be able to detect any change in the underwater acoustic environment, TWG could have some response to noise, even if slight. However, as

[30] Brenton Spies, University of California Los Angeles, Research Biologist, email message to author, October 6, 2015.

shown in *Maes*, it is unlikely TWG would have an avoidance response. As a result, no distance buffer is required for the protection of TWG from noise.

As previously discussed in Section 7.1.2.5, the Proposed Action would not result in effects from vibration that would adversely affect fish embryos or mature fish. However, TWG may still be able to perceive vibrations.

Conservation Measures for the protection of TWG are the same as those discussed in Section 7.2.2.5. Conservation Measures protective of UTS would necessarily be protective of TWG, since TWG is the less sensitive species.

Therefore, the Proposed Action could result in adverse effects to TWG if noise and/or vibration results in interference with TWG activities/behavior, to the detriment of the TWG. Conservation Measures are summarized in Section 8.0.

7.3.2.6. Predation

The Proposed Action may result in the same or lesser potential effects to TWG from predation than discussed in Section 7.2.2.6.

Under the Proposed Action, the removal of riparian vegetation may result in loss of refuge habitat, which may result in an increased risk of predation by exposure. The bullhead is also a predator of the TWG (Section 4.2.3), but the Proposed Action would not cause any loss of habitat in the San Antonio Creek lagoon where most TWG are known to congregate. Nevertheless, to the extent that TWG are present in the Main Construction Area and the removal of riparian vegetation results in loss of some temporary refuge/protective cover from predators, then the potential exists for adverse effects to TWG where the loss of vegetation results in increased exposure to predators. Finally, the USAF would continue to remove non-native invasive predators during species surveys on San Antonio Creek.

Therefore, the Proposed Action could result in adverse effects to TWG from increased predation incidental to vegetation removal and noise/vibration disturbance, if they are present in the Action Area. However, no additional Conservation Measures are proposed because this is an unavoidable effect of the Proposed Action.

7.3.3 Conclusion

Based on the foregoing analysis of effects and considering Conservation Measures, Proposed Action *may affect*, and is *likely to adversely affect* the TWG.

A summary of Conservation Measures that would be implemented as part of the Proposed Action are presented in Section 8.0.

Because it cannot be guaranteed that there will be no accidental takes of UTS, the USAF requests incidental take coverage for the TWG, consistent with past consultations for UTS. TWG were not included as part of the incidental take statement for the San Antonio Creek Restoration Project (USFWS 2009), however, since TWG would experience effects similar to UTS by virtue of being a fish in San Antonio Creek, the USAF requests take coverage of two adult or fry TWG before re-initation would be required.

8.0 Conservation Measures

The USAF will implement the Conservation Measures (general and species specific) listed below, including a project modification to minimize and/or avoid potential effects on ESA-listed species from the Proposed Action.

Project Modification:

- The initial project design included the installation of a drain to divert runoff from the agricultural field depression into San Antonio Creek to curb existing bank erosion that could undermine the bridge overtime. The USAF will now construct a berm near the agricultural depression to direct surface runoff away from San Antonio Creek.

General (apply for the protection of all species):

- A USFWS-approved biologist will be present for all project activities that may affect listed species to implement and/or oversee the implementation of the CMs in this BA.
- A USFWS-approved biologist will be present during annual maintenance activities, which may require entry into San Antonio Creek since it will not be diverted subsequent to this Proposed Action.
- The construction contractor would provide the USFWS-approved biologist with a schedule of planned construction activities at least 48 hours in advance.
- Prior to the commencement of construction activities, a USFWS-approved biologist will conduct environmental sensitivity training for all project personnel to provide an overview on the listed species that may be encountered during the project, applicable regulatory policies and provisions regarding their protection, and the avoidance and minimization measures to be adhered to in order to protect these species. Crewmembers will be briefed on the reporting process in the event that an inadvertent injury occurs to a listed species during construction. At a minimum, crewmembers shall report any injury to the on-site biologist.
- Equipment and vehicles shall be cleaned of weed seeds prior to use in the Action Area to prevent the introduction of weeds. Prior to transport, any skid plates shall be removed and cleaned. If equipment vehicles move from one watershed to another on base, wheels, undercarriages, and bumpers will be cleaned prior to traveling. If no nearby wash facility or means to collect on site and dispose of rinse water to a sewer is available, air blast equipment vehicles on site.
- Prior to removing riparian vegetation, the USAF contractor will pre-tag vegetation that is more than 2-inches so that the USAF botanist and biologists can ensure effects within the scope of this BA. Plants less than 2-inches in diameter will not be removed since they do not present a risk of harm to the bridge. In addition, prior to vegetation removal, a biologist capable of identifying ESA-listed plants will confirm lack of presence.
- The USAF would ensure equipment operating within the hydrologic floodplain/riparian area is placed on protective mats to prevent contamination of the creek bed. USAF would require vehicles to be maintained and stored outside of the hydrologic floodplain, in the staging areas, to avoid the potential for inadvertent spills into the creek and riparian areas. Fueling of equipment will be conducted in pre-designated areas, outside of the live stream, and spill containment materials will be placed around the equipment before refueling. Stationary equipment (e.g. cranes) will be outfitted with drip pans and hydrocarbon absorbent pads. If it is necessary to refuel or repair equipment within the riparian corridor, a USFWS-qualified biologist will be present to monitor activities.
- Instream construction activities, including application of Aquamaster®, would be completed or paused and all construction equipment and materials in the hydrologic floodplain of San Antonio Creek would be removed prior to the onset of significant rainfall (0.5 inches within a 24-hour period).

- o Although the USAF has determined that there will be not affect to ESA-listed riparian birds, the USAF as a general matter requires that any vegetation clearing will occur outside of bird nesting season. Bird nesting season is from 15 February through 15 August. In addition to ensuring compliance with the Migratory Bird Treaty Act, this CM would ensure any undetected ESA-listed birds are not present during vegetation removal. If work occurs during nesting season, a qualified biologist would conduct bird nest surveys prior to project activities. Contractor will coordinate with 30 CES/CEIEA prior to work.
- o The USAF would continue to remove non-native invasive predators encountered during survey efforts (i.e., bullfrogs).
- o The USAF would comply with any additional requirements imposed under the CWA, [31] determined during the NEPA process, to ensure effects to water quality remain within acceptable levels.

California red-legged frog:

- o The USAF would relocate CRLF prior to construction activities in the Main Construction Area. Only a USFWS-approved biologist may relocate CRLFs.
- o The USAF would install temporary exclusionary fencing within the Main Construction Area prior to work, monitored daily by a USFWS-approved biologist, to ensure CRLF do not enter or remain trapped in the Main Construction Area.
- o All personnel working in the Main Construction Area will adhere to the requirements stated in the Declining Amphibian Populations Task Force Fieldwork Code of Practice (USFWS 2002a) (see Appendix F).
- o The USAF would not use the herbicide Aquamaster® until receipt of a Biological Opinion authorizing such use per the recent California Court injunction pertaining to CRLFs (USEPA 2015b). As set forth in this BA, limitations on use of Aquamaster® are as follows:
  - ▪ The USAF and/or DoD-approved herbicide applicator would ensure any nonionic surfactant added to the Aquamaster® solution is not toxic or prohibited.
  - ▪ Aquamaster® will be applied by hand to cut stumps and/or remaining foliage using wipe applicators or sponges.
  - ▪ Appropriate spill prevention measures will be adopted when working in the San Antonio Creek hydrologic floodplain.

  In the event the limitation associated with Aquamaster® application, presented in this BA, cannot be followed, the USAF would only allow mechanical or manual methods of vegetation removal, excluding the use of vehicles in San Antonio Creek.

Unarmored threespine stickleback:

- o Same as CRLF, tailored to UTS with the following exceptions:
  - ▪ *The Declining Amphibian Populations Task Force Fieldwork Code of Practice* is not applicable to UTS.

[31] See e.g., Water Quality Order No. 2013-0002-DWQ, General Permit No. CAG990005, Statewide General NPDES Permit For Residual Aquatic Pesticide Discharges to Waters of The United States from Algae and Aquatic Weed Control Applications (Appendix G).

- The USAF would divert San Antonio Creek during construction activities. At a maximum the diversion would occur 14.1 feet away from construction activities.

Tidewater goby:

- o Same as UTS, tailored to TWG.

9.0 Conclusions

The USAF requests formal consultation with the USFWS on the adverse effects to California red-legged frog, unarmored threespine stickleback and tidewater goby based on the analysis contained in this BA and the USAF's ESA determinations (see Table 10).

Table 10 – ESA Determinations

Species	ESA Determination
California red-legged frog	May affect, likely to adversely affect
Unarmored threespine stickleback	May affect, likely to adversely affect
Tidewater goby	May affect, likely to adversely affect

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ventura Fish and Wildlife Office
2493 Portola Road, Suite B
Ventura, California 93003

IN REPLY REFER TO:
08EVEN00-2016-F-0103

August 10, 2018

Beatrice L. Kephart
30 CES/CEI
1028 Iceland Avenue
Vandenberg Air Force Base, California 93437-6010

Subject: Biological Opinion for the Erosion Protection System Maintenance at the San Antonio Road West Bridge, Vandenberg Air Force Base, Santa Barbara County, California (2016-F-0103)

Dear Ms. Kephart:

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion based on our review of the U.S. Air Force's (Air Force) proposed project to maintain the integrity of a bridge over San Antonio Creek on Vandenberg Air Force Base (VAFB) and its effects on the federally threatened California red-legged frog (*Rana draytonii*), endangered unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*), and tidewater goby (*Eucyclogobius newberryi*), in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). We received your request to initiate formal consultation on March 10, 2016.

We have based this biological opinion on information that accompanied your March 10, 2016, request for consultation, including the biological assessment (BA) (Air Force 2016), additional information regarding the project received via emails, and information in our files. We can make a record of this consultation available at the Ventura Fish and Wildlife Office.

Consultation History

On March 10, 2016, we received the Air Force's request for formal consultation, including the BA, for the proposed San Antonio Creek maintenance project (Air Force 2016).

On August 25, 2016, we received an update to the BA consisting of additional information regarding a proposed berm, a revision of the project area and acreage, and the removal of upland herbicide application from the proposed action (L. Lum, U.S. Air Force, pers. comm. 2016).

On December 19, 2016, the Air Force requested we place the consultation on hold due to expected changes to the project description associated with State-required wetland mitigation.

On March 9, 2018, we received a draft of the Mitigation and Monitoring Plan for the San Antonio Road West Bridge Maintenance at VAFB. We received a revised version of the plan on April 5, 2018 (ManTech SRS Technologies [ManTech] 2018), which also included the removal of the previously proposed berm from the project description. Additional and clarifying information regarding the revised project description and Mitigation and Monitoring Plan was provided by the Air Force during March, April and May 2018 (R. Evans, U.S. Air Force, pers. comm. 2018a, 2018b; Lum, pers. comm. 2018a, 2018b, 2018c, 2018d).

On August 3, 2018, the Service provided the Air Force with a draft biological opinion. The Air Force (Evans, pers. comm. 2018c) provided comments on the draft biological opinion on August 7, 2018; we have incorporated the Air Force's comments into this biological opinion, as appropriate.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The Air Force proposes to repair gabions and reduce vegetation growth in the San Antonio Creek channel and its hydrologic floodplain to ensure that creek flow, under normal and flood conditions, does not undermine the stability of the bridge. The Air Force anticipates that the proposed initial activities would take approximately 90 days, although future periodic vegetation reductions may be required to maintain suitable conditions. The proposed actions would be limited to daytime hours and commence upon completion of the Air Force's responsibilities under the National Environmental Policy Act (NEPA). The proposed mitigation activities would be conducted over a 3-year period, with monitoring planned for a minimum of 5 years or until success criteria are met.

Staging Areas

The Air Force would require two staging areas to carry out the project; these staging areas would be located on opposite sides of San Antonio Road West (Figure 1). The southern staging area would be approximately 0.38 acre and the northern area approximately 0.03 acre. The Air Force would clear and grub the staging areas prior to implementing the main construction.

Water Diversion

The Air Force would dam, divert and dewater within the primary construction area to facilitate inspection, repair and/or replacement of the gabions that underline the creek. Currently, a beaver dam is located just upstream of the bridge and has resulted in a large backup of water (several feet deep and wide) that would need to be lowered, for manageability, prior to damming or diverting the creek. The Air Force anticipates lowering this upstream area to a desired water depth (approximately 2 to 3 feet) by piercing a small hole in the upstream beaver dam. A Service-approved biological monitor would be present during these activities to ensure that the rate of water release from the beaver dam is not too fast, creating excessive turbulence downstream, or causing anoxic conditions and/or the stranding of animals in any backwater pockets.

After achieving the desired water depth, the Air Force would install a dam upstream of the beaver dam, to control downstream flow, and install a dam downstream of the main construction area, to facilitate creek diversion and prevent backflow once the culvert is installed. Prior to installing the dams, a Service-approved biologist would inspect and relocate any California red-legged frogs, unarmored threespine sticklebacks, or tidewater gobies that remain in the upstream beaver pond.

After dam installation, up to two culverts (pipes) would be installed through the main construction area, one through each bay, connecting the upstream and downstream dams. The culvert pipes would also pass through the upstream beaver dam because it would be retained. Once installed, the Air Force would be able to direct San Antonio Creek to flow through either bay via the culverts. As designed, the culverts would allow the continued flow of San Antonio Creek while bypassing the area under the bridge where ground-disturbing activities are occurring. The culverts would serve to keep soil and debris out of the creek, protect sensitive species, and prevent flowing water from flooding the construction site. During these activities, a Service-approved biologist would be present to monitor for and relocate California red-legged frogs, unarmored threespine sticklebacks, or tidewater gobies. As the Air Force switches between the use of the two culverts, a Service-approved biologist would be present during these activities to monitor for and relocate California red-legged frogs, unarmored threespine sticklebacks, or tidewater gobies.

After creek diversion activities are complete, the Air Force would dewater the main construction area, as needed, to implement the proposed project. This would involve activating the dams and then using water pumps to remove any water remaining in the main construction area, after creek diversion, as well as any groundwater encountered during digging (to access the gabion baskets) and thereafter directing the water onto an adjacent agricultural field. The Air Force would design the pump system to avoid trapping or suctioning California red-legged frogs, unarmored threespine sticklebacks, or tidewater gobies as well as require a Service-approved biologist to monitor these activities. Mesh screens would be incorporated into the water pump system to reduce the possibility of animals being suctioned and trapped in the pump. Before dewatering occurs, the biologist would confirm no California red-legged frogs, unarmored threespine sticklebacks, or tidewater gobies (any life stage) are present in the water subject to dewatering. If California red-legged frogs, unarmored threespine sticklebacks, or tidewater gobies are present, the biologist would capture and relocate these individuals. Once dewatering begins, the Air Force would ensure that the dewatering rate would not exceed the ability of the biologist to confirm whether California red-legged frogs, unarmored threespine sticklebacks, or tidewater gobies are entering the pumps.

Gabions

In order to inspect and repair/replace gabions, the Air Force would remove sediment from an approximate 0.1-acre area under the bridge to facilitate the inspection and/or replacement and repair of gabions. The gabions were originally installed 3 feet below ground surface, but depth of gabions is not presently known and likely varies. After the Air Force removes the sediment, they would inspect and replace any failed or excessively worn wire fabric. If necessary, the Air Force would repair gabions by adding additional rock-fill and securely attaching wire fabric over the damaged sections.

To complete the proposed action, a crane, front loader (i.e., bobcat), shovels, soil container/bin, and dump truck would be used. The Air Force would use a crane, located in one of the staging areas, to place the bobcat and container/bin under the bridge deck, within the San Antonio Creek hydrologic floodplain. The bobcat would then be used to loosen and load sediment from large patches of sediment under the bridge deck and place it into the container. In addition, Air Force personnel with shovels would loosen and remove sediment from smaller patches. The crane would then raise the container, as filled, and transfer the sediment to a dump truck waiting in the staging area. This process would continue until the all the sediment covering the gabions is removed and all gabions are exposed.

Vegetation Reduction

The Air Force would cut riparian vegetation using mechanical and/or manual cutting (i.e., chainsaw or handsaw) within the main construction area (Figure 1), under the bridge and extending outward approximately 60 and 80 feet to the northeast and southwest of the creek, respectively, and up to 16 to 18 feet in width. The Air Force would only cut woody vegetative material with stems greater than or equal to 2 inches in diameter down to within 3 inches of the ground and/or water surface. Vegetation less than 2 inches would remain. The Air Force anticipates cutting only willow riparian vegetation (willow trees) along the banks of San Antonio Creek because those trees tend to be the woody vegetation equal to or greater than 2 inches in diameter. The Air Force would leave woody vegetation of other types and/or smaller dimensions that are scattered throughout the construction area in place. While the Air Force would carry out this work in and around San Antonio Creek and personnel may need to enter San Antonio Creek, they would not dam or divert San Antonio Creek during vegetation reduction activities. The Air Force will only clear/grub vegetation between August 16th and February 14th (i.e., outside of bird nesting season).

The Air Force would periodically inspect the erosion protection system to maintain good condition. It is possible that the Air Force would need to reduce vegetation periodically (e.g., annually), depending on the rate of regrowth and using the same criteria discussed above.

Site Restoration

The Air Force would restore the area impacted during the repairs and maintenance to the bridge during the final stages of all construction activities as construction machinery and materials are removed. The Air Force would remove all surplus and waste materials from the project area, unless they are also required for the restoration effort. To the extent feasible and practicable, the Air Force would restore the site contours, river channel, and habitat types to pre-construction conditions, except directly under the bridge where maintenance activities would occur. The Air Force would stabilize all exposed soil areas on the banks, upland staging, and access areas with native vegetation.

An upland native grass seed mix that is approved by the base botanist would be applied to upland areas. Weed-free mulch would be used to protect the seed and provide temporary stabilization. Once the native grassland is established, the Air Force would install native shrub container plantings in the upland areas. Depending on availability, the Air Force may use irrigation in upland areas as needed to achieve the establishment of native vegetation. Irrigation water would either come from a municipal source or water pumped from the creek. If using water from San Antonio Creek, the Air Force would pump water from the creek into containers for hand-watering or into a drip irrigation system. A qualified biologist would place the irrigation pump intake in a 30 gallon barrel with fine mesh (0.125 inch) screened holes to protect listed species from entering the pump intake.

Wetland Mitigation

Due to the nature of the proposed action, the requirement for riparian vegetation removal and subsequent maintenance to keep vegetation cleared under the bridge, State-required mitigation to compensate for impacts to California State Waters would take place off site. The proposed mitigation area consists of 0.5 acres located approximately 0.75 mile west of the proposed project area on the south side of San Antonio Creek between the existing willow riparian zone and adjacent farm field (Figure 2). The Air Force proposes to enhance 0.48 acre of willow riparian habitat by conducting invasive plant treatments and other site preparation activities followed by revegetation with native plants, including willows, over a 3-year period. The Mitigation and Monitoring Plan (ManTech 2018) and additional correspondence with Air Force staff (Lum, pers. comm. 2018a, 2018d) contain additional details of the following proposed activities.

<u>Access</u>

Two access routes are proposed to the mitigation site (Figure 2). The western access route is an old, slightly overgrown agricultural access road, measuring between 5 and 6 feet wide and approximately 0.5 mile long, which traverses sparse riparian woodland. The eastern route measures between 5 and 6 feet wide and approximately 1 mile long and traverses sparse central coast scrub, non-native broadleaf, and non-native grassland; it is not a pre-existing road or trail. Only minor vegetation trimming using hand tools will be required to access the mitigation site.

Site Preparation

Because the proposed mitigation site is currently heavily vegetated by whitetop (*Lepidium draba*) and black mustard (*Brassica nigra*), site preparation would require broadleaf-specific herbicide treatment with chlorsulfuron (tradename Telar®XP; proposed application rate equal to 1-3 ounces/acre) for 2 consecutive years. An initial treatment of the entire mitigation area would be conducted in the late dry season (August – October), followed by three to four spot treatments per year, for 2 years, as needed. In addition, harrowing and seed application would be conducted during the first years' winter, with a follow-up seed application during the winter of the second year, and two spot herbicide treatments of non-native grasses with glyphosate (tradename Rodeo®; proposed concentration equal to 1.5 percent) as needed. An oil-based surfactant (e.g., Agri-dex; proposed concentration equal to 1 percent) would be used with both chlorsulfuron and glyphosate for adhesion, spread, and penetration of the active ingredients; a spray indicator dye would also be used. Harrowing would be accomplished by dragging a rigid toothed harrow pulled behind a six-wheel drive utility terrain vehicle (e.g., Polaris Ranger). Only native species would be used in the seed application which would include a mixture of foothill needle grass (*Stipa lepida*), purple needle grass (*Stipa pulchra*), California brome (*Bromus carinatus*), meadow barley (*Hordeum brachyantherum*), and small fescue (*Festuca microstachys*). Seeding is expected to reduce re-infestation of the site by the invasive broadleaf whitetop without compromising the establishment of the willow pole plantings that will be installed in year three of the mitigation. Glyphosate treatments would be conducted using an ultra-low volume herbicide applicator to ensure that only the target species receive herbicide treatment while minimizing damage to native grasses.

Plantings

Willow pole planting and container planting of riparian plants such as California blackberry (*Rubus ursinus*), elderberry (*Sambucus nigra*), and giant rye (*Elymus condensatus*) would occur during the winter of the third year. Willow cuttings would be harvested in the vicinity of San Antonio Creek from areas within the San Antonio Creek riparian corridor as approved by a 30 CES/CEI biologist. Willow cuttings would be collected and planted in January or early February, when the willows are dormant and at a time that would take advantage of winter rains. No more than 25 percent of a single tree's biomass would be harvested. Willows would be installed using one or more of the following methods:

1. Water jet installation: If site conditions are dry and allow for equipment, a truck and trailer or water pump hose would be used to liquefy the soil to create a hole that is 1 inch in diameter, or approximately the diameter of the willow pole. Willow cuttings will be installed to a depth of the soil's capillary fringe; using this method, willow cuttings will be installed at a depth of 3 to 4 feet.

2. Hand-held power auger: This method could be used if a water truck or trailer cannot access the site. The auger would be used to drill a hole 4 to 6 inches in diameter and 2.5 to 4.5 feet deep. One to three willow cuttings would be set in each hole. The exposed hole

would then be filled with a slurry of muddy soil to ensure good soil contact with the planting.

3. Steel Rod: A hole would be manually driven with a 5-foot steel rod (0.75-inch diameter) to approximately 3 to 4 feet in depth, depending on soil conditions. The willow cuttings would then be installed in the hole, and the soil would be compacted around the willow stem.

Water used during the pole planting installation would be supplied from a water tank on a nearby vehicle or pumped from an open section of the creek. All pumping would occur with an onsite Service-approved biological monitor present to ensure that California red legged frog, unarmored threespine stickleback, and tidewater goby are not impacted. A wire screen (no larger than 0.125-inch mesh) would be placed around the pump inlet to prevent the entrapment of any living organisms. Subsequent irrigation for maintenance purposes would follow the above procedures and would continue on an as-needed basis to promote downward development of the root systems.

Holes for container plants would be dug manually with a hand trowel to approximately 6 to 12 inches in depth and backfilled with native soil. To protect plants from herbivory and browsing, all container plants will be installed with a wire mesh cage placed around the root ball and a fence wire fabricated cage to protect the body of the plant.

To reduce competition for newly planted willows and container plantings, spot treatments (using chlorsulfuron and/or glyphosate) of whitetop and other non-native plants would be applied as needed.

Follow-up Herbicide Treatments

The final activities associated with site mitigation would include monitoring and spot treatment of whitetop, black mustard, and other non-native invasive plants as needed. Treatments would be conducted during the last 6 months of the third year (expected to be from January through mid-June).

Monitoring

The Air Force would monitor the site for a minimum of 5 years or until success criteria are met. Monitoring would be conducted using walking transects following the California Native Plant Society's Rapid Vegetation Assessment methodology. Monitoring would be conducted at both the mitigation site and a reference site which would be selected in nearby intact native habitat. The following success criteria would be applied to determine if the site has achieved restoration goals:

1. Native cover within the mitigation site is at or above that of the reference site.

2. Non-native cover within the mitigation site is at or below that of the reference site.

3. Evidence that the site is sustainable by showing signs of regeneration (progeny and new growth) of healthy plants, a low mortality rate, and resistance to invasion by weeds.

Avoidance and Minimization Measures

To minimize adverse effects to California red-legged frog, unarmored threespine stickleback and tidewater goby, the Air Force would implement the following measures to minimize and/or avoid potential effects on listed species. To some degree, we have collated protective measures from throughout the BA (Air Force 2016), the programmatic biological opinion (Service 2015) and the Mitigation and Monitoring Plan (ManTech 2018), and changed the wording of some measures to improve clarity, but we have not changed the substance of the measures the Air Force has proposed. The BA (Air Force 2016), programmatic biological opinion (Service 2015), Mitigation and Monitoring Plan (ManTech 2018), and additional correspondence with Air Force staff (Evans, pers. comm. 2016, 2018a, 2018b; Lum, pers. comm. 2018a) contain additional details of the following proposed protective measures.

1. A Service-approved biologist will be present for all project activities that may affect listed species to implement and/or oversee the implementation of the avoidance and minimization measures in this biological opinion.

2. The Air Force will provide the Service-approved biologist with a schedule of planned construction activities at least 48 hours in advance.

3. Prior to the commencement of construction and mitigation activities, a Service-approved biologist will conduct environmental sensitivity training for all project personnel to provide an overview on the listed species that may be encountered during the project, applicable regulatory policies and provisions regarding their protection, and the avoidance and minimization measures to be implemented to protect these species. The biologist will brief project personnel on the reporting process in the event that an inadvertent injury occurs to a listed species during project activities. At a minimum, project personnel must report any injury to the on-site biologist.

4. A Service-approved biologist will monitor, capture and relocate California red-legged frogs (adults and tadpoles) immediately prior to and during project activities including site preparation (i.e., clearing and grubbing staging areas), dam construction, culvert installation, dewatering, and general construction activities. The Service-approved biologist will search all potential hiding spots for California red-legged frogs. If any life stage of the California red-legged frog is found and these individuals are likely to be killed or injured by work activities, the approved biologist will be allowed sufficient time to move them from the site before work begins.

5. Prior to construction activities in the main construction area, the Air Force will install temporary exclusionary fencing along the edges. A Service-approved biologist will monitor the area daily to relocate California red-legged frogs that enter the main construction area. The Air Force may incorporate some attractant (i.e., temporary shelter feature) at the edges of the exclusionary fencing to aid in the capture and relocation of any California red-legged frogs that enter the main construction area.

6. Prior to installing the dams, a Service-approved biologist would inspect, capture and relocate any California red-legged frogs that remain in the upstream beaver pond. In addition, the Service-approved biological monitor will be present during damming activities to ensure that the rate of water release from the beaver dam is not too fast, creating excessive turbulence downstream, or causing anoxic conditions and/or the stranding of animals, including the California red-legged frog, in any backwater pockets.

7. Prior to dewatering, a Service-approved biologist will inspect, capture and relocate any California red-legged frogs that remain in the main construction area. In addition, the Air Force will design the pump system to avoid trapping or suctioning California red-legged frogs. Finally, dewatering will be conducted at a rate not to exceed the ability of the biologist to visually confirm whether California red-legged frogs are entering the pumps.

8. The Service-approved biologist will relocate any California red-legged frogs that are found the shortest distance possible to a location that contains suitable habitat and that will not be affected by activities associated with the proposed project; to the extent practicable, the relocation site will be in the same drainage.

9. Only approved biologists will participate in activities associated with the capture, handling and monitoring of California red-legged frogs. All personnel working in the main construction area will adhere to the practices listed in the Declining Amphibian Populations Task Force Fieldwork Code of Practice (Service 2002).

10. No more than two days prior to beginning project activities, the Air Force will install nets with mesh no larger than 0.125-inch to exclude unarmored threespine sticklebacks and tidewater gobies from the project area. These nets will be set up within the main channel of the creek 50 feet upstream and 50 feet downstream of the project area, and will be continually monitored and maintained to prevent them from becoming clogged. These nets will be removed immediately following the completion of project activities.

11. Prior to any construction activities, including dam construction, culvert installation, dewatering, and general construction activities, a Service-approved biologist will survey the project area for the presence of unarmored threespine sticklebacks and tidewater gobies of any life stage. A Service-approved biologist will relocate all unarmored threespine sticklebacks and tidewater gobies observed within the project site to suitable habitat immediately downstream of the project site.

12. The active creek channel will be diverted through culverts passing through the project site to ensure continued flow and allow species to travel through the pipes and around the project area.

13. The Air Force will divert San Antonio Creek at least 14.1 feet away from construction activities, if feasible based on site conditions, to minimize impacts to unarmored threespine sticklebacks from noise and vibrations to the maximum extent practicable.

14. The dewatering intake will be screened with 0.125-inch mesh to prevent unarmored threespine sticklebacks and tidewater gobies from entering the system. A Service-approved biologist will be present during and after the dewatering to relocate any unarmored threespine sticklebacks and tidewater gobies that enter the work area prior to construction.

15. A Service-approved biologist will monitor the project area every work day, including the exclusion nets, until all unarmored threespine sticklebacks and tidewater gobies are removed from the work site. At that point, the Service-approved biologist may appoint project personnel to periodically monitor the exclusion nets for the duration of the project; however, the Service-approved biologist must be on-call for immediate assistance, if needed, until project completion.

16. Surface water pump intakes, including any used for irrigation, will be completely screened with 0.125-inch mesh to prevent entrainment of unarmored threespine sticklebacks and tidewater gobies.

17. The Air Force will ensure equipment operating within the hydrologic floodplain/riparian area is placed on protective mats to prevent contamination of the creek bed. The Air Force will require vehicles and equipment to be maintained and stored outside of the hydrologic floodplain, in the staging areas, to avoid the potential for inadvertent spills into the creek and riparian areas. All equipment will be fueled in pre-designated areas, outside of the live stream and on impervious surfaces to the maximum extent practicable, and spill containment materials will be placed around the equipment before refueling. Stationary equipment (e.g., cranes) will be outfitted with drip pans and hydrocarbon absorbent pads. If it is necessary to refuel or repair equipment within the riparian corridor, a Service-approved biologist will monitor activities. Spill containment equipment will be present at all project sites where fuels or other hazardous substances, including herbicides, are brought to the site. Qualified personnel will conduct daily inspections of the equipment and the staging and maintenance areas for leaks of hazardous substances.

18. A Service-approved biologist will be present during periodic vegetation reduction activities, which may require entry into San Antonio Creek.

19. Prior to cutting riparian vegetation, the Air Force contractor will pre-tag vegetation that is more than 2-inches so that the Air Force botanist and biologists can ensure project effects do not exceed those analyzed and authorized in this biological opinion. Plants less than 2-inches in diameter will not be cut because they do not present a risk of harm to the bridge.

20. Prior to use of mitigation access routes, a Service-approve biologist will clear the routes of any debris that could shelter California red-legged frogs.

21. No vehicle traffic will occur on a mitigation access route if surface water is present unless the route is pre-cleared by a Service-approved biologist.

22. No off-road access or herbicide application will occur in California red-legged frog habitat during periods of precipitation.

23. All herbicides used during mitigation activities will be applied in accordance with the herbicide label and Department of Defense (DoD) recommendations. All applications within or adjacent to aquatic resources will use appropriately labeled products only. All herbicides applied will be DoD-approved.

24. Chlorsulfuron and glyphosate usage in and adjacent to aquatic features will adhere to the following special precautions:
    a. Herbicides will be used with the surfactant Agri-Dex.
    b. No herbicide will be used within 15 feet of permanent aquatic habitats or ephemeral aquatic habitats when surface water or surface saturation of soils is present.
    c. No herbicide will be used in permanent or ephemeral aquatic habitats 24 hours before or after a significant precipitation event (0.1 inch or more).
    d. No herbicide will be applied directly to water.

25. Herbicide mixing will be conducted at least 250 feet from sensitive habitat.

26. All herbicide application will occur during daylight hours.

27. Spraying of herbicides will only be conducted when wind speeds do not exceed 10 miles per hour or as indicated by label instructions.

28. No overnight staging of equipment will occur at the mitigation site.

29. All trash, including food waste, will be properly disposed of offsite outside of sensitive habitat to prevent environmental degradation and avoid attracting mesocarnivores.

30. The Air Force will clean all equipment and vehicles of weed seeds prior to use in the project area to prevent the introduction of weeds. Prior to transport, any skid plates must be removed and cleaned. If equipment or vehicles move from one watershed to another

on base, the Air Force will clean wheels, undercarriages, and bumpers prior to traveling. If there is no nearby wash facility or means to collect on site and dispose of rinse water to a sewer is available, the Air Force will air blast equipment vehicles on site.

31. The Air Force will remove non-native invasive predators encountered during survey efforts (e.g., bullfrogs, crayfish, brown bullheads).

32. The Air Force will request approval of any biologist it wishes to employ as a Service-approved biologist at least 30 days prior to any such activities being conducted. In the request, the Air Force will include the name of the biologist(s), qualifications, references, for which species the biologist(s) is requesting authorization to monitor, and what monitoring activities the biologist(s) would complete.

ANALYTICAL FRAMEWORK FOR THE JEOPARDY DETERMINATION

Section 7(a)(2) of the Endangered Species Act requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of listed species. "Jeopardize the continued existence of" means "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02).

The jeopardy analysis in this biological opinion relies on four components: (1) the Status of the Species, which describes the range-wide condition of the California red-legged frog, unarmored threespine stickleback and tidewater goby, the factors responsible for that condition, and survival and recovery needs; (2) the Environmental Baseline, which analyzes the condition of the California red-legged frog, unarmored threespine stickleback and tidewater goby in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the California red-legged frog, unarmored threespine stickleback and tidewater goby; (3) the Effects of the Action, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the California red-legged frog, unarmored threespine stickleback and tidewater goby; and (4) the Cumulative Effects, which evaluates the effects of future, non-Federal activities, that are reasonably certain to occur in the action area, on the California red-legged frog, unarmored threespine stickleback and tidewater goby.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed Federal action in the context of the current status of the California red-legged frog, unarmored threespine stickleback and tidewater goby, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to reduce appreciably the likelihood of both the survival and recovery of these species in the wild by reducing the reproduction, numbers, and distribution of that species.

STATUS OF THE SPECIES

California Red-legged Frog

Legal Status

The California red-legged frog was federally listed as threatened on May 23, 1996 (61 Federal Register (FR) 25813). The Service designated revised critical habitat for the California red-legged frog on March 17, 2010 (75 FR 12816). VAFB lands were excluded from the revised designated critical habitat under section 4(b)(2) of the Act due to potential impacts on national security (75 FR 12816); thus, critical habitat will not be discussed further in this biological opinion. We issued a recovery plan for the species on May 28, 2002 (Service 2002).

Natural History

The California red-legged frog uses a variety of habitat types, including various aquatic systems, riparian, and upland habitats. They have been found at elevations ranging from sea level to approximately 5,000 feet. California red-legged frogs use the environment in a variety of ways, and in many cases they may complete their entire life cycle in a particular area without using other components (i.e., a pond is suitable for each life stage and use of upland habitat or a riparian corridor is not necessary). Populations appear to persist where a mosaic of habitat elements exists, embedded within a matrix of dispersal habitat. Adults are often associated with dense, shrubby riparian or emergent vegetation and areas with deep (greater than 1.6 feet) still or slow-moving water; the largest summer densities of California red-legged frogs are associated with deep-water pools with dense stands of overhanging willows (*Salix* spp.) and an intermixed fringe of cattails (*Typha latifolia*) (Hayes and Jennings 1988).

California red-legged frog breed in aquatic habitats; larvae, juveniles, and adult frogs have been collected from streams, creeks, ponds, marshes, deep pools and backwaters within streams and creeks, dune ponds, lagoons, and estuaries. They frequently breed in artificial impoundments such as stock ponds, given the proper management of hydro-period, pond structure, vegetative cover, and control of exotic predators. While frogs successfully breed in streams and riparian systems, high spring flows and cold temperatures in streams often make these sites risky egg and tadpole environments. An important factor influencing the suitability of aquatic breeding sites is the general lack of introduced aquatic predators. Accessibility to sheltering habitat is essential for the survival of California red-legged frogs within a watershed, and can be a factor limiting population numbers and distribution. Hayes and Tennant (1985) found juveniles to seek prey diurnally and nocturnally, whereas adults were largely nocturnal.

During periods of wet weather, starting with the first rains of fall, some individual California red-legged frogs may make long-distance overland excursions through upland habitats to reach breeding sites. In Santa Cruz County, Bulger et al. (2003) found marked California red-legged frogs moving up to 1.7 miles through upland habitats, via point-to-point, straight-line migrations without apparent regard to topography, rather than following riparian corridors. Most of these overland movements occurred at night and took up to 2 months. Similarly, in San Luis Obispo County, Rathbun and Schneider (2001) documented the movement of a male California red-legged frog between two ponds that were 1.78 miles apart in less than 32 days; however, most California red-legged frogs in the Bulger et al. (2003) study were non-migrating frogs and always remained within 426 feet of their aquatic site of residence (half of the frogs always stayed within 82 feet of water). Rathbun et al. (1993) radio-tracked three California red-legged frogs near the coast in San Luis Obispo County at various times between July and January; these frogs also stayed rather close to water and never strayed more than 85 feet into upland vegetation. Scott (2002) radio-tracked nine California red-legged frogs in East Las Virgenes Creek in Ventura County from January to June 2001, which remained relatively sedentary as well; the longest within-channel movement was 280 feet and the farthest movement away from the stream was 30 ft. On VAFB, Christopher (2018) radio-tracked 26 California red-legged frogs at four former wastewater treatment settling ponds and found that the vast majority of observations were in, or within approximately 17 feet, of water. The longest distance between water and a land observation was 141 feet, and the greatest distance undertaken by a frog between breeding ponds was 686 feet (Christopher 2018).

After breeding, California red-legged frogs often disperse from their breeding habitat to forage and seek suitable dry-season habitat. Cover within dry-season aquatic habitat could include boulders, downed trees, and logs; agricultural features such as drains, watering troughs, spring boxes, abandoned sheds, or hay-ricks, and industrial debris. California red-legged frogs use small mammal burrows and moist leaf litter (Rathbun et al. 1993; Jennings and Hayes 1994); incised stream channels with portions narrower and deeper than 18 inches may also provide habitat (61 FR 25814). This type of dispersal and habitat use, however, is not observed in all California red-legged frogs and is most likely dependent on the year-to-year variations in climate and habitat suitability and varying requisites per life stage.

Although the presence of California red-legged frogs is correlated with still water deeper than approximately 1.6 ft, riparian shrubbery, and emergent vegetation (Jennings and Hayes 1994), California red-legged frogs appear to be absent from numerous locations in the species' historical range where these elements are well represented. The cause of local extirpations does not appear to be restricted solely to loss of aquatic habitat. The most likely causes of local extirpation are thought to be changes in faunal composition of aquatic ecosystems (i.e., the introduction of non-native predators and competitors) and landscape-scale disturbances that disrupt California red-legged frog population processes, such as dispersal and colonization. The introduction of contaminants or changes in water temperature may also play a role in local extirpations. These changes may also promote the spread of predators, competitors, parasites, and diseases.

Rangewide Status

The historical range of the California red-legged frog extended coastally from southern Mendocino County and inland from the vicinity of Redding, California, southward to northwestern Baja California, Mexico (Storer 1925, Jennings and Hayes 1985; Shaffer et al.

2004). The California red-legged frog has sustained a 70 percent reduction in its geographic range because of several factors acting singly or in combination (Davidson et al. 2001). Over-harvesting, habitat loss, non-native species introduction, and urban encroachment are the primary factors that have negatively affected the California red-legged frog throughout its range (Jennings and Hayes 1985, Hayes and Jennings 1988). Habitat loss and degradation, combined with over-exploitation and introduction of exotic predators, were important factors in the decline of the California red-legged frog in the early to mid-1900s.

Continuing threats to the California red-legged frog include direct habitat loss due to stream alteration and loss of aquatic habitat, indirect effects of expanding urbanization, competition or predation from non-native species including the bullfrog, catfish (*Ictalurus* spp.), bass (*Micropterus* spp.), mosquito fish (*Gambusia affinis*), red swamp crayfish (*Procambarus clarkii*), and signal crayfish (*Pacifastacus leniusculus*). Chytrid fungus (*Batrachochytrium dendrobatidis*) is a waterborne fungus that can decimate amphibian populations, and is considered a threat to California red-legged frog populations.

A 5-year review of the status of the California red-legged frog was initiated in May 2011, but has not yet been completed.

<u>Recovery</u>

The final recovery plan for the California red-legged frog (Service 2002) states that the goal of recovery efforts is to reduce threats and improve the population status of the California red-legged frog sufficiently to warrant delisting. The recovery plan describes a strategy for delisting, which includes: (1) protecting known populations and reestablishing historical populations; (2) protecting suitable habitat, corridors, and core areas; (3) developing and implementing management plans for preserved habitat, occupied watersheds, and core areas; (4) developing land use guidelines; (5) gathering biological and ecological data necessary for conservation of the species; (6) monitoring existing populations and conducting surveys for new populations; and (7) establishing an outreach program. The California red-legged frog would be considered for delisting when:

1. Suitable habitats within all core areas are protected and/or managed for California red-legged frogs in perpetuity, and the ecological integrity of these areas is not threatened by adverse anthropogenic habitat modification (including indirect effects of upstream/downstream land uses).

2. Existing populations throughout the range are stable (i.e., reproductive rates allow for long-term viability without human intervention). Population status will be documented through establishment and implementation of a scientifically acceptable population monitoring program for at least a 15-year period, which is approximately 4 to 5 generations of the California red-legged frog. This 15-year period should coincide with an average precipitation cycle.

3. Populations are geographically distributed in a manner that allows for the continued existence of viable metapopulations despite fluctuations in the status of individual populations (i.e., when populations are stable or increasing at each core area).

4. The species is successfully reestablished in portions of its historical range such that at least one reestablished population is stable/increasing at each core area where California red-legged frog are currently absent.

5. The amount of additional habitat needed for population connectivity, recolonization, and dispersal has been determined, protected, and managed for California red-legged frogs.

The recovery plan identifies eight recovery units based on the assumption that various regional areas of the species' range are essential to its survival and recovery. The recovery status of the California red-legged frog is considered within the smaller scale of recovery units as opposed to the overall range. These recovery units correspond to major watershed boundaries as defined by U.S. Geological Survey (USGS) hydrologic units and the limits of the range of the California red-legged frog. The goal of the 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 California 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 support long-term viability within existing populations. This management strategy allows 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 the California red-legged frog.

Unarmored Threespine Stickleback

Legal Status

The Service listed the unarmored threespine stickleback as endangered on October 13, 1970 (35 FR 16047). The Service proposed critical habitat for the unarmored threespine stickleback on November 17, 1980 (45 FR 76012), in two reaches of the Santa Clara River, and single reaches of both San Francisquito Creek and San Antonio Creek. In 2002, the Service determined that critical habitat should not be designated, primarily due to the large number of outstanding non-discretionary critical habitat designations at that time (67 FR 58580). The unarmored threespine stickleback is also a fully protected species under California law (see California Fish and Game Code, Section 5515 (b)(9)). The Service first issued a recovery plan for the unarmored threespine stickleback in 1977, which was revised in December 1985 (Service 1985). We completed a 5-year review for the subspecies in May 2009 (Service 2009).

Natural History

The unarmored threespine stickleback is a small (up to 2.36 inches), scaleless, freshwater fish inhabiting slow moving reaches or quiet water microhabitats of streams and rivers. Favorable habitats for the unarmored threespine stickleback are usually shaded by dense and abundant vegetation. In more open reaches, algal mats or barriers may provide refuge for the subspecies. Unarmored threespine sticklebacks feed primarily on benthic insects, small crustaceans, and snails, and to a lesser degree, on flat worms, nematodes, and terrestrial insects. They reproduce throughout the year, but breeding activity is reduced from October to January. Reproduction occurs in areas with adequate aquatic vegetation and gentle flow of water where males establish and vigorously defend territories. The male builds a nest of fine plant debris and algal strands and courts all females that enter his territory; a single nest may contain the eggs of several females. Following spawning, the male defends the nest and eventually the newly hatched fry. The smallest specimens of unarmored threespine sticklebacks captured outside of a nest are approximately 0.40 inch standard length. Unarmored threespine stickleback populations tend to decline due to natural mortality and low recruitment during the winter, and most individuals live for only 1 year, rarely surviving to 2 or 3 years (Moyle 2002, Swift 1999).

Rangewide Status

Unarmored threespine sticklebacks were historically distributed throughout southern California, including low-gradient portions of the Los Angeles, San Gabriel, and Santa Ana Rivers, and from a few localities in Santa Barbara County. At the time of listing in 1970, however, they were only known to occur in the upper reaches of the Santa Clara River, including Soledad Canyon (Baskin 1974). Current extant populations are restricted to the upper Santa Clara River and its tributaries in Los Angeles and Ventura Counties, San Antonio Creek on VAFB in Santa Barbara County, Shay Creek (tributary to Baldwin Lake) in San Bernardino County, and San Felipe Creek in San Diego County. The San Felipe Creek population is the result of transplantations in the 1970s and 1980s. Additional transplants in various locations in southern California were attempted, but all failed, including a transplanted population in the Mohave River that introgressed with partially-armored threespine stickleback (Swift et al. 1993). In the Santa Maria River drainage in Santa Barbara County, populations previously regarded as the unarmored threespine stickleback were replaced by the partially armored threespine stickleback and by intermediate types through competition, introgressive hybridization or both, following the introduction of trout for a recreational fishery that introduced partially-armored stickleback to the watershed (Moyle 2002).

As summarized in the 2009 5-year review for the subspecies, genetic studies indicate that the Santa Clara River fish are genetically distinct from the San Antonio Creek fish (which are more closely related to the coastal partially armored stickleback (*Gasterosteus aculeatus microcephalus*), and from the San Bernardino fish (which are genetically unique and may warrant taxonomic revision) (Service 2009). Within the Santa Clara River, there are different genetic strains of unarmored threespine sticklebacks. The unarmored threespine sticklebacks in Soledad Canyon are distinct from the unarmored threespine sticklebacks in Bouquet Canyon, San Francisquito Canyon, and the Valencia-Newhall Ranch area. All unarmored threespine sticklebacks are also distinct from the partially armored stickleback in the lower Santa Clara River in Ventura County below the dry Piru gap (Richmond et al. 2014). The unarmored threespine sticklebacks in Bouquet Canyon have become hybridized with partially armored sticklebacks from the lower Santa Clara River below the Piru Gap. In 2014, the Valencia-Newhall area fish were translocated into San Francisquito Canyon due to drying up of habitat as a result of the drought. The former San Francisquito Canyon population had become extirpated as a result of the Copper Fire in 2002, and subsequent high flows in 2005. In 2017, unarmored threespine sticklebacks from Soledad Canyon were translocated to Fish Canyon Creek in the Angeles National Forest due to the 2016 Sand Fire and the subsequent rain event. Thus, there are currently two unique genetic strains of pure unarmored threespine sticklebacks in the Santa Clara River Watershed remaining, fish in Soledad Canyon/Fish Canyon Creek and fish in San Francisquito Canyon/Valencia-Newhall.

At the time of listing, there was no abundance data for the unarmored threespine stickleback. Even now, no range-wide, long-term monitoring program is currently being conducted for the subspecies, and data on population dynamics are limited. Despite the availability of survey methods that can estimate constant variability in local abundance (i.e., annual and seasonal changes in distribution and abundance hamper efforts to estimate population size for this short-lived species), estimates of population size are generally lacking due to minimal survey efforts. Unarmored threespine stickleback populations also vary with between-year changes in environmental conditions, such as drought. While unarmored threespine sticklebacks may be seasonally abundant in most years, the subspecies' restricted distribution renders it vulnerable to catastrophic extirpation.

The unarmored threespine stickleback faces a series of threats that include channelization and other habitat modifications associated with urbanization, agricultural practices, and recreation; agricultural, industrial, and municipal water pollution; stream flow alterations caused by water diversion and ground water pumping; the introduction of competing and predatory species; and hybridization with partially armored threespine stickleback.

Channelization and other habitat modifications result in the destruction and degradation of unarmored threespine stickleback habitat. Rivers and streams that once supported unarmored threespine sticklebacks have been either severely altered or reduced for the most part to concrete-lined drains. Stream channelization can diminish the side channels and backwater pool habitat used by unarmored threespine stickleback, and by scouring of stream channels which may eliminate or reduce the substrate needed for nests (Baskin 1974). The population of unarmored threespine sticklebacks in Bouquet Canyon (part of the Santa Clara River drainage) currently faces the threat of channelization. Irrigation of farm crops currently causes discharges of silt in the Santa Clara River and San Antonio Creek drainages, resulting in the destruction of unarmored threespine stickleback habitat by covering the substrate of pools and backwater channels with fine sediment or completely filling them in. Unmanaged off-road vehicle (ORV) use can also increase siltation in pools as well as damage riparian vegetation, compact soils, disturb the water in stream channels, and even crush unarmored threespine stickleback. In recent times this activity has grown and pressure to find new locations to drive these ORVs has increased. ORV activities continue to be a threat to the unarmored threespine stickleback in Soledad Canyon (part of the Santa Clara River drainage) and the Santa Clara River despite efforts by law enforcement to stop trespassing into the Santa Clara River. In Soledad Canyon, ORV use occurs on private property within the creek bed. Habitat degradation can also occur when people or livestock trample stream banks and sand or gravel bars, increasing sedimentation and damaging emergent vegetation that provide food and shelter for unarmored threespine stickleback.

Water quality conditions in the Santa Clara River drainage, San Antonio Creek, and Shay Creek are all compromised by urbanization and agricultural activities. Nonpoint-source pollution includes storm water run-off through human-made drainage systems that convey large amounts of organic matter, pesticides, fertilizers, heavy metals, oil and grease and other hydrocarbons, and other debris into streams. Agricultural sources of pollution include runoff from fields where fertilizers have been used on crops, and runoff from areas containing large concentrations of livestock and their waste. In addition, discharge of chlorine or other chemicals into creeks from the drainage of treated recreational water bodies (as required by the Los Angeles County Health Department) is a potential concern.

Habitat for the unarmored threespine stickleback exists in San Francisquito Creek at its confluence with Drinkwater Canyon in the Angeles National Forest, which is maintained by water releases from a reservoir in Drinkwater Canyon. The Los Angeles Department of Water and Power releases 1 cubic foot per second of water throughout the year to satisfy the rights of private property owners downstream of the reservoir; however, the flow is temporarily terminated when the pipes are cleaned. Without careful management and timing of discharges, any remaining unarmored threespine stickleback in upper San Francisquito Canyon could be lost.

Pumping of groundwater, especially during dry years, is also a severe threat to unarmored threespine stickleback. Such problems exist in the upper San Antonio drainage, the Santa Clara River drainage (including Soledad Canyon and Bouquet Canyon), and Shay Creek because of domestic and agricultural use.

Introduced aquatic vertebrates and invertebrates are predators on one or more of the life stages of unarmored threespine stickleback. These include African clawed frogs (*Xenopus laevis*), bullfrogs, red swamp crayfish, signal crayfish, and various species of fishes, especially bass, catfish, mosquito fish, and sunfish (*Lepomis* spp.). The only location currently occupied by unarmored threespine sticklebacks that is not compromised by non-native predators or competitors is Shay Creek. We are not currently aware of any attempts to manage vertebrate or invertebrate populations of non-native species within locations occupied by the unarmored threespine stickleback. In addition, certain non-native species may serve as vectors for the Ich parasite (*Ichthyopthirius multifilis*) that could infect populations of unarmored threespine stickleback. Populations of unarmored threespine stickleback in the Angeles National Forest were severely affected by the introduction of Ich in 1995 (U.S. Forest Service 2000). Introduced goldfish (*Carasius auratus*) were suspected to be the source of the Ich infestation. In addition, the Santa Clara River drainage, including Soledad Canyon, Bouquet Canyon Creek, and San Francisquito Creek, and portions of the San Antonio Creek drainage are impacted by non-native *Arundo donax* (giant reed). Coffman (2007) notes that *Arundo donax* threatens river ecosystems by affecting natural river processes such as lowering groundwater tables, decreasing surface water levels in streams, increasing the potential for wildfires, and the loss of animal and plant diversity.

The 2009 5-year review for the unarmored threespine stickleback states that the subspecies continues to be threatened by: agricultural, industrial, and municipal water pollution; channelization and other habitat modifications associated with urbanization; stream flow alterations caused by water diversion; groundwater pumping; introduction of competing and predatory species; hybridization with partially armored threespine stickleback; drought; and stochastic extinction. Although some efforts have been and are being made to acquire habitat for the species, little has been done so far, and none of the recovery criteria in the recovery plan for the unarmored threespine stickleback (Service 1985) have been fully met. Based on these ongoing threats and the small number and isolation of existing populations, the 5-year review concludes that the unarmored threespine stickleback continues to be threatened with extinction throughout all or a significant portion of its range.

<u>Recovery</u>

The revised recovery plan for the unarmored threespine stickleback designated three areas as very important for the survival and recovery of the subspecies: (1) two disjunct reaches of the Santa Clara River in Los Angeles County; (2) a short reach of San Francisquito Canyon; and (3) the lowermost 8.4 miles in San Antonio Creek in Santa Barbara County (Service 1985).

The recovery plan states that the subspecies could be considered recovered when: (1) habitat conditions for each of the known remnant populations have been stabilized at or near historical carrying capacities; (2) the other known threats have been addressed in a manner that assures the continued existence of these populations; and (3) at least five self-sustaining populations have been maintained within the historical range of unarmored threespine stickleback for a period of 5 consecutive years without significant threats to their continued existence.

The recovery plan also states that to reach the point of recovery, the known extant populations must be preserved and protected, additional populations will need to be successfully reintroduced into historical habitats, the spread of exotic organisms will need to be controlled, and degraded habitats will need to be restored and maintained. To do this, adequate instream flows must be maintained in all essential habitats, land uses must be regulated to maintain good water quality, the introduction of additional exotic organisms must be prevented, the spread of established populations of exotic organisms controlled, suitable reintroduction sites within the historical range must be found, and habitat conditions must be monitored to ensure that satisfactory conditions for unarmored threespine stickleback are being maintained.

The recovery strategy for the unarmored threespine stickleback, as defined in the recovery plan, includes the following actions: (1) close regulation of removal (take) of the species; (2) monitoring and appropriate management of habitat conditions; (3) implementation of contingency plans to protect the species from natural or man-made disasters; and (4) establishment of additional populations in suitable reintroduction sites as needed.

Tidewater Goby

Legal Status

The Service listed the tidewater goby as endangered on March 7, 1994 (59 FR 5494). The Service published a proposed rule to downlist the tidewater goby on March 13, 2014 (79 FR 14339). The proposed downlisting has not been finalized and the species remains listed as endangered. Critical habitat for the tidewater goby was first designated on November 20, 2000 (65 FR 69693), and later revised in 2008 (73 FR 5920) and 2013 (78 FR 8746). VAFB lands were exempted from designated critical habitat under section 4(a)(3)(B)(i) of the Act for having an approved Integrated Natural Resources Management Plan (INRMP) that was found to provide a conservation benefit to the species. Thus, critical habitat will not be discussed further in this biological opinion. We completed a recovery plan for the tidewater goby on December 12, 2005 (Service 2005) and a 5-year review for the species in September 2007 (Service 2007).

Natural History

The tidewater goby is endemic to California and is one of the only species of fish to live exclusively in brackish water coastal lagoons, estuaries, and marshes in California (Swift et al. 1989, Moyle 2002). Tidewater goby habitat is characterized by fairly still, but not stagnant, brackish water. They can withstand a wide range of habitat conditions and have been documented in waters with salinity levels that range from 0 to 42 parts per thousand (ppt), though they usually are found in less saline water (Swift et al. 1989), temperatures ranging from 9 to 25 degrees Celsius (48 to 77 degrees Fahrenheit) (Swenson 1995) and are typically found in water less than 1 meter deep, though they can inhabit deeper habitat (Swenson 1995). They are generally found over substrate that has a high percentage of sand and gravel (Worcester 1992) and are often clumped in areas that have sparse to medium dense cover by aquatic plants or algae (Worcester 1992). Tidewater gobies often migrate upstream and are commonly found up to 1 kilometer (0.6 mile) up from a lagoon or estuary (Service 2005), and have been recorded as far as 5 to 8 kilometers (3 to 5 miles) upstream of tidal areas (Irwin and Soltz 1985).

Tidewater gobies feed on small invertebrates, including amphipods, ostracods, snails, mysids, and aquatic insect larvae, particularly chironomid larvae (Swift et al. 1989). Predators of tidewater gobies include staghorn sculpin (*Leptocottus armatus*), prickly sculpin (*Cottus asper*), starry flounder (*Platichthys stellatus*), and largemouth bass (*Micropterus salmoides*); native birds and other predatory fish likely also prey on gobies (Swift et al. 1997, Swift et al. 1989).

The tidewater goby is primarily an annual species (Swift et al. 1989), although there is some variation in life history and some individuals have lived up to 3 years in captivity (Swenson 1999). If reproductive output during a single season fails, few (if any) tidewater gobies survive into the next year. Reproduction typically peaks from late April or May to July and can continue into November or December depending on the seasonal temperature and amount of rainfall (Swift et al. 1989, Worcester 1992, Goldberg 1977). Males begin the breeding ritual by digging burrows (3 to 4 inches deep) in clean, coarse sand of open areas. Unlike most other fish, females court the males (Swift et al. 1989). Once chosen by a male, females will then deposit eggs into the burrows, averaging 400 eggs per spawning effort (Swift et al. 1989, Swenson 1995). Males remain in the burrows to guard the eggs and frequently forego feeding (Moyle 2002).

Within 9 to 11 days after eggs are laid, larvae emerge and are approximately 4 to 6 mm in standard length (0.16 to 0.24 inch) (Swift et al. 1989, Service 2005). Larval traits (larval duration, size at settlement, and growth rate) are correlated with water temperature, which varies considerably in the seasonally closed estuaries that tidewater gobies inhabit (Spies and Steele 2016). Larval tidewater gobies are pelagic for an average of 21-27 days and settle once they grow to approximately 12 to 13 mm in standard length (Spies et al. 2014). When they reach this life stage, they become substrate-oriented, spending the majority of time on the bottom rather than in the water column. Both males and females can breed more than once in a season, with a lifetime reproductive potential of 3 to 12 spawning events (Swenson 1999). Vegetation is critical for over-wintering tidewater gobies because it provides refuge from high water flows and tidewater goby densities are greatest among emergent and submerged vegetation (Moyle 2002).

Because of their typically annual life history and seasonally changing environment, population sizes of tidewater gobies vary greatly spatially and seasonally, with recorded numbers ranging from 0 to 198 individuals per square meter (Swenson 1995). After the spring spawning season, there is typically an annual die-off of adults (Swift et al. 1989, Swenson 1995).

Rangewide Status

Historically, the tidewater goby occurred in at least 150 California coastal lagoons and estuaries, from Tillas Slough near the Oregon/California border south to Agua Hedionda Lagoon in northern San Diego County (Swift et al. 1989, page 13). The southern extent of its distribution has been reduced by approximately 8 miles (cite). The species is currently known to occur in about 103 localities, although the number of sites fluctuates with climatic conditions. Some locations presumed to be occupied have not been surveyed in over 10 years. Currently, the most stable populations are in lagoons and estuaries of intermediate size (5 to 124 acres) that are relatively unaffected by human activities (Service 2005).

Local populations of tidewater gobies are best characterized as metapopulations (Lafferty et al. 1999a), or "a network of semi-isolated populations with some level of regular or intermittent migration and gene flow among them, in which individual populations may go extinct but can then be recolonized from other populations" (Groom et al. 2006). Therefore, the stability of a metapopulation depends on the connectivity of subpopulations.

Tidewater gobies enter the marine environment when sandbars are breached during storm events and appear to be able to disperse at least 9 kilometers (5.6 miles) (Lafferty et al. 1999b). The species' tolerance of high salinities for short periods of time enables it to withstand marine environment conditions where salinities are approximately 35 ppt, thereby allowing the species to re-establish or colonize lagoons and estuaries following flood events (Swift et al. 1997). Genetic studies indicate that the tidewater goby population is highly geographically structured, indicating that there is low geneflow (Dawson et al. 2001, Dawson et al. 2002) and thus natural recolonization events are likely rare. It is estimated that the southernmost population of tidewater goby has been separated from other lineages for 2 to 4 million years, and it has been recognized as a distinct species (*Eucyclogobius kristinae*, the southern tidewater goby) (Swift et al. 2016), but as of now the tidewater goby remains listed under the Endangered Species Act as one entity.

Native predators are not known to be important regulators of tidewater goby population size in the lagoons of southern California. Rather, population declines are attributed to environmental conditions. The decline of the tidewater goby is attributed primarily to habitat loss or degradation resulting from urban, agricultural, and industrial development in and around coastal wetlands, lagoons, and estuaries (Irwin and Soltz 1985). Some extirpations appear to be related to pollution, upstream water diversions, and the introduction of non-native predatory fish species, most notably centrarchid sunfish and bass (Swift et al. 1989). These threats continue to affect some of the remaining populations of tidewater gobies. Climate change and the attendant sea level rise may further reduce suitable habitat for the tidewater goby as lagoons and estuaries are inundated with saltwater (Cayan et al. 2006) and severe storms interacting with increased sea levels may breach lagoons more frequently.

In 2014, the Service issued a 12-month finding proposing to reclassify the tidewater goby as threatened under the Act. During the public comment period, we received substantive comments regarding the proposed change in the species' status and new scientific information has been published regarding the species. The tidewater goby remains listed as endangered and its population is currently stable, but still faces ongoing and likely increasing threats of urbanization, artificial breeching, and introduced predators.

<u>Recovery</u>

The goal of the tidewater goby recovery plan (Service 2005) is to conserve and recover the tidewater goby throughout its range by managing threats and maintaining viable metapopulations within each recovery unit while retaining morphological and genetic adaptations to regional and local environmental conditions. The decline of the tidewater goby is attributed primarily to habitat loss or degradation resulting from urban, agricultural, and industrial development in and around coastal wetlands. The recovery plan identifies six recovery units based on morphological differences (Ahnelt et. al. 2004) that are supported by genetic work done by Dawson et al. (2001) – North Coast Unit, Greater Bay Unit, Central Coast Unit, Conception Unit, Los Angeles/Ventura Unit, and South Coast Unit – and 26 recovery sub-units.

The recovery plan specifies that the tidewater goby may be considered for downlisting when:

1. Specific threats to each metapopulation (e.g., coastal development, upstream diversion, channelization of rivers and streams, etc.) have been addressed through the development and implementation of individual management plans that cumulatively cover the full range of the species; and

2. A metapopulation viability analysis based on scientifically-credible monitoring over a 10-year period indicates that each recovery unit is viable. The target for downlisting is for individual sub-units within each recovery unit to have a 75 percent or better chance of persistence for a minimum of 100 years.

The tidewater goby may be considered for delisting when the downlisting criteria have been met and a metapopulation viability analysis projects that all recovery units are viable and have a 95 percent probability of persistence for 100 years.

ENVIRONMENTAL BASELINE

Action Area

The implementing regulations for section 7(a)(2) of the Act define the "action area" as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 Code of Federal Regulations 402.02). The action area for this biological opinion includes both staging areas, the stretch of San Antonio Creek and upland areas within the main construction area, 50 feet of San Antonio Creek upstream from the main construction area (location of fish exclusion netting), 400 feet of San Antonio Creek downstream from the main construction area (limit of potential effects from sedimentation and increased turbidity anticipated by the Air Force), the mitigation area, and the access routes to the mitigation site (Figures 1 and 2). In total, the proposed action would affect approximately 2.34 acres with periodic maintenance affecting some or all of the same areas (Table 1). Ground-disturbing activities would occur in the staging areas, main construction area, and mitigation (planting) area only.

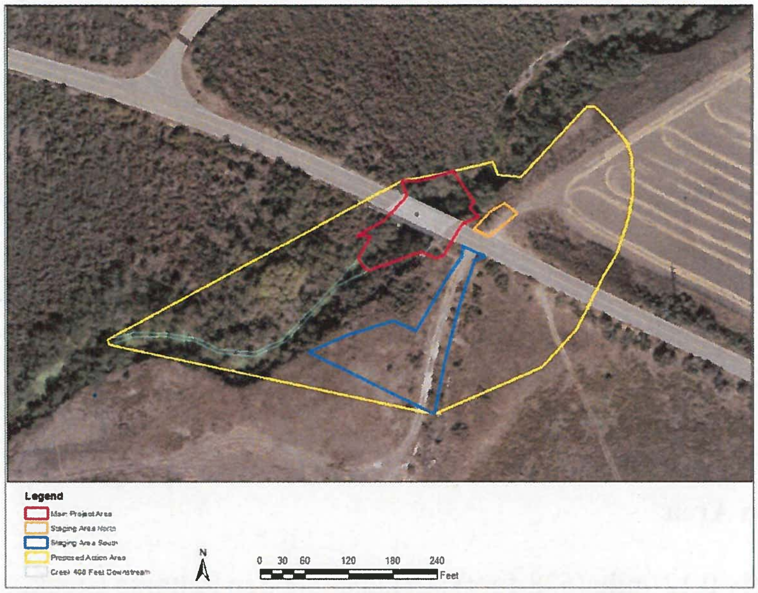

Figure 1. Location of project components within action area (Source: Lum, pers. comm 2018c).

Figure 2. Location of mitigation area and proposed access routes (Source: Mitigation and Monitoring Plan for the San Antonio Road West Bridge Maintenance at Vandenberg Air Force Base, CA; ManTech 2018).

Table 1 – Proposed action area acreage

Proposed Action Areas	Acres	Square Feet
Main construction area (gabions, vegetation, and a portion of San Antonio Creek)	0.27	11,780
Staging area – north	0.03	1,178
Staging area – south	0.38	16,678
Upstream creek (50 linear ft)	0.01	305
Downstream creek (400 linear ft)	0.06	2,442
Mitigation area	0.50	21,780
Mitigation access	1.09	47,520
Total action area	**2.34**	**101,683**

Habitat Characteristics of the Action Area

The action area covers an approximately 0.12-mile (628-foot) stretch along San Antonio Creek, approximately 9.9 km (6.2 mi) from the ocean, and includes a portion of the creek (classified as a permanent waterbody) and a drainage (classified as dry; only flows during storms). Within this area, the San Antonio Creek hydrologic floodplain is narrow, extending approximately 40 feet wide to the tops of its steep banks (Figure 3). The San Antonio Creek is located between 110 to 114 feet above sea level (ASL), with the top of bank located at 128 to 130 feet ASL; a 16 to 18-foot differential. The portion of San Antonio Creek under the bridge is typically shallow and flows east to west under the bridge. During a 2016 habitat assessment, the creek channel in this vicinity was predominantly composed of pools and impounded waters with limited flow resulting from beaver dams which have persisted over multiple years due to a lack of scouring winter flows (ManTech 2016). Storm drains and culverts do not exist within the action area.

Habitat within the action area consists of central coast arroyo willow riparian forest and scrub, central coastal scrub, non-native grasses and forbs, and agriculture (Figure 3). A 2016 habitat assessment of the project area found that riparian vegetation is limited to the San Antonio Creek channel bottom and does not occur on the upper terrace (ManTech 2016). Where rip-rap was previously installed along banks or where the channel is bound by sheer slopes, banks are largely unvegetated; in cases where a lower terrace with soft sediments is present, bank vegetation is dense. Instream vegetation cover is impacted by the degree of canopy shading, water depth, amount of flow, and degree of beaver activity. ManTech (2016) found that areas with significant canopy cover were largely unvegetated due to restricted light. Emergent vegetation was limited to a narrow band along the banks, and areas within beaver dam pools were largely free of emergent vegetation due to depth. Lack of flow within beaver impoundments led to near 100 percent cover of duckweed (*Lemna* sp.) and/or mosquito fern (*Azolla* sp.) on the water surface; where flow occurred despite the dams, duckweed and mosquito fern cover was lower, but subsurface cover of filamentous green algae was very high. The incidence of instream refugia, much of which consisted of dense accumulations of small woody debris, was high within both the hydrated channel and the channel at bank full within the project area (ManTech 2016).

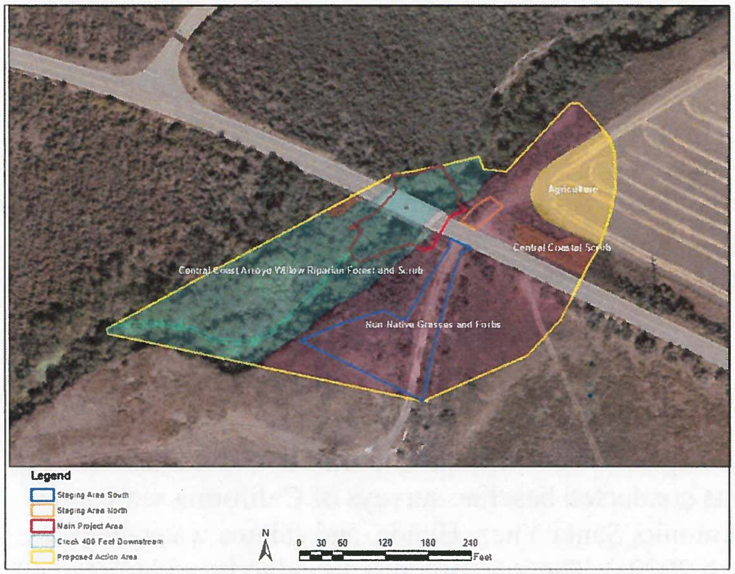

Figure 3. Vegetation types within the proposed action area (Source: Lum, pers. comm 2018c).

Status of the Species in the Action Area

California Red-legged Frog

VAFB is located in the relative middle of the current range of the California red-legged frog. California red-legged frogs occur in nearly all permanent streams and ponds on the base, including in Shuman Creek, San Antonio Creek, San Antonio Lagoon, Santa Ynez River, Bear Creek, and Honda Creek (Christopher 1996, Service 2002). San Antonio Creek, its lagoon, and nearby habitat (including dune swales) may be the most important habitat on VAFB (Christopher 1996, Service 2002). Surveys during multiple years have detected California red-legged frogs in San Antonio Creek upstream, downstream, and within the project area. Monitoring in San Antonio Creek upstream of the proposed action area was conducted in 2008-2013 related to the San Antonio Creek Bank Stabilization project. A total of 191 California red-legged frogs were observed during the 2008-2009 surveys, 603 frogs were observed during the 2011-2012 surveys, and 1,681 frogs were observed during the 2012-2013 surveys (ManTech 2013). Although more California red-legged frogs were observed during 2011-2012 and 2012-2013, these frogs were found disproportionately in stretches not directly affected by project activities (ManTech 2013). In 2014, ManTech conducted surveys in multiple VAFB wetlands and watersheds, including San Antonio Creek upstream and downstream of the proposed action area and in San Antonio Creek Terrace Pond, to assess California red-legged frog numbers. Surveys of San Antonio Creek were conducted in July and August 2014 and found a total of 112 California red-legged frogs in an area upstream of the action area, 48 in an area downstream of the action area, and 209 in San Antonio Creek Terrace Pond (ManTech 2015). Population surveys were conducted within and adjacent to the proposed project area during February, May, August and October 2016 and found a total of 73 California red-legged frogs, with a maximum of 23 frogs observed during the May survey (ManTech 2016). In addition, 14 tadpoles were captured during a July 2016 sampling for larval California red-legged frogs (ManTech 2016). The greater water depth and lack of flow created by beaver impoundments in this area appeared to be highly favorable for California red-legged frog breeding success (ManTech 2016).

Based on these and other survey results, we assume that VAFB supports a substantial population of California red-legged frogs, although there is not enough existing data to accurately estimate the California red-legged frog population on base. As survey data show, the number of California red-legged frogs at a site or series of sites can vary widely from year to year. When conditions are favorable, California red-legged frogs may experience extremely high rates of reproduction and produce large numbers of dispersing young, which may result in an associated increase in number of occupied sites. Conversely, frogs may temporarily disappear from a normally occupied area (Service 2002).

VAFB is known to contain California red-legged frogs infected with the chytrid fungus. During the spring and summer of 2008, biologists conducted baseline surveys of California red-legged frogs and bullfrogs from Shuman, San Antonio, Santa Ynez, Honda, and Jalama watersheds, as well as select isolated wetlands (ManTech 2009a). The infection was found to be widespread on base, being present at all but one site that was sampled. Forty-one percent of all California red-legged frogs (n=100) tested positive for chytrid fungus; however, chytrid fungus did not have a negative effect on post-metamorphic frogs. Frogs with higher infection loads did not show clinical signs of chytrid infection, nor were infected frogs thinner than non-infected frogs. Basewide surveys repeated in 2013 and 2014 found California red-legged frog population persistence and statistically similar densities, suggested that VAFB populations can remain relatively stable, if not increasing densities in spite of chytrid fungus infection (ManTech 2014). Additional surveys were conducted within the project area during 2016, and 80 percent of the California red-legged frogs sampled tested positive for chytrid fungus (ManTech 2016). This was higher than incidence levels previously observed in upstream portions of San Antonio Creek.

Non-native mosquito fish and red swamp crayfish were also detected in high numbers during 2016 surveys within and adjacent to the project area, and the density of red swamp crayfish within this area of San Antonio Creek had increased dramatically compared with previous observations (ManTech 2016). The lack of flow has made environmental conditions much more favorable for crayfish. They are potential direct predators on tadpoles and fish, but are known to prefer slower moving prey such as aquatic insect larvae and snails (Klose and Cooper 2012). Crayfish are also facultative omnivores and may feed primarily on vegetative material in the absence of suitable prey; as such they potentially compete with both amphibian larvae for food resources (Gherardi and Acquistapace 2007). When crayfish do engage in direct predation on tadpoles, this frequently results in tail damage rather than death (Nunes et al. 2010). No notable tail damage was observed in California red-legged frogs or Baja California treefrog (*Pseudacris hypochondriaca*) tadpoles captured during aquatic surveys in 2016, suggesting that although crayfish densities are high they may not be preying on tadpoles (ManTech 2016).

Recovery

The action area lies within Core Area 24 (Santa Maria-Santa Ynez River) of Recovery Unit 5 (Central Coast) for the California red-legged frog (Service 2002). The recovery unit was described in the recovery plan as having a "high recovery status," meaning the unit supports many populations of the species, has many areas of high habitat quality, and threat levels that ranged from low to high. The stated conservation needs for this Core Area are to protect existing populations, reduce contamination of habitat, control non-native predators, implement management guidelines for recreation, cease stocking dune ponds with non-native warm water fish, manage flows to decrease impacts of water diversions, implement guidelines for channel maintenance activities, and to preserve buffers from agriculture.

Some protections are afforded to the California red-legged frog on VAFB due to implementation of the Air Force's INRMP. So far, the Air Force has implemented several actions that provide a positive conservation benefit: (1) public outreach and education; (2) working with researchers from the University of California, Santa Barbara, USGS, and the Department of the Navy, including chytridiomycosis studies; (3) surveys for new populations; (4) monitoring of known populations; and other actions. These efforts are consistent with the goals from the recovery plan of protecting known populations; protecting suitable habitat, corridors, and core areas; developing land use guidelines; gathering biological and ecological data necessary for conservation of the species; and monitoring existing populations and conducting surveys for new populations. In addition, since 2009, the Air Force has released many California red-legged frogs into the proposed action area in support of separate projects such as the Installation Restoration Program Site 13-C ABRES Complex Artificial Basins.

<u>Unarmored Threespine Stickleback</u>

On VAFB, unarmored threespine sticklebacks exist in lower San Antonio Creek (downstream of Barka Slough) and are found mostly in the creek channel rather than the lagoon (ManTech 2009c, Swift 1999). The unarmored threespine stickleback was experimentally introduced into Cañada Honda Creek on VAFB in 1984. However, no individuals have been documented in the Cañada Honda Creek for at least 15 years, thus the translocation effort is now considered to have been unsuccessful.

Suitable habitat for unarmored threespine sticklebacks in San Antonio Creek consists of shallow areas of moderate current with copious quantities of aquatic vegetation (Irwin and Soltz 1982, Service 1985). Various portions of the creek have been surveyed at different times over the last several decades. Irwin and Soltz (1982) found the unarmored threespine stickleback throughout most of San Antonio Creek downstream of Barka Slough. However, major floods completely scoured the stream channel of San Antonio Creek in the spring of 1983 causing stickleback numbers to decline to low levels. In the spring of 1999, Swift conducted surveys within approximately 8 km (4.97 mi) of lower San Antonio Creek, from the lagoon upstream to approximately 1.5 km (0.9 mi) past the Lompoc-Casmalia Road crossing, as part of pre-project assessment related to bridge construction at the El Rancho Road creek crossing. Swift (1999) found that unarmored threespine stickleback was most abundant in low gradient, cool water that almost completely lacked aquatic predators, and was most concentrated approximately 2 km (1.24 mi) both upstream and downstream of the El Rancho Road bridge. The unarmored threespine stickleback was by far the most common fish observed in the creek above the lagoon during these surveys, comprising more than 99 percent of the fishes taken (Swift 1999). Based on the number of captured sticklebacks (3,454) and calculated densities, Swift (1999) estimated that 47,682 stickleback inhabited the lower ~8 km of San Antonio Creek above the lagoon. Presence absence surveys conducted in San Antonio Creek from the U.S. Highway 1 bridge upstream to the VAFB boundary during 2004 did not find any unarmored threespine sticklebacks.

In 2008, as part of San Antonio Creek Bank Stabilization project monitoring, ManTech biologists repeated and expanded upon surveys conducted by Swift in 1999, surveying the original 7 sites plus an additional 7 sites located between Lompoc-Casmalia Road and U.S. Highway 1. During the 2008 surveys, a total of 18,653 unarmored threespine sticklebacks were captured, including 2,047 sticklebacks captured within a 100-meter segment of the proposed action area at the San Antonio Bridge (ManTech 2009c). Within the proposed action area, 82 arroyo chub, 5 prickly sculpin, and approximately 50 brown bullhead (whose stomach contents included 2 sticklebacks) were also captured. Results from the 2008 surveys indicated that unarmored threespine sticklebacks were primarily confined to the stretch of San Antonio Creek from its mouth upstream to just south of Lee Road (ManTech 2009c). Very small to no populations of unarmored threespine sticklebacks were found upstream of the Lee Road bridge, where sites were dominated by arroyo chub (ManTech 2009c). The five most-upstream sites, which are upstream from the proposed action area, were resurveyed in 2009 and 2012. Within these five sites, 1,729 unarmored threespine sticklebacks were captured in 2012, compared to 5,290 in 2009 and 2,460 in 2008 (ManTech 2013). The large decrease in numbers from 2009 to 2012 was entirely within 1 site; however, unarmored threespine sticklebacks increased substantially at another site and were also found at 3 sites where they had not been found previously.

Based on these results, the unarmored threespine stickleback population on San Antonio Creek appears highly dynamic in distribution and abundance, possibly responding to varying environmental conditions such as flow rates, scour events, depth profiles, or vegetative cover (ManTech 2013). Unfortunately, available environmental and survey data are insufficient for a robust analysis, nor are existing data sufficient to estimate population size. However, ManTech's data indicates that changes in aquatic vegetative cover and average/maximum depths were not significantly correlated with changes in unarmored threespine stickleback densities (ManTech 2013).

Unarmored threespine sticklebacks were also incidentally captured during the California red-legged frog surveys conducted within and adjacent to the proposed project area in 2016. A total of 43 unarmored threespine sticklebacks were captured at four sampling locations, with an observed density of 0.24 fish per square meter, compared to a density of 5.69 fish per square meter observed within the proposed project area in 2008 (ManTech 2016). ManTech (2016) reported that the decline in unarmored threespine stickleback densities and the presence of high numbers of mosquito fish support a change in flow regime as lower dissolved oxygen levels present in low flow open water habitat favor mosquito fish over unarmored threespine stickleback (Walton et al. 2007). The density of red swamp crayfish within this area of San Antonio Creek also increased dramatically (ManTech 2016). Crayfish have been experimentally shown to not affect abundance of species such as fast moving mosquitofish (Gherardi and Acquistapace 2007). Unarmored threespine sticklebacks are fast moving midwater feeders as well (Walton et al. 2007) and as such may not be significantly affected by crayfish.

Recovery

The revised recovery plan for the unarmored threespine stickleback (Service 1985) identified three areas as very important for the survival and recovery of the subspecies. One of these areas is the lowermost 8.4 miles of San Antonio Creek, from the mouth of the creek at the Pacific Ocean and including the natural dunes or sandbars in the stream mouth, upstream into Barka Slough. Thus, this recovery unit includes the proposed action area. Lateral floodplain areas elevated less than 10 feet above the main streambed constitute seasonal marsh utilized for feeding and reproduction by the stickleback and are considered a necessary component of the essential habitat. While specific recovery functions were not assigned to any of recovery units, the overall goals are: 1) to preserve and protect extant populations, 2) reintroduce populations into historical habitats, 3) control the spread of exotic organisms, and 4) restore and maintain degraded habitats (Service 1985).

Key threats to unarmored threespine stickleback on VAFB include: habitat loss due to the drawdown of the San Antonio Aquifer, which results in decreased water flow in San Antonio Creek; and beaver activity in San Antonio Creek, which results in pooling and may encourage the introduction of exotic, predatory fish species. In addition, flood events in San Antonio Creek may result in population decreases if the lagoon breaches and unarmored threespine sticklebacks disperse into the ocean (Service 1985).

Some protections are afforded to the unarmored threespine stickleback on VAFB due to implementation of the Air Force's INRMP. So far, the Air Force has implemented actions consistent with the recovery plan that provide a positive conservation benefit including prohibiting introduction of nonnative fish species into streams on VAFB. Avoidance and minimization of adverse impacts to unarmored threespine sticklebacks are incorporated into project planning, and project-specific monitoring (such as those discussed above) provides valuable information regarding population of the subspecies in San Antonio Creek.

<u>Tidewater Goby</u>

Tidewater goby has been documented in all of the major drainages on VAFB including: Shuman Creek, San Antonio Creek, Santa Ynez River, Cañada Honda, and Jalama Creek. At San Antonio Creek, which is characterized by low gradient and habitat continuity between the lagoon and tributary stream, tidewater gobies have been documented in ponded freshwater habitats as far as

7.4 km (4.6 mi) upstream from the ocean (Swift et al. 1997). Tidewater gobies disperse to upstream habitat in the fall until high winter flows cause them to retreat or migrate back downstream to the lagoon. The available tidewater goby habitat at San Antonio encompasses approximately 2.0 to 3.0 hectares (4.9 to 7.4 acres) (Service 2005).

Although population estimates are not readily available for tidewater goby, the Air Force has evaluated populations on VAFB on a project-by-project basis, because the populations fluctuate yearly. Researchers have identified San Antonio Creek and Santa Ynez lagoons as the most important habitats supporting the tidewater goby. The channel and/or lagoon of San Antonio Creek have been surveyed for tidewater gobies several times over the last 35 years. Surveys conducted by Irwin and Soltz (1984) in 1981 and 1982 detected tidewater gobies in large numbers the lagoon (5,760 gobies captured) as well as in beaver ponds and other large pools upstream (882 gobies captured) to at least Lompoc-Casmalia Road (8 km from the ocean). In 1994-1995, Swift et al. (1997) repeatedly sampled the lagoon and intermittently sampled upstream portions of the creek. Based on survey results, they estimated tidewater goby population size fluctuated between an average low of about 15,300 in January 1995 to an average high of about 290,000 the previous August. Few gobies were found in the creek channel during this study, or during individual sampling events in 1996 (Swift et al. 1997). In the spring of 1999, Swift conducted surveys within approximately 8 km (4.97 mi) of lower San Antonio Creek, from the lagoon upstream to approximately 1.5 km (0.9 mi) past the Lompoc-Casmalia Road crossing, as part of pre-project assessment related to bridge construction at the El Rancho Road creek crossing. Swift (1999) again found that tidewater gobies were concentrated in the San Antonio Creek lagoon as compared to its channel (1,331 gobies captured in the lagoon versus 2 captured upstream). In 2008, ManTech (2009c) resurveyed the channel of the San Antonio Creek in 2008, but did not include sampling in the lagoon; no tidewater gobies were detected in these surveys. In addition, no tidewater gobies were captured during the 2016 seine surveys conducted within and adjacent to the proposed project area (ManTech 2016).

Historically, tidewater gobies have been detected far upstream in the San Antonio drainage, often one to a few adult fish taken at El Rancho or Lompoc-Casmalia road crossings. Extensive collecting in 1975 (see Swift et al. 1997), 1982-1983 (Irwin and Soltz 1984), and 1994-1996 (Swift et al. 1997) indicates this occurrence upstream varies over the years, possibly related to precipitation and extreme weather events. Large numbers of tidewater gobies were present far upstream in San Antonio Creek in 1982 and 1983, during a series of above average rainfall years. Collections in 1994 and 1995 failed to find any tidewater gobies more than approximately 3 km (1.9 mi) above the lagoon; during this time, the creek was dry in the fall, apparently a continuation of the effects of a drought from 1986 to 1992 (Swift et al. 1997). However, with the return of flowing water in the following year, tidewater gobies did not disperse into the creek as happened in the Santa Ynez River. Swift et al. (1997) postulated that possibly two or more years of flowing water are needed for tidewater gobies to recolonize upstream. Surveys in 2008, during which no gobies were found in the creek channel, followed the 2006-2007 winter rainy season which was one of the driest on record for VAFB. Thus, drying of the stream during the drought years, and perhaps exacerbated by additional groundwater withdrawal upstream, has the potential to eliminate most of this upstream habitat in the San Antonio Creek.

Because tidewater gobies appear to spend all life stages in lagoons, estuaries, and river mouths, their population may experience a decline if flushed out by the breaching of sandbars following storm events (Service 2005). However, population decline in one area may lead to colonization of others areas up and down the coast, as is suspected to be the case with Honda Creek (Swift et al. 1997, Service 2005).

Recovery

San Antonio Creek is included in the Conception Recovery Unit for the tidewater goby. The Conception Recovery Unit is divided into three sub-units; San Antonio Creek is included in Sub-Unit CO 2, which extends from Point Sal to Point Arguello over a generally sandy coast. Sub-Unit CO 2 is located entirely within Santa Barbara County. Primary tasks for this recovery unit as recommended in the recovery plan include: (1) population monitoring; (2) substantiate Sub-Units based on genetic studies; (3) improve habitat and remove threats; and (4) consider recolonization if there is a 25 percent reduction in the number of inhabited locations. The 5-year review does not specify the recovery function of the San Antonio Creek for the tidewater goby.

Key threats to tidewater gobies on VAFB include: susceptibility of coastal lagoons to degradation through upstream diversion of water (dewaters stream habitat, affects marsh habitats, and alters temperature and salinity); pollution from private, agricultural, and municipal sewage effluents; siltation (*e.g.*, resulting from off-base cattle overgrazing and feral pig activity); and urban development of surrounding lands. Introduced predatory fish, especially centrarchids and channel catfish, crayfish, and mosquito fish may threaten populations through direct predation on eggs, larvae, and adults.

Some protections are afforded to the tidewater goby on VAFB due to implementation of the Air Force's INRMP. So far, the Air Force has implemented actions consistent with the recovery plan that provide a positive conservation benefit including prohibiting introduction of nonnative fish species into streams on VAFB. Avoidance and minimization of adverse impacts to unarmored threespine sticklebacks are incorporated into project planning, and project-specific monitoring (such as those discussed above) provides valuable information regarding population of the tidewater goby in San Antonio Creek.

EFFECTS OF THE ACTION

California Red-legged Frog

California red-legged frogs (all life stages) could be inadvertently injured or killed by workers, vehicles, or construction equipment during preconstruction activities (staging, creek damming and diversion activities, dewatering) and if frogs enter the main construction area during construction activities (sediment removal, repair/replacement of gabions, vegetation cutting). Frogs could also be inadvertently injured or killed by workers, vehicles, or equipment during mitigation site access, preparation and planting activities. Water diversion and dewatering activities, including the use of water pumps could result in the suctioning or trapping of

California red-legged frogs. California red-legged frogs dispersing from areas adjacent to the action area are subject to mortality or injury from vehicle strikes and construction activities associated with the proposed project. California red-legged frogs that are not able to disperse from the action area may be crushed by worker foot traffic or the use of heavy equipment. Effects could range from crushing the leg of a California red-legged frog resulting in injury to completely running over or stepping on an individual rendering it unrecognizable among excavated soil and vegetation.

To minimize effects to this species, the Air Force would have a Service-approved biologist conduct pre-construction surveys, including surveys prior to each stage of the proposed diversion/dewatering, and capture and relocate all California red-legged frogs to the nearest suitable habitat outside of the project area prior to the onset of project activities. The Air Force would design all diversion and dewatering systems to avoid trapping or suctioning California red-legged frogs, and would control the rate of all water intakes/release to ensure adverse impacts to California red-legged frogs can be detected and avoided. The Air Force would also install temporary exclusionary fencing intended to prevent California red-legged frogs from entering the main construction area. However, because fencing would still be somewhat passable by frogs, the Air Force would also conduct daily biological monitoring by a Service-approved biologist to minimize adverse effects on California red-legged frogs and their habitat (e.g., find and relocate frogs which enter the main construction area). Recent observations suggest that California red-legged frog exhibit strong site fidelity (AECOM 2011). The Air Force's proposal to have a daily biological monitor present on site could minimize the effect of translocated individuals returning to the site. Furthermore, the translocation of individuals from the project area would likely reduce the level of mortality that otherwise would occur if California red-legged frogs were not removed.

Relocating California red-legged frogs out of harm's way may reduce injury or mortality from equipment, foot traffic, or ground disturbing activities; however, injury or mortality of individuals may occur as a result of improper handling, containment, or transport of individuals or from releasing them into unsuitable habitat (e.g., where exotic predators are present). Observations of diseased and parasite-infected amphibians are frequently reported, and relocation of California red-legged frogs has the potential to result in transmission of the chytrid infection, recently documented in San Antonio Creek (ManTech 2014). This has given rise to concerns that releasing amphibians following a period of captivity, during which time they can pick up infections of disease agents, may cause an increased risk of mortality in wild populations. Amphibian pathogens and parasites can also be carried between habitats on the hands, footwear, or equipment of fieldworkers, which can spread them to localities containing species which have had little or no prior contact with such pathogens or parasites. We anticipate the risk of improper handling, containment, or transport of California red-legged frogs would be reduced or eliminated through the Air Force's proposed minimization measures including: using only Service-approved biologists to monitor, capture, or handle California red-legged frogs; conducting an educational briefing for all project personnel prior to the start of work activities; and adherence of all personnel working in the main construction area to the practices listed in the Declining Amphibian Populations Task Force Fieldwork Code of Practice (Service 2002).

Despite the foregoing minimization measures, the proposed project would tend to adversely affect early life phases of California red-legged frogs (eggs and juveniles) to a greater extent than adults, with eggs being more at risk than juveniles which normally can be observed and relocated. Juveniles are active during both the day and night and are restricted to aquatic habitats during certain life cycle phases, which make them less able to move away from certain threats as compared to adult California red-legged frogs. The Service-approved biological monitor may be able to relocate California red-legged frog tadpoles, but tadpoles may avoid detection due to their small size. In addition, California red-legged frogs generally breed from November to April, and metamorphosis from tadpoles to juveniles (terrestrial phase) may take up to 28 weeks (5 months), but could be delayed up to 1 year. As a result, early life phases of California red-legged frogs (eggs and juveniles) may occur in the main construction area throughout the year and adverse effects to early life stages may occur from the proposed project . For example, California red-legged frog egg masses and tadpoles may go undetected and be suctioned by the water pumps.

We anticipate the measures proposed by the Air Force would minimize and control the above adverse direct effects from pre-construction and construction activities; however, some early life phases of California red-legged frogs could be inadvertently injured or killed during pre-construction and construction activities due to the inability to detect and/or relocate all instances and life phases of California red-legged frogs within the main construction area.

Herbicides that are applied to invasive plant treatment areas within or adjacent to California red-legged frog habitat have the potential to come in contact with California red-legged frogs through direct dermal exposure in their terrestrial or aquatic habitats. The herbicides proposed for use during mitigation activities contain the active ingredients glyphosate (approved for aquatic use) and chlorsulfuron.

California red-legged frog eggs, tadpoles, juveniles and adults can be exposed to glyphosate products in aquatic habitats through direct overspray of wetlands, drift from treated areas, or contaminated runoff from treated areas. The half-life of glyphosate in pond water ranges between 12 days and 10 weeks (Extension Toxicology Network 1996). Additionally, juvenile and adult California red-legged frogs can be exposed in terrestrial habitats that have been treated. Glyphosate readily sorbs to soil particles and can be degraded by microbes in 7 to 70 days depending on soil conditions (Giesy et al. 2000).

No information is available regarding the toxicity of glyphosate products specifically to California red-legged frogs. Studies exploring the lethal and sublethal effects of glyphosate products on other amphibians, including ranids, are available but are largely focused on aquatic stages of the species and formulations of glyphosate that include surfactants. Several studies suggest that the toxicity of glyphosate products is linked with the surfactant, and not the glyphosate (Howe et al. 2004; Govindarajulu 2008). Vincent and Davidson (2015) examined the effects of glyphosate on western toad (*Anaxyrus* [*Bufo*] *boreas)* tadpoles; short-term toxicity trials were conducted for glyphosate in the form of isoproprylamine salt (IPA) as well as mixed with surfactants, including Agri-dex (the surfactant the Air Force has proposed for mitigation activities). The median lethal concentration (LC50) reported for 24-hour and 48-hour exposures were 8,279 milligrams per liter (mg/L) and 6,392 mg/L, respectively, for glyphosate IPA alone, compared to 5,092 mg/L (24 hour) and 4,254 mg/L (48 hour) for glyphosate IPA mixed with Agri-dex (Vincent and Davidson 2015). Although the glyphosate IPA mixed with Agri-dex was found to be more toxic than glyphosate IPA alone, the results of this study and others (Smith et al. 2004; Washington State Department of Agriculture 2004) suggest that Agri-dex has a relatively low toxicity. The concentration of glyphosate with Agri-dex that the Air Force has proposed using in mitigation activities is substantially lower than these toxicity thresholds.

Glyphosate toxicity data for California red-legged frogs or other amphibians that inhabit terrestrial environments is also lacking. The U.S. Environmental Protection Agency (EPA) uses toxicity data from avian receptors as a surrogate for California red-legged frogs in terrestrial environments (EPA 2008). The EPA compiled toxicity data for technical glyphosate (formulated without a surfactant) that were deemed suitable to act as surrogates for California red-legged frogs (EPA 2008). These studies showed that glyphosate is slightly toxic to the selected avian species with the lowest LC50 value reported as ingestion of greater than 3,196 miligrams of active ingredient per kilogram of body weight (EPA 2008), although no mortalities occurred in any of the studies so this number is likely to be strongly conservative. Based on these conservative numbers, the EPA used a modeling approach to further understand risk to California red-legged frogs from glyphosate exposure in terrestrial habitats. The EPA determined that California red-legged frogs may be at risk of some toxic effects if glyphosate is applied at an application rate of 5.5 pounds per acre. At the maximum-allowable application rate of 8 pounds per acre for Rodeo, there is the potential for California red-legged frogs to be adversely affected in terrestrial environments, although this conclusion appears to be highly conservative.

As with glyphosate, California red-legged frog eggs, tadpoles, juveniles and adults can be exposed to chlorsulfuron products in aquatic habitats through direct overspray of wetlands, drift from treated areas, or contaminated runoff from treated areas. Additionally, juvenile and adult California red-legged frogs can be exposed in terrestrial habitats that have been treated. The half-life of chlorsulfuron in soil ranges from 1 to 3 months, with a typical half-life of 40 days, depending on soil and weather conditions (Klotzbach and Durkin 2004).

No information is available regarding the toxicity of chlorsulfuron specifically to California red-legged frogs or other similar amphibian species. In the absence of robust toxicity data for amphibians in aquatic habitats, the EPA uses fish toxicity as a surrogate. Acute toxicity studies conducted on fish have indicated that chlorsulfuron is practically non-toxic to tested fish, with LC50 values ranging from greater than 250 mg/L in rainbow trout to greater than 980 mg/L in sheepshead minnow (Klotzbach and Durkin 2004). Similarly, a long-term exposure study found that survival of rainbow trout embryos and alevins was not affected at chlorsulfuron concentrations up to 900 mg/L (Klotzbach and Durkin 2004). However, fingerlings appear to be more sensitive than embryos and alevins, with 40 percent mortality in the 900 mg/L exposure group; no mortality in fingerlings was observed at chlorsulfuron concentrations less than 900 mg/L. Based on assessment of trout length (the most sensitive effect) performed at the completion of the study, the no-effect-observed concentration value of 32 mg/L was determined and a lowest-observed-effect concentration value of 66 mg/L was determined. Chlorsulfuron does not tend to bioaccumulate in fish (Klotzbach and Durkin 2004).

Chlorsulfuron toxicity data for California red-legged frogs or other amphibians that inhabit terrestrial environments is also lacking. The EPA uses toxicity data from avian receptors as a surrogate for California red-legged frogs in terrestrial environments (EPA 2008). Acute toxicity studies for avian species indicate chlorsulfuron is practically non-toxic to birds, with acute LC50 values for mallard ducks and bobwhite quail greater than 5,000 milligrams of active ingredient per kilogram. The concentration of chlorsulfuron the Air Force is proposing is substantially lower than the acute and chronic toxicity thresholds for various fish and bird species that act as suitable surrogates for the California red-legged frog.

In this project, neither glyphosate nor chlorsulfuron will be applied directly to water or used within 15 feet of aquatic habitat having surface water or saturated soils present. Herbicides will also not be used in aquatic habitat within 24 hours (before or after) of precipitation events of 0.1 inch or more. Based on these minimization measures and the low proposed concentrations, the chance of toxicity to California red-legged frogs from glyphosate and chlorsulfuron use is very low.

The proposed pre-construction and construction activities would temporarily disturb California red-legged frog aquatic, upland, and dispersal habitat within the project area. The main construction area supports approximately 0.16 and 0.11 acres of aquatic/riparian and upland California red-legged frog -habitat, respectively. In addition, clearing and grubbing of vegetation in the staging areas would affect 0.41 acres of upland habitat. Up to 0.07 acres of aquatic/riparian habitat would be disturbed through human activity (associated with upstream water diversion and monitoring activities and downstream sedimentation and increased turbidity. Therefore, approximately 0.75 acres of California red-legged frog habitat could be affected by the proposed construction, initally.

In addition to the initial habitat disturbance, future periodic-vegetation maintenance (cutting) in the main construction area could affect up to the same acreage initially affected because maintenance would conform to the same requirements (cut woody vegetation with stems greater than or equal to 2 inches in diameter). The acreage of vegetation cut depends on the rate of regrowth, but the initial estimates provide an upper limit because the existing vegetation is the accumulation of years of growth. Therefore, future periodic vegetation reduction would occur as needed and may affect up to, but not exceed, the initial acreage estimates.

California red-legged frogs could be affected by the vegetation reduction, as vegetation maintenance would likely cause a change in habitat structure and possibly function. The Air Force does anticipate some canopy reduction, but the root structure of cut vegetation would remain intact and any cut willow trees would be able to regrow. Changes to the habitat structure in the main construction area could have indirect negative effects on adult California red-legged frogs, and to a lesser degree juveniles, by reducing habitat suitability in the area. Because California red-legged frogs tend to deposit egg masses on emergent vegetation, cutting vegetation may affect the use of this area by the species for breeding, foraging and refuge. However, because California red-legged frogs are not deterred by obstacles, an area with reduced vegetation cover would likely still be used for dispersal/transit by some phases to upstream/downstream locations.

Decreases in riparian canopy cover could also result in a reduction in California red-legged frog prey (aquatic and terrestrial invertebrates) which depend on the presence of riparian vegetation. Cutting some willow trees down to stumps could cause some change in the invertebrate community in the action area because there would be a reduced canopy and leaf litter input. However, vegetation less than 2-inches in diameter would remain, and the proposed reduction may not be detrimental to the persistence of invertebrate communities if they are able to move into adjacent and better habitats until conditions become favorable again. Dense riparian vegetation exists both upstream and downstream of the main construction area and any detritus or broken down organic matter would pass through the project area. As a result, invertebrates in the project area could remain present or at worst, relocate into adjacent habitats until conditions in the main construction area become favorable again. The proposed project would not directly change any of the features of San Antonio Creek (i.e., stream size, gradient, and connectivity to a floodplain) that could further affect invertebrate communities.

In addition, the proposed vegetation reduction may contribute to the existing habitat degradation issues related to water quality within the watershed already affecting California red-legged frogs. Cutting willows and riparian vegetation to within 3 inches of the ground or water surface may compromise the effectiveness of existing riparian vegetative buffers to provide ecosystem services such as slowing erosion/sedimentation (by stabilizing soils/trapping sediment), slowing storm flow velocities, and reducing the concentration of pollutants in surface water runoff. However, because roots of cut vegetation would remain in place, the existing vegetation could continue to stabilize soils, trap sediment, and filter pollutants at some (probably reduced) level. In addition, the project area constitutes only a small portion of the watershed where these ecosystem services and/or processes would continue.

The proposed pre-construction and construction activities could also cause water quality impacts from increased soil erosion due to exposed soils and the effects of soil compaction. Increased exposed soils may result from clearing and grubbing the staging areas adjacent to San Antonio Creek and loosening the soil under the bridge to access the gabions. Exposed and loosened soil would be susceptible to off-site transport by wind or water (stormwater and restoring flow after culverts and dams removed). Conversely, use of heavy equipment in undeveloped areas (staging areas and under the bridge) may cause soil compaction, reducing soil permeability. Reduced permeability may lead to soils having a decreased ability to filter pollutants or contribute to increased flow rates affecting water quality. However, under the bridge, soil compaction may be beneficial in packing down any loose soils and preventing sedimentation or increased turbidity in San Antonio Creek prior to restoring flow. The Air Force does not anticipate any increased erosion from vegetation reduction activities because no uprooting would occur, thereby continuing to stabilize soils in the project area.

Water quality impacts may inadvertently occur during the use of heavy equipment in the San Antonio Creek riparian area and hydrologic floodplain. To minimize potential effects, the Air Force would implement standard VAFB spill prevention and control measures including conducting vehicle and equipment maintenance outside of the hydrologic floodplain and storing vehicles and equipment in the staging areas to avoid the potential for inadvertent spills into the creek and riparian areas. However, because work would occur within the hydrologic floodplain/riparian areas it is likely that residue from vehicles (i.e., particulates from diesel engines, chainsaw oil residue) would enter the watershed despite compliance with any prevention and control measures. The Air Force would comply with requirements imposed through the NEPA process, including compliance with the Clean Water Act for effects to wetlands and water quality, to ensure effects are within acceptable levels.

Short-term noise and vibration generated during pre-construction and construction activities, and future periodic vegetation maintenance, may cause California red-legged frogs to temporarily abandon habitat adjacent to work areas. Such disturbance may increase the potential for predation and desiccation when California red-legged frogs leave shelter sites; however, these effects would be temporary, lasting only for the duration of the construction activities. If California red-legged frogs are driven from the vicinity of the work activities, we expect that they would return upon the completion of construction or find other suitable refuge nearby. In addition, the Air Force would continue to remove non-native invasive species such as bullfrogs during VAFB species surveys in San Antonio Creek, which would tend to reduce predation of California red-legged frogs to some degree.

Given that habitat loss/degradation, prey reduction, and increased predation risk as a result of pre-construction and construction activities would be short-term in nature, we anticipate the indirect effects of the proposed pre-construction and construction activities to be temporary and minimal. Future vegetation maintenance activities, likely resulting in changes and reductions in riparian vegetation (canopy structure and coverage), are anticipated to be long-term and potentially cause changes in California red-legged frog use of the creek within the main construction area. However, because this area represents a small portion of the watershed, there is suitable habitat upstream and downstream of the main construction area which California red-legged frogs may use, and the proposed maintenance would not entirely remove the riparian vegetation (leaving stems less than 2 inches in diameter and roots of larger plants), we expect the effects on California red-legged frogs to be minor. In addition, because the proposed mitigation would result in the enhancement/restoration of approximately 0.48 acre of willow riparian habitat, we expect that the availability and suitability of breeding habitat for California red-legged frogs in this area would be increased, thereby helping to offset potential long-term effects related to future vegetation maintenance at the bridge.

<u>Effects on Recovery</u>

With implementation of the mitigation activities and minimization measures proposed by the Air Force, direct and indirect impacts to the California red-legged frog would likely be low and would not reduce the likelihood of recovery of the California red-legged frog within the Central

Coast Recovery Unit. Because the action area is within a recovery unit with "high recovery status," the proposed project is not likely to reduce the potential contribution of the action area to the conservation of the California red-legged frog. In other words, the populations of California red-legged frog in the recovery unit are considered plentiful and many of those are of high quality. Overall, the effects to the species and its habitat would be relatively minor. Additionally, the project would meet the recovery goal of removing non-native predators. Therefore, we anticipate that the proposed project will not diminish the species' ability to recover.

Unarmored Threespine Stickleback

The proposed project may result in direct and indirect effects on unarmored threespine sticklebacks for reasons similar to those discussed for California red-legged frogs. Unarmored threespine sticklebacks (all life stages) could be inadvertently crushed by workers or construction equipment during creek damming and diversion activities, dewatering, and construction activities in the main construction area. The Air Force would divert San Antonio Creek from flowing through the main construction area during the sediment removal and gabion repair/replacement, but not during the vegetation reduction activities (initial or future maintenance). Because unarmored threespine sticklebacks are confined to the flowing water of San Antonio Creek, they are not able to avoid potential impacts of the proposed project to the same extent as California red-legged frogs by moving to upland areas. However, the proposed minimization measures including exclusion netting, pre-construction surveys, relocation of sticklebacks, diversion of San Antonio Creek, and intake screens would avoid most effects to the subspecies (i.e., adults and juveniles that are visible).

A Service-approved biologist would oversee all construction activities having the potential to adversely affect unarmored threespine sticklebacks in addition to being present during future-periodic inspection and maintenance activities, because San Antonio Creek would not be diverted beyond completion of the gabion repair. Unarmored threespine sticklebacks could be inadvertently injured or killed in exclusion nets. To minimize this potential effect, the Air Force would continually monitor upstream and downstream netting. Dewatering activities may result in the death of unarmored threespine sticklebacks in the dewatered area due to stranding resulting in desiccation, suffocation, or opportunistic predation. To minimize this potential effect, the Air Force would use a Service-approved biologist to relocate all unarmored threespine sticklebacks out of areas to be dewatered to suitable habitat immediately downstream of the project site. Using a Service-approved biologist is expected to minimize the potential to injure or kill unarmored threespine sticklebacks during capture and relocation activities, which can result from improper handling, physiological stress, increased competition, or from being released into unsuitable habitat. During dewatering and irrigation, unarmored threespine sticklebacks may also be entrained by pump intakes. To minimize the likelihood of this, the Air Force would cover all pump intakes with wire screens having no greater than 0.125-inch mesh size to minimize the potential for unarmored threespine sticklebacks to be caught in the inflow. We anticipate the measures proposed by the Air Force would minimize adverse effects from dewatering the project area and relocating unarmored threespine sticklebacks.

Despite the foregoing minimization measures, the potential exists that some unarmored threespine sticklebacks may not be located or may still be killed or injured during the capture and relocation procedures. In addition, unarmored threespine sticklebacks may be breeding during the proposed project, and any eggs located within the dewatering area would not be detectable. These eggs may be destroyed during the proposed project.

The proposed project could adversely impact up to 0.27 acres of unarmored threespine stickleback habitat (breeding, feeding, or refuge) within the main construction area, and up to another 0.07 total acres upstream and downstream of this area (associated with upstream water diversion and monitoring activities and downstream sedimentation and increased turbidity). The area under the bridge (bottom of the channel) would be disturbed and there would be a reduction of some willow riparian vegetation, which could adversely affect water temperature, stream flow, or chemistry of unarmored threespine stickleback habitat. Because riparian vegetation provides temperature control for fish populations, reducing willow canopies in the main construction area may contribute to increased temperature in San Antonio Creek by removing canopies that currently provide shade (thus decreasing habitat value and temperature control). However, vegetation less than 2-inches in diameter would not be cut to offer some level of temperature control. Riparian canopy reduction could also contribute to a reduction in unarmored threespine stickleback prey as discussed above for the California red-legged frog, namely through a reduction in leaf litter within the main construction area and potential displacement into adjacent habitat.

The proposed pre-construction and construction activities could also cause water quality impacts from increased soil erosion due to exposed soils and the effects of soil compaction, as discussed above for the California red-legged frog. Increased exposed and loosened soils, in staging areas and under the bridge, would be susceptible to off-site transport by wind or water. Exposed soils under the bridge may result in short-term turbidity and sedimentation in the action area when the creek is restored to normal flow (after culverts/dams removed) because newly exposed/loosened soils could be transported by the flow. Potential soil compaction under the bridge from heavy equipment use may be beneficial in packing down any loose soils and preventing sedimentation or increased turbidity in San Antonio Creek prior to restoring flow. However, soil compaction in undeveloped areas would also reduce soil permeability, leading to soils having a decreased ability to filter pollutants or contributing to increased flow rates.

Increased sedimentation and turbidity could adversely affect unarmored threespine sticklebacks by impairing the efficiency of their gill filaments and exposing them to higher salinities and/or predation as they flee downstream. Direct effects of sedimentation include mortality, reduced physiological function, and nest smothering. Indirect effects of sedimentation include potential alteration to the food web which could create cascading effects to higher trophic levels. A reduction in phytoplankton can result from increased turbidity, which can thereafter reduce zooplankton, in turn reducing benthic macroinvertebrates, and thus reduce prey available to unarmored threespine sticklebacks (Henley et al. 2000). While the Air Force does not anticipate any increased erosion from vegetation reduction activities because the roots of the cut stumps would remain in place and continue to slow flow and trap sediment, some increased turbidity is likely to occur during future periodic vegetation maintenance activities within the main construction area. The effects of sedimentation and turbidity resulting from the proposed project would be minimized by the Air Force's proposal to divert the active river channel around the work area to ensure flow is not impeded during construction and implement best management practices during all project activities. We anticipate these measures would control and minimize erosion and sedimentation.

Water quality impacts may inadvertently occur during the use and operation of construction equipment and vehicles in the hydrologic floodplain of San Antonio Creek. Although the Air Force would implement standard spill prevention measures, contaminant/pollutant residue (particulate matter) from vehicles and equipment working in the hydrologic floodplain may generate pollutants that would enter the watershed.

While there would be no in-water work because the Air Force would divert San Antonio Creek, noise and vibration generated during project activities would likely disturb unarmored threespine sticklebacks beyond the dewatered area to some degree. During periodic vegetation maintenance activities, sticklebacks would likely be disturbed if a chainsaw is used. Such disturbance may increase the potential for predation by causing unarmored threespine sticklebacks to find other refuge habitat or otherwise interfere with their activities or behavior. However, these effects are temporary, lasting only for the duration of the construction or maintenance activities. If unarmored threespine sticklebacks are driven from the vicinity of the work activities, we expect that they would return upon the completion of construction. The Air Force proposes to divert San Antonio Creek at least 14.1 feet away from construction activities, if feasible based on site conditions to minimize impacts to unarmored threespine sticklebacks from noise and vibrations to the maximum extent practicable (Air Force 2016). In addition, the Air Force would continue to remove non-native invasive species such as brown bullhead during VAFB species surveys in San Antonio Creek, which would tend to reduce predation of unarmored threespine sticklebacks to some degree.

Given that habitat loss/degradation, prey reduction, and increased predation risk as a result of pre-construction and construction activities would be short-term in nature, we anticipate the indirect effects of the proposed pre-construction and construction activities would be temporary and minimal. The effects of future vegetation maintenance activities, likely resulting in changes and reductions in riparian vegetation (canopy structure and coverage), would be long-term and potentially cause changes in unarmored threespine stickleback use of the creek within the main construction area. However, because this area represents a small portion of the watershed, there is suitable habitat upstream and downstream of the main construction area which unarmored threespine sticklebacks may use, and the proposed maintenance would not entirely remove the riparian vegetation (leaving stems less than 2 inches in diameter and roots of larger plants), we expect the effects on unarmored threespine sticklebacks to be minor.

Effects on Recovery

With implementation of the minimization measures proposed by the Air Force, direct and indirect impacts to the unarmored threespine stickleback would likely be low and would not reduce the likelihood of recovery of the subspecies within the San Antonio Creek watershed. Overall, the effects to the unarmored threespine stickleback and its habitat would be relatively minor. Additionally, the project would meet the recovery goal of removing non-native predators. Therefore, we anticipate that the proposed project will not diminish the subspecies' ability to recover.

Tidewater Goby

The proposed project may result direct and indirect effects on tidewater gobies for reasons similar to those discussed for unarmored threespine sticklebacks. Tidewater gobies could be inadvertently injured or killed during by exclusion, relocation, or construction activities in the main construction area. However, because tidewater gobies are primarily found in the lagoon (approximately 6 miles downstream), the potential for this to occur would be lower. In addition, reproduction is not likely to occur in the project area. The proposed minimization measures including exclusion netting, pre-construction surveys, relocation of tidewater gobies, diversion of San Antonio Creek, and intake screens would avoid most effects to the species.

A Service-approved biologist would oversee all construction activities having the potential to adversely affect tidewater gobies in addition to being present during future-periodic inspection and maintenance activities, because San Antonio Creek would not be diverted beyond completion of the gabion repair. Tidewater gobies could be inadvertently injured or killed in exclusion nets. To minimize this potential effect, the Air Force would continually monitor upstream and downstream netting. Dewatering activities may result in the death of tidewater gobies in the dewatered area due to stranding resulting in desiccation, suffocation, or opportunistic predation. To minimize this potential effect, the Air Force would use a Service-approved biologist to relocate all tidewater gobies out of areas to be dewatered to suitable habitat immediately downstream of the project site. Using a Service-approved biologist is expected to minimize the potential to injure or kill tidewater gobies during capture and relocation activities, which can result from improper handling, physiological stress, increased competition, or from being released into unsuitable habitat. During dewatering and irrigation, tidewater gobies may also be entrained by pump intakes. To minimize the likelihood of this, the Air Force would cover all pump intakes with wire screens having no greater than 0.125-inch mesh size to minimize the potential for tidewater gobies to be caught in the inflow. We anticipate the measures proposed by the Air Force would minimize adverse effects from dewatering the project area and relocating tidewater gobies.

Despite the foregoing minimization measures, the potential exists that some tidewater gobies may not be located (especially due to their small size) or may still be killed or injured during the capture and relocation procedures. However, we expect this effect would be limited to a very small number of tidewater gobies based on previous survey results and the continued drought conditions.

Because the tidewater goby's primary habitat within this watershed is downstream of the project area, the proposed project is not expected to cause permanent loss of tidewater goby habitat and habitat-related effects are expected to be less adverse than those discussed for unarmored threespine stickleback. The proposed vegetation reduction is less likely to affect tidewater gobies, which are more dependent on submerged aquatic vegetation rather than riparian vegetation for shelter. If tidewater gobies occur in the project area, riparian canopy reduction could contribute to a reduction in tidewater goby prey (invertebrates) through a reduction in leaf litter within the main construction area and potential displacement into adjacent habitat. However, the potential effects would be limited to the immediate area, and we do not expect prey would be affected any significant distance downstream or in the lagoon.

Likewise, although the proposed project could also cause water quality impacts from increased soil erosion due to exposed soils and the effects of soil compaction, effects would be limited to the project area vicinity and are not expected to affect tidewater gobies in or near the lagoon. Exposed soils that are transported outside of the action area would have time to settle out of the main water column before reaching tidewater goby habitat. Water quality impacts may inadvertently occur during the use and operation of construction equipment and vehicles in the hydrologic floodplain of San Antonio Creek. Although the Air Force would implement standard spill prevention measures, contaminant/pollutant residue (particulate matter) from vehicles and equipment working in the hydrologic floodplain may generate pollutants that would enter the watershed. We expect any impacts to downstream tidewater gobies and their primary habitat in the lagoon and lower reaches of the creek would be minimal and temporary in nature.

While there would be no in-water work because the Air Force would divert San Antonio Creek, noise and vibration generated during project activities could disturb any tidewater gobies in the project area beyond the dewatered area to some degree. During periodic vegetation maintenance activities, gobies could be disturbed if a chainsaw is used. However, tidewater gobies are less sensitive than unarmored threespine sticklebacks to the effects of sound because adults do not have a specialized anatomical feature such as a gas/swim bladder (which is lost after their larval phase). In addition, analysis by VAFB suggests it is unlikely tidewater gobies would have an avoidance response (Air Force 2016). Regardless, any potential effects to tidewater gobies would be temporary, lasting only for the duration of the construction or maintenance activities, and if tidewater gobies are driven from the vicinity of the work activities, we expect that they would return upon the completion of activities. The Air Force's minimization measures to protect unarmored threespine sticklebacks from noise and vibrations would provide additional protection to tidewater gobies.

Effects on Recovery

The goal of the tidewater goby recovery plan is to conserve and recover the tidewater goby throughout its range by managing threats and perpetuating viable metapopulations within each recovery unit while maintaining morphological and genetic adaptations to regional and local environmental conditions. We do not expect proposed project to substantially affect the conservation of tidewater gobies within the Conception Recovery Unit, in terms of the recovery strategy described in the recovery plan because:

1. The tidewater goby recovery plan emphasizes the importance of the conservation of population units rather than individual fish, and the effects of the replacement of the proposed project are not expected to cause population-level declines in San Antonio Creek; and

2. The proposed project would not adversely affect the metapopulation dynamics between individual populations within the Conception Recovery Unit.

With implementation of the minimization measures proposed by the Air Force, direct and indirect impacts to the tidewater goby would likely be low and would not reduce the likelihood of recovery of the species within the San Antonio Creek watershed. Overall, the effects to the tidewater goby and its habitat would be relatively minor. Additionally, the project would meet the recovery goal of removing non-native predators. Therefore, we anticipate that the proposed project will not diminish the species' ability to recover.

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. We do not consider future Federal actions that are unrelated to the proposed action in this section because they require separate consultation pursuant to section 7 of the Act. Because the entire VAFB is a Federal installation, we are not aware of any non-Federal actions that are reasonably certain to occur in the action area.

CONCLUSION

In determining whether a proposed action is likely to jeopardize the continued existence of a species, we consider the effects of the action with respect to the reproduction, numbers, and distribution of the species. In that context, the following paragraphs summarize the effects of the proposed project on the California red-legged frog, unarmored threespine stickleback, and tidewater goby.

California Red-legged Frog

Reproduction

The proposed project would temporarily reduce the amount of available California red-legged frog breeding habitat within the action area during construction activities, and may reduce suitability of breeding habitat within the main construction area as long as vegetation maintenance is ongoing. Such disruptions could potentially affect a portion of breeding California red-legged frogs at VAFB. If vegetation maintenance resulted in a permanent loss of breeding habitat, the amount of habitat affected would be small (0.27 acres) and constitutes a small percentage of California red-legged frog breeding habitat on VAFB and rangewide. In addition, this loss of habitat would be offset by the restoration and enhancement of 0.48 acre of California red-legged frog breeding habitat further downstream. The Air Force would use a Service-approved biologist to survey for and relocate all California red-legged frogs to the nearest suitable habitat outside of the project area prior to the onset of construction activities. The Air Force would also install temporary exclusionary fencing and have a Service-approved biologist monitor the area daily to relocate California red-legged frogs that enter the main construction area. We expect these measures to greatly minimize disturbances to breeding activity. Therefore, we expect minimal impacts to breeding California red-legged frogs and conclude that the proposed project will not reduce the reproduction of the species on VAFB, in the Central Coast Recovery Unit, or rangewide.

Number

We are unable to determine the precise number of California red-legged frogs that could occur in the action area and may be affected by proposed project because the numbers of individuals in the action area likely vary from year to year. The proposed activities could directly and indirectly affect individual California red-legged frogs to the point of injury or death, although we expect injury or mortality to be minimal. The number of California red-legged frogs we expect to be affected by the proposed activities is very small relative to VAFB populations and those in the entirety of the species' range. Therefore, we do not expect the proposed project will reduce the number of California red-legged frog on VAFB, in the Central Coast Recovery Unit, or rangewide.

Distribution

The proposed project could temporarily displace California red-legged frogs from portions of the action area and could cause injury or mortality; however, the Air Force would implement measures to minimize the risk of adverse effects on California red-legged frogs. Future vegetation maintenance could decrease habitat suitability in the main construction area and result in localized changes in the distribution of California red-legged frogs – this is more likely to result in reduced numbers of the species within the main construction area, rather than complete avoidance of the area by the species. In addition, the main construction area is small (0.27 acres) and there is suitable habitat located immediately upstream and downstream. Therefore, we do not expect the effects of the proposed project to reduce the distribution of the California red-legged frog on VAFB, in the Central Coast Recovery Unit, or rangewide.

Recovery

The action area lies within the Central Coast Recovery Unit. The proposed action would not result in any appreciable change in reproduction, population numbers, or distribution of the

California red-legged frog and would not preclude the Service's ability to implement any of the measures identified in the recovery plan for the species. Therefore we conclude that the proposed action would not appreciably reduce the likelihood of recovery of the California red-legged frog in the Central Coast Recovery Unit or rangewide.

After reviewing the current status of the California red-legged frog, the environmental baseline for the action area, the effects of the proposed project at VAFB, and the cumulative effects, it is the Service's biological opinion that the Air Force's proposal to conduct erosion protection and maintenance activities at the San Antonio Creek West Bridge on VAFB, is not likely to jeopardize the continued existence of the California red-legged frog. We have determined that the reproduction, numbers, and distribution of the species would not be reduced, and that the proposed project would not reduce appreciably the likelihood of the recovery of the California red-legged frog as envisioned in the recovery plan due to the relatively small size of the affected area and the measures the Air Force proposes to avoid and minimize the potential effects.

Unarmored Threespine Stickleback

Reproduction

The proposed project would temporarily reduce the amount of available breeding habitat for the unarmored threespine stickleback within the action area during construction activities, and may reduce suitability of breeding habitat within the main construction area as long as vegetation maintenance is ongoing. Such disruptions could potentially affect a portion of breeding unarmored threespine stickleback at VAFB. If vegetation maintenance resulted in a permanent loss of breeding habitat, the amount of habitat affected would be small (0.27 acres) and constitutes a small percentage of unarmored threespine stickleback breeding habitat on VAFB and rangewide. The Air Force would install exclusionary netting upstream and downstream of the main construction area and a Service-approved biologist survey for and relocate all unarmored threespine sticklebacks to suitable downstream habitat outside of the action area prior to the onset of construction activities. The Air Force would also divert the San Antonio Creek to ensure continued flow and allow species to travel through the pipes and around the project area. We expect these measures to greatly minimize disturbances to breeding activity. Therefore, we expect minimal impacts to breeding unarmored threespine sticklebacks and conclude that the proposed project will not reduce the reproduction of the subspecies on VAFB or rangewide.

Numbers

A 2008 survey conducted of a 100-m segment of the San Antonio creek located within the current proposed action area resulted in the capture of 2,047 unarmored threespine sticklebacks. Based on this single estimate, the main construction area could easily contain over 1,000 unarmored threespine sticklebacks. However, a 2016 survey found a much lower density of sticklebacks, suggesting the main construction area may contain less than 100 individuals. Thus, we are unable to determine the precise number of unarmored threespine sticklebacks that could occur in the action area and may be affected by proposed project because the numbers of individuals in the action area likely vary from year to year. The proposed activities could directly and indirectly affect individual unarmored threespine sticklebacks to the point of injury or death, although we expect injury or mortality to be minimal based on the Air Force's proposed minimization measures. The number of unarmored threespine sticklebacks we expect to be affected by the proposed activities is small relative to VAFB populations and those in the entirety of the subspecies' range. Therefore, we do not expect the proposed project will reduce the number of unarmored threespine sticklebacks on VAFB or rangewide.

Distribution

The proposed project could temporarily displace unarmored threespine sticklebacks from portions of the action area and could cause injury or mortality; however, the Air Force would implement measures to minimize the risk of adverse effects on unarmored threespine sticklebacks. Future vegetation maintenance could decrease habitat suitability in the main construction area and result in localized changes in the distribution of unarmored threespine sticklebacks – this is more likely to result in reduced numbers of the subspecies within the main construction area, rather than complete avoidance of the area by the subspecies. In addition, the main construction area is small (0.27 acres) and there is suitable habitat located immediately upstream and downstream. Therefore, we do not expect the effects of the proposed project to reduce the distribution of the unarmored threespine sticklebacks on VAFB or rangewide.

Recovery

The action area is within a portion of San Antonio Creek which has been identified as one of three areas that is very important for the survival and recovery of the unarmored threespine stickleback. The proposed action would not result in any appreciable change in reproduction, population numbers, or distribution of the unarmored threespine stickleback and would not preclude the Service's ability to implement any of the measures identified in the recovery plan for the subspecies. Consequently, we conclude that the proposed actions would not reduce appreciably the likelihood of recovery of the unarmored threespine stickleback.

After reviewing the current status of the unarmored threespine stickleback, the environmental baseline for the action area, the effects of the proposed project at VAFB, and the cumulative effects, it is the Service's biological opinion that the Air Force's proposal to conduct erosion protection and maintenance activities at the San Antonio Creek West Bridge on VAFB, is not likely to jeopardize the continued existence of the unarmored threespine stickleback. We have determined that the reproduction, numbers, and distribution of the subspecies would not be reduced, and that the proposed project would not reduce appreciably the likelihood of the recovery of the unarmored threespine stickleback as envisioned in the recovery plan due to the size of the affected area and the measures the Air Force proposes to avoid and minimize the potential effects.

Tidewater Goby

Reproduction

The proposed project is not expected to reduce the amount of available breeding habitat for the tidewater goby, which is primarily located in the lagoon (over 6 miles downstream). Therefore, we expect minimal impacts to breeding tidewater gobies and conclude that the proposed project will not reduce the reproduction of the species on VAFB or rangewide.

Number

We are unable to determine the precise number of tidewater gobies that could occur in the action area and may be affected by the proposed project because the numbers of individuals in the action area vary from year to year. Based on historical survey results and continued drought conditions, we expect the number of tidewater gobies that would be affected is very small. The proposed activities could directly and indirectly affect any individual tidewater gobies in the action area to the point of injury or death, although we expect injury or mortality to be minimal based on the Air Force's proposed minimization measures. The Air Force would install exclusionary netting upstream and downstream of the main construction area and a Service-approved biologist survey for and relocate all tidewater gobies to suitable downstream habitat outside of the action area prior to the onset of construction activities. The Air Force would also divert the San Antonio Creek to ensure continued flow and allow species to travel through the pipes and around the project area. In addition, the Air Force would install 0.125 inch mesh over pump intakes to avoid entrainment of tidewater gobies. The number of tidewater gobies we expect to be affected by the proposed activities is very small relative to VAFB populations and those in the entirety of the species' range. Therefore, we do not expect the proposed project will reduce the number of tidewater gobies on VAFB or rangewide.

Distribution

The proposed project could temporarily displace tidewater gobies from portions of the action area and could cause injury or mortality; however, the Air Force would implement measures to minimize the risk of adverse effects on tidewater gobies. In addition, effects of the project would be localized to the vicinity of the project area, and are not expected to impact tidewater gobies downstream (e.g., in the lagoon). Therefore, we do not expect the effects of the proposed project to reduce the distribution of the tidewater gobies on VAFB or rangewide.

Recovery

The action area is included in the Conception Recovery Unit (Subunit CO2) for the tidewater goby. The proposed action would not result in any appreciable change in reproduction, population numbers, or distribution of the tidewater goby and would not preclude the Service's ability to implement any of the measures identified in the recovery plan for the species.

Consequently, we conclude that the proposed actions would not appreciably reduce the likelihood of recovery of the tidewater goby.

After reviewing the current status of the tidewater goby, the environmental baseline for the action area, the effects of the proposed project at VAFB, and the cumulative effects, it is the Service's biological opinion that the Air Force's proposal to conduct erosion protection and maintenance activities at the San Antonio Creek West Bridge on VAFB, is not likely to jeopardize the continued existence of the tidewater goby. We have determined that the reproduction, numbers, and distribution of the species would not be reduced, and that the proposed project would not appreciably reduce the likelihood of the recovery of the tidewater goby as envisioned in the recovery plan due to the limited use of the area by tidewater gobies and the measures the Air Force proposes to avoid and minimize the potential effects.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened wildlife species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to wildlife 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. 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 the purpose of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

In June 2015, the Service finalized new regulations implementing the incidental take provisions of section 7(a)(2) of the Act. The new regulations also clarify the standard regarding when the Service formulates an Incidental Take Statement [50 CFR 402.14(g)(7)], from "...if such take may occur" to "...if such take is reasonably certain to occur." This is not a new standard, but merely a clarification and codification of the applicable standard that the Service has been using and is consistent with case law. The standard does not require a guarantee that take will result; only that the Service establishes a rational basis for a finding of take. The Service continues to rely on the best available scientific and commercial data, as well as professional judgment, in reaching these determinations and resolving uncertainties or information gaps.

California Red-legged Frog

We anticipate that some California red-legged frogs will be taken as a result of the proposed action. We expect the incidental take to be in the form of capture, injury, or mortality. We cannot quantify the precise number of California red-legged frog that may be taken as a result of the actions that the Air Force has proposed because California red-legged frogs move over time. Repeated surveys of San Antonio Creek upstream and downstream of the project area indicate the number (total, and per meter) of California red-legged frogs in a stretch of creek can vary greatly between months and years. Based on this, we are not able to reliably estimate the number of California red-legged frogs that would be taken by the proposed actions. Individuals injured or killed during translocation efforts are likely to be observed; however, mortality from other sources, including the indirect effects of translocation (e.g., unable to find food in a new location) or displacement from the action area, would be difficult to observe. In addition, some frogs may go undetected for capturing. Finding a dead or injured California red-legged frog may also be unlikely due to their cryptic coloration and potential to be quickly scavenged. The protective measures proposed by the Air Force are likely to prevent mortality or injury of most individuals.

Consequently, we are unable to reasonably anticipate the actual number of California red-legged frogs that would be taken by the proposed project; however, we must provide a level at which formal consultation would have to be reinitiated. The Environmental Baseline and Effects Analysis sections of this biological opinion indicate that adverse effects to the California red-legged frog would likely be low given the nature of the proposed activities and protective measures, and we, therefore, anticipate that take of the California red-legged frog would also be low. We also recognize that for every California red-legged frog found dead or injured, other individuals may be killed or injured that are not detected, so when we determine an appropriate take level we are anticipating that the actual take would be higher and we set the number below that level.

We anticipate that all California red-legged frogs encountered in the construction area will be captured, and that some injury or mortality will occur as a result of unpredictable circumstances. Because we are unable to reasonably anticipate the actual number of California red-legged frogs that would be captured, we are using injury or mortality during capture as a measure of the take we anticipate, as described above.

Based on the proposed project activities, detection of California red-legged frogs within the action area, and the uncertainty of how many California red-legged frogs would be captured and moved out of harm's way, we have determined that the amount of take in the form of injury or mortality during all project activities within the action area should be less than 10 percent of the total number of California red-legged frogs that are captured and relocated during all project activities. Therefore, if 20 or fewer California red-legged frogs are captured and 2 or more individuals are found dead or injured during any and all project activities, the Air Force must contact our office immediately to determine whether additional measures may be needed before proceeding with the action. If more than 20 California red-legged frogs are captured and 10 percent or more are found dead or injured during any and all project activities, the Air Force must contact our office immediately to determine whether additional measures may be needed before proceeding with the action. Project activities that are likely to cause additional take should cease during this review period because the exemption provided under section 7(o)(2) would lapse and any additional take would not be exempt from the section 9 prohibitions.

Unarmored Threespine Stickleback

We anticipate that some unarmored threespine sticklebacks could be taken as a result of the proposed action. We expect the incidental take to be in the form of capture, injury, or mortality. We cannot quantify the precise number of unarmored threespine sticklebacks that may be taken as a result of Air Force's proposed action because unarmored threespine sticklebacks are a mobile species in their aquatic environment and the abundance or distribution of the subspecies may have changed since the time of the most recent surveys in the project area. The 2008 and 2016 survey results indicate that the number of unarmored threespine sticklebacks within the project area may vary greatly between years, thus preventing us from reliably estimating the number of individuals that would be taken. In addition, individuals may not be detected due to their cryptic nature and small size. Finding a dead or injured unarmored threespine stickleback is unlikely. The protective measures proposed by the Air Force are likely to minimize injury and mortality of most individuals.

Consequently, we are unable to reasonably anticipate the actual number of unarmored threespine sticklebacks that would be taken by the proposed actions; however, we must provide a level at which formal consultation would have to be reinitiated. The Environmental Baseline and Effects Analysis sections of this biological opinion indicate that adverse effects to unarmored threespine sticklebacks would likely be low given the nature of the proposed activities and protective measures, and we, therefore, anticipate that take of unarmored threespine sticklebacks would also be low. We also recognize that for every unarmored threespine stickleback found dead or injured, other individuals may be killed or injured that are not detected, so when we determine an appropriate take level we are anticipating that the actual take would be higher and we set the number below that level.

The considerations we used in arriving at the take we anticipate include: (1) unarmored threespine stickleback populations fluctuate greatly in number of individuals; (2) dead or injured individuals are difficult to detect; (3) some unarmored threespine sticklebacks may be killed or injured by project activities; (4) minimization measures proposed by the Air Force should be effective at minimizing adverse effects to unarmored threespine sticklebacks; and (5) the level of take we anticipate must be consistent with a non-jeopardy determination, in that it cannot appreciably reduce the numbers, reproduction, or distribution of the subspecies. We anticipate that all unarmored threespine sticklebacks encountered in the construction area will be captured, and that some injury or mortality will occur as a result of unpredictable circumstances. Because we are unable to reasonably anticipate the actual number of unarmored threespine sticklebacks that would be captured, we are using injury or mortality during capture as a measure of the take we anticipate, as described above.

Based on the proposed project activities, the detection of unarmored threespine sticklebacks within the action area, and the large uncertainty of how many unarmored threespine sticklebacks would be captured and moved out of harm's way, we have determined that the amount of take in the form of injury or mortality during all project activities within the action area should be less than 10 percent of the total number of unarmored threespine sticklebacks that are captured and relocated during all project activities. Therefore, if 50 or fewer unarmored threespine sticklebacks are captured and 5 or more individuals are found dead or injured during any and all project activities, the Air Force must contact our office immediately to determine whether additional measures may be needed before proceeding with the action. If more than 50 unarmored threespine sticklebacks are captured and 10 percent or more are found dead or injured during any and all project activities, the Air Force must contact our office immediately to determine whether additional measures may be needed before proceeding with the action. Project activities that are likely to cause additional take should cease during this review period because the exemption provided under section 7(o)(2) would lapse and any additional take would not be exempt from the section 9 prohibitions.

Tidewater Goby

We anticipate that some tidewater gobies could be taken as a result of the proposed action. We expect the incidental take to be in the form of capture, injury, or mortality. We cannot quantify the precise number of tidewater gobies that may be taken as a result of the Air Force's proposed action because tidewater gobies are a mobile species in their aquatic environment and may have entered the construction area since the time of the last surveys in the project area (2016). In addition, individuals may not be detected due to their cryptic nature and small size. Finding a dead or injured tidewater goby is unlikely. The protective measures proposed by the Air Force are likely to minimize injury and mortality of most individuals.

While we are unable to reasonably anticipate the actual number of tidewater gobies that would be taken by the proposed action, we must provide a level at which formal consultation would have to be reinitiated. The Environmental Baseline and Effects Analysis sections of this biological opinion indicate that adverse effects to tidewater gobies would likely be very low given the distance of the project area from the tidewater goby's primary habitat in and near San Antonio Creek lagoon, as well as the nature of the proposed activities and protective measures, and we, therefore, anticipate that take of tidewater gobies would also be very low. We also recognize that for every tidewater goby found dead or injured, other individuals may be killed or injured that are not detected, so when we determine an appropriate take level we are anticipating that the actual take would be higher and we set the number below that level.

The considerations we used in arriving at the take we anticipate include: (1) tidewater goby populations fluctuate greatly in number of individuals; (2) dead or injured individuals are difficult to detect; (3) some tidewater gobies may be killed or injured by project activities; (4) minimization measures proposed by the Air Force should be effective at minimizing adverse effects to tidewater gobies; and (5) the level of take we anticipate must be consistent with a non-jeopardy determination, in that it cannot appreciably reduce the numbers, reproduction, or distribution of the species. We anticipate that all tidewater gobies encountered in the construction area will be captured, and that some injury or mortality will occur as a result of unpredictable circumstances. Because we are unable to reasonably anticipate the actual number of tidewater gobies that would be captured, we are using injury or mortality during capture as a measure of the take we anticipate, as described above.

Based on the proposed project activities, the uncertainty whether tidewater gobies occur within the action area, and the uncertainty of how many tidewater gobies would be captured and moved out of harm's way, we have determined that the amount of take in the form of injury or mortality during all project activities within the action area should be less than 10 percent of the total number of tidewater gobies that are captured and relocated during all project activities. Therefore, if 20 or fewer tidewater gobies are captured and 2 or more individuals are found dead or injured during any and all project activities, the Air Force must contact our office immediately to determine whether additional measures may be needed before proceeding with the action. If more than 20 tidewater gobies are captured and 10 percent or more are found dead or injured during any and all project activities, the Air Force must contact our office immediately to determine whether additional measures may be needed before proceeding with the action. Project activities that are likely to cause additional take should cease during this review period because the exemption provided under section 7(o)(2) would lapse and any additional take would not be exempt from the section 9 prohibitions.

REASONABLE AND PRUDENT MEASURES/ TERMS AND CONDITIONS

The Service's evaluation of the effects of the proposed action includes consideration of the measures developed by the Air Force, and repeated in the Description of the Proposed Action portion of this biological opinion, to minimize the adverse effects of the proposed action on the California red-legged frog, unarmored threespine stickleback, and tidewater goby. The Service believes these measures are adequate and appropriate to minimize the impacts of the incidental take of California red-legged frog, unarmored threespine stickleback, and tidewater goby. Therefore, we are not including any reasonable and prudent measures and terms and conditions in this incidental take statement. Any subsequent changes in the minimization measures proposed by the Air Force may constitute a modification of the proposed action and may warrant reinitiation of formal consultation, as specified at 50 CFR 402.16.

REPORTING REQUIREMENTS

The Air Force must provide a written report to the Service within 60 days following completion of the proposed construction activities. The reports must include the following information for California red-legged frogs, unarmored threespine sticklebacks, and tidewater gobies affected by the proposed actions – the number of individuals found, captured and relocated from the action area, injured, or killed during project activities; the dates and times of capture, relocation, injury, or mortality; the circumstances of any injuries or mortalities, if known; approximate size and life stage of individuals; and a description and map of relocation sites. The report must contain a brief discussion of any problems encountered in implementing minimization measures, results of biological surveys and sighting records, and any other pertinent information. We encourage you to submit recommendations regarding modification of or additional measures that would improve or maintain protection of the unarmored threespine stickleback or tidewater goby, while simplifying compliance with the Act.

For a minimum of 5 years or until mitigation success criteria have been met, the Air Force must provide a written annual report describing project activities during the previous year to the Service by August 31st. The reports must contain information on: (1) the type, location and timing of activities that occurred in the action area (e.g., vegetation maintenance, monitoring, etc.); (2) a brief description of the activities including equipment used; (3) the number of listed species affected and the manner in which they were affected; (4) steps taken to avoid or minimize effects; (5) for vegetation maintenance activities, a list of plant species that were cut and the area (square feet) affected, whether maintenance activities required entry into San Antonio Creek, and photos of the area both before and after maintenance; (6) for mitigation monitoring activities, monitoring results to include percent cover by plant species and survival of planted willow and container plantings; (7) the results of any surveys or observations of California red-legged frogs, unarmored threespine sticklebacks, or tidewater gobies in the previous year; (8) a record of observations of any other listed species observed during project activities; and (9) any other pertinent information.

DISPOSITION OF DEAD OR INJURED SPECIMENS

Within 1 working day of locating a dead or injured California red-legged frog, unarmored threespine stickleback, or tidewater goby, the Air Force must make initial notification by telephone and writing to the Ventura Fish and Wildlife Office in Ventura, California, (2493 Portola Road, Suite B, Ventura, California 93003, (805) 644-1766). The notification must include the time and date, location of the carcass, a photograph, cause of death if known, and any other pertinent information.

Care must be taken in handling injured animals to ensure effective treatment and care and in handling dead specimens to preserve biological material in the best possible state for later analysis. Injured animals must be transported to a qualified veterinarian. If any injured California red-legged frogs, unarmored threespine sticklebacks, or tidewater gobies survive, the Air Force should contact us regarding their final disposition.

The remains of California red-legged frogs, unarmored threespine sticklebacks, or tidewater gobies must be placed with educational or research institutions holding the appropriate State and Federal permits, such as the Santa Barbara Natural History Museum (Contact: Paul Collins, Santa Barbara Natural History Museum, Vertebrate Zoology Department, 2559 Puesta Del Sol, Santa Barbara, California 93460, (805) 682-4711, extension 321).

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to use 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 to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. We recommend that the Air Force advise Service-approved biologist(s) to relocate other native reptiles or amphibians found within work areas to suitable habitat outside of Project areas if such actions are in compliance with State laws.

2. We recommend that the Air Force advise Service-approved biologist(s) to remove non-native aquatic animals such as bullfrogs, crayfish, and brown bullhead which may prey on California red-legged frogs, unarmored threespine stickleback, and tidewater goby whenever these are detected during project monitoring activities.

3. We recommend the Air Force investigate the efficacy of capture and relocation of California red-legged frogs to determine if use of this minimization measure reduces adverse effects of project actions on the species. As part of this, information on repeat capture and behavior of individuals post-movement should be noted.

4. We recommend that the Air Force continue conducting periodic surveys of California red-legged frog, unarmored threespine stickleback, and tidewater goby on VAFB to assess populations base-wide and provide continuous evaluation of status at known and new sites.

The Service requests notification of the implementation of any conservation recommendations so we may be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats.

REINITIATION NOTICE

This concludes formal consultation on the actions outlined in the request for formal consultation dated March 10, 2016, and subsequent revisions to the project description on August 25, 2016, March 26, 2018, and April 5, 2018. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (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 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, the exemption issued pursuant to section 7(o)(2) may have lapsed and any further take could be a violation of section 4(d) or 9. Consequently, we recommend that any operations causing such take cease pending reinitiation.

If you have any questions regarding this consultation, please contact Heather Tipton of my staff at (805) 677-3326, or by electronic mail at heather_tipton@fws.gov.

Sincerely,

Stephen P. Henry
Field Supervisor

cc:
Darryl York, VAFB
Rhys Evans, VAFB

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PERSONAL COMMUNICATIONS

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On March 9, 2018, we received a draft of the Mitigation and Monitoring Plan for the San Antonio Road West Bridge Maintenance at VAFB. We received a revised version of the plan on April 5, 2018 (ManTech SRS Technologies [ManTech] 2018), which also included the removal of the previously proposed berm from the project description. Additional and clarifying information regarding the revised project description and Mitigation and Monitoring Plan was provided by the Air Force during March, April and May 2018 (R. Evans, U.S. Air Force, pers. comm. 2018a, 2018b; Lum, pers. comm. 2018a, 2018b, 2018c, 2018d).

On August 3, 2018, the Service provided the Air Force with a draft biological opinion. The Air Force (Evans, pers. comm. 2018c) provided comments on the draft biological opinion on August 7, 2018; we have incorporated the Air Force's comments into this biological opinion, as appropriate.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The Air Force proposes to repair gabions and reduce vegetation growth in the San Antonio Creek channel and its hydrologic floodplain to ensure that creek flow, under normal and flood conditions, does not undermine the stability of the bridge. The Air Force anticipates that the proposed initial activities would take approximately 90 days, although future periodic vegetation reductions may be required to maintain suitable conditions. The proposed actions would be limited to daytime hours and commence upon completion of the Air Force's responsibilities under the National Environmental Policy Act (NEPA). The proposed mitigation activities would be conducted over a 3-year period, with monitoring planned for a minimum of 5 years or until success criteria are met.

Staging Areas

The Air Force would require two staging areas to carry out the project; these staging areas would be located on opposite sides of San Antonio Road West (Figure 1). The southern staging area would be approximately 0.38 acre and the northern area approximately 0.03 acre. The Air Force would clear and grub the staging areas prior to implementing the main construction.

Water Diversion

The Air Force would dam, divert and dewater within the primary construction area to facilitate inspection, repair and/or replacement of the gabions that underline the creek. Currently, a beaver dam is located just upstream of the bridge and has resulted in a large backup of water (several feet deep and wide) that would need to be lowered, for manageability, prior to damming or diverting the creek. The Air Force anticipates lowering this upstream area to a desired water depth (approximately 2 to 3 feet) by piercing a small hole in the upstream beaver dam. A Service-approved biological monitor would be present during these activities to ensure that the rate of water release from the beaver dam is not too fast, creating excessive turbulence downstream, or causing anoxic conditions and/or the stranding of animals in any backwater pockets.

After achieving the desired water depth, the Air Force would install a dam upstream of the beaver dam, to control downstream flow, and install a dam downstream of the main construction area, to facilitate creek diversion and prevent backflow once the culvert is installed. Prior to installing the dams, a Service-approved biologist would inspect and relocate any California red-legged frogs, unarmored threespine sticklebacks, or tidewater gobies that remain in the upstream beaver pond.

After dam installation, up to two culverts (pipes) would be installed through the main construction area, one through each bay, connecting the upstream and downstream dams. The culvert pipes would also pass through the upstream beaver dam because it would be retained. Once installed, the Air Force would be able to direct San Antonio Creek to flow through either bay via the culverts. As designed, the culverts would allow the continued flow of San Antonio Creek while bypassing the area under the bridge where ground-disturbing activities are occurring. The culverts would serve to keep soil and debris out of the creek, protect sensitive species, and prevent flowing water from flooding the construction site. During these activities, a Service-approved biologist would be present to monitor for and relocate California red-legged frogs, unarmored threespine sticklebacks, or tidewater gobies. As the Air Force switches between the use of the two culverts, a Service-approved biologist would be present during these activities to monitor for and relocate California red-legged frogs, unarmored threespine sticklebacks, or tidewater gobies.

After creek diversion activities are complete, the Air Force would dewater the main construction area, as needed, to implement the proposed project. This would involve activating the dams and then using water pumps to remove any water remaining in the main construction area, after creek diversion, as well as any groundwater encountered during digging (to access the gabion baskets) and thereafter directing the water onto an adjacent agricultural field. The Air Force would design the pump system to avoid trapping or suctioning California red-legged frogs, unarmored threespine sticklebacks, or tidewater gobies as well as require a Service-approved biologist to monitor these activities. Mesh screens would be incorporated into the water pump system to reduce the possibility of animals being suctioned and trapped in the pump. Before dewatering occurs, the biologist would confirm no California red-legged frogs, unarmored threespine sticklebacks, or tidewater gobies (any life stage) are present in the water subject to dewatering. If California red-legged frogs, unarmored threespine sticklebacks, or tidewater gobies are present, the biologist would capture and relocate these individuals. Once dewatering begins, the Air Force would ensure that the dewatering rate would not exceed the ability of the biologist to confirm whether California red-legged frogs, unarmored threespine sticklebacks, or tidewater gobies are entering the pumps.

Gabions

In order to inspect and repair/replace gabions, the Air Force would remove sediment from an approximate 0.1-acre area under the bridge to facilitate the inspection and/or replacement and repair of gabions. The gabions were originally installed 3 feet below ground surface, but depth of gabions is not presently known and likely varies. After the Air Force removes the sediment, they would inspect and replace any failed or excessively worn wire fabric. If necessary, the Air Force would repair gabions by adding additional rock-fill and securely attaching wire fabric over the damaged sections.

To complete the proposed action, a crane, front loader (i.e., bobcat), shovels, soil container/bin, and dump truck would be used. The Air Force would use a crane, located in one of the staging areas, to place the bobcat and container/bin under the bridge deck, within the San Antonio Creek hydrologic floodplain. The bobcat would then be used to loosen and load sediment from large patches of sediment under the bridge deck and place it into the container. In addition, Air Force personnel with shovels would loosen and remove sediment from smaller patches. The crane would then raise the container, as filled, and transfer the sediment to a dump truck waiting in the staging area. This process would continue until the all the sediment covering the gabions is removed and all gabions are exposed.

Vegetation Reduction

The Air Force would cut riparian vegetation using mechanical and/or manual cutting (i.e., chainsaw or handsaw) within the main construction area (Figure 1), under the bridge and extending outward approximately 60 and 80 feet to the northeast and southwest of the creek, respectively, and up to 16 to 18 feet in width. The Air Force would only cut woody vegetative material with stems greater than or equal to 2 inches in diameter down to within 3 inches of the ground and/or water surface. Vegetation less than 2 inches would remain. The Air Force anticipates cutting only willow riparian vegetation (willow trees) along the banks of San Antonio Creek because those trees tend to be the woody vegetation equal to or greater than 2 inches in diameter. The Air Force would leave woody vegetation of other types and/or smaller dimensions that are scattered throughout the construction area in place. While the Air Force would carry out this work in and around San Antonio Creek and personnel may need to enter San Antonio Creek, they would not dam or divert San Antonio Creek during vegetation reduction activities. The Air Force will only clear/grub vegetation between August 16th and February 14th (i.e., outside of bird nesting season).

The Air Force would periodically inspect the erosion protection system to maintain good condition. It is possible that the Air Force would need to reduce vegetation periodically (e.g., annually), depending on the rate of regrowth and using the same criteria discussed above.

Site Restoration

The Air Force would restore the area impacted during the repairs and maintenance to the bridge during the final stages of all construction activities as construction machinery and materials are removed. The Air Force would remove all surplus and waste materials from the project area, unless they are also required for the restoration effort. To the extent feasible and practicable, the Air Force would restore the site contours, river channel, and habitat types to pre-construction conditions, except directly under the bridge where maintenance activities would occur. The Air Force would stabilize all exposed soil areas on the banks, upland staging, and access areas with native vegetation.

An upland native grass seed mix that is approved by the base botanist would be applied to upland areas. Weed-free mulch would be used to protect the seed and provide temporary stabilization. Once the native grassland is established, the Air Force would install native shrub container plantings in the upland areas. Depending on availability, the Air Force may use irrigation in upland areas as needed to achieve the establishment of native vegetation. Irrigation water would either come from a municipal source or water pumped from the creek. If using water from San Antonio Creek, the Air Force would pump water from the creek into containers for hand-watering or into a drip irrigation system. A qualified biologist would place the irrigation pump intake in a 30 gallon barrel with fine mesh (0.125 inch) screened holes to protect listed species from entering the pump intake.

Wetland Mitigation

Due to the nature of the proposed action, the requirement for riparian vegetation removal and subsequent maintenance to keep vegetation cleared under the bridge, State-required mitigation to compensate for impacts to California State Waters would take place off site. The proposed mitigation area consists of 0.5 acres located approximately 0.75 mile west of the proposed project area on the south side of San Antonio Creek between the existing willow riparian zone and adjacent farm field (Figure 2). The Air Force proposes to enhance 0.48 acre of willow riparian habitat by conducting invasive plant treatments and other site preparation activities followed by revegetation with native plants, including willows, over a 3-year period. The Mitigation and Monitoring Plan (ManTech 2018) and additional correspondence with Air Force staff (Lum, pers. comm. 2018a, 2018d) contain additional details of the following proposed activities.

<u>Access</u>

Two access routes are proposed to the mitigation site (Figure 2). The western access route is an old, slightly overgrown agricultural access road, measuring between 5 and 6 feet wide and approximately 0.5 mile long, which traverses sparse riparian woodland. The eastern route measures between 5 and 6 feet wide and approximately 1 mile long and traverses sparse central coast scrub, non-native broadleaf, and non-native grassland; it is not a pre-existing road or trail. Only minor vegetation trimming using hand tools will be required to access the mitigation site.

Site Preparation

Because the proposed mitigation site is currently heavily vegetated by whitetop (*Lepidium draba*) and black mustard (*Brassica nigra*), site preparation would require broadleaf-specific herbicide treatment with chlorsulfuron (tradename Telar®XP; proposed application rate equal to 1-3 ounces/acre) for 2 consecutive years. An initial treatment of the entire mitigation area would be conducted in the late dry season (August – October), followed by three to four spot treatments per year, for 2 years, as needed. In addition, harrowing and seed application would be conducted during the first years' winter, with a follow-up seed application during the winter of the second year, and two spot herbicide treatments of non-native grasses with glyphosate (tradename Rodeo®; proposed concentration equal to 1.5 percent) as needed. An oil-based surfactant (e.g., Agri-dex; proposed concentration equal to 1 percent) would be used with both chlorsulfuron and glyphosate for adhesion, spread, and penetration of the active ingredients; a spray indicator dye would also be used. Harrowing would be accomplished by dragging a rigid toothed harrow pulled behind a six-wheel drive utility terrain vehicle (e.g., Polaris Ranger). Only native species would be used in the seed application which would include a mixture of foothill needle grass (*Stipa lepida*), purple needle grass (*Stipa pulchra*), California brome (*Bromus carinatus*), meadow barley (*Hordeum brachyantherum*), and small fescue (*Festuca microstachys*). Seeding is expected to reduce re-infestation of the site by the invasive broadleaf whitetop without compromising the establishment of the willow pole plantings that will be installed in year three of the mitigation. Glyphosate treatments would be conducted using an ultra-low volume herbicide applicator to ensure that only the target species receive herbicide treatment while minimizing damage to native grasses.

Plantings

Willow pole planting and container planting of riparian plants such as California blackberry (*Rubus ursinus*), elderberry (*Sambucus nigra*), and giant rye (*Elymus condensatus*) would occur during the winter of the third year. Willow cuttings would be harvested in the vicinity of San Antonio Creek from areas within the San Antonio Creek riparian corridor as approved by a 30 CES/CEI biologist. Willow cuttings would be collected and planted in January or early February, when the willows are dormant and at a time that would take advantage of winter rains. No more than 25 percent of a single tree's biomass would be harvested. Willows would be installed using one or more of the following methods:

1. Water jet installation: If site conditions are dry and allow for equipment, a truck and trailer or water pump hose would be used to liquefy the soil to create a hole that is 1 inch in diameter, or approximately the diameter of the willow pole. Willow cuttings will be installed to a depth of the soil's capillary fringe; using this method, willow cuttings will be installed at a depth of 3 to 4 feet.

2. Hand-held power auger: This method could be used if a water truck or trailer cannot access the site. The auger would be used to drill a hole 4 to 6 inches in diameter and 2.5 to 4.5 feet deep. One to three willow cuttings would be set in each hole. The exposed hole

would then be filled with a slurry of muddy soil to ensure good soil contact with the planting.

3. Steel Rod: A hole would be manually driven with a 5-foot steel rod (0.75-inch diameter) to approximately 3 to 4 feet in depth, depending on soil conditions. The willow cuttings would then be installed in the hole, and the soil would be compacted around the willow stem.

Water used during the pole planting installation would be supplied from a water tank on a nearby vehicle or pumped from an open section of the creek. All pumping would occur with an onsite Service-approved biological monitor present to ensure that California red legged frog, unarmored threespine stickleback, and tidewater goby are not impacted. A wire screen (no larger than 0.125-inch mesh) would be placed around the pump inlet to prevent the entrapment of any living organisms. Subsequent irrigation for maintenance purposes would follow the above procedures and would continue on an as-needed basis to promote downward development of the root systems.

Holes for container plants would be dug manually with a hand trowel to approximately 6 to 12 inches in depth and backfilled with native soil. To protect plants from herbivory and browsing, all container plants will be installed with a wire mesh cage placed around the root ball and a fence wire fabricated cage to protect the body of the plant.

To reduce competition for newly planted willows and container plantings, spot treatments (using chlorsulfuron and/or glyphosate) of whitetop and other non-native plants would be applied as needed.

Follow-up Herbicide Treatments

The final activities associated with site mitigation would include monitoring and spot treatment of whitetop, black mustard, and other non-native invasive plants as needed. Treatments would be conducted during the last 6 months of the third year (expected to be from January through mid-June).

Monitoring

The Air Force would monitor the site for a minimum of 5 years or until success criteria are met. Monitoring would be conducted using walking transects following the California Native Plant Society's Rapid Vegetation Assessment methodology. Monitoring would be conducted at both the mitigation site and a reference site which would be selected in nearby intact native habitat. The following success criteria would be applied to determine if the site has achieved restoration goals:

1. Native cover within the mitigation site is at or above that of the reference site.
2. Non-native cover within the mitigation site is at or below that of the reference site.
3. Evidence that the site is sustainable by showing signs of regeneration (progeny and new growth) of healthy plants, a low mortality rate, and resistance to invasion by weeds.

Avoidance and Minimization Measures

To minimize adverse effects to California red-legged frog, unarmored threespine stickleback and tidewater goby, the Air Force would implement the following measures to minimize and/or avoid potential effects on listed species. To some degree, we have collated protective measures from throughout the BA (Air Force 2016), the programmatic biological opinion (Service 2015) and the Mitigation and Monitoring Plan (ManTech 2018), and changed the wording of some measures to improve clarity, but we have not changed the substance of the measures the Air Force has proposed. The BA (Air Force 2016), programmatic biological opinion (Service 2015), Mitigation and Monitoring Plan (ManTech 2018), and additional correspondence with Air Force staff (Evans, pers. comm. 2016, 2018a, 2018b; Lum, pers. comm. 2018a) contain additional details of the following proposed protective measures.

1. A Service-approved biologist will be present for all project activities that may affect listed species to implement and/or oversee the implementation of the avoidance and minimization measures in this biological opinion.
2. The Air Force will provide the Service-approved biologist with a schedule of planned construction activities at least 48 hours in advance.
3. Prior to the commencement of construction and mitigation activities, a Service-approved biologist will conduct environmental sensitivity training for all project personnel to provide an overview on the listed species that may be encountered during the project, applicable regulatory policies and provisions regarding their protection, and the avoidance and minimization measures to be implemented to protect these species. The biologist will brief project personnel on the reporting process in the event that an inadvertent injury occurs to a listed species during project activities. At a minimum, project personnel must report any injury to the on-site biologist.
4. A Service-approved biologist will monitor, capture and relocate California red-legged frogs (adults and tadpoles) immediately prior to and during project activities including site preparation (i.e., clearing and grubbing staging areas), dam construction, culvert installation, dewatering, and general construction activities. The Service-approved biologist will search all potential hiding spots for California red-legged frogs. If any life stage of the California red-legged frog is found and these individuals are likely to be killed or injured by work activities, the approved biologist will be allowed sufficient time to move them from the site before work begins.

5. Prior to construction activities in the main construction area, the Air Force will install temporary exclusionary fencing along the edges. A Service-approved biologist will monitor the area daily to relocate California red-legged frogs that enter the main construction area. The Air Force may incorporate some attractant (i.e., temporary shelter feature) at the edges of the exclusionary fencing to aid in the capture and relocation of any California red-legged frogs that enter the main construction area.

6. Prior to installing the dams, a Service-approved biologist would inspect, capture and relocate any California red-legged frogs that remain in the upstream beaver pond. In addition, the Service-approved biological monitor will be present during damming activities to ensure that the rate of water release from the beaver dam is not too fast, creating excessive turbulence downstream, or causing anoxic conditions and/or the stranding of animals, including the California red-legged frog, in any backwater pockets.

7. Prior to dewatering, a Service-approved biologist will inspect, capture and relocate any California red-legged frogs that remain in the main construction area. In addition, the Air Force will design the pump system to avoid trapping or suctioning California red-legged frogs. Finally, dewatering will be conducted at a rate not to exceed the ability of the biologist to visually confirm whether California red-legged frogs are entering the pumps.

8. The Service-approved biologist will relocate any California red-legged frogs that are found the shortest distance possible to a location that contains suitable habitat and that will not be affected by activities associated with the proposed project; to the extent practicable, the relocation site will be in the same drainage.

9. Only approved biologists will participate in activities associated with the capture, handling and monitoring of California red-legged frogs. All personnel working in the main construction area will adhere to the practices listed in the Declining Amphibian Populations Task Force Fieldwork Code of Practice (Service 2002).

10. No more than two days prior to beginning project activities, the Air Force will install nets with mesh no larger than 0.125-inch to exclude unarmored threespine sticklebacks and tidewater gobies from the project area. These nets will be set up within the main channel of the creek 50 feet upstream and 50 feet downstream of the project area, and will be continually monitored and maintained to prevent them from becoming clogged. These nets will be removed immediately following the completion of project activities.

11. Prior to any construction activities, including dam construction, culvert installation, dewatering, and general construction activities, a Service-approved biologist will survey the project area for the presence of unarmored threespine sticklebacks and tidewater gobies of any life stage. A Service-approved biologist will relocate all unarmored threespine sticklebacks and tidewater gobies observed within the project site to suitable habitat immediately downstream of the project site.

12. The active creek channel will be diverted through culverts passing through the project site to ensure continued flow and allow species to travel through the pipes and around the project area.

13. The Air Force will divert San Antonio Creek at least 14.1 feet away from construction activities, if feasible based on site conditions, to minimize impacts to unarmored threespine sticklebacks from noise and vibrations to the maximum extent practicable.

14. The dewatering intake will be screened with 0.125-inch mesh to prevent unarmored threespine sticklebacks and tidewater gobies from entering the system. A Service-approved biologist will be present during and after the dewatering to relocate any unarmored threespine sticklebacks and tidewater gobies that enter the work area prior to construction.

15. A Service-approved biologist will monitor the project area every work day, including the exclusion nets, until all unarmored threespine sticklebacks and tidewater gobies are removed from the work site. At that point, the Service-approved biologist may appoint project personnel to periodically monitor the exclusion nets for the duration of the project; however, the Service-approved biologist must be on-call for immediate assistance, if needed, until project completion.

16. Surface water pump intakes, including any used for irrigation, will be completely screened with 0.125-inch mesh to prevent entrainment of unarmored threespine sticklebacks and tidewater gobies.

17. The Air Force will ensure equipment operating within the hydrologic floodplain/riparian area is placed on protective mats to prevent contamination of the creek bed. The Air Force will require vehicles and equipment to be maintained and stored outside of the hydrologic floodplain, in the staging areas, to avoid the potential for inadvertent spills into the creek and riparian areas. All equipment will be fueled in pre-designated areas, outside of the live stream and on impervious surfaces to the maximum extent practicable, and spill containment materials will be placed around the equipment before refueling. Stationary equipment (e.g., cranes) will be outfitted with drip pans and hydrocarbon absorbent pads. If it is necessary to refuel or repair equipment within the riparian corridor, a Service-approved biologist will monitor activities. Spill containment equipment will be present at all project sites where fuels or other hazardous substances, including herbicides, are brought to the site. Qualified personnel will conduct daily inspections of the equipment and the staging and maintenance areas for leaks of hazardous substances.

18. A Service-approved biologist will be present during periodic vegetation reduction activities, which may require entry into San Antonio Creek.

19. Prior to cutting riparian vegetation, the Air Force contractor will pre-tag vegetation that is more than 2-inches so that the Air Force botanist and biologists can ensure project effects do not exceed those analyzed and authorized in this biological opinion. Plants less than 2-inches in diameter will not be cut because they do not present a risk of harm to the bridge.

20. Prior to use of mitigation access routes, a Service-approve biologist will clear the routes of any debris that could shelter California red-legged frogs.

21. No vehicle traffic will occur on a mitigation access route if surface water is present unless the route is pre-cleared by a Service-approved biologist.

22. No off-road access or herbicide application will occur in California red-legged frog habitat during periods of precipitation.

23. All herbicides used during mitigation activities will be applied in accordance with the herbicide label and Department of Defense (DoD) recommendations. All applications within or adjacent to aquatic resources will use appropriately labeled products only. All herbicides applied will be DoD-approved.

24. Chlorsulfuron and glyphosate usage in and adjacent to aquatic features will adhere to the following special precautions:
    a. Herbicides will be used with the surfactant Agri-Dex.
    b. No herbicide will be used within 15 feet of permanent aquatic habitats or ephemeral aquatic habitats when surface water or surface saturation of soils is present.
    c. No herbicide will be used in permanent or ephemeral aquatic habitats 24 hours before or after a significant precipitation event (0.1 inch or more).
    d. No herbicide will be applied directly to water.

25. Herbicide mixing will be conducted at least 250 feet from sensitive habitat.

26. All herbicide application will occur during daylight hours.

27. Spraying of herbicides will only be conducted when wind speeds do not exceed 10 miles per hour or as indicated by label instructions.

28. No overnight staging of equipment will occur at the mitigation site.

29. All trash, including food waste, will be properly disposed of offsite outside of sensitive habitat to prevent environmental degradation and avoid attracting mesocarnivores.

30. The Air Force will clean all equipment and vehicles of weed seeds prior to use in the project area to prevent the introduction of weeds. Prior to transport, any skid plates must be removed and cleaned. If equipment or vehicles move from one watershed to another

on base, the Air Force will clean wheels, undercarriages, and bumpers prior to traveling. If there is no nearby wash facility or means to collect on site and dispose of rinse water to a sewer is available, the Air Force will air blast equipment vehicles on site.

31. The Air Force will remove non-native invasive predators encountered during survey efforts (e.g., bullfrogs, crayfish, brown bullheads).

32. The Air Force will request approval of any biologist it wishes to employ as a Service-approved biologist at least 30 days prior to any such activities being conducted. In the request, the Air Force will include the name of the biologist(s), qualifications, references, for which species the biologist(s) is requesting authorization to monitor, and what monitoring activities the biologist(s) would complete.

ANALYTICAL FRAMEWORK FOR THE JEOPARDY DETERMINATION

Section 7(a)(2) of the Endangered Species Act requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of listed species. "Jeopardize the continued existence of" means "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02).

The jeopardy analysis in this biological opinion relies on four components: (1) the Status of the Species, which describes the range-wide condition of the California red-legged frog, unarmored threespine stickleback and tidewater goby, the factors responsible for that condition, and survival and recovery needs; (2) the Environmental Baseline, which analyzes the condition of the California red-legged frog, unarmored threespine stickleback and tidewater goby in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the California red-legged frog, unarmored threespine stickleback and tidewater goby; (3) the Effects of the Action, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the California red-legged frog, unarmored threespine stickleback and tidewater goby; and (4) the Cumulative Effects, which evaluates the effects of future, non-Federal activities, that are reasonably certain to occur in the action area, on the California red-legged frog, unarmored threespine stickleback and tidewater goby.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed Federal action in the context of the current status of the California red-legged frog, unarmored threespine stickleback and tidewater goby, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to reduce appreciably the likelihood of both the survival and recovery of these species in the wild by reducing the reproduction, numbers, and distribution of that species.

STATUS OF THE SPECIES

California Red-legged Frog

Legal Status

The California red-legged frog was federally listed as threatened on May 23, 1996 (61 Federal Register (FR) 25813). The Service designated revised critical habitat for the California red-legged frog on March 17, 2010 (75 FR 12816). VAFB lands were excluded from the revised designated critical habitat under section 4(b)(2) of the Act due to potential impacts on national security (75 FR 12816); thus, critical habitat will not be discussed further in this biological opinion. We issued a recovery plan for the species on May 28, 2002 (Service 2002).

Natural History

The California red-legged frog uses a variety of habitat types, including various aquatic systems, riparian, and upland habitats. They have been found at elevations ranging from sea level to approximately 5,000 feet. California red-legged frogs use the environment in a variety of ways, and in many cases they may complete their entire life cycle in a particular area without using other components (i.e., a pond is suitable for each life stage and use of upland habitat or a riparian corridor is not necessary). Populations appear to persist where a mosaic of habitat elements exists, embedded within a matrix of dispersal habitat. Adults are often associated with dense, shrubby riparian or emergent vegetation and areas with deep (greater than 1.6 feet) still or slow-moving water; the largest summer densities of California red-legged frogs are associated with deep-water pools with dense stands of overhanging willows (*Salix* spp.) and an intermixed fringe of cattails (*Typha latifolia*) (Hayes and Jennings 1988).

California red-legged frog breed in aquatic habitats; larvae, juveniles, and adult frogs have been collected from streams, creeks, ponds, marshes, deep pools and backwaters within streams and creeks, dune ponds, lagoons, and estuaries. They frequently breed in artificial impoundments such as stock ponds, given the proper management of hydro-period, pond structure, vegetative cover, and control of exotic predators. While frogs successfully breed in streams and riparian systems, high spring flows and cold temperatures in streams often make these sites risky egg and tadpole environments. An important factor influencing the suitability of aquatic breeding sites is the general lack of introduced aquatic predators. Accessibility to sheltering habitat is essential for the survival of California red-legged frogs within a watershed, and can be a factor limiting population numbers and distribution. Hayes and Tennant (1985) found juveniles to seek prey diurnally and nocturnally, whereas adults were largely nocturnal.

During periods of wet weather, starting with the first rains of fall, some individual California red-legged frogs may make long-distance overland excursions through upland habitats to reach breeding sites. In Santa Cruz County, Bulger et al. (2003) found marked California red-legged frogs moving up to 1.7 miles through upland habitats, via point-to-point, straight-line migrations without apparent regard to topography, rather than following riparian corridors. Most of these overland movements occurred at night and took up to 2 months. Similarly, in San Luis Obispo County, Rathbun and Schneider (2001) documented the movement of a male California red-legged frog between two ponds that were 1.78 miles apart in less than 32 days; however, most California red-legged frogs in the Bulger et al. (2003) study were non-migrating frogs and always remained within 426 feet of their aquatic site of residence (half of the frogs always stayed within 82 feet of water). Rathbun et al. (1993) radio-tracked three California red-legged frogs near the coast in San Luis Obispo County at various times between July and January; these frogs also stayed rather close to water and never strayed more than 85 feet into upland vegetation. Scott (2002) radio-tracked nine California red-legged frogs in East Las Virgenes Creek in Ventura County from January to June 2001, which remained relatively sedentary as well; the longest within-channel movement was 280 feet and the farthest movement away from the stream was 30 ft. On VAFB, Christopher (2018) radio-tracked 26 California red-legged frogs at four former wastewater treatment settling ponds and found that the vast majority of observations were in, or within approximately 17 feet, of water. The longest distance between water and a land observation was 141 feet, and the greatest distance undertaken by a frog between breeding ponds was 686 feet (Christopher 2018).

After breeding, California red-legged frogs often disperse from their breeding habitat to forage and seek suitable dry-season habitat. Cover within dry-season aquatic habitat could include boulders, downed trees, and logs; agricultural features such as drains, watering troughs, spring boxes, abandoned sheds, or hay-ricks, and industrial debris. California red-legged frogs use small mammal burrows and moist leaf litter (Rathbun et al. 1993; Jennings and Hayes 1994); incised stream channels with portions narrower and deeper than 18 inches may also provide habitat (61 FR 25814). This type of dispersal and habitat use, however, is not observed in all California red-legged frogs and is most likely dependent on the year-to-year variations in climate and habitat suitability and varying requisites per life stage.

Although the presence of California red-legged frogs is correlated with still water deeper than approximately 1.6 ft, riparian shrubbery, and emergent vegetation (Jennings and Hayes 1994), California red-legged frogs appear to be absent from numerous locations in the species' historical range where these elements are well represented. The cause of local extirpations does not appear to be restricted solely to loss of aquatic habitat. The most likely causes of local extirpation are thought to be changes in faunal composition of aquatic ecosystems (i.e., the introduction of non-native predators and competitors) and landscape-scale disturbances that disrupt California red-legged frog population processes, such as dispersal and colonization. The introduction of contaminants or changes in water temperature may also play a role in local extirpations. These changes may also promote the spread of predators, competitors, parasites, and diseases.

Rangewide Status

The historical range of the California red-legged frog extended coastally from southern Mendocino County and inland from the vicinity of Redding, California, southward to northwestern Baja California, Mexico (Storer 1925, Jennings and Hayes 1985; Shaffer et al.

2004). The California red-legged frog has sustained a 70 percent reduction in its geographic range because of several factors acting singly or in combination (Davidson et al. 2001). Over-harvesting, habitat loss, non-native species introduction, and urban encroachment are the primary factors that have negatively affected the California red-legged frog throughout its range (Jennings and Hayes 1985, Hayes and Jennings 1988). Habitat loss and degradation, combined with over-exploitation and introduction of exotic predators, were important factors in the decline of the California red-legged frog in the early to mid-1900s.

Continuing threats to the California red-legged frog include direct habitat loss due to stream alteration and loss of aquatic habitat, indirect effects of expanding urbanization, competition or predation from non-native species including the bullfrog, catfish (*Ictalurus* spp.), bass (*Micropterus* spp.), mosquito fish (*Gambusia affinis*), red swamp crayfish (*Procambarus clarkii*), and signal crayfish (*Pacifastacus leniusculus*). Chytrid fungus (*Batrachochytrium dendrobatidis*) is a waterborne fungus that can decimate amphibian populations, and is considered a threat to California red-legged frog populations.

A 5-year review of the status of the California red-legged frog was initiated in May 2011, but has not yet been completed.

Recovery

The final recovery plan for the California red-legged frog (Service 2002) states that the goal of recovery efforts is to reduce threats and improve the population status of the California red-legged frog sufficiently to warrant delisting. The recovery plan describes a strategy for delisting, which includes: (1) protecting known populations and reestablishing historical populations; (2) protecting suitable habitat, corridors, and core areas; (3) developing and implementing management plans for preserved habitat, occupied watersheds, and core areas; (4) developing land use guidelines; (5) gathering biological and ecological data necessary for conservation of the species; (6) monitoring existing populations and conducting surveys for new populations; and (7) establishing an outreach program. The California red-legged frog would be considered for delisting when:

1. Suitable habitats within all core areas are protected and/or managed for California red-legged frogs in perpetuity, and the ecological integrity of these areas is not threatened by adverse anthropogenic habitat modification (including indirect effects of upstream/downstream land uses).

2. Existing populations throughout the range are stable (i.e., reproductive rates allow for long-term viability without human intervention). Population status will be documented through establishment and implementation of a scientifically acceptable population monitoring program for at least a 15-year period, which is approximately 4 to 5 generations of the California red-legged frog. This 15-year period should coincide with an average precipitation cycle.

3. Populations are geographically distributed in a manner that allows for the continued existence of viable metapopulations despite fluctuations in the status of individual populations (i.e., when populations are stable or increasing at each core area).

4. The species is successfully reestablished in portions of its historical range such that at least one reestablished population is stable/increasing at each core area where California red-legged frog are currently absent.

5. The amount of additional habitat needed for population connectivity, recolonization, and dispersal has been determined, protected, and managed for California red-legged frogs.

The recovery plan identifies eight recovery units based on the assumption that various regional areas of the species' range are essential to its survival and recovery. The recovery status of the California red-legged frog is considered within the smaller scale of recovery units as opposed to the overall range. These recovery units correspond to major watershed boundaries as defined by U.S. Geological Survey (USGS) hydrologic units and the limits of the range of the California red-legged frog. The goal of the 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 California 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 support long-term viability within existing populations. This management strategy allows 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 the California red-legged frog.

Unarmored Threespine Stickleback

Legal Status

The Service listed the unarmored threespine stickleback as endangered on October 13, 1970 (35 FR 16047). The Service proposed critical habitat for the unarmored threespine stickleback on November 17, 1980 (45 FR 76012), in two reaches of the Santa Clara River, and single reaches of both San Francisquito Creek and San Antonio Creek. In 2002, the Service determined that critical habitat should not be designated, primarily due to the large number of outstanding non-discretionary critical habitat designations at that time (67 FR 58580). The unarmored threespine stickleback is also a fully protected species under California law (see California Fish and Game Code, Section 5515 (b)(9)). The Service first issued a recovery plan for the unarmored threespine stickleback in 1977, which was revised in December 1985 (Service 1985). We completed a 5-year review for the subspecies in May 2009 (Service 2009).

Natural History

The unarmored threespine stickleback is a small (up to 2.36 inches), scaleless, freshwater fish inhabiting slow moving reaches or quiet water microhabitats of streams and rivers. Favorable habitats for the unarmored threespine stickleback are usually shaded by dense and abundant vegetation. In more open reaches, algal mats or barriers may provide refuge for the subspecies. Unarmored threespine sticklebacks feed primarily on benthic insects, small crustaceans, and snails, and to a lesser degree, on flat worms, nematodes, and terrestrial insects. They reproduce throughout the year, but breeding activity is reduced from October to January. Reproduction occurs in areas with adequate aquatic vegetation and gentle flow of water where males establish and vigorously defend territories. The male builds a nest of fine plant debris and algal strands and courts all females that enter his territory; a single nest may contain the eggs of several females. Following spawning, the male defends the nest and eventually the newly hatched fry. The smallest specimens of unarmored threespine sticklebacks captured outside of a nest are approximately 0.40 inch standard length. Unarmored threespine stickleback populations tend to decline due to natural mortality and low recruitment during the winter, and most individuals live for only 1 year, rarely surviving to 2 or 3 years (Moyle 2002, Swift 1999).

Rangewide Status

Unarmored threespine sticklebacks were historically distributed throughout southern California, including low-gradient portions of the Los Angeles, San Gabriel, and Santa Ana Rivers, and from a few localities in Santa Barbara County. At the time of listing in 1970, however, they were only known to occur in the upper reaches of the Santa Clara River, including Soledad Canyon (Baskin 1974). Current extant populations are restricted to the upper Santa Clara River and its tributaries in Los Angeles and Ventura Counties, San Antonio Creek on VAFB in Santa Barbara County, Shay Creek (tributary to Baldwin Lake) in San Bernardino County, and San Felipe Creek in San Diego County. The San Felipe Creek population is the result of transplantations in the 1970s and 1980s. Additional transplants in various locations in southern California were attempted, but all failed, including a transplanted population in the Mohave River that introgressed with partially-armored threespine stickleback (Swift et al. 1993). In the Santa Maria River drainage in Santa Barbara County, populations previously regarded as the unarmored threespine stickleback were replaced by the partially armored threespine stickleback and by intermediate types through competition, introgressive hybridization or both, following the introduction of trout for a recreational fishery that introduced partially-armored stickleback to the watershed (Moyle 2002).

As summarized in the 2009 5-year review for the subspecies, genetic studies indicate that the Santa Clara River fish are genetically distinct from the San Antonio Creek fish (which are more closely related to the coastal partially armored stickleback (*Gasterosteus aculeatus microcephalus*), and from the San Bernardino fish (which are genetically unique and may warrant taxonomic revision) (Service 2009). Within the Santa Clara River, there are different genetic strains of unarmored threespine sticklebacks. The unarmored threespine sticklebacks in Soledad Canyon are distinct from the unarmored threespine sticklebacks in Bouquet Canyon, San Francisquito Canyon, and the Valencia-Newhall Ranch area. All unarmored threespine sticklebacks are also distinct from the partially armored stickleback in the lower Santa Clara River in Ventura County below the dry Piru gap (Richmond et al. 2014). The unarmored threespine sticklebacks in Bouquet Canyon have become hybridized with partially armored sticklebacks from the lower Santa Clara River below the Piru Gap. In 2014, the Valencia-Newhall area fish were translocated into San Francisquito Canyon due to drying up of habitat as a result of the drought. The former San Francisquito Canyon population had become extirpated as a result of the Copper Fire in 2002, and subsequent high flows in 2005. In 2017, unarmored threespine sticklebacks from Soledad Canyon were translocated to Fish Canyon Creek in the Angeles National Forest due to the 2016 Sand Fire and the subsequent rain event. Thus, there are currently two unique genetic strains of pure unarmored threespine sticklebacks in the Santa Clara River Watershed remaining, fish in Soledad Canyon/Fish Canyon Creek and fish in San Francisquito Canyon/Valencia-Newhall.

At the time of listing, there was no abundance data for the unarmored threespine stickleback. Even now, no range-wide, long-term monitoring program is currently being conducted for the subspecies, and data on population dynamics are limited. Despite the availability of survey methods that can estimate constant variability in local abundance (i.e., annual and seasonal changes in distribution and abundance hamper efforts to estimate population size for this short-lived species), estimates of population size are generally lacking due to minimal survey efforts. Unarmored threespine stickleback populations also vary with between-year changes in environmental conditions, such as drought. While unarmored threespine sticklebacks may be seasonally abundant in most years, the subspecies' restricted distribution renders it vulnerable to catastrophic extirpation.

The unarmored threespine stickleback faces a series of threats that include channelization and other habitat modifications associated with urbanization, agricultural practices, and recreation; agricultural, industrial, and municipal water pollution; stream flow alterations caused by water diversion and ground water pumping; the introduction of competing and predatory species; and hybridization with partially armored threespine stickleback.

Channelization and other habitat modifications result in the destruction and degradation of unarmored threespine stickleback habitat. Rivers and streams that once supported unarmored threespine sticklebacks have been either severely altered or reduced for the most part to concrete-lined drains. Stream channelization can diminish the side channels and backwater pool habitat used by unarmored threespine stickleback, and by scouring of stream channels which may eliminate or reduce the substrate needed for nests (Baskin 1974). The population of unarmored threespine sticklebacks in Bouquet Canyon (part of the Santa Clara River drainage) currently faces the threat of channelization. Irrigation of farm crops currently causes discharges of silt in the Santa Clara River and San Antonio Creek drainages, resulting in the destruction of unarmored threespine stickleback habitat by covering the substrate of pools and backwater channels with fine sediment or completely filling them in. Unmanaged off-road vehicle (ORV) use can also increase siltation in pools as well as damage riparian vegetation, compact soils, disturb the water in stream channels, and even crush unarmored threespine stickleback. In recent times this activity has grown and pressure to find new locations to drive these ORVs has increased. ORV activities continue to be a threat to the unarmored threespine stickleback in Soledad Canyon (part of the Santa Clara River drainage) and the Santa Clara River despite efforts by law enforcement to stop trespassing into the Santa Clara River. In Soledad Canyon, ORV use occurs on private property within the creek bed. Habitat degradation can also occur when people or livestock trample stream banks and sand or gravel bars, increasing sedimentation and damaging emergent vegetation that provide food and shelter for unarmored threespine stickleback.

Water quality conditions in the Santa Clara River drainage, San Antonio Creek, and Shay Creek are all compromised by urbanization and agricultural activities. Nonpoint-source pollution includes storm water run-off through human-made drainage systems that convey large amounts of organic matter, pesticides, fertilizers, heavy metals, oil and grease and other hydrocarbons, and other debris into streams. Agricultural sources of pollution include runoff from fields where fertilizers have been used on crops, and runoff from areas containing large concentrations of livestock and their waste. In addition, discharge of chlorine or other chemicals into creeks from the drainage of treated recreational water bodies (as required by the Los Angeles County Health Department) is a potential concern.

Habitat for the unarmored threespine stickleback exists in San Francisquito Creek at its confluence with Drinkwater Canyon in the Angeles National Forest, which is maintained by water releases from a reservoir in Drinkwater Canyon. The Los Angeles Department of Water and Power releases 1 cubic foot per second of water throughout the year to satisfy the rights of private property owners downstream of the reservoir; however, the flow is temporarily terminated when the pipes are cleaned. Without careful management and timing of discharges, any remaining unarmored threespine stickleback in upper San Francisquito Canyon could be lost.

Pumping of groundwater, especially during dry years, is also a severe threat to unarmored threespine stickleback. Such problems exist in the upper San Antonio drainage, the Santa Clara River drainage (including Soledad Canyon and Bouquet Canyon), and Shay Creek because of domestic and agricultural use.

Introduced aquatic vertebrates and invertebrates are predators on one or more of the life stages of unarmored threespine stickleback. These include African clawed frogs (*Xenopus laevis*), bullfrogs, red swamp crayfish, signal crayfish, and various species of fishes, especially bass, catfish, mosquito fish, and sunfish (*Lepomis* spp.). The only location currently occupied by unarmored threespine sticklebacks that is not compromised by non-native predators or competitors is Shay Creek. We are not currently aware of any attempts to manage vertebrate or invertebrate populations of non-native species within locations occupied by the unarmored threespine stickleback. In addition, certain non-native species may serve as vectors for the Ich parasite (*Ichthyopthirius multifilis*) that could infect populations of unarmored threespine stickleback. Populations of unarmored threespine stickleback in the Angeles National Forest were severely affected by the introduction of Ich in 1995 (U.S. Forest Service 2000). Introduced goldfish (*Carasius auratus*) were suspected to be the source of the Ich infestation. In addition, the Santa Clara River drainage, including Soledad Canyon, Bouquet Canyon Creek, and San Francisquito Creek, and portions of the San Antonio Creek drainage are impacted by non-native *Arundo donax* (giant reed). Coffman (2007) notes that *Arundo donax* threatens river ecosystems by affecting natural river processes such as lowering groundwater tables, decreasing surface water levels in streams, increasing the potential for wildfires, and the loss of animal and plant diversity.

The 2009 5-year review for the unarmored threespine stickleback states that the subspecies continues to be threatened by: agricultural, industrial, and municipal water pollution; channelization and other habitat modifications associated with urbanization; stream flow alterations caused by water diversion; groundwater pumping; introduction of competing and predatory species; hybridization with partially armored threespine stickleback; drought; and stochastic extinction. Although some efforts have been and are being made to acquire habitat for the species, little has been done so far, and none of the recovery criteria in the recovery plan for the unarmored threespine stickleback (Service 1985) have been fully met. Based on these ongoing threats and the small number and isolation of existing populations, the 5-year review concludes that the unarmored threespine stickleback continues to be threatened with extinction throughout all or a significant portion of its range.

Recovery

The revised recovery plan for the unarmored threespine stickleback designated three areas as very important for the survival and recovery of the subspecies: (1) two disjunct reaches of the Santa Clara River in Los Angeles County; (2) a short reach of San Francisquito Canyon; and (3) the lowermost 8.4 miles in San Antonio Creek in Santa Barbara County (Service 1985).

The recovery plan states that the subspecies could be considered recovered when: (1) habitat conditions for each of the known remnant populations have been stabilized at or near historical carrying capacities; (2) the other known threats have been addressed in a manner that assures the continued existence of these populations; and (3) at least five self-sustaining populations have been maintained within the historical range of unarmored threespine stickleback for a period of 5 consecutive years without significant threats to their continued existence.

The recovery plan also states that to reach the point of recovery, the known extant populations must be preserved and protected, additional populations will need to be successfully reintroduced into historical habitats, the spread of exotic organisms will need to be controlled, and degraded habitats will need to be restored and maintained. To do this, adequate instream flows must be maintained in all essential habitats, land uses must be regulated to maintain good water quality, the introduction of additional exotic organisms must be prevented, the spread of established populations of exotic organisms controlled, suitable reintroduction sites within the historical range must be found, and habitat conditions must be monitored to ensure that satisfactory conditions for unarmored threespine stickleback are being maintained.

The recovery strategy for the unarmored threespine stickleback, as defined in the recovery plan, includes the following actions: (1) close regulation of removal (take) of the species; (2) monitoring and appropriate management of habitat conditions; (3) implementation of contingency plans to protect the species from natural or man-made disasters; and (4) establishment of additional populations in suitable reintroduction sites as needed.

Tidewater Goby

Legal Status

The Service listed the tidewater goby as endangered on March 7, 1994 (59 FR 5494). The Service published a proposed rule to downlist the tidewater goby on March 13, 2014 (79 FR 14339). The proposed downlisting has not been finalized and the species remains listed as endangered. Critical habitat for the tidewater goby was first designated on November 20, 2000 (65 FR 69693), and later revised in 2008 (73 FR 5920) and 2013 (78 FR 8746). VAFB lands were exempted from designated critical habitat under section 4(a)(3)(B)(i) of the Act for having an approved Integrated Natural Resources Management Plan (INRMP) that was found to provide a conservation benefit to the species. Thus, critical habitat will not be discussed further in this biological opinion. We completed a recovery plan for the tidewater goby on December 12, 2005 (Service 2005) and a 5-year review for the species in September 2007 (Service 2007).

Natural History

The tidewater goby is endemic to California and is one of the only species of fish to live exclusively in brackish water coastal lagoons, estuaries, and marshes in California (Swift et al. 1989, Moyle 2002). Tidewater goby habitat is characterized by fairly still, but not stagnant, brackish water. They can withstand a wide range of habitat conditions and have been documented in waters with salinity levels that range from 0 to 42 parts per thousand (ppt), though they usually are found in less saline water (Swift et al. 1989), temperatures ranging from 9 to 25 degrees Celsius (48 to 77 degrees Fahrenheit) (Swenson 1995) and are typically found in water less than 1 meter deep, though they can inhabit deeper habitat (Swenson 1995). They are generally found over substrate that has a high percentage of sand and gravel (Worcester 1992) and are often clumped in areas that have sparse to medium dense cover by aquatic plants or algae (Worcester 1992). Tidewater gobies often migrate upstream and are commonly found up to 1 kilometer (0.6 mile) up from a lagoon or estuary (Service 2005), and have been recorded as far as 5 to 8 kilometers (3 to 5 miles) upstream of tidal areas (Irwin and Soltz 1985).

Tidewater gobies feed on small invertebrates, including amphipods, ostracods, snails, mysids, and aquatic insect larvae, particularly chironomid larvae (Swift et al. 1989). Predators of tidewater gobies include staghorn sculpin (*Leptocottus armatus*), prickly sculpin (*Cottus asper*), starry flounder (*Platichthys stellatus*), and largemouth bass (*Micropterus salmoides*); native birds and other predatory fish likely also prey on gobies (Swift et al. 1997, Swift et al. 1989).

The tidewater goby is primarily an annual species (Swift et al. 1989), although there is some variation in life history and some individuals have lived up to 3 years in captivity (Swenson 1999). If reproductive output during a single season fails, few (if any) tidewater gobies survive into the next year. Reproduction typically peaks from late April or May to July and can continue into November or December depending on the seasonal temperature and amount of rainfall (Swift et al. 1989, Worcester 1992, Goldberg 1977). Males begin the breeding ritual by digging burrows (3 to 4 inches deep) in clean, coarse sand of open areas. Unlike most other fish, females court the males (Swift et al. 1989). Once chosen by a male, females will then deposit eggs into the burrows, averaging 400 eggs per spawning effort (Swift et al. 1989, Swenson 1995). Males remain in the burrows to guard the eggs and frequently forego feeding (Moyle 2002).

Within 9 to 11 days after eggs are laid, larvae emerge and are approximately 4 to 6 mm in standard length (0.16 to 0.24 inch) (Swift et al. 1989, Service 2005). Larval traits (larval duration, size at settlement, and growth rate) are correlated with water temperature, which varies considerably in the seasonally closed estuaries that tidewater gobies inhabit (Spies and Steele 2016). Larval tidewater gobies are pelagic for an average of 21-27 days and settle once they grow to approximately 12 to 13 mm in standard length (Spies et al. 2014). When they reach this life stage, they become substrate-oriented, spending the majority of time on the bottom rather than in the water column. Both males and females can breed more than once in a season, with a lifetime reproductive potential of 3 to 12 spawning events (Swenson 1999). Vegetation is critical for over-wintering tidewater gobies because it provides refuge from high water flows and tidewater goby densities are greatest among emergent and submerged vegetation (Moyle 2002).

Because of their typically annual life history and seasonally changing environment, population sizes of tidewater gobies vary greatly spatially and seasonally, with recorded numbers ranging from 0 to 198 individuals per square meter (Swenson 1995). After the spring spawning season, there is typically an annual die-off of adults (Swift et al. 1989, Swenson 1995).

Rangewide Status

Historically, the tidewater goby occurred in at least 150 California coastal lagoons and estuaries, from Tillas Slough near the Oregon/California border south to Agua Hedionda Lagoon in northern San Diego County (Swift et al. 1989, page 13). The southern extent of its distribution has been reduced by approximately 8 miles (cite). The species is currently known to occur in about 103 localities, although the number of sites fluctuates with climatic conditions. Some locations presumed to be occupied have not been surveyed in over 10 years. Currently, the most stable populations are in lagoons and estuaries of intermediate size (5 to 124 acres) that are relatively unaffected by human activities (Service 2005).

Local populations of tidewater gobies are best characterized as metapopulations (Lafferty et al. 1999a), or "a network of semi-isolated populations with some level of regular or intermittent migration and gene flow among them, in which individual populations may go extinct but can then be recolonized from other populations" (Groom et al. 2006). Therefore, the stability of a metapopulation depends on the connectivity of subpopulations.

Tidewater gobies enter the marine environment when sandbars are breached during storm events and appear to be able to disperse at least 9 kilometers (5.6 miles) (Lafferty et al. 1999b). The species' tolerance of high salinities for short periods of time enables it to withstand marine environment conditions where salinities are approximately 35 ppt, thereby allowing the species to re-establish or colonize lagoons and estuaries following flood events (Swift et al. 1997). Genetic studies indicate that the tidewater goby population is highly geographically structured, indicating that there is low geneflow (Dawson et al. 2001, Dawson et al. 2002) and thus natural recolonization events are likely rare. It is estimated that the southernmost population of tidewater goby has been separated from other lineages for 2 to 4 million years, and it has been recognized as a distinct species (*Eucyclogobius kristinae*, the southern tidewater goby) (Swift et al. 2016), but as of now the tidewater goby remains listed under the Endangered Species Act as one entity.

Native predators are not known to be important regulators of tidewater goby population size in the lagoons of southern California. Rather, population declines are attributed to environmental conditions. The decline of the tidewater goby is attributed primarily to habitat loss or degradation resulting from urban, agricultural, and industrial development in and around coastal wetlands, lagoons, and estuaries (Irwin and Soltz 1985). Some extirpations appear to be related to pollution, upstream water diversions, and the introduction of non-native predatory fish species, most notably centrarchid sunfish and bass (Swift et al. 1989). These threats continue to affect some of the remaining populations of tidewater gobies. Climate change and the attendant sea level rise may further reduce suitable habitat for the tidewater goby as lagoons and estuaries are inundated with saltwater (Cayan et al. 2006) and severe storms interacting with increased sea levels may breach lagoons more frequently.

In 2014, the Service issued a 12-month finding proposing to reclassify the tidewater goby as threatened under the Act. During the public comment period, we received substantive comments regarding the proposed change in the species' status and new scientific information has been published regarding the species. The tidewater goby remains listed as endangered and its population is currently stable, but still faces ongoing and likely increasing threats of urbanization, artificial breeching, and introduced predators.

<u>Recovery</u>

The goal of the tidewater goby recovery plan (Service 2005) is to conserve and recover the tidewater goby throughout its range by managing threats and maintaining viable metapopulations within each recovery unit while retaining morphological and genetic adaptations to regional and local environmental conditions. The decline of the tidewater goby is attributed primarily to habitat loss or degradation resulting from urban, agricultural, and industrial development in and around coastal wetlands. The recovery plan identifies six recovery units based on morphological differences (Ahnelt et. al. 2004) that are supported by genetic work done by Dawson et al. (2001) – North Coast Unit, Greater Bay Unit, Central Coast Unit, Conception Unit, Los Angeles/Ventura Unit, and South Coast Unit – and 26 recovery sub-units.

The recovery plan specifies that the tidewater goby may be considered for downlisting when:

1. Specific threats to each metapopulation (e.g., coastal development, upstream diversion, channelization of rivers and streams, etc.) have been addressed through the development and implementation of individual management plans that cumulatively cover the full range of the species; and

2. A metapopulation viability analysis based on scientifically-credible monitoring over a 10-year period indicates that each recovery unit is viable. The target for downlisting is for individual sub-units within each recovery unit to have a 75 percent or better chance of persistence for a minimum of 100 years.

The tidewater goby may be considered for delisting when the downlisting criteria have been met and a metapopulation viability analysis projects that all recovery units are viable and have a 95 percent probability of persistence for 100 years.

ENVIRONMENTAL BASELINE

Action Area

The implementing regulations for section 7(a)(2) of the Act define the "action area" as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 Code of Federal Regulations 402.02). The action area for this biological opinion includes both staging areas, the stretch of San Antonio Creek and upland areas within the main construction area, 50 feet of San Antonio Creek upstream from the main construction area (location of fish exclusion netting), 400 feet of San Antonio Creek downstream from the main construction area (limit of potential effects from sedimentation and increased turbidity anticipated by the Air Force), the mitigation area, and the access routes to the mitigation site (Figures 1 and 2). In total, the proposed action would affect approximately 2.34 acres with periodic maintenance affecting some or all of the same areas (Table 1). Ground-disturbing activities would occur in the staging areas, main construction area, and mitigation (planting) area only.

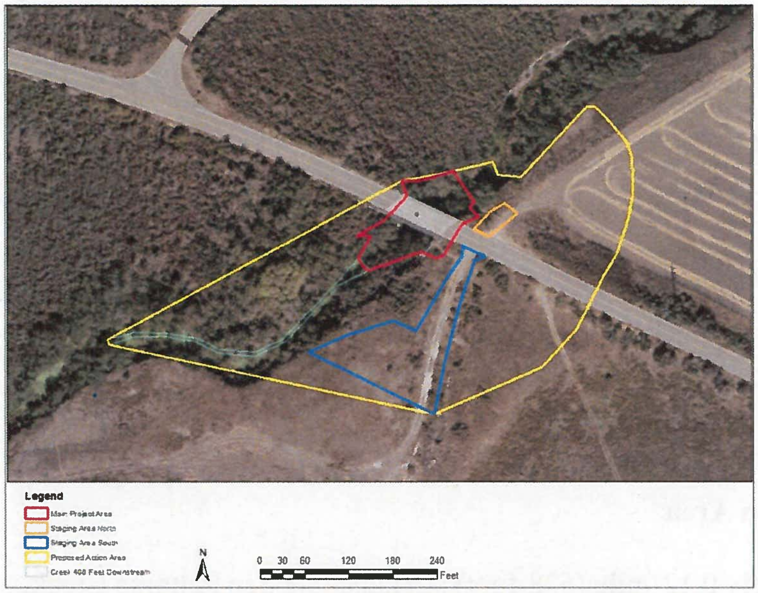

Figure 1. Location of project components within action area (Source: Lum, pers. comm 2018c).

Figure 2. Location of mitigation area and proposed access routes (Source: Mitigation and Monitoring Plan for the San Antonio Road West Bridge Maintenance at Vandenberg Air Force Base, CA; ManTech 2018).

Table 1 – Proposed action area acreage

Proposed Action Areas	Acres	Square Feet
Main construction area (gabions, vegetation, and a portion of San Antonio Creek)	0.27	11,780
Staging area – north	0.03	1,178
Staging area – south	0.38	16,678
Upstream creek (50 linear ft)	0.01	305
Downstream creek (400 linear ft)	0.06	2,442
Mitigation area	0.50	21,780
Mitigation access	1.09	47,520
Total action area	**2.34**	**101,683**

Habitat Characteristics of the Action Area

The action area covers an approximately 0.12-mile (628-foot) stretch along San Antonio Creek, approximately 9.9 km (6.2 mi) from the ocean, and includes a portion of the creek (classified as a permanent waterbody) and a drainage (classified as dry; only flows during storms). Within this area, the San Antonio Creek hydrologic floodplain is narrow, extending approximately 40 feet wide to the tops of its steep banks (Figure 3). The San Antonio Creek is located between 110 to 114 feet above sea level (ASL), with the top of bank located at 128 to 130 feet ASL; a 16 to 18-foot differential. The portion of San Antonio Creek under the bridge is typically shallow and flows east to west under the bridge. During a 2016 habitat assessment, the creek channel in this vicinity was predominantly composed of pools and impounded waters with limited flow resulting from beaver dams which have persisted over multiple years due to a lack of scouring winter flows (ManTech 2016). Storm drains and culverts do not exist within the action area.

Habitat within the action area consists of central coast arroyo willow riparian forest and scrub, central coastal scrub, non-native grasses and forbs, and agriculture (Figure 3). A 2016 habitat assessment of the project area found that riparian vegetation is limited to the San Antonio Creek channel bottom and does not occur on the upper terrace (ManTech 2016). Where rip-rap was previously installed along banks or where the channel is bound by sheer slopes, banks are largely unvegetated; in cases where a lower terrace with soft sediments is present, bank vegetation is dense. Instream vegetation cover is impacted by the degree of canopy shading, water depth, amount of flow, and degree of beaver activity. ManTech (2016) found that areas with significant canopy cover were largely unvegetated due to restricted light. Emergent vegetation was limited to a narrow band along the banks, and areas within beaver dam pools were largely free of emergent vegetation due to depth. Lack of flow within beaver impoundments led to near 100 percent cover of duckweed (*Lemna* sp.) and/or mosquito fern (*Azolla* sp.) on the water surface; where flow occurred despite the dams, duckweed and mosquito fern cover was lower, but subsurface cover of filamentous green algae was very high. The incidence of instream refugia, much of which consisted of dense accumulations of small woody debris, was high within both the hydrated channel and the channel at bank full within the project area (ManTech 2016).

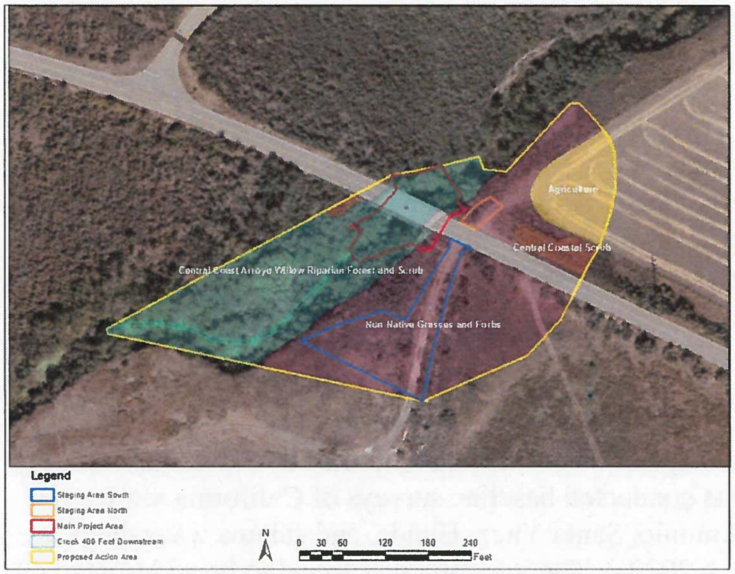

Figure 3. Vegetation types within the proposed action area (Source: Lum, pers. comm 2018c).

Status of the Species in the Action Area

California Red-legged Frog

VAFB is located in the relative middle of the current range of the California red-legged frog. California red-legged frogs occur in nearly all permanent streams and ponds on the base, including in Shuman Creek, San Antonio Creek, San Antonio Lagoon, Santa Ynez River, Bear Creek, and Honda Creek (Christopher 1996, Service 2002). San Antonio Creek, its lagoon, and nearby habitat (including dune swales) may be the most important habitat on VAFB (Christopher 1996, Service 2002). Surveys during multiple years have detected California red-legged frogs in San Antonio Creek upstream, downstream, and within the project area. Monitoring in San Antonio Creek upstream of the proposed action area was conducted in 2008-2013 related to the San Antonio Creek Bank Stabilization project. A total of 191 California red-legged frogs were observed during the 2008-2009 surveys, 603 frogs were observed during the 2011-2012 surveys, and 1,681 frogs were observed during the 2012-2013 surveys (ManTech 2013). Although more California red-legged frogs were observed during 2011-2012 and 2012-2013, these frogs were found disproportionately in stretches not directly affected by project activities (ManTech 2013). In 2014, ManTech conducted surveys in multiple VAFB wetlands and watersheds, including San Antonio Creek upstream and downstream of the proposed action area and in San Antonio Creek Terrace Pond, to assess California red-legged frog numbers. Surveys of San Antonio Creek were conducted in July and August 2014 and found a total of 112 California red-legged frogs in an area upstream of the action area, 48 in an area downstream of the action area, and 209 in San Antonio Creek Terrace Pond (ManTech 2015). Population surveys were conducted within and adjacent to the proposed project area during February, May, August and October 2016 and found a total of 73 California red-legged frogs, with a maximum of 23 frogs observed during the May survey (ManTech 2016). In addition, 14 tadpoles were captured during a July 2016 sampling for larval California red-legged frogs (ManTech 2016). The greater water depth and lack of flow created by beaver impoundments in this area appeared to be highly favorable for California red-legged frog breeding success (ManTech 2016).

Based on these and other survey results, we assume that VAFB supports a substantial population of California red-legged frogs, although there is not enough existing data to accurately estimate the California red-legged frog population on base. As survey data show, the number of California red-legged frogs at a site or series of sites can vary widely from year to year. When conditions are favorable, California red-legged frogs may experience extremely high rates of reproduction and produce large numbers of dispersing young, which may result in an associated increase in number of occupied sites. Conversely, frogs may temporarily disappear from a normally occupied area (Service 2002).

VAFB is known to contain California red-legged frogs infected with the chytrid fungus. During the spring and summer of 2008, biologists conducted baseline surveys of California red-legged frogs and bullfrogs from Shuman, San Antonio, Santa Ynez, Honda, and Jalama watersheds, as well as select isolated wetlands (ManTech 2009a). The infection was found to be widespread on base, being present at all but one site that was sampled. Forty-one percent of all California red-legged frogs (n=100) tested positive for chytrid fungus; however, chytrid fungus did not have a negative effect on post-metamorphic frogs. Frogs with higher infection loads did not show clinical signs of chytrid infection, nor were infected frogs thinner than non-infected frogs. Basewide surveys repeated in 2013 and 2014 found California red-legged frog population persistence and statistically similar densities, suggested that VAFB populations can remain relatively stable, if not increasing densities in spite of chytrid fungus infection (ManTech 2014). Additional surveys were conducted within the project area during 2016, and 80 percent of the California red-legged frogs sampled tested positive for chytrid fungus (ManTech 2016). This was higher than incidence levels previously observed in upstream portions of San Antonio Creek.

Non-native mosquito fish and red swamp crayfish were also detected in high numbers during 2016 surveys within and adjacent to the project area, and the density of red swamp crayfish within this area of San Antonio Creek had increased dramatically compared with previous observations (ManTech 2016). The lack of flow has made environmental conditions much more favorable for crayfish. They are potential direct predators on tadpoles and fish, but are known to prefer slower moving prey such as aquatic insect larvae and snails (Klose and Cooper 2012). Crayfish are also facultative omnivores and may feed primarily on vegetative material in the absence of suitable prey; as such they potentially compete with both amphibian larvae for food resources (Gherardi and Acquistapace 2007). When crayfish do engage in direct predation on tadpoles, this frequently results in tail damage rather than death (Nunes et al. 2010). No notable tail damage was observed in California red-legged frogs or Baja California treefrog (*Pseudacris hypochondriaca*) tadpoles captured during aquatic surveys in 2016, suggesting that although crayfish densities are high they may not be preying on tadpoles (ManTech 2016).

Recovery

The action area lies within Core Area 24 (Santa Maria-Santa Ynez River) of Recovery Unit 5 (Central Coast) for the California red-legged frog (Service 2002). The recovery unit was described in the recovery plan as having a "high recovery status," meaning the unit supports many populations of the species, has many areas of high habitat quality, and threat levels that ranged from low to high. The stated conservation needs for this Core Area are to protect existing populations, reduce contamination of habitat, control non-native predators, implement management guidelines for recreation, cease stocking dune ponds with non-native warm water fish, manage flows to decrease impacts of water diversions, implement guidelines for channel maintenance activities, and to preserve buffers from agriculture.

Some protections are afforded to the California red-legged frog on VAFB due to implementation of the Air Force's INRMP. So far, the Air Force has implemented several actions that provide a positive conservation benefit: (1) public outreach and education; (2) working with researchers from the University of California, Santa Barbara, USGS, and the Department of the Navy, including chytridiomycosis studies; (3) surveys for new populations; (4) monitoring of known populations; and other actions. These efforts are consistent with the goals from the recovery plan of protecting known populations; protecting suitable habitat, corridors, and core areas; developing land use guidelines; gathering biological and ecological data necessary for conservation of the species; and monitoring existing populations and conducting surveys for new populations. In addition, since 2009, the Air Force has released many California red-legged frogs into the proposed action area in support of separate projects such as the Installation Restoration Program Site 13-C ABRES Complex Artificial Basins.

<u>Unarmored Threespine Stickleback</u>

On VAFB, unarmored threespine sticklebacks exist in lower San Antonio Creek (downstream of Barka Slough) and are found mostly in the creek channel rather than the lagoon (ManTech 2009c, Swift 1999). The unarmored threespine stickleback was experimentally introduced into Cañada Honda Creek on VAFB in 1984. However, no individuals have been documented in the Cañada Honda Creek for at least 15 years, thus the translocation effort is now considered to have been unsuccessful.

Suitable habitat for unarmored threespine sticklebacks in San Antonio Creek consists of shallow areas of moderate current with copious quantities of aquatic vegetation (Irwin and Soltz 1982, Service 1985). Various portions of the creek have been surveyed at different times over the last several decades. Irwin and Soltz (1982) found the unarmored threespine stickleback throughout most of San Antonio Creek downstream of Barka Slough. However, major floods completely scoured the stream channel of San Antonio Creek in the spring of 1983 causing stickleback numbers to decline to low levels. In the spring of 1999, Swift conducted surveys within approximately 8 km (4.97 mi) of lower San Antonio Creek, from the lagoon upstream to approximately 1.5 km (0.9 mi) past the Lompoc-Casmalia Road crossing, as part of pre-project assessment related to bridge construction at the El Rancho Road creek crossing. Swift (1999) found that unarmored threespine stickleback was most abundant in low gradient, cool water that almost completely lacked aquatic predators, and was most concentrated approximately 2 km (1.24 mi) both upstream and downstream of the El Rancho Road bridge. The unarmored threespine stickleback was by far the most common fish observed in the creek above the lagoon during these surveys, comprising more than 99 percent of the fishes taken (Swift 1999). Based on the number of captured sticklebacks (3,454) and calculated densities, Swift (1999) estimated that 47,682 stickleback inhabited the lower ~8 km of San Antonio Creek above the lagoon. Presence absence surveys conducted in San Antonio Creek from the U.S. Highway 1 bridge upstream to the VAFB boundary during 2004 did not find any unarmored threespine sticklebacks.

In 2008, as part of San Antonio Creek Bank Stabilization project monitoring, ManTech biologists repeated and expanded upon surveys conducted by Swift in 1999, surveying the original 7 sites plus an additional 7 sites located between Lompoc-Casmalia Road and U.S. Highway 1. During the 2008 surveys, a total of 18,653 unarmored threespine sticklebacks were captured, including 2,047 sticklebacks captured within a 100-meter segment of the proposed action area at the San Antonio Bridge (ManTech 2009c). Within the proposed action area, 82 arroyo chub, 5 prickly sculpin, and approximately 50 brown bullhead (whose stomach contents included 2 sticklebacks) were also captured. Results from the 2008 surveys indicated that unarmored threespine sticklebacks were primarily confined to the stretch of San Antonio Creek from its mouth upstream to just south of Lee Road (ManTech 2009c). Very small to no populations of unarmored threespine sticklebacks were found upstream of the Lee Road bridge, where sites were dominated by arroyo chub (ManTech 2009c). The five most-upstream sites, which are upstream from the proposed action area, were resurveyed in 2009 and 2012. Within these five sites, 1,729 unarmored threespine sticklebacks were captured in 2012, compared to 5,290 in 2009 and 2,460 in 2008 (ManTech 2013). The large decrease in numbers from 2009 to 2012 was entirely within 1 site; however, unarmored threespine sticklebacks increased substantially at another site and were also found at 3 sites where they had not been found previously.

Based on these results, the unarmored threespine stickleback population on San Antonio Creek appears highly dynamic in distribution and abundance, possibly responding to varying environmental conditions such as flow rates, scour events, depth profiles, or vegetative cover (ManTech 2013). Unfortunately, available environmental and survey data are insufficient for a robust analysis, nor are existing data sufficient to estimate population size. However, ManTech's data indicates that changes in aquatic vegetative cover and average/maximum depths were not significantly correlated with changes in unarmored threespine stickleback densities (ManTech 2013).

Unarmored threespine sticklebacks were also incidentally captured during the California red-legged frog surveys conducted within and adjacent to the proposed project area in 2016. A total of 43 unarmored threespine sticklebacks were captured at four sampling locations, with an observed density of 0.24 fish per square meter, compared to a density of 5.69 fish per square meter observed within the proposed project area in 2008 (ManTech 2016). ManTech (2016) reported that the decline in unarmored threespine stickleback densities and the presence of high numbers of mosquito fish support a change in flow regime as lower dissolved oxygen levels present in low flow open water habitat favor mosquito fish over unarmored threespine stickleback (Walton et al. 2007). The density of red swamp crayfish within this area of San Antonio Creek also increased dramatically (ManTech 2016). Crayfish have been experimentally shown to not affect abundance of species such as fast moving mosquitofish (Gherardi and Acquistapace 2007). Unarmored threespine sticklebacks are fast moving midwater feeders as well (Walton et al. 2007) and as such may not be significantly affected by crayfish.

Recovery

The revised recovery plan for the unarmored threespine stickleback (Service 1985) identified three areas as very important for the survival and recovery of the subspecies. One of these areas is the lowermost 8.4 miles of San Antonio Creek, from the mouth of the creek at the Pacific Ocean and including the natural dunes or sandbars in the stream mouth, upstream into Barka Slough. Thus, this recovery unit includes the proposed action area. Lateral floodplain areas elevated less than 10 feet above the main streambed constitute seasonal marsh utilized for feeding and reproduction by the stickleback and are considered a necessary component of the essential habitat. While specific recovery functions were not assigned to any of recovery units, the overall goals are: 1) to preserve and protect extant populations, 2) reintroduce populations into historical habitats, 3) control the spread of exotic organisms, and 4) restore and maintain degraded habitats (Service 1985).

Key threats to unarmored threespine stickleback on VAFB include: habitat loss due to the drawdown of the San Antonio Aquifer, which results in decreased water flow in San Antonio Creek; and beaver activity in San Antonio Creek, which results in pooling and may encourage the introduction of exotic, predatory fish species. In addition, flood events in San Antonio Creek may result in population decreases if the lagoon breaches and unarmored threespine sticklebacks disperse into the ocean (Service 1985).

Some protections are afforded to the unarmored threespine stickleback on VAFB due to implementation of the Air Force's INRMP. So far, the Air Force has implemented actions consistent with the recovery plan that provide a positive conservation benefit including prohibiting introduction of nonnative fish species into streams on VAFB. Avoidance and minimization of adverse impacts to unarmored threespine sticklebacks are incorporated into project planning, and project-specific monitoring (such as those discussed above) provides valuable information regarding population of the subspecies in San Antonio Creek.

<u>Tidewater Goby</u>

Tidewater goby has been documented in all of the major drainages on VAFB including: Shuman Creek, San Antonio Creek, Santa Ynez River, Cañada Honda, and Jalama Creek. At San Antonio Creek, which is characterized by low gradient and habitat continuity between the lagoon and tributary stream, tidewater gobies have been documented in ponded freshwater habitats as far as

7.4 km (4.6 mi) upstream from the ocean (Swift et al. 1997). Tidewater gobies disperse to upstream habitat in the fall until high winter flows cause them to retreat or migrate back downstream to the lagoon. The available tidewater goby habitat at San Antonio encompasses approximately 2.0 to 3.0 hectares (4.9 to 7.4 acres) (Service 2005).

Although population estimates are not readily available for tidewater goby, the Air Force has evaluated populations on VAFB on a project-by-project basis, because the populations fluctuate yearly. Researchers have identified San Antonio Creek and Santa Ynez lagoons as the most important habitats supporting the tidewater goby. The channel and/or lagoon of San Antonio Creek have been surveyed for tidewater gobies several times over the last 35 years. Surveys conducted by Irwin and Soltz (1984) in 1981 and 1982 detected tidewater gobies in large numbers the lagoon (5,760 gobies captured) as well as in beaver ponds and other large pools upstream (882 gobies captured) to at least Lompoc-Casmalia Road (8 km from the ocean). In 1994-1995, Swift et al. (1997) repeatedly sampled the lagoon and intermittently sampled upstream portions of the creek. Based on survey results, they estimated tidewater goby population size fluctuated between an average low of about 15,300 in January 1995 to an average high of about 290,000 the previous August. Few gobies were found in the creek channel during this study, or during individual sampling events in 1996 (Swift et al. 1997). In the spring of 1999, Swift conducted surveys within approximately 8 km (4.97 mi) of lower San Antonio Creek, from the lagoon upstream to approximately 1.5 km (0.9 mi) past the Lompoc-Casmalia Road crossing, as part of pre-project assessment related to bridge construction at the El Rancho Road creek crossing. Swift (1999) again found that tidewater gobies were concentrated in the San Antonio Creek lagoon as compared to its channel (1,331 gobies captured in the lagoon versus 2 captured upstream). In 2008, ManTech (2009c) resurveyed the channel of the San Antonio Creek in 2008, but did not include sampling in the lagoon; no tidewater gobies were detected in these surveys. In addition, no tidewater gobies were captured during the 2016 seine surveys conducted within and adjacent to the proposed project area (ManTech 2016).

Historically, tidewater gobies have been detected far upstream in the San Antonio drainage, often one to a few adult fish taken at El Rancho or Lompoc-Casmalia road crossings. Extensive collecting in 1975 (see Swift et al. 1997), 1982-1983 (Irwin and Soltz 1984), and 1994-1996 (Swift et al. 1997) indicates this occurrence upstream varies over the years, possibly related to precipitation and extreme weather events. Large numbers of tidewater gobies were present far upstream in San Antonio Creek in 1982 and 1983, during a series of above average rainfall years. Collections in 1994 and 1995 failed to find any tidewater gobies more than approximately 3 km (1.9 mi) above the lagoon; during this time, the creek was dry in the fall, apparently a continuation of the effects of a drought from 1986 to 1992 (Swift et al. 1997). However, with the return of flowing water in the following year, tidewater gobies did not disperse into the creek as happened in the Santa Ynez River. Swift et al. (1997) postulated that possibly two or more years of flowing water are needed for tidewater gobies to recolonize upstream. Surveys in 2008, during which no gobies were found in the creek channel, followed the 2006-2007 winter rainy season which was one of the driest on record for VAFB. Thus, drying of the stream during the drought years, and perhaps exacerbated by additional groundwater withdrawal upstream, has the potential to eliminate most of this upstream habitat in the San Antonio Creek.

Because tidewater gobies appear to spend all life stages in lagoons, estuaries, and river mouths, their population may experience a decline if flushed out by the breaching of sandbars following storm events (Service 2005). However, population decline in one area may lead to colonization of others areas up and down the coast, as is suspected to be the case with Honda Creek (Swift et al. 1997, Service 2005).

Recovery

San Antonio Creek is included in the Conception Recovery Unit for the tidewater goby. The Conception Recovery Unit is divided into three sub-units; San Antonio Creek is included in Sub-Unit CO 2, which extends from Point Sal to Point Arguello over a generally sandy coast. Sub-Unit CO 2 is located entirely within Santa Barbara County. Primary tasks for this recovery unit as recommended in the recovery plan include: (1) population monitoring; (2) substantiate Sub-Units based on genetic studies; (3) improve habitat and remove threats; and (4) consider recolonization if there is a 25 percent reduction in the number of inhabited locations. The 5-year review does not specify the recovery function of the San Antonio Creek for the tidewater goby.

Key threats to tidewater gobies on VAFB include: susceptibility of coastal lagoons to degradation through upstream diversion of water (dewaters stream habitat, affects marsh habitats, and alters temperature and salinity); pollution from private, agricultural, and municipal sewage effluents; siltation (*e.g.*, resulting from off-base cattle overgrazing and feral pig activity); and urban development of surrounding lands. Introduced predatory fish, especially centrarchids and channel catfish, crayfish, and mosquito fish may threaten populations through direct predation on eggs, larvae, and adults.

Some protections are afforded to the tidewater goby on VAFB due to implementation of the Air Force's INRMP. So far, the Air Force has implemented actions consistent with the recovery plan that provide a positive conservation benefit including prohibiting introduction of nonnative fish species into streams on VAFB. Avoidance and minimization of adverse impacts to unarmored threespine sticklebacks are incorporated into project planning, and project-specific monitoring (such as those discussed above) provides valuable information regarding population of the tidewater goby in San Antonio Creek.

EFFECTS OF THE ACTION

California Red-legged Frog

California red-legged frogs (all life stages) could be inadvertently injured or killed by workers, vehicles, or construction equipment during preconstruction activities (staging, creek damming and diversion activities, dewatering) and if frogs enter the main construction area during construction activities (sediment removal, repair/replacement of gabions, vegetation cutting). Frogs could also be inadvertently injured or killed by workers, vehicles, or equipment during mitigation site access, preparation and planting activities. Water diversion and dewatering activities, including the use of water pumps could result in the suctioning or trapping of

California red-legged frogs. California red-legged frogs dispersing from areas adjacent to the action area are subject to mortality or injury from vehicle strikes and construction activities associated with the proposed project. California red-legged frogs that are not able to disperse from the action area may be crushed by worker foot traffic or the use of heavy equipment. Effects could range from crushing the leg of a California red-legged frog resulting in injury to completely running over or stepping on an individual rendering it unrecognizable among excavated soil and vegetation.

To minimize effects to this species, the Air Force would have a Service-approved biologist conduct pre-construction surveys, including surveys prior to each stage of the proposed diversion/dewatering, and capture and relocate all California red-legged frogs to the nearest suitable habitat outside of the project area prior to the onset of project activities. The Air Force would design all diversion and dewatering systems to avoid trapping or suctioning California red-legged frogs, and would control the rate of all water intakes/release to ensure adverse impacts to California red-legged frogs can be detected and avoided. The Air Force would also install temporary exclusionary fencing intended to prevent California red-legged frogs from entering the main construction area. However, because fencing would still be somewhat passable by frogs, the Air Force would also conduct daily biological monitoring by a Service-approved biologist to minimize adverse effects on California red-legged frogs and their habitat (e.g., find and relocate frogs which enter the main construction area). Recent observations suggest that California red-legged frog exhibit strong site fidelity (AECOM 2011). The Air Force's proposal to have a daily biological monitor present on site could minimize the effect of translocated individuals returning to the site. Furthermore, the translocation of individuals from the project area would likely reduce the level of mortality that otherwise would occur if California red-legged frogs were not removed.

Relocating California red-legged frogs out of harm's way may reduce injury or mortality from equipment, foot traffic, or ground disturbing activities; however, injury or mortality of individuals may occur as a result of improper handling, containment, or transport of individuals or from releasing them into unsuitable habitat (e.g., where exotic predators are present). Observations of diseased and parasite-infected amphibians are frequently reported, and relocation of California red-legged frogs has the potential to result in transmission of the chytrid infection, recently documented in San Antonio Creek (ManTech 2014). This has given rise to concerns that releasing amphibians following a period of captivity, during which time they can pick up infections of disease agents, may cause an increased risk of mortality in wild populations. Amphibian pathogens and parasites can also be carried between habitats on the hands, footwear, or equipment of fieldworkers, which can spread them to localities containing species which have had little or no prior contact with such pathogens or parasites. We anticipate the risk of improper handling, containment, or transport of California red-legged frogs would be reduced or eliminated through the Air Force's proposed minimization measures including: using only Service-approved biologists to monitor, capture, or handle California red-legged frogs; conducting an educational briefing for all project personnel prior to the start of work activities; and adherence of all personnel working in the main construction area to the practices listed in the Declining Amphibian Populations Task Force Fieldwork Code of Practice (Service 2002).

Despite the foregoing minimization measures, the proposed project would tend to adversely affect early life phases of California red-legged frogs (eggs and juveniles) to a greater extent than adults, with eggs being more at risk than juveniles which normally can be observed and relocated. Juveniles are active during both the day and night and are restricted to aquatic habitats during certain life cycle phases, which make them less able to move away from certain threats as compared to adult California red-legged frogs. The Service-approved biological monitor may be able to relocate California red-legged frog tadpoles, but tadpoles may avoid detection due to their small size. In addition, California red-legged frogs generally breed from November to April, and metamorphosis from tadpoles to juveniles (terrestrial phase) may take up to 28 weeks (5 months), but could be delayed up to 1 year. As a result, early life phases of California red-legged frogs (eggs and juveniles) may occur in the main construction area throughout the year and adverse effects to early life stages may occur from the proposed project . For example, California red-legged frog egg masses and tadpoles may go undetected and be suctioned by the water pumps.

We anticipate the measures proposed by the Air Force would minimize and control the above adverse direct effects from pre-construction and construction activities; however, some early life phases of California red-legged frogs could be inadvertently injured or killed during pre-construction and construction activities due to the inability to detect and/or relocate all instances and life phases of California red-legged frogs within the main construction area.

Herbicides that are applied to invasive plant treatment areas within or adjacent to California red-legged frog habitat have the potential to come in contact with California red-legged frogs through direct dermal exposure in their terrestrial or aquatic habitats. The herbicides proposed for use during mitigation activities contain the active ingredients glyphosate (approved for aquatic use) and chlorsulfuron.

California red-legged frog eggs, tadpoles, juveniles and adults can be exposed to glyphosate products in aquatic habitats through direct overspray of wetlands, drift from treated areas, or contaminated runoff from treated areas. The half-life of glyphosate in pond water ranges between 12 days and 10 weeks (Extension Toxicology Network 1996). Additionally, juvenile and adult California red-legged frogs can be exposed in terrestrial habitats that have been treated. Glyphosate readily sorbs to soil particles and can be degraded by microbes in 7 to 70 days depending on soil conditions (Giesy et al. 2000).

No information is available regarding the toxicity of glyphosate products specifically to California red-legged frogs. Studies exploring the lethal and sublethal effects of glyphosate products on other amphibians, including ranids, are available but are largely focused on aquatic stages of the species and formulations of glyphosate that include surfactants. Several studies suggest that the toxicity of glyphosate products is linked with the surfactant, and not the glyphosate (Howe et al. 2004; Govindarajulu 2008). Vincent and Davidson (2015) examined the effects of glyphosate on western toad (*Anaxyrus* [*Bufo*] *boreas)* tadpoles; short-term toxicity trials were conducted for glyphosate in the form of isoproprylamine salt (IPA) as well as mixed with surfactants, including Agri-dex (the surfactant the Air Force has proposed for mitigation activities). The median lethal concentration (LC50) reported for 24-hour and 48-hour exposures were 8,279 milligrams per liter (mg/L) and 6,392 mg/L, respectively, for glyphosate IPA alone, compared to 5,092 mg/L (24 hour) and 4,254 mg/L (48 hour) for glyphosate IPA mixed with Agri-dex (Vincent and Davidson 2015). Although the glyphosate IPA mixed with Agri-dex was found to be more toxic than glyphosate IPA alone, the results of this study and others (Smith et al. 2004; Washington State Department of Agriculture 2004) suggest that Agri-dex has a relatively low toxicity. The concentration of glyphosate with Agri-dex that the Air Force has proposed using in mitigation activities is substantially lower than these toxicity thresholds.

Glyphosate toxicity data for California red-legged frogs or other amphibians that inhabit terrestrial environments is also lacking. The U.S. Environmental Protection Agency (EPA) uses toxicity data from avian receptors as a surrogate for California red-legged frogs in terrestrial environments (EPA 2008). The EPA compiled toxicity data for technical glyphosate (formulated without a surfactant) that were deemed suitable to act as surrogates for California red-legged frogs (EPA 2008). These studies showed that glyphosate is slightly toxic to the selected avian species with the lowest LC50 value reported as ingestion of greater than 3,196 miligrams of active ingredient per kilogram of body weight (EPA 2008), although no mortalities occurred in any of the studies so this number is likely to be strongly conservative. Based on these conservative numbers, the EPA used a modeling approach to further understand risk to California red-legged frogs from glyphosate exposure in terrestrial habitats. The EPA determined that California red-legged frogs may be at risk of some toxic effects if glyphosate is applied at an application rate of 5.5 pounds per acre. At the maximum-allowable application rate of 8 pounds per acre for Rodeo, there is the potential for California red-legged frogs to be adversely affected in terrestrial environments, although this conclusion appears to be highly conservative.

As with glyphosate, California red-legged frog eggs, tadpoles, juveniles and adults can be exposed to chlorsulfuron products in aquatic habitats through direct overspray of wetlands, drift from treated areas, or contaminated runoff from treated areas. Additionally, juvenile and adult California red-legged frogs can be exposed in terrestrial habitats that have been treated. The half-life of chlorsulfuron in soil ranges from 1 to 3 months, with a typical half-life of 40 days, depending on soil and weather conditions (Klotzbach and Durkin 2004).

No information is available regarding the toxicity of chlorsulfuron specifically to California red-legged frogs or other similar amphibian species. In the absence of robust toxicity data for amphibians in aquatic habitats, the EPA uses fish toxicity as a surrogate. Acute toxicity studies conducted on fish have indicated that chlorsulfuron is practically non-toxic to tested fish, with LC50 values ranging from greater than 250 mg/L in rainbow trout to greater than 980 mg/L in sheepshead minnow (Klotzbach and Durkin 2004). Similarly, a long-term exposure study found that survival of rainbow trout embryos and alevins was not affected at chlorsulfuron concentrations up to 900 mg/L (Klotzbach and Durkin 2004). However, fingerlings appear to be more sensitive than embryos and alevins, with 40 percent mortality in the 900 mg/L exposure group; no mortality in fingerlings was observed at chlorsulfuron concentrations less than 900 mg/L. Based on assessment of trout length (the most sensitive effect) performed at the completion of the study, the no-effect-observed concentration value of 32 mg/L was determined and a lowest-observed-effect concentration value of 66 mg/L was determined. Chlorsulfuron does not tend to bioaccumulate in fish (Klotzbach and Durkin 2004).

Chlorsulfuron toxicity data for California red-legged frogs or other amphibians that inhabit terrestrial environments is also lacking. The EPA uses toxicity data from avian receptors as a surrogate for California red-legged frogs in terrestrial environments (EPA 2008). Acute toxicity studies for avian species indicate chlorsulfuron is practically non-toxic to birds, with acute LC50 values for mallard ducks and bobwhite quail greater than 5,000 milligrams of active ingredient per kilogram. The concentration of chlorsulfuron the Air Force is proposing is substantially lower than the acute and chronic toxicity thresholds for various fish and bird species that act as suitable surrogates for the California red-legged frog.

In this project, neither glyphosate nor chlorsulfuron will be applied directly to water or used within 15 feet of aquatic habitat having surface water or saturated soils present. Herbicides will also not be used in aquatic habitat within 24 hours (before or after) of precipitation events of 0.1 inch or more. Based on these minimization measures and the low proposed concentrations, the chance of toxicity to California red-legged frogs from glyphosate and chlorsulfuron use is very low.

The proposed pre-construction and construction activities would temporarily disturb California red-legged frog aquatic, upland, and dispersal habitat within the project area. The main construction area supports approximately 0.16 and 0.11 acres of aquatic/riparian and upland California red-legged frog -habitat, respectively. In addition, clearing and grubbing of vegetation in the staging areas would affect 0.41 acres of upland habitat. Up to 0.07 acres of aquatic/riparian habitat would be disturbed through human activity (associated with upstream water diversion and monitoring activities and downstream sedimentation and increased turbidity. Therefore, approximately 0.75 acres of California red-legged frog habitat could be affected by the proposed construction, initally.

In addition to the initial habitat disturbance, future periodic-vegetation maintenance (cutting) in the main construction area could affect up to the same acreage initially affected because maintenance would conform to the same requirements (cut woody vegetation with stems greater than or equal to 2 inches in diameter). The acreage of vegetation cut depends on the rate of regrowth, but the initial estimates provide an upper limit because the existing vegetation is the accumulation of years of growth. Therefore, future periodic vegetation reduction would occur as needed and may affect up to, but not exceed, the initial acreage estimates.

California red-legged frogs could be affected by the vegetation reduction, as vegetation maintenance would likely cause a change in habitat structure and possibly function. The Air Force does anticipate some canopy reduction, but the root structure of cut vegetation would remain intact and any cut willow trees would be able to regrow. Changes to the habitat structure in the main construction area could have indirect negative effects on adult California red-legged frogs, and to a lesser degree juveniles, by reducing habitat suitability in the area. Because California red-legged frogs tend to deposit egg masses on emergent vegetation, cutting vegetation may affect the use of this area by the species for breeding, foraging and refuge. However, because California red-legged frogs are not deterred by obstacles, an area with reduced vegetation cover would likely still be used for dispersal/transit by some phases to upstream/downstream locations.

Decreases in riparian canopy cover could also result in a reduction in California red-legged frog prey (aquatic and terrestrial invertebrates) which depend on the presence of riparian vegetation. Cutting some willow trees down to stumps could cause some change in the invertebrate community in the action area because there would be a reduced canopy and leaf litter input. However, vegetation less than 2-inches in diameter would remain, and the proposed reduction may not be detrimental to the persistence of invertebrate communities if they are able to move into adjacent and better habitats until conditions become favorable again. Dense riparian vegetation exists both upstream and downstream of the main construction area and any detritus or broken down organic matter would pass through the project area. As a result, invertebrates in the project area could remain present or at worst, relocate into adjacent habitats until conditions in the main construction area become favorable again. The proposed project would not directly change any of the features of San Antonio Creek (i.e., stream size, gradient, and connectivity to a floodplain) that could further affect invertebrate communities.

In addition, the proposed vegetation reduction may contribute to the existing habitat degradation issues related to water quality within the watershed already affecting California red-legged frogs. Cutting willows and riparian vegetation to within 3 inches of the ground or water surface may compromise the effectiveness of existing riparian vegetative buffers to provide ecosystem services such as slowing erosion/sedimentation (by stabilizing soils/trapping sediment), slowing storm flow velocities, and reducing the concentration of pollutants in surface water runoff. However, because roots of cut vegetation would remain in place, the existing vegetation could continue to stabilize soils, trap sediment, and filter pollutants at some (probably reduced) level. In addition, the project area constitutes only a small portion of the watershed where these ecosystem services and/or processes would continue.

The proposed pre-construction and construction activities could also cause water quality impacts from increased soil erosion due to exposed soils and the effects of soil compaction. Increased exposed soils may result from clearing and grubbing the staging areas adjacent to San Antonio Creek and loosening the soil under the bridge to access the gabions. Exposed and loosened soil would be susceptible to off-site transport by wind or water (stormwater and restoring flow after culverts and dams removed). Conversely, use of heavy equipment in undeveloped areas (staging areas and under the bridge) may cause soil compaction, reducing soil permeability. Reduced permeability may lead to soils having a decreased ability to filter pollutants or contribute to increased flow rates affecting water quality. However, under the bridge, soil compaction may be beneficial in packing down any loose soils and preventing sedimentation or increased turbidity in San Antonio Creek prior to restoring flow. The Air Force does not anticipate any increased erosion from vegetation reduction activities because no uprooting would occur, thereby continuing to stabilize soils in the project area.

Water quality impacts may inadvertently occur during the use of heavy equipment in the San Antonio Creek riparian area and hydrologic floodplain. To minimize potential effects, the Air Force would implement standard VAFB spill prevention and control measures including conducting vehicle and equipment maintenance outside of the hydrologic floodplain and storing vehicles and equipment in the staging areas to avoid the potential for inadvertent spills into the creek and riparian areas. However, because work would occur within the hydrologic floodplain/riparian areas it is likely that residue from vehicles (i.e., particulates from diesel engines, chainsaw oil residue) would enter the watershed despite compliance with any prevention and control measures. The Air Force would comply with requirements imposed through the NEPA process, including compliance with the Clean Water Act for effects to wetlands and water quality, to ensure effects are within acceptable levels.

Short-term noise and vibration generated during pre-construction and construction activities, and future periodic vegetation maintenance, may cause California red-legged frogs to temporarily abandon habitat adjacent to work areas. Such disturbance may increase the potential for predation and desiccation when California red-legged frogs leave shelter sites; however, these effects would be temporary, lasting only for the duration of the construction activities. If California red-legged frogs are driven from the vicinity of the work activities, we expect that they would return upon the completion of construction or find other suitable refuge nearby. In addition, the Air Force would continue to remove non-native invasive species such as bullfrogs during VAFB species surveys in San Antonio Creek, which would tend to reduce predation of California red-legged frogs to some degree.

Given that habitat loss/degradation, prey reduction, and increased predation risk as a result of pre-construction and construction activities would be short-term in nature, we anticipate the indirect effects of the proposed pre-construction and construction activities to be temporary and minimal. Future vegetation maintenance activities, likely resulting in changes and reductions in riparian vegetation (canopy structure and coverage), are anticipated to be long-term and potentially cause changes in California red-legged frog use of the creek within the main construction area. However, because this area represents a small portion of the watershed, there is suitable habitat upstream and downstream of the main construction area which California red-legged frogs may use, and the proposed maintenance would not entirely remove the riparian vegetation (leaving stems less than 2 inches in diameter and roots of larger plants), we expect the effects on California red-legged frogs to be minor. In addition, because the proposed mitigation would result in the enhancement/restoration of approximately 0.48 acre of willow riparian habitat, we expect that the availability and suitability of breeding habitat for California red-legged frogs in this area would be increased, thereby helping to offset potential long-term effects related to future vegetation maintenance at the bridge.

<u>Effects on Recovery</u>

With implementation of the mitigation activities and minimization measures proposed by the Air Force, direct and indirect impacts to the California red-legged frog would likely be low and would not reduce the likelihood of recovery of the California red-legged frog within the Central

Coast Recovery Unit. Because the action area is within a recovery unit with "high recovery status," the proposed project is not likely to reduce the potential contribution of the action area to the conservation of the California red-legged frog. In other words, the populations of California red-legged frog in the recovery unit are considered plentiful and many of those are of high quality. Overall, the effects to the species and its habitat would be relatively minor. Additionally, the project would meet the recovery goal of removing non-native predators. Therefore, we anticipate that the proposed project will not diminish the species' ability to recover.

Unarmored Threespine Stickleback

The proposed project may result in direct and indirect effects on unarmored threespine sticklebacks for reasons similar to those discussed for California red-legged frogs. Unarmored threespine sticklebacks (all life stages) could be inadvertently crushed by workers or construction equipment during creek damming and diversion activities, dewatering, and construction activities in the main construction area. The Air Force would divert San Antonio Creek from flowing through the main construction area during the sediment removal and gabion repair/replacement, but not during the vegetation reduction activities (initial or future maintenance). Because unarmored threespine sticklebacks are confined to the flowing water of San Antonio Creek, they are not able to avoid potential impacts of the proposed project to the same extent as California red-legged frogs by moving to upland areas. However, the proposed minimization measures including exclusion netting, pre-construction surveys, relocation of sticklebacks, diversion of San Antonio Creek, and intake screens would avoid most effects to the subspecies (i.e., adults and juveniles that are visible).

A Service-approved biologist would oversee all construction activities having the potential to adversely affect unarmored threespine sticklebacks in addition to being present during future-periodic inspection and maintenance activities, because San Antonio Creek would not be diverted beyond completion of the gabion repair. Unarmored threespine sticklebacks could be inadvertently injured or killed in exclusion nets. To minimize this potential effect, the Air Force would continually monitor upstream and downstream netting. Dewatering activities may result in the death of unarmored threespine sticklebacks in the dewatered area due to stranding resulting in desiccation, suffocation, or opportunistic predation. To minimize this potential effect, the Air Force would use a Service-approved biologist to relocate all unarmored threespine sticklebacks out of areas to be dewatered to suitable habitat immediately downstream of the project site. Using a Service-approved biologist is expected to minimize the potential to injure or kill unarmored threespine sticklebacks during capture and relocation activities, which can result from improper handling, physiological stress, increased competition, or from being released into unsuitable habitat. During dewatering and irrigation, unarmored threespine sticklebacks may also be entrained by pump intakes. To minimize the likelihood of this, the Air Force would cover all pump intakes with wire screens having no greater than 0.125-inch mesh size to minimize the potential for unarmored threespine sticklebacks to be caught in the inflow. We anticipate the measures proposed by the Air Force would minimize adverse effects from dewatering the project area and relocating unarmored threespine sticklebacks.

Despite the foregoing minimization measures, the potential exists that some unarmored threespine sticklebacks may not be located or may still be killed or injured during the capture and relocation procedures. In addition, unarmored threespine sticklebacks may be breeding during the proposed project, and any eggs located within the dewatering area would not be detectable. These eggs may be destroyed during the proposed project.

The proposed project could adversely impact up to 0.27 acres of unarmored threespine stickleback habitat (breeding, feeding, or refuge) within the main construction area, and up to another 0.07 total acres upstream and downstream of this area (associated with upstream water diversion and monitoring activities and downstream sedimentation and increased turbidity). The area under the bridge (bottom of the channel) would be disturbed and there would be a reduction of some willow riparian vegetation, which could adversely affect water temperature, stream flow, or chemistry of unarmored threespine stickleback habitat. Because riparian vegetation provides temperature control for fish populations, reducing willow canopies in the main construction area may contribute to increased temperature in San Antonio Creek by removing canopies that currently provide shade (thus decreasing habitat value and temperature control). However, vegetation less than 2-inches in diameter would not be cut to offer some level of temperature control. Riparian canopy reduction could also contribute to a reduction in unarmored threespine stickleback prey as discussed above for the California red-legged frog, namely through a reduction in leaf litter within the main construction area and potential displacement into adjacent habitat.

The proposed pre-construction and construction activities could also cause water quality impacts from increased soil erosion due to exposed soils and the effects of soil compaction, as discussed above for the California red-legged frog. Increased exposed and loosened soils, in staging areas and under the bridge, would be susceptible to off-site transport by wind or water. Exposed soils under the bridge may result in short-term turbidity and sedimentation in the action area when the creek is restored to normal flow (after culverts/dams removed) because newly exposed/loosened soils could be transported by the flow. Potential soil compaction under the bridge from heavy equipment use may be beneficial in packing down any loose soils and preventing sedimentation or increased turbidity in San Antonio Creek prior to restoring flow. However, soil compaction in undeveloped areas would also reduce soil permeability, leading to soils having a decreased ability to filter pollutants or contributing to increased flow rates.

Increased sedimentation and turbidity could adversely affect unarmored threespine sticklebacks by impairing the efficiency of their gill filaments and exposing them to higher salinities and/or predation as they flee downstream. Direct effects of sedimentation include mortality, reduced physiological function, and nest smothering. Indirect effects of sedimentation include potential alteration to the food web which could create cascading effects to higher trophic levels. A reduction in phytoplankton can result from increased turbidity, which can thereafter reduce zooplankton, in turn reducing benthic macroinvertebrates, and thus reduce prey available to unarmored threespine sticklebacks (Henley et al. 2000). While the Air Force does not anticipate any increased erosion from vegetation reduction activities because the roots of the cut stumps would remain in place and continue to slow flow and trap sediment, some increased turbidity is likely to occur during future periodic vegetation maintenance activities within the main construction area. The effects of sedimentation and turbidity resulting from the proposed project would be minimized by the Air Force's proposal to divert the active river channel around the work area to ensure flow is not impeded during construction and implement best management practices during all project activities. We anticipate these measures would control and minimize erosion and sedimentation.

Water quality impacts may inadvertently occur during the use and operation of construction equipment and vehicles in the hydrologic floodplain of San Antonio Creek. Although the Air Force would implement standard spill prevention measures, contaminant/pollutant residue (particulate matter) from vehicles and equipment working in the hydrologic floodplain may generate pollutants that would enter the watershed.

While there would be no in-water work because the Air Force would divert San Antonio Creek, noise and vibration generated during project activities would likely disturb unarmored threespine sticklebacks beyond the dewatered area to some degree. During periodic vegetation maintenance activities, sticklebacks would likely be disturbed if a chainsaw is used. Such disturbance may increase the potential for predation by causing unarmored threespine sticklebacks to find other refuge habitat or otherwise interfere with their activities or behavior. However, these effects are temporary, lasting only for the duration of the construction or maintenance activities. If unarmored threespine sticklebacks are driven from the vicinity of the work activities, we expect that they would return upon the completion of construction. The Air Force proposes to divert San Antonio Creek at least 14.1 feet away from construction activities, if feasible based on site conditions to minimize impacts to unarmored threespine sticklebacks from noise and vibrations to the maximum extent practicable (Air Force 2016). In addition, the Air Force would continue to remove non-native invasive species such as brown bullhead during VAFB species surveys in San Antonio Creek, which would tend to reduce predation of unarmored threespine sticklebacks to some degree.

Given that habitat loss/degradation, prey reduction, and increased predation risk as a result of pre-construction and construction activities would be short-term in nature, we anticipate the indirect effects of the proposed pre-construction and construction activities would be temporary and minimal. The effects of future vegetation maintenance activities, likely resulting in changes and reductions in riparian vegetation (canopy structure and coverage), would be long-term and potentially cause changes in unarmored threespine stickleback use of the creek within the main construction area. However, because this area represents a small portion of the watershed, there is suitable habitat upstream and downstream of the main construction area which unarmored threespine sticklebacks may use, and the proposed maintenance would not entirely remove the riparian vegetation (leaving stems less than 2 inches in diameter and roots of larger plants), we expect the effects on unarmored threespine sticklebacks to be minor.

Effects on Recovery

With implementation of the minimization measures proposed by the Air Force, direct and indirect impacts to the unarmored threespine stickleback would likely be low and would not reduce the likelihood of recovery of the subspecies within the San Antonio Creek watershed. Overall, the effects to the unarmored threespine stickleback and its habitat would be relatively minor. Additionally, the project would meet the recovery goal of removing non-native predators. Therefore, we anticipate that the proposed project will not diminish the subspecies' ability to recover.

Tidewater Goby

The proposed project may result direct and indirect effects on tidewater gobies for reasons similar to those discussed for unarmored threespine sticklebacks. Tidewater gobies could be inadvertently injured or killed during by exclusion, relocation, or construction activities in the main construction area. However, because tidewater gobies are primarily found in the lagoon (approximately 6 miles downstream), the potential for this to occur would be lower. In addition, reproduction is not likely to occur in the project area. The proposed minimization measures including exclusion netting, pre-construction surveys, relocation of tidewater gobies, diversion of San Antonio Creek, and intake screens would avoid most effects to the species.

A Service-approved biologist would oversee all construction activities having the potential to adversely affect tidewater gobies in addition to being present during future-periodic inspection and maintenance activities, because San Antonio Creek would not be diverted beyond completion of the gabion repair. Tidewater gobies could be inadvertently injured or killed in exclusion nets. To minimize this potential effect, the Air Force would continually monitor upstream and downstream netting. Dewatering activities may result in the death of tidewater gobies in the dewatered area due to stranding resulting in desiccation, suffocation, or opportunistic predation. To minimize this potential effect, the Air Force would use a Service-approved biologist to relocate all tidewater gobies out of areas to be dewatered to suitable habitat immediately downstream of the project site. Using a Service-approved biologist is expected to minimize the potential to injure or kill tidewater gobies during capture and relocation activities, which can result from improper handling, physiological stress, increased competition, or from being released into unsuitable habitat. During dewatering and irrigation, tidewater gobies may also be entrained by pump intakes. To minimize the likelihood of this, the Air Force would cover all pump intakes with wire screens having no greater than 0.125-inch mesh size to minimize the potential for tidewater gobies to be caught in the inflow. We anticipate the measures proposed by the Air Force would minimize adverse effects from dewatering the project area and relocating tidewater gobies.

Despite the foregoing minimization measures, the potential exists that some tidewater gobies may not be located (especially due to their small size) or may still be killed or injured during the capture and relocation procedures. However, we expect this effect would be limited to a very small number of tidewater gobies based on previous survey results and the continued drought conditions.

Because the tidewater goby's primary habitat within this watershed is downstream of the project area, the proposed project is not expected to cause permanent loss of tidewater goby habitat and habitat-related effects are expected to be less adverse than those discussed for unarmored threespine stickleback. The proposed vegetation reduction is less likely to affect tidewater gobies, which are more dependent on submerged aquatic vegetation rather than riparian vegetation for shelter. If tidewater gobies occur in the project area, riparian canopy reduction could contribute to a reduction in tidewater goby prey (invertebrates) through a reduction in leaf litter within the main construction area and potential displacement into adjacent habitat. However, the potential effects would be limited to the immediate area, and we do not expect prey would be affected any significant distance downstream or in the lagoon.

Likewise, although the proposed project could also cause water quality impacts from increased soil erosion due to exposed soils and the effects of soil compaction, effects would be limited to the project area vicinity and are not expected to affect tidewater gobies in or near the lagoon. Exposed soils that are transported outside of the action area would have time to settle out of the main water column before reaching tidewater goby habitat. Water quality impacts may inadvertently occur during the use and operation of construction equipment and vehicles in the hydrologic floodplain of San Antonio Creek. Although the Air Force would implement standard spill prevention measures, contaminant/pollutant residue (particulate matter) from vehicles and equipment working in the hydrologic floodplain may generate pollutants that would enter the watershed. We expect any impacts to downstream tidewater gobies and their primary habitat in the lagoon and lower reaches of the creek would be minimal and temporary in nature.

While there would be no in-water work because the Air Force would divert San Antonio Creek, noise and vibration generated during project activities could disturb any tidewater gobies in the project area beyond the dewatered area to some degree. During periodic vegetation maintenance activities, gobies could be disturbed if a chainsaw is used. However, tidewater gobies are less sensitive than unarmored threespine sticklebacks to the effects of sound because adults do not have a specialized anatomical feature such as a gas/swim bladder (which is lost after their larval phase). In addition, analysis by VAFB suggests it is unlikely tidewater gobies would have an avoidance response (Air Force 2016). Regardless, any potential effects to tidewater gobies would be temporary, lasting only for the duration of the construction or maintenance activities, and if tidewater gobies are driven from the vicinity of the work activities, we expect that they would return upon the completion of activities. The Air Force's minimization measures to protect unarmored threespine sticklebacks from noise and vibrations would provide additional protection to tidewater gobies.

Effects on Recovery

The goal of the tidewater goby recovery plan is to conserve and recover the tidewater goby throughout its range by managing threats and perpetuating viable metapopulations within each recovery unit while maintaining morphological and genetic adaptations to regional and local environmental conditions. We do not expect proposed project to substantially affect the conservation of tidewater gobies within the Conception Recovery Unit, in terms of the recovery strategy described in the recovery plan because:

1. The tidewater goby recovery plan emphasizes the importance of the conservation of population units rather than individual fish, and the effects of the replacement of the proposed project are not expected to cause population-level declines in San Antonio Creek; and

2. The proposed project would not adversely affect the metapopulation dynamics between individual populations within the Conception Recovery Unit.

With implementation of the minimization measures proposed by the Air Force, direct and indirect impacts to the tidewater goby would likely be low and would not reduce the likelihood of recovery of the species within the San Antonio Creek watershed. Overall, the effects to the tidewater goby and its habitat would be relatively minor. Additionally, the project would meet the recovery goal of removing non-native predators. Therefore, we anticipate that the proposed project will not diminish the species' ability to recover.

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. We do not consider future Federal actions that are unrelated to the proposed action in this section because they require separate consultation pursuant to section 7 of the Act. Because the entire VAFB is a Federal installation, we are not aware of any non-Federal actions that are reasonably certain to occur in the action area.

CONCLUSION

In determining whether a proposed action is likely to jeopardize the continued existence of a species, we consider the effects of the action with respect to the reproduction, numbers, and distribution of the species. In that context, the following paragraphs summarize the effects of the proposed project on the California red-legged frog, unarmored threespine stickleback, and tidewater goby.

California Red-legged Frog

Reproduction

The proposed project would temporarily reduce the amount of available California red-legged frog breeding habitat within the action area during construction activities, and may reduce suitability of breeding habitat within the main construction area as long as vegetation maintenance is ongoing. Such disruptions could potentially affect a portion of breeding California red-legged frogs at VAFB. If vegetation maintenance resulted in a permanent loss of breeding habitat, the amount of habitat affected would be small (0.27 acres) and constitutes a small percentage of California red-legged frog breeding habitat on VAFB and rangewide. In addition, this loss of habitat would be offset by the restoration and enhancement of 0.48 acre of California red-legged frog breeding habitat further downstream. The Air Force would use a Service-approved biologist to survey for and relocate all California red-legged frogs to the nearest suitable habitat outside of the project area prior to the onset of construction activities. The Air Force would also install temporary exclusionary fencing and have a Service-approved biologist monitor the area daily to relocate California red-legged frogs that enter the main construction area. We expect these measures to greatly minimize disturbances to breeding activity. Therefore, we expect minimal impacts to breeding California red-legged frogs and conclude that the proposed project will not reduce the reproduction of the species on VAFB, in the Central Coast Recovery Unit, or rangewide.

Number

We are unable to determine the precise number of California red-legged frogs that could occur in the action area and may be affected by proposed project because the numbers of individuals in the action area likely vary from year to year. The proposed activities could directly and indirectly affect individual California red-legged frogs to the point of injury or death, although we expect injury or mortality to be minimal. The number of California red-legged frogs we expect to be affected by the proposed activities is very small relative to VAFB populations and those in the entirety of the species' range. Therefore, we do not expect the proposed project will reduce the number of California red-legged frog on VAFB, in the Central Coast Recovery Unit, or rangewide.

Distribution

The proposed project could temporarily displace California red-legged frogs from portions of the action area and could cause injury or mortality; however, the Air Force would implement measures to minimize the risk of adverse effects on California red-legged frogs. Future vegetation maintenance could decrease habitat suitability in the main construction area and result in localized changes in the distribution of California red-legged frogs – this is more likely to result in reduced numbers of the species within the main construction area, rather than complete avoidance of the area by the species. In addition, the main construction area is small (0.27 acres) and there is suitable habitat located immediately upstream and downstream. Therefore, we do not expect the effects of the proposed project to reduce the distribution of the California red-legged frog on VAFB, in the Central Coast Recovery Unit, or rangewide.

Recovery

The action area lies within the Central Coast Recovery Unit. The proposed action would not result in any appreciable change in reproduction, population numbers, or distribution of the

California red-legged frog and would not preclude the Service's ability to implement any of the measures identified in the recovery plan for the species. Therefore we conclude that the proposed action would not appreciably reduce the likelihood of recovery of the California red-legged frog in the Central Coast Recovery Unit or rangewide.

After reviewing the current status of the California red-legged frog, the environmental baseline for the action area, the effects of the proposed project at VAFB, and the cumulative effects, it is the Service's biological opinion that the Air Force's proposal to conduct erosion protection and maintenance activities at the San Antonio Creek West Bridge on VAFB, is not likely to jeopardize the continued existence of the California red-legged frog. We have determined that the reproduction, numbers, and distribution of the species would not be reduced, and that the proposed project would not reduce appreciably the likelihood of the recovery of the California red-legged frog as envisioned in the recovery plan due to the relatively small size of the affected area and the measures the Air Force proposes to avoid and minimize the potential effects.

Unarmored Threespine Stickleback

Reproduction

The proposed project would temporarily reduce the amount of available breeding habitat for the unarmored threespine stickleback within the action area during construction activities, and may reduce suitability of breeding habitat within the main construction area as long as vegetation maintenance is ongoing. Such disruptions could potentially affect a portion of breeding unarmored threespine stickleback at VAFB. If vegetation maintenance resulted in a permanent loss of breeding habitat, the amount of habitat affected would be small (0.27 acres) and constitutes a small percentage of unarmored threespine stickleback breeding habitat on VAFB and rangewide. The Air Force would install exclusionary netting upstream and downstream of the main construction area and a Service-approved biologist survey for and relocate all unarmored threespine sticklebacks to suitable downstream habitat outside of the action area prior to the onset of construction activities. The Air Force would also divert the San Antonio Creek to ensure continued flow and allow species to travel through the pipes and around the project area. We expect these measures to greatly minimize disturbances to breeding activity. Therefore, we expect minimal impacts to breeding unarmored threespine sticklebacks and conclude that the proposed project will not reduce the reproduction of the subspecies on VAFB or rangewide.

Numbers

A 2008 survey conducted of a 100-m segment of the San Antonio creek located within the current proposed action area resulted in the capture of 2,047 unarmored threespine sticklebacks. Based on this single estimate, the main construction area could easily contain over 1,000 unarmored threespine sticklebacks. However, a 2016 survey found a much lower density of sticklebacks, suggesting the main construction area may contain less than 100 individuals. Thus, we are unable to determine the precise number of unarmored threespine sticklebacks that could occur in the action area and may be affected by proposed project because the numbers of individuals in the action area likely vary from year to year. The proposed activities could directly and indirectly affect individual unarmored threespine sticklebacks to the point of injury or death, although we expect injury or mortality to be minimal based on the Air Force's proposed minimization measures. The number of unarmored threespine sticklebacks we expect to be affected by the proposed activities is small relative to VAFB populations and those in the entirety of the subspecies' range. Therefore, we do not expect the proposed project will reduce the number of unarmored threespine sticklebacks on VAFB or rangewide.

Distribution

The proposed project could temporarily displace unarmored threespine sticklebacks from portions of the action area and could cause injury or mortality; however, the Air Force would implement measures to minimize the risk of adverse effects on unarmored threespine sticklebacks. Future vegetation maintenance could decrease habitat suitability in the main construction area and result in localized changes in the distribution of unarmored threespine sticklebacks – this is more likely to result in reduced numbers of the subspecies within the main construction area, rather than complete avoidance of the area by the subspecies. In addition, the main construction area is small (0.27 acres) and there is suitable habitat located immediately upstream and downstream. Therefore, we do not expect the effects of the proposed project to reduce the distribution of the unarmored threespine sticklebacks on VAFB or rangewide.

Recovery

The action area is within a portion of San Antonio Creek which has been identified as one of three areas that is very important for the survival and recovery of the unarmored threespine stickleback. The proposed action would not result in any appreciable change in reproduction, population numbers, or distribution of the unarmored threespine stickleback and would not preclude the Service's ability to implement any of the measures identified in the recovery plan for the subspecies. Consequently, we conclude that the proposed actions would not reduce appreciably the likelihood of recovery of the unarmored threespine stickleback.

After reviewing the current status of the unarmored threespine stickleback, the environmental baseline for the action area, the effects of the proposed project at VAFB, and the cumulative effects, it is the Service's biological opinion that the Air Force's proposal to conduct erosion protection and maintenance activities at the San Antonio Creek West Bridge on VAFB, is not likely to jeopardize the continued existence of the unarmored threespine stickleback. We have determined that the reproduction, numbers, and distribution of the subspecies would not be reduced, and that the proposed project would not reduce appreciably the likelihood of the recovery of the unarmored threespine stickleback as envisioned in the recovery plan due to the size of the affected area and the measures the Air Force proposes to avoid and minimize the potential effects.

Tidewater Goby

Reproduction

The proposed project is not expected to reduce the amount of available breeding habitat for the tidewater goby, which is primarily located in the lagoon (over 6 miles downstream). Therefore, we expect minimal impacts to breeding tidewater gobies and conclude that the proposed project will not reduce the reproduction of the species on VAFB or rangewide.

Number

We are unable to determine the precise number of tidewater gobies that could occur in the action area and may be affected by the proposed project because the numbers of individuals in the action area vary from year to year. Based on historical survey results and continued drought conditions, we expect the number of tidewater gobies that would be affected is very small. The proposed activities could directly and indirectly affect any individual tidewater gobies in the action area to the point of injury or death, although we expect injury or mortality to be minimal based on the Air Force's proposed minimization measures. The Air Force would install exclusionary netting upstream and downstream of the main construction area and a Service-approved biologist survey for and relocate all tidewater gobies to suitable downstream habitat outside of the action area prior to the onset of construction activities. The Air Force would also divert the San Antonio Creek to ensure continued flow and allow species to travel through the pipes and around the project area. In addition, the Air Force would install 0.125 inch mesh over pump intakes to avoid entrainment of tidewater gobies. The number of tidewater gobies we expect to be affected by the proposed activities is very small relative to VAFB populations and those in the entirety of the species' range. Therefore, we do not expect the proposed project will reduce the number of tidewater gobies on VAFB or rangewide.

Distribution

The proposed project could temporarily displace tidewater gobies from portions of the action area and could cause injury or mortality; however, the Air Force would implement measures to minimize the risk of adverse effects on tidewater gobies. In addition, effects of the project would be localized to the vicinity of the project area, and are not expected to impact tidewater gobies downstream (e.g., in the lagoon). Therefore, we do not expect the effects of the proposed project to reduce the distribution of the tidewater gobies on VAFB or rangewide.

Recovery

The action area is included in the Conception Recovery Unit (Subunit CO2) for the tidewater goby. The proposed action would not result in any appreciable change in reproduction, population numbers, or distribution of the tidewater goby and would not preclude the Service's ability to implement any of the measures identified in the recovery plan for the species.

Consequently, we conclude that the proposed actions would not appreciably reduce the likelihood of recovery of the tidewater goby.

After reviewing the current status of the tidewater goby, the environmental baseline for the action area, the effects of the proposed project at VAFB, and the cumulative effects, it is the Service's biological opinion that the Air Force's proposal to conduct erosion protection and maintenance activities at the San Antonio Creek West Bridge on VAFB, is not likely to jeopardize the continued existence of the tidewater goby. We have determined that the reproduction, numbers, and distribution of the species would not be reduced, and that the proposed project would not appreciably reduce the likelihood of the recovery of the tidewater goby as envisioned in the recovery plan due to the limited use of the area by tidewater gobies and the measures the Air Force proposes to avoid and minimize the potential effects.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened wildlife species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to wildlife 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. 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 the purpose of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

In June 2015, the Service finalized new regulations implementing the incidental take provisions of section 7(a)(2) of the Act. The new regulations also clarify the standard regarding when the Service formulates an Incidental Take Statement [50 CFR 402.14(g)(7)], from "…if such take may occur" to "…if such take is reasonably certain to occur." This is not a new standard, but merely a clarification and codification of the applicable standard that the Service has been using and is consistent with case law. The standard does not require a guarantee that take will result; only that the Service establishes a rational basis for a finding of take. The Service continues to rely on the best available scientific and commercial data, as well as professional judgment, in reaching these determinations and resolving uncertainties or information gaps.

California Red-legged Frog

We anticipate that some California red-legged frogs will be taken as a result of the proposed action. We expect the incidental take to be in the form of capture, injury, or mortality. We cannot quantify the precise number of California red-legged frog that may be taken as a result of the actions that the Air Force has proposed because California red-legged frogs move over time. Repeated surveys of San Antonio Creek upstream and downstream of the project area indicate the number (total, and per meter) of California red-legged frogs in a stretch of creek can vary greatly between months and years. Based on this, we are not able to reliably estimate the number of California red-legged frogs that would be taken by the proposed actions. Individuals injured or killed during translocation efforts are likely to be observed; however, mortality from other sources, including the indirect effects of translocation (e.g., unable to find food in a new location) or displacement from the action area, would be difficult to observe. In addition, some frogs may go undetected for capturing. Finding a dead or injured California red-legged frog may also be unlikely due to their cryptic coloration and potential to be quickly scavenged. The protective measures proposed by the Air Force are likely to prevent mortality or injury of most individuals.

Consequently, we are unable to reasonably anticipate the actual number of California red-legged frogs that would be taken by the proposed project; however, we must provide a level at which formal consultation would have to be reinitiated. The Environmental Baseline and Effects Analysis sections of this biological opinion indicate that adverse effects to the California red-legged frog would likely be low given the nature of the proposed activities and protective measures, and we, therefore, anticipate that take of the California red-legged frog would also be low. We also recognize that for every California red-legged frog found dead or injured, other individuals may be killed or injured that are not detected, so when we determine an appropriate take level we are anticipating that the actual take would be higher and we set the number below that level.

We anticipate that all California red-legged frogs encountered in the construction area will be captured, and that some injury or mortality will occur as a result of unpredictable circumstances. Because we are unable to reasonably anticipate the actual number of California red-legged frogs that would be captured, we are using injury or mortality during capture as a measure of the take we anticipate, as described above.

Based on the proposed project activities, detection of California red-legged frogs within the action area, and the uncertainty of how many California red-legged frogs would be captured and moved out of harm's way, we have determined that the amount of take in the form of injury or mortality during all project activities within the action area should be less than 10 percent of the total number of California red-legged frogs that are captured and relocated during all project activities. Therefore, if 20 or fewer California red-legged frogs are captured and 2 or more individuals are found dead or injured during any and all project activities, the Air Force must contact our office immediately to determine whether additional measures may be needed before proceeding with the action. If more than 20 California red-legged frogs are captured and 10 percent or more are found dead or injured during any and all project activities, the Air Force must contact our office immediately to determine whether additional measures may be needed before proceeding with the action. Project activities that are likely to cause additional take should cease during this review period because the exemption provided under section 7(o)(2) would lapse and any additional take would not be exempt from the section 9 prohibitions.

Unarmored Threespine Stickleback

We anticipate that some unarmored threespine sticklebacks could be taken as a result of the proposed action. We expect the incidental take to be in the form of capture, injury, or mortality. We cannot quantify the precise number of unarmored threespine sticklebacks that may be taken as a result of Air Force's proposed action because unarmored threespine sticklebacks are a mobile species in their aquatic environment and the abundance or distribution of the subspecies may have changed since the time of the most recent surveys in the project area. The 2008 and 2016 survey results indicate that the number of unarmored threespine sticklebacks within the project area may vary greatly between years, thus preventing us from reliably estimating the number of individuals that would be taken. In addition, individuals may not be detected due to their cryptic nature and small size. Finding a dead or injured unarmored threespine stickleback is unlikely. The protective measures proposed by the Air Force are likely to minimize injury and mortality of most individuals.

Consequently, we are unable to reasonably anticipate the actual number of unarmored threespine sticklebacks that would be taken by the proposed actions; however, we must provide a level at which formal consultation would have to be reinitiated. The Environmental Baseline and Effects Analysis sections of this biological opinion indicate that adverse effects to unarmored threespine sticklebacks would likely be low given the nature of the proposed activities and protective measures, and we, therefore, anticipate that take of unarmored threespine sticklebacks would also be low. We also recognize that for every unarmored threespine stickleback found dead or injured, other individuals may be killed or injured that are not detected, so when we determine an appropriate take level we are anticipating that the actual take would be higher and we set the number below that level.

The considerations we used in arriving at the take we anticipate include: (1) unarmored threespine stickleback populations fluctuate greatly in number of individuals; (2) dead or injured individuals are difficult to detect; (3) some unarmored threespine sticklebacks may be killed or injured by project activities; (4) minimization measures proposed by the Air Force should be effective at minimizing adverse effects to unarmored threespine sticklebacks; and (5) the level of take we anticipate must be consistent with a non-jeopardy determination, in that it cannot appreciably reduce the numbers, reproduction, or distribution of the subspecies. We anticipate that all unarmored threespine sticklebacks encountered in the construction area will be captured, and that some injury or mortality will occur as a result of unpredictable circumstances. Because we are unable to reasonably anticipate the actual number of unarmored threespine sticklebacks that would be captured, we are using injury or mortality during capture as a measure of the take we anticipate, as described above.

Based on the proposed project activities, the detection of unarmored threespine sticklebacks within the action area, and the large uncertainty of how many unarmored threespine sticklebacks would be captured and moved out of harm's way, we have determined that the amount of take in the form of injury or mortality during all project activities within the action area should be less than 10 percent of the total number of unarmored threespine sticklebacks that are captured and relocated during all project activities. Therefore, if 50 or fewer unarmored threespine sticklebacks are captured and 5 or more individuals are found dead or injured during any and all project activities, the Air Force must contact our office immediately to determine whether additional measures may be needed before proceeding with the action. If more than 50 unarmored threespine sticklebacks are captured and 10 percent or more are found dead or injured during any and all project activities, the Air Force must contact our office immediately to determine whether additional measures may be needed before proceeding with the action. Project activities that are likely to cause additional take should cease during this review period because the exemption provided under section 7(o)(2) would lapse and any additional take would not be exempt from the section 9 prohibitions.

Tidewater Goby

We anticipate that some tidewater gobies could be taken as a result of the proposed action. We expect the incidental take to be in the form of capture, injury, or mortality. We cannot quantify the precise number of tidewater gobies that may be taken as a result of the Air Force's proposed action because tidewater gobies are a mobile species in their aquatic environment and may have entered the construction area since the time of the last surveys in the project area (2016). In addition, individuals may not be detected due to their cryptic nature and small size. Finding a dead or injured tidewater goby is unlikely. The protective measures proposed by the Air Force are likely to minimize injury and mortality of most individuals.

While we are unable to reasonably anticipate the actual number of tidewater gobies that would be taken by the proposed action, we must provide a level at which formal consultation would have to be reinitiated. The Environmental Baseline and Effects Analysis sections of this biological opinion indicate that adverse effects to tidewater gobies would likely be very low given the distance of the project area from the tidewater goby's primary habitat in and near San Antonio Creek lagoon, as well as the nature of the proposed activities and protective measures, and we, therefore, anticipate that take of tidewater gobies would also be very low. We also recognize that for every tidewater goby found dead or injured, other individuals may be killed or injured that are not detected, so when we determine an appropriate take level we are anticipating that the actual take would be higher and we set the number below that level.

The considerations we used in arriving at the take we anticipate include: (1) tidewater goby populations fluctuate greatly in number of individuals; (2) dead or injured individuals are difficult to detect; (3) some tidewater gobies may be killed or injured by project activities; (4) minimization measures proposed by the Air Force should be effective at minimizing adverse effects to tidewater gobies; and (5) the level of take we anticipate must be consistent with a non-jeopardy determination, in that it cannot appreciably reduce the numbers, reproduction, or distribution of the species. We anticipate that all tidewater gobies encountered in the construction area will be captured, and that some injury or mortality will occur as a result of unpredictable circumstances. Because we are unable to reasonably anticipate the actual number of tidewater gobies that would be captured, we are using injury or mortality during capture as a measure of the take we anticipate, as described above.

Based on the proposed project activities, the uncertainty whether tidewater gobies occur within the action area, and the uncertainty of how many tidewater gobies would be captured and moved out of harm's way, we have determined that the amount of take in the form of injury or mortality during all project activities within the action area should be less than 10 percent of the total number of tidewater gobies that are captured and relocated during all project activities. Therefore, if 20 or fewer tidewater gobies are captured and 2 or more individuals are found dead or injured during any and all project activities, the Air Force must contact our office immediately to determine whether additional measures may be needed before proceeding with the action. If more than 20 tidewater gobies are captured and 10 percent or more are found dead or injured during any and all project activities, the Air Force must contact our office immediately to determine whether additional measures may be needed before proceeding with the action. Project activities that are likely to cause additional take should cease during this review period because the exemption provided under section 7(o)(2) would lapse and any additional take would not be exempt from the section 9 prohibitions.

REASONABLE AND PRUDENT MEASURES/ TERMS AND CONDITIONS

The Service's evaluation of the effects of the proposed action includes consideration of the measures developed by the Air Force, and repeated in the Description of the Proposed Action portion of this biological opinion, to minimize the adverse effects of the proposed action on the California red-legged frog, unarmored threespine stickleback, and tidewater goby. The Service believes these measures are adequate and appropriate to minimize the impacts of the incidental take of California red-legged frog, unarmored threespine stickleback, and tidewater goby. Therefore, we are not including any reasonable and prudent measures and terms and conditions in this incidental take statement. Any subsequent changes in the minimization measures proposed by the Air Force may constitute a modification of the proposed action and may warrant reinitiation of formal consultation, as specified at 50 CFR 402.16.

REPORTING REQUIREMENTS

The Air Force must provide a written report to the Service within 60 days following completion of the proposed construction activities. The reports must include the following information for California red-legged frogs, unarmored threespine sticklebacks, and tidewater gobies affected by the proposed actions – the number of individuals found, captured and relocated from the action area, injured, or killed during project activities; the dates and times of capture, relocation, injury, or mortality; the circumstances of any injuries or mortalities, if known; approximate size and life stage of individuals; and a description and map of relocation sites. The report must contain a brief discussion of any problems encountered in implementing minimization measures, results of biological surveys and sighting records, and any other pertinent information. We encourage you to submit recommendations regarding modification of or additional measures that would improve or maintain protection of the unarmored threespine stickleback or tidewater goby, while simplifying compliance with the Act.

For a minimum of 5 years or until mitigation success criteria have been met, the Air Force must provide a written annual report describing project activities during the previous year to the Service by August 31st. The reports must contain information on: (1) the type, location and timing of activities that occurred in the action area (e.g., vegetation maintenance, monitoring, etc.); (2) a brief description of the activities including equipment used; (3) the number of listed species affected and the manner in which they were affected; (4) steps taken to avoid or minimize effects; (5) for vegetation maintenance activities, a list of plant species that were cut and the area (square feet) affected, whether maintenance activities required entry into San Antonio Creek, and photos of the area both before and after maintenance; (6) for mitigation monitoring activities, monitoring results to include percent cover by plant species and survival of planted willow and container plantings; (7) the results of any surveys or observations of California red-legged frogs, unarmored threespine sticklebacks, or tidewater gobies in the previous year; (8) a record of observations of any other listed species observed during project activities; and (9) any other pertinent information.

DISPOSITION OF DEAD OR INJURED SPECIMENS

Within 1 working day of locating a dead or injured California red-legged frog, unarmored threespine stickleback, or tidewater goby, the Air Force must make initial notification by telephone and writing to the Ventura Fish and Wildlife Office in Ventura, California, (2493 Portola Road, Suite B, Ventura, California 93003, (805) 644-1766). The notification must include the time and date, location of the carcass, a photograph, cause of death if known, and any other pertinent information.

Care must be taken in handling injured animals to ensure effective treatment and care and in handling dead specimens to preserve biological material in the best possible state for later analysis. Injured animals must be transported to a qualified veterinarian. If any injured California red-legged frogs, unarmored threespine sticklebacks, or tidewater gobies survive, the Air Force should contact us regarding their final disposition.

The remains of California red-legged frogs, unarmored threespine sticklebacks, or tidewater gobies must be placed with educational or research institutions holding the appropriate State and Federal permits, such as the Santa Barbara Natural History Museum (Contact: Paul Collins, Santa Barbara Natural History Museum, Vertebrate Zoology Department, 2559 Puesta Del Sol, Santa Barbara, California 93460, (805) 682-4711, extension 321).

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to use 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 to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. We recommend that the Air Force advise Service-approved biologist(s) to relocate other native reptiles or amphibians found within work areas to suitable habitat outside of Project areas if such actions are in compliance with State laws.

2. We recommend that the Air Force advise Service-approved biologist(s) to remove non-native aquatic animals such as bullfrogs, crayfish, and brown bullhead which may prey on California red-legged frogs, unarmored threespine stickleback, and tidewater goby whenever these are detected during project monitoring activities.

3. We recommend the Air Force investigate the efficacy of capture and relocation of California red-legged frogs to determine if use of this minimization measure reduces adverse effects of project actions on the species. As part of this, information on repeat capture and behavior of individuals post-movement should be noted.

4. We recommend that the Air Force continue conducting periodic surveys of California red-legged frog, unarmored threespine stickleback, and tidewater goby on VAFB to assess populations base-wide and provide continuous evaluation of status at known and new sites.

The Service requests notification of the implementation of any conservation recommendations so we may be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats.

REINITIATION NOTICE

This concludes formal consultation on the actions outlined in the request for formal consultation dated March 10, 2016, and subsequent revisions to the project description on August 25, 2016, March 26, 2018, and April 5, 2018. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (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 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, the exemption issued pursuant to section 7(o)(2) may have lapsed and any further take could be a violation of section 4(d) or 9. Consequently, we recommend that any operations causing such take cease pending reinitiation.

If you have any questions regarding this consultation, please contact Heather Tipton of my staff at (805) 677-3326, or by electronic mail at heather_tipton@fws.gov.

Sincerely,

Stephen P. Henry
Field Supervisor

cc:
Darryl York, VAFB
Rhys Evans, VAFB

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