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October 20, 2016

Memorandum

To: Regional Director, Fish and Wildlife Service, Albuquerque, New Mexico

From: Field Supervisor

Subject: Intra-Service Biological and Conference Opinion on the San Rafael Ranch Habitat Conservation Plan, Arizona

This biological and conference opinion (BCO) responds to the U.S. Fish and Wildlife Service (USFWS) requirement for intra-Service consultation on the proposed issuance of a section 10(a)(l)(B) incidental take permit (TE-12133A-O) to the San Rafael Cattle Company (SRCC; also applicant), pursuant to section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544), as amended (Act), authorizing the incidental take of six covered species. Along with the permit application, SRCC submitted a draft of the San Rafael Ranch Habitat Conservation Plan (SRRHCP; Harlow 2015). The SRRHCP permit area covers non-Federal lands in the San Rafael Valley of Santa Cruz County, Arizona (See Figure 1).

This BCO analyzes and addresses the potential adverse effects that issuance of this permit may have on the endangered Huachuca water umbel (*Lilaeopsis schaffneriana* ssp. *recurva*) and designated critical habitat, the endangered Canelo Hills ladies'-tresses (*Spiranthes delitescens*), the endangered Gila chub (*Gila intermedia*) and designated critical habitat, the endangered Sonora tiger salamander (*Ambystoma mavortium stebbinsi*), and the northern Mexican gartersnake (*Thamnophis eques megalops*) and proposed critical habitat. We also analyze the potential effects that issuance of this permit may have on the candidate Huachuca springsnail (*Pyrgulopsis thompsoni*). Consistent with our policies concerning intra-service consultations

addressing candidate species and for the purpose of this opinion, we will treat the Huachuca springsnail herein as if it were proposed for listing as threatened or endangered.

We determined that this action may affect, but is not likely to adversely affect the nonessential experimental population of northern aplomado falcon (*Falco femoralis septentrionalis*), the threatened Mexican spotted owl (*Strix occidentalis lucida*) and designated critical habitat, the threatened western yellow-billed cuckoo (*Coccyzus americanus*) and proposed critical habitat, the endangered lesser long-nosed bat (*Leptonycteris curasoae yerbabuenae*), the endangered ocelot (*Leopardus [=Felis] pardalis*), and the endangered jaguar (*Panthera onca*) and its critical habitat.

Concurrences with the determinations on these species are in Appendix A. We further determined that this action will have no effect on the endangered Mexican gray wolf (*Canis lupus baileyi*) because it is not known or reasonably certain to occur within the action area during the term of the permit.

This BCO is based on information provided in the final SRRHCP dated December 16, 2015, the draft Low Effect Screening Document (LESO) dated November 13, 2015; telephone conversations; field investigations; USFWS files; and other sources of information. References cited in this BCO are not a complete bibliography of all references available on the species of concern, the activities covered in the SRRHCP and their effects, or on other subjects considered in this opinion. A complete administrative record of this consultation is on file in the Arizona Ecological Services Office (AESO). If there are any questions concerning this BCO, please contact Doug Duncan (520) 670-6150 x236 or Scott Richardson x242.

**CONSULTATION HISTORY**

- May 27, 2009: USFWS received the draft SRRHCP and application for the section 10(a)(1)(B) incidental take permit (ITP) from SRCC.

- April 30, 2010: The SRCC approved modifications made to the draft SRRHCP and requested that USFWS announce its availability for public comment in the Federal Register.

- June 22, 2010: The draft SRRHCP and draft LESO were available for public review. July 22, 2010: The 30-day public review period ended.

- August 2010 -May 2011: USFWS and the SRCC addressed public comments and outstanding issues related to the draft SRRHCP.

- May 21, 2011: The SRCC submitted an amended final SRRHCP

- May 22, 2011: USFWS initiated intra-service formal consultation and conference on the issuance of the ITP associated with the SRRHCP and its implementation.

- September, 2011: The applicant decided to suspend any activities associated with the draft HCP. July, 2014: The applicant decided to pursue completion of the HCP.

- September 24, 2015: USFWS received the draft SRRHCP and application for the section 10(a)(1)(B) incidental take permit (ITP) from SRCC.

- October 19, 2015: The SRCC approved modifications made to the draft SRRHCP and requested that USFWS announce its availability for public comment in the Federal Register.

- November 12, 2015: The draft SRRHCP and draft LESO were available for public review.

- December 14, 2015: The 30-day public review period ended.

- December 14, 2015: The applicant transmitted comments on a draft of the proposed action.

- January 7, 2016: The applicant transmitted comments on a draft of the BCO.

- March 24, 2016: The applicant transmitted comments on a draft of the BCO.

- April 1, 2016: The applicant transmitted comments on a draft of the permit stipulations.

- May 19, 2016: We transmitted the final package, including the BCO, to the regional office.

- June 29, 2016: We received comments on the BCO from the regional office.

## BIOLOGICAL OPINION

### DESCRIPTION OF THE PROPOSED ACTION

The proposed action is our issuance of a section 10(a)(1)(B) permit to SRCC for the incidental take of animal species in association with the implementation of a habitat conservation plan. Two plant species are covered under the San Rafael Ranch Habitat Conservation Plan (SRRHCP) to address effects and conservation actions related to these plant species. However, the section 9 prohibitions of the ESA differ between animals and plants and Sections 7(b)(4) and 7(o)(2) of the ESA generally do not apply to listed plant species. However, for simplicity, the following discussion of effects from covered activities on plants is analogous to the discussion of effects of take on the covered animal species. The permit would allow incidental take of six species for 30 years resulting from livestock management activities on the 18,500-acre San Rafael Ranch (SRR) owned by SRCC and potentially on a lease covering the 3,560-acre San Rafael State Natural Area (SRSNA), owned by Arizona State Parks. There is currently a special use permit for the applicant to graze on the SRSNA; we assume that will continue for the

purposes of this BCO. Thus, the effects of livestock on both the SRR and the SRSNA will be considered in this BCO. Livestock grazing, watering, and fencing are the only actions by the SRCC that will be covered on the SRSNA. If there is no agreement allowing the SRCC to graze the SRSNA, no grazing activities by the SRCC will be covered there. The six covered species include Gila chub, Sonora tiger salamander, northern Mexican gartersnake, Huachuca springsnail, Huachuca water umbel, and Canelo Hills' ladies-tresses.

Two additional listed species, the Gila topminnow (*Poeciliopsis o. occidentalis*) and the Chiricahua leopard frog (*Lithobates chiricahuensis*), occur, or may occur, within the permit area and are briefly discussed in the SRRHCP. However, the occurrence of the Gila topminnow and the Chiricahua leopard frog within the permit area is or will be the result of reestablishment. These actions and any impacts and incidental take above the baseline associated with actions for these two species have been evaluated under the Biological Opinions for the issuance of enhancement of survival permits under section 10(a)(1)(A) of the Act to the Arizona Game and Fish Department (AGFD) in association with statewide Safe Harbor Agreements (22410-2003-F-0022, USFWS 2008 for Gila topminnow, and 02-21-03-F-0083, USFWS 2006 for Chiricahua leopard frog). We do not anticipate that effects associated with the covered actions within the SRRHCP will exceed those evaluated under the issuance of the enhancement of survival permits and, therefore, this BCO will not address effects related to these species under the SRRHCP any further. To see the complete analysis of effects to these two species under the statewide Safe Harbor Agreements, see our website (http://www.fws.gov/southwest/es/arizona/) and click on the "Document Library" tab and then on the "Section 7 Biological Opinions" tab.

The SRRHCP has two purposes: 1) to provide a regulatory framework and early agreement to enable the SRCC to cooperate with the USFWS, the Arizona Game and Fish Department, and other conservation organizations for the translocation and reestablishment of new populations of covered species on the SRR; and 2) as a result of covered activities, allow for the incidental take of covered species that already exist on the covered lands and of new populations of covered species that are established by the cooperating agencies and organizations to promote recovery of these species. A complete description of the proposed action and associated conservation measures are included in the SRRHCP and are incorporated herein by reference. The covered activities proposed by SRCC in the SRRHCP include three categories of activities related to livestock management that have the potential to result in incidental take of covered species. These include the watering and grazing by cattle, including herding cattle within and between pastures; maintenance of stock tanks, wells, waterlines, fences, roads and utility lines supporting these facilities; and management of brush and invasive plants. The conservation actions proposed by SRCC in the final SRRHCP consist of activities and measures to protect the covered species in the course of carrying out the covered activities. The final SRRHCP also allows conservation and recovery actions for the covered species to occur on SRR.

**Covered Activities**

The SRCC proposes to cover watering and grazing of cattle in stock tanks, riparian pastures, and uplands, as well as herding cattle between all pastures throughout the SRR and SRSNA (covered area). There are 31 pastures on the SRR and the SRSNA. The SRCC currently maintains over 80 stock tanks on the SRR for watering cattle, including 43 drinkers and 37 stock ponds. The

drinkers are above ground tanks with troughs fed from specific point groundwater sources (e.g., springs or wells) and the stock ponds are earthen impoundments typically fed by surface runoff. Stock ponds may also be fed by overflow from nearby drinkers. The SRCC waters cattle in stock tanks throughout the year. The SRCC waters and grazes cattle in riparian pastures along six miles of the Santa Cruz River and its tributaries from November 1 through March 31 annually. The SRCC also waters and grazes cattle within the pasture that contains Sheehy Spring for short periods during the year; however, in some years this pasture is not grazed. Cattle are herded within and between all pastures on the SRR throughout the year. Grazing on all pastures is managed under a rest-rotation system as detailed in the Ranch Grazing Plan authored by the Natural Resources Conservation Service. The overall ranch goals identified in the Ranch Grazing Plan are very similar to the goals identified by the SRCC in the SRRHCP. Indeed, much of the verbiage regarding goals and objectives found in the SRRHCP came from the grazing plan. We consider the proper management of livestock grazing under this plan to be a conservation measure (see the more detailed description below in the Conservation Measures section) that is part of the proposed action contributing to the reduction of effects to or benefitting the covered species in the SRRHCP.

The SRCC proposes to cover the maintenance of stock tanks, wells, waterlines, fences, roads and utility lines as a necessary part of management of the SRR. The maintenance of cattle watering sources and their associated infrastructure also serves to provide habitat for two covered species, the Sonora tiger salamander and northern Mexican gartersnake. Gila chub and water umbel may be established in stock tanks as conservation actions as described in the SRRHCP. Stock tanks must be periodically cleaned of sediment to maintain storage capacity. This occurs infrequently, averaging every 20 to 25 years. Also, stock tanks may be periodically dried to reduce or eliminate non-native fish and other non-native aquatic species, including the American bullfrog (*Lithobates catesbeiana*), that have negative effects on the covered species. Roads are used for routine ranching activities, including herding, patrolling, and access to maintain infrastructure. Fencing divides the SRR into individual pastures and allows for rotational grazing and cattle exclusion when necessary. Wells, waterlines, and utility lines provide water to drinkers and stock ponds. Maintenance of these facilities consists of periodic structural repairs, clearing of vegetation and brush from facility corridors, and grading of roads. All of these facilities will be maintained within their existing footprint. Construction of new facilities or stock tanks is not covered under the SRRHCP. Hay production (generally at the "farm") for supplemental feeding is also a covered action. Also, opportunities for positive conservation actions for the covered species are allowed under the SRRHCP.

The SRCC proposes primarily chemical, but also mechanical, removal of non-native grasses and invasive native shrubs on some areas on the SRR. Shrub areas are generally less than one acre. The SRCC holds or will obtain the appropriate permits for herbicide application and herbicides will be applied in accordance with product labels, in compliance with state guidelines and in conformance with use recommendations of the Natural Resources Conservation Service (NRCS) [Arizona Revised Statute 3-363-10(a), Natural Resource Conservation Service 2002, Natural Resource Conservation Service 2008]. As per regulation, the SRRHCP includes an adaptive management strategy, funding mechanisms, reports, and procedures to address changed and unforeseen circumstances.

Conservation Measures

Conservation measures in the proposed SRRHCP will be implemented by the SRCC to minimize take and to avoid, minimize, and mitigate to the maximum extent practicable the anticipated effects of the covered activities on the covered species. In addition to covering activities that may incidentally take covered species, the SRRHCP is intended to provide the regulatory framework and agreement such that SRRCC can fully cooperate with partners on conservation opportunities to improve the status and distribution of covered species on the ranch. These conservation measures are as follows:

1. Implement rotational short duration grazing annually of the pasture containing Sheehy Spring, which provides habitat for four of the six covered species. This pasture is not grazed in some years.

2. Limit grazing of riparian pastures along the Santa Cruz River to November 1st through March 31st, reducing the impacts of grazing on riparian resources by grazing outside the active growing season and sensitive life history periods for the covered species.

3. Where feasible, manage water in stock tanks for use by covered species, as well as control of non-native invasive species.

4. Maintain stock tanks following guidelines developed in part from the Fish and Wildlife Service in the Sonora Tiger Salamander Recovery Plan (USFWS 2002a).

5. Maintain fences around all pastures to prevent access by cattle when pastures should not be grazed. Fences will also be maintained around some stock tanks to limit access by cattle.

6. Conduct brush and invasive plant management activities using best management practices to prevent associated sediments and herbicides from entering aquatic habitats (White 2007). Herbicides will not be used in habitats containing covered plant species. Invasive species management will typically result in benefits to the covered species.

7. Maintain and improve riparian condition through effective ranch management.

8. Personnel will not knowingly engage in the release of non-native fish, amphibian, or invertebrate species within the covered area.

9. Support and work with (as funding is available) partners as needed for non-native species removal actions.

10. As funding becomes available, work with partners to install exclosure fencing of stock tanks occupied by covered species and add drinkers for livestock use adjacent to these stock tanks.

11. Promote conservation and recovery of covered species by allowing establishment of new populations of covered species on the SRR.

12. Develop an oral and written educational program to provide information to those participating in and implementing the SRRHCP regarding the unique species and habitats found on the SRR and make them aware of the conservation measures and programs being undertaken on the SRR that are related to the covered activities and species of the SRRHCP.

13. Conduct compliance and effects monitoring related to actions in the SRRHCP and this BCO by collecting information related to take including the specific action taken, the covered activity under which the specific action was taken, how many of each species were taken, and the extent of species' habitat affected.

    a. The SRCC will meet annually with the USFWS to review terms and conditions of the permit and to determine compliance with the terms and conditions;

    b. The SRCC will monitor its covered actions to determine if incidental take occurs. A report including the action, species, date, and any other pertinent information shall be included. The take report will include observations of individuals of covered species that may have been taken, and the measure of incidental take found in this BCO.

14. Conduct effectiveness monitoring through the establishment of permanent photo plots as specified in the SRRHCP. Photo monitoring will be designed to address habitat condition and changes in habitat availability. Photo plots will document the integrity of aquatic habitats, the integrity of fencing, vegetation cover, and presence of non-native species.

15. Meet with the USFWS annually to establish a plan for species monitoring. If adequate partner funding or personnel are not available for species monitoring, the SRCC will ensure that the monitoring is completed, as specified in the SRRHCP.

**Action Area**

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR § 402.02). In delineating the action area, we evaluated the farthest reaching physical, chemical, and biotic effects of the action on the environment.

The SRRHCP covers a total of 22,060 acres, including 18,375 acres of rangeland and 125 acres of irrigated pasture owned by the SRCC. In addition, the SRRHCP also covers 3,560 acres of grazing preference on the Arizona State Parks, SRSNA, consistent with any lease terms. The Santa Cruz River bisects the action area, flowing from its headwaters in the San Rafael Valley south into Mexico.

## ANALYTICAL FRAMEWORK FOR THE JEOPARDY AND ADVERSE MODIFICATION DETERMINATIONS

### Jeopardy Determination

In accordance with policy and regulation, the jeopardy analysis in this Biological and Conference Opinion relies on four components: 1) the Status of the Species, which evaluates the Huachuca water umbel, the Canelo Hills ladies'-tresses, the Gila chub, the Sonora tiger salamander, the northern Mexican gartersnake, and the candidate Huachuca springsnail range-wide condition, the factors responsible for that condition, and its survival and recovery needs; 2) the Environmental Baseline, which evaluates the condition of the Huachuca water umbel, the Canelo Hills ladies'-tresses, the Gila chub, the Sonora tiger salamander, the northern Mexican gartersnake, and the candidate Huachuca springsnail in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the Huachuca water umbel, the Canelo Hills ladies'-tresses, the Gila chub, the Sonora tiger salamander, the northern Mexican gartersnake, and the candidate Huachuca springsnail; 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 species; and 4) Cumulative Effects, which evaluates the effects of future, non-Federal activities in the action area on the species.

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 species' current status, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the species in the wild. The jeopardy analysis in this Biological Opinion considers the range-wide survival and recovery needs of the species and the role of the action area in its survival and recovery as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

### Adverse Modification Determination

This Biological and Conference Opinion relies on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. In accordance with policy and regulation, the adverse modification analysis in this Biological and Conference Opinion relies on four components: 1) the Status of Critical Habitat, which evaluates the range-wide condition of designated critical habitat for the Huachuca water umbel and northern Mexican gartersnake (proposed CH) in terms of physical and biological features, the factors responsible for that condition, and the intended value of the critical habitat for conservation of the species; 2) the Environmental Baseline, which evaluates the condition of the critical habitat in the action area, the factors responsible for that condition, and the value of the critical habitat for conservation of the species in the action area; 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 physical and biological features and how that will influence the value of affected critical habitat units for conservation of the species; and 4) the Cumulative Effects, which evaluates the effects of future, non-Federal activities in the action area on the

physical and biological features and how that will influence the value of affected critical habitat units for conservation of the species.

For purposes of the adverse modification determination, the effects of the proposed Federal action on the species' critical habitat are evaluated in the context of the range-wide condition of the critical habitat, taking into account any cumulative effects, to determine if the critical habitat range-wide would remain functional (or would not preclude or significantly delay the current ability for the physical and biological features to be functionally established in areas of currently unsuitable but capable habitat) such that the value of critical habitat for the conservation of the species is not appreciably diminished.

## STATUS OF THE SPECIES AND CRITICAL HABITAT

### Huachuca Water Umbel

On January 6, 1997, we listed the Huachuca water umbel (umbel) as an endangered species (62 FR 665; USFWS 1997); in 1999, 83.2 kilometers (km)(5 l.7 miles [mi]) of streams or rivers in Cochise and Santa Cruz counties, Arizona, were designated as critical habitat (64 FR 37441; USFWS 1999a). A Five-Year Review of the taxon was finalized in August, 2014 (FWS 2014a) and a draft recovery plan was released in March, 2016 (USFWS 2016a).

Because this taxon is clonal in nature and it is not practicable to identify individuals, the term "occurrence" is used to denote concentrations of this taxon within a distinct locality that are relatively distant from other concentrations. Occurrences are more likely to share underground root systems, and are often separated from one another by geological or hydrological features. Within occurrences, clusters of stems separated by areas without stems are denoted herein as "patches." An occurrence can consist of one to many patches; patches can have one or a few stems or form carpets of stems.

The umbel is a semi-aquatic to fully aquatic herbaceous perennial plant of the carrot family (Apiaceae). For a complete description of the Huachuca water umbel, see FWS 2014a and 2016a. The umbel is restricted to cienegas, rivers, streams, and springs in permanently wet (or nearly so) muddy or silty substrates with some organic content (64 FR 37441; USFWS 1999a). The taxon is generally found in shallow and slow-flowing waters that are relatively stable, or in active stream channels containing refugial sites where the plants can escape the effect of scouring floods (USFWS 1997, USFWS 1999a). In upper watersheds that generally do not experience scouring floods, the umbel occurs in microsites where interspecific plant competition is low. At these sites, the umbel occurs on wetted soils interspersed with other plants at low density, along the periphery of the wetted channel, or in small openings in the understory. In stream and river habitats, the umbel can occur in backwaters, side channels, and nearby springs.

Through both rhizomes and seeds, the taxon can survive short periods without water, though is generally considered a taxon of perennial water environments. Found between 855 and 2,170 m (2,805 and 7,120 ft) in elevation, the range of the taxon crosses the Sierra Madrean Region of southeastern Arizona and adjacent portions of Sonora, Mexico (Titus and Titus 2008c, Vernadero Group and the Desert Botanical Garden 2012).

Habitat degradation over time has resulted in decreased number and size of umbel occurrences, potentially decreasing genetic diversity, and making the taxon more vulnerable to extinction as a result of stochastic events (Vernadero Group and the Desert Botanical Garden 2012). The clonal nature of the taxon may also reduce genetic diversity, increasing vulnerability. Occurrences in many cases are isolated, as well, which makes the chance of natural recolonization after extirpation less likely. The restriction of the umbel to a relatively small area in southeastern Arizona and adjacent Mexico increases the chance that a single environmental catastrophe, such as a severe tropical storm or drought, could eliminate appreciable numbers of occurrences.

In the United States (U.S.), we are aware of 30 locations supporting extant occurrences of umbel, eight locations where all umbel occurrences are considered extirpated, and six locations where no occurrences have been relocated in recent years (USFWS 2014a). In the U.S., the umbel occurs on lands administered by the U.S. Army Fort Huachuca, the Forest Service, the Bureau of Land Management, the USFWS, Arizona State Parks, Pima County, The Nature Conservancy, and private landowners. The majority of umbel occurs along the San Pedro River, in the Huachuca Mountains, and along Cienega Creek, in the Santa Cruz River watershed. In Sonora, Mexico, we are aware of 21 locations supporting umbel occurrences, though most of these locations have not been revisited in recent years. In Mexico, most umbel occurs on private lands of the San Pedro River and its tributaries in the San Pedro River Watershed (Anderson 2006). The umbel also occurs within the Santa Cruz, Rio Yaqui, Rio Sonora, and Rio Concepcion watersheds in Mexico (USFWS 2014a).

Although we now are aware of many more occurrences of umbel in both the U.S. and in Mexico than at the time of listing, there are no occurrences that appear to be increasing in size and many are reported from single patches among competing vegetation or in aquatic habitat that is in danger of being lost to groundwater pumping or drought. Many other occurrences have not been relocated in many years and are believed extirpated due to changes in suitability of habitat.

Threats

Threats to the taxon identified through research and consultations that could potentially impact umbel include: aquatic habitat degradation, wildfire and resulting sedimentation, invasive, non-native plant competition, improper livestock grazing, and recreation and the effects of drought and climate change.

Aquatic habitat degradation - Human activities such as groundwater overdraft, surface water diversion, impoundment, channelization, improper livestock grazing, agriculture, mining, sand and gravel operations, road building, non-native species introduction, urbanization, wood cutting, wildfire, and recreation all contribute to aquatic habitat loss and degradation within the historical range of the umbel (Hendrickson and Minckley 1984, Bahre 1991, Hereford 1993).

Wildfire and resulting sedimentation - Fire would generally not burn the wetland habitat of umbel due to high humidity and fuel moisture; however it has the potential to burn adjacent upland habitats causing indirect effects on the umbel and its habitat throughout the range of

the taxon (USFWS 2009). Effects include increased runoff of floodwaters including greater flood peaks, deposition of debris and sediment originating in the burned area, and potential for scouring of individual umbel plants and habitat (USFWS 2014a).

Invasive, non-native plants - Invasive non-native plants have increased their presence within riparian and aquatic habitat of southeastern Arizona, and this invasion and expansion of infestations are expected to continue. Because the umbel is sensitive to competition from both native and non-native herbaceous plants, the continued increase in non-native species will lead to a decrease in the presence of umbel throughout the range of the taxon.

Livestock grazing - Umbel are affected by livestock grazing in the following ways: 1) trampling, 2) direct impacts from construction of range projects, 3) changes in stream geomorphology that lead to erosion, sedimentation, and downcutting, 4) watershed degradation and resulting adverse effects to stream hydrology, and 5) consumption (USFWS 1999a, Anderson 2006). Observations of umbel response to grazing indicate the taxon is capable of experiencing light to moderate grazing with negligible impact (Edwards, USFS, pers. comm., February 21, 2001; J. Simms, BLM, pers. comm., October 26, 2011; Anderson 2006; Rorabaugh 2013). More intensive grazing or grazing during dry periods, when cattle spend a disproportionate amount of their time, if not controlled, in riparian areas, may result in harmful effects to umbel and other riparian obligates (Edwards pers. comm., February 21, 2001; Krueper 1996, USFWS 2002b, 2014a; Malcom and Radke 2008).

Recreation - Riparian areas and cienegas offer important recreational opportunities for the residents of southern Arizona and northern Sonora (USFWS 1997). This visitation is expected to increase with increases in human population, as well as drought conditions and the desire to be near water. Recreational activities, if poorly managed, can result in soil compaction, streambank destabilization, erosion and sedimentation, increases in the presence of invasive non-native plant species, and trampling of umbel and other riparian plant species, thus reducing habitat quality.

Drought and climate change -The umbel evolved in the Southwest and has persisted in many locations throughout its range through historical droughts such as those of the 1950s, yet, given the severity and persistence of the present multi-decade drought (Bowers 2005, Garfin et al. 2013, CLIMAS 2014), it is unknown how long umbel will maintain viability in de-watered habitat. It has been suggested that seed from this taxon may persist for five to ten years in such situations (Titus and Titus 2008a, 2008b, 2008c,). Projections for the southwestern U.S. are that precipitation will be less (Seager et al. 2007, Karl et al 2009) and that temperatures will rise (Karl et al. 2009, Overpeck et al. 2012). In addition, in a warmer environment, an enhanced hydrologic cycle is expected; rainfall events are predicted to be less frequent, but more intense, and larger flood events more common (Karl et al. 2009). Such large floods can destroy umbel patches, and even entire occurrences, if no niches in backwaters are present to ensure recolonization.

Critical Habitat

Seven Critical Habitat units have been designated for the umbel; all are in Santa Cruz and Cochise counties, Arizona, and include stream courses and adjacent areas of riparian vegetation. Unit 2 is within the action area. The Scotia, Sunnyside, and Bear canyon units (3, 4, 6) are within the Coronado National Forest. The remaining Units are in lands adjacent to Forest lands. The following general areas are designated as critical habitat (see legal descriptions for exact critical habitat boundaries):

Unit l About 1.25 mile of Sonoita Creek southwest of Sonoita;
Unit 2 About 2.7 miles of the Santa Cruz River on both sides of Forest Road 61, plus about 1.9 miles of an unnamed tributary to the east of the river;
Unit 3 About 3.4 miles of Scotia Canyon upstream from near Forest Road 48;
Unit 4 About 0.7 mile of Sunnyside Canyon near Forest Road 117 in the Huachuca Mountains;
Unit 5 About 3.8 miles of Garden Canyon near its confluence with Sawmill Canyon;
Unit 6 About 1.0 mile of Rattlesnake Canyon and 0.6 mile of an unnamed canyon, both of which are tributaries to Lone Mountain Canyon; about 1.0 mile of Lone Mountain Canyon; and about 1.0 mile of Bear Canyon; an approximate 0.6-mile reach of an unnamed tributary to Bear Canyon; and
Unit 7 About 33.7 miles of the San Pedro River from the perennial flow reach north of Fairbank (Arizona Department of Water Resources 1991) to 0.13 mile south of Hereford, San Pedro Riparian National Conservation Area.

The primary constituent elements of critical habitat for the umbel include, but are not limited to, the habitat components that provide:

1. Sufficient perennial base flows to provide a permanently or nearly permanently wetted substrate for growth and reproduction of umbel;

2. A stream channel that is relatively stable, but subject to periodic flooding that provides for rejuvenation of the riparian plant community and produces open microsites for umbel expansion;

3. A riparian plant community that is relatively stable over time and in which non-native species do not exist or are at a density that has little or no adverse effect on resources available for umbel growth and reproduction; and

4. In streams and rivers, refugial sites in each watershed and in each reach, including but not limited to springs or backwaters of mainstem rivers that allow each occurrence to survive catastrophic floods and recolonize larger areas.

Activities that may destroy or adversely modify critical habitat include those that alter the primary constituent elements to the extent that the value of critical habitat for both the survival and recovery of umbel is appreciably diminished. Such activities are also likely to jeopardize the continued existence of the species.

Multiple Federal actions affect this species every year. About 48 formal section 7 consultations have considered the impacts proposed actions on the Huachuca water umbel. Actions on non-

Federal land with no Federal nexus do not require section 7 consultation. Most biological opinions in Arizona can be found here: https://www.fws.gov/southwest/es/arizona/Biological.htm. Survey work and recovery projects also occur and are summarized in the Five-Year Review and draft recovery plan (FWS 2014a, 2016).

**Canelo Hills ladies' tresses**

On January 6, 1997, we listed the Canelo Hills ladies' tresses as an endangered species (62 FR 665; USFWS 1997). Neither a five-year review nor a recovery plan has been written for this species.

The Canelo Hills ladies' tresses is a member of the orchid family. Each slender, erect plant has 5 to 10 linear-lanceolate grass-like leaves. Leaves grow on the stem and are approximately 7.1 in (18 cm) long and 0.6 in (1.5 cm) wide (Sheviak 1990). The flower stalk is about 20 in (50 cm) tall containing about 40 white flowers positioned in a spiral at the top of the stalk. Flowering occurs from July to early August, during the monsoon rainy season. McClaran and Sundt (1992) suggest the average lifespan of the species is 3 to 4 years; however, other orchids can remain vegetative (non-flowering) for many years (Newman 1991).

As with most terrestrial orchids, successful seedling establishment probably depends on the successful formation of mycorrhizae (McClaran and Sundt 1992). The time needed for subterranean structures to produce aboveground growth is unknown. Plants may remain in a dormant, subterranean state or remain vegetative for more than one consecutive year. Plants that flower one year can become dormant, vegetative, or reproductive the next year (Newman 1991, McClaran and Sundt 1992).

The Canelo Hills ladies' tresses is a species sensitive to interspecific competition, requiring both ample light penetration and little competition for nutrients (Newman 1991). Fishbein and Gori (1992) report the dominance of spikerush (*Eleocharis* spp.), Kentucky bluegrass (*Poa pratensis*), and sedge (*Carex* spp.) at Canelo Hills Cienega, all of which could easily compete with Canelo Hills ladies' tresses. These species very likely also co-occur with Canelo Hills ladies' tresses at the other four known locations. Canelo Hills ladies' tresses require some level of disturbance to reduce competition periodical. This disturbance can be from periodic flooding, fire, or soil churning from moderate levels of grazing.

The sponge-like organic soils of cienegas moderate flood flows, making scouring from flooding events uncommon (Stromberg 1993). Live streams are always changing, and habitat can be gained or lost at any time. Change in the flood hydrograph, sediment supply, or other factors can create new habitat for Canelo Hills ladies' tresses.

Fire may play a role in reducing interspecific competition in cienega habitat (Newman 1991). In recent centuries, disturbance from fire in southwestern cienegas is thought to have occurred about every 38 years, being highly correlated with El Nino winter precipitation followed by La Nina drying periods (Brunelle et al. 2010). The El Nino events encourage fine fuel growth and connectivity, while the La Nina events enable surface fires from surrounding grasslands to burn

lightly through cienegas and remove fine fuels (Brunelle, pers. comm., August 16, 2011). Fires occur naturally in many wetlands only during drought years (Schmalzer and Hinkle 1992).

Grazing over the past 10,000 years by mammoth, ground sloth, bison, camelid species, deer, and antelope have played an important role in southwestern cienegas (Stromberg 1993, Gori 1994). In the last 500 years, cattle and horse grazing occurred in these areas (Gori 1994). Light to moderate grazing of domestic livestock may help maintain Canelo Hills ladies' tresses by removing competing vegetation.

All populations of Canelo Hills ladies' tresses occur in cienega habitats where scouring floods are uncommon. Soils supporting the populations are finely grained, highly organic, and seasonally or perennially saturated. It is found intermixed with tall grasses and sedges at about 5,000 feet in elevation. Springs are the primary water source, but a creek near one locality contributes near-surface groundwater (McClaran and Sundt 1992).

The dominant vegetation associated with the Canelo Hills ladies' tresses includes grasses, sedges, rushes (*Juncus* spp.), spike rush, cattails (*Typha* spp.), and horsetails (*Equisetum* spp.). Associated grass species include the non-native Kentucky bluegrass and Johnson grass (*Sorghum halepense*), as well as, native muhlys (*Muhlenbergia aspeifolia* and *M. utilis*; Fishbein and Gori 1994). The surrounding vegetation is semi-desert grassland or oak savannah.

Populations of this species are known to exist in only five cienegas in southern Arizona. One population is found in Cochise County and four are found in Santa Cruz County. One population is found at the Arizona Nature Conservancy's Canelo Hills Cienega. Three other populations are found on private land, one in the San Rafael Valley, one in the Babacomari Cienega, and one on private property near Turkey Creek. The fifth population is on Coronado National Forest land in the Canelo Hills.

Estimating Canelo Hills ladies' tresses population size and stability is difficult because non-flowering plants are very hard to find in the dense herbaceous vegetation in which they typically occur. Population size is likely to be underestimated because dormant plants may not be counted. McClaran and Sundt (1992) monitored and marked individuals in a Canelo Hills ladies' tresses population during a three-year period. They concluded that the subpopulations at both monitored sites were stable between 1987 and 1989, although Newman (1991) reported that one monitored site was reduced to one non-flowering plant in 1991. Despite searches for this species in several of the locations in recent years, no plants have been located in any population since 2006, except at Sheehy Spring, where casual observations by USFWS personnel and the land owner have continued to find ladies'-tresses, although none were observed in 2014 or in 2015.

Threats

Modification of hydrology - Canelo Hills ladies' tresses occur in cienegas where soils are seasonally or perennially saturated. Human activities such as groundwater overdrafts, surface water diversions, impoundments, channelization, improper livestock grazing, agriculture, mining, road building, non-native species introductions, urbanization, wood

cutting, and recreation all contribute to riparian and cienega habitat loss and degradation in southern Arizona.

Non-native species invasion - Johnson grass is invading at least one Canelo Hills ladies' tresses site (Gori 1993) and likely this and other non-native plants are present in all five populations. Such non-native species form dense monocultures, displacing less competitive native plants.

Improper livestock grazing - The Canelo Hills ladies' tresses, like many species in the genus, shows an affinity for habitats with sparse herbaceous cover (McClaran and Sundt 1992); which light to moderate livestock grazing can promote. The species would likely be adversely affected by heavy livestock grazing, however. Similarly, the mowing of pastures, particularly when the species is flowering, can be very detrimental and may prevent seed set or result in mortality of plants.

Fire during flowering times - Early in the season, fires benefit Canelo Hills ladies' tresses by removing competing vegetation before emergence. However, fires in July or August, the period when the plant is aboveground, may negatively impact Canelo Hills ladies' tresses (Gori and Backer 1999).

Small population size - Limited numbers of populations and individuals threatens this taxon with extinction as a result of stochastic events that are often exacerbated by habitat disturbance. For instance, restriction of the species to a relatively small area in southeastern Arizona increases the chance that a single environmental catastrophe, such as a severe tropical storm or drought, could eliminate populations or cause extinction.

Critical Habitat

There is no critical habitat designated for this species.

Few Federal actions affect this species due to its limited range, and most sites are on non-Federal lands. About 24 formal section 7 consultations have considered the impacts proposed actions on the Canelo Hills ladies' tresses. Actions on non-Federal land with no Federal nexus do not require section 7 consultation.

**Huachuca Springsnail**

The Huachuca springsnail is a candidate species as most recently noted in the 2015 USFWS Candidate Notice of Review (CNOR)(79 FR 72449; USFWS 2014c, 2015a). It first became a Candidate on February 28, 1996, and a 12-month finding is due in 2016. The species is also identified as a Species of Greatest Conservation Need (tier l a) in the Arizona State Wildlife Action Plan (AGFD 2006). Status of the Huachuca springsnail is updated annually by the USFWS and published in the CNOR and information provided herein is summarized from the most recent USFWS "species assessment and listing priority assignment form" (USFWS 2014c, 2015a).

In the arid Southwest, snails of the family Hydrobiidae are largely relicts of the wetter Pleistocene Age (1.6 million-10,000 years ago) and are typically distributed across the landscape as geographically isolated populations exhibiting a high degree of endemism (found only in a particular area or region)(Bequart and Miller 1973, Taylor 1987, Shepard 1993, Hershler and Sada 2002). Springsnails are strictly aquatic and respiration occurs through an internal gill. The Huachuca springsnail is a moderate to large size snail (0.05-0.13 in tall). The shell is moderately convex with three to five slightly shouldered whorls. The inner lip of the shell is thin. The aperture is fused to or separate from body whorl. The umbilicus is chink-like or open. Identification must be verified by characteristics of reproductive organs.

The Huachuca springsnail is endemic to Santa Cruz and Cochise counties in southeastern Arizona and adjacent portions of northern Sonora, Mexico. The species was first collected in 1969. Based on information in USFWS files, there is no documentation of extirpation of Huachuca springsnail from any known locality. Although loss of cienegas during the last century in southeastern Arizona is well-documented (Hendrickson and Minckley 1984), we do not know whether that loss resulted in the loss of any population of Huachuca springsnail. The species likely occurs at 21 sites, 19 in Arizona and two in Sonora, Mexico (Myers 2010). It is known from nine sites in the upper San Pedro River drainage, including several in the Huachuca Mountains, Canelo Hills, and San Rafael Valley in Arizona. It is also known from the Sonoita Creek drainage and Ojo Caliente Spring in Sonora, Mexico. Other potential locations of the species have not been verified, including Rancho Los Fresnos in Sonora. There is additional suitable habitat within the range of the species that has not been surveyed for Huachuca springsnail. There is relatively new information that shows significant genetic divergence between populations of this species, particularly between populations on the east slope of the Huachuca Mountains and those at lower elevations along Sonoita Creek and in the San Rafael Valley (Hurt 2004). What these differences mean to the taxonomy of springsnail populations currently defined as Huachuca springsnail is unknown, particularly since not every site currently identified as Huachuca springsnail was included in the original taxonomic study conducted by Hershler and Landye (1988).

The habitat of the Huachuca springsnail is characterized by various aquatic and emergent plant species that occur within plains grassland, oak and pine-oak woodlands, and coniferous forest vegetation communities within the Huachuca Mountains and the San Rafael Valley. Based on current knowledge, important habitat elements for the Huachuca springsnail appear to include: 1) permanent free-flowing springs; 2) shallow, unpolluted water; 3) coarse firm substrates such as pebble, gravel, cobble, and woody debris and 4) native aquatic macrophytes, algae, and periphyton. The most common habitat for the Huachuca springsnail is a rheocrene ecosystem (water emerging from the ground as a flowing stream). Substrate is typically firm and characterized by cobble, gravel, woody debris, and aquatic vegetation. These substrate types provide suitable surfaces for grazing and egg laying (Taylor 1987, Hershler 1998). The species is typically found in the shallower areas of springs, often in gravelly seeps at the spring source. Many springsnail species exhibit decreased abundance further away from spring vents, presumably due to their need for stable water chemistry and flow regime provided by spring waters (Hershler 1994, Hershler 1998, Hershler and Sada 2002, Martinez and Thome 2006). Hydrobiid snails such as the Huachuca springsnail feed primarily on periphyton, which is a

complex mixture of algae, bacteria, microbes, and detritus that live upon submerged surfaces in aquatic environments (Hershler and Sada 2002, Lysne et al. 2007).

The Huachuca springsnail is threatened by habitat modification and loss through streamflow alteration, catastrophic wildfire, and, to a lesser extent, livestock grazing, recreation, military activities, and timber harvest. Altered stream flows, whether by drought, groundwater pumping, impoundment, or other direct stream alterations, could affect the Huachuca springsnail by eliminating habitat, if flows stop completely, or altering the specific habitat parameters so that the habitat is no longer suitable. Habitat modification can cause changes in substrate composition at levels that alter periphyton availability or water quality (temperature, oxygenation, and turbidity) such that conditions are outside of parameters used by the species. This can result in reduced fecundity, recruitment, population viability, and extirpation. Because springsnails are typically found in shallow flowing water, factors that alter springsnail habitat by changing water depth, velocity, substrate composition, vegetation, and water chemistry can cause population reduction or extirpation. The significance of habitat modification for springsnails is reflected in Hershler and Williams (1996), who recommend that efforts to maintain springsnail populations should focus on maintenance of natural springhead integrity.

Another primary threat to the Huachuca springsnail is catastrophic fire. Fire frequency and intensities in southwestern forests are much altered from historical conditions (Dahms and Geils 1997). Catastrophic fire could result in habitat loss in the Huachuca Mountains. A fire in occupied springsnail habitat could extirpate the population through habitat modification in the form of charcoal, sedimentation, and erosion. Furthermore, millions of gallons of fire retardants and suppressants are broadly applied aerially and from the ground to wildlands in the western United States each year. Contamination of aquatic sites can occur via direct application or runoff from treated uplands. These chemicals are ammonia-based, which in itself can be potentially toxic; however, many formulations also contain yellow prussiate of soda (sodium ferrocyanide), which is added as an anticorrosive agent. Such formulations kill a variety of aquatic and other organisms. The U.S. Forest Service concluded that lethal concentrations of retardant contaminated Three Forks Springs waters in east-central Arizona (76 FR 20464; USFWS 201la). This contamination resulted in the near disappearance of the Three Forks springsnail (*Pyrgulopsis trivalis*), a closely related species to Huachuca springsnail (USFWS 201la). A June 2011 fire burned through 30,526 acres in the southern half of the Huachuca Mountains including occupied habitat of the Huachuca Springsnail At least three populations occur within the fire perimeter, but effects to these populations are yet unknown (USFWS files).

Additionally, occupied springsnail sites may be affected by grazing, recreational use, military activities, and timber harvest. Livestock grazing currently occurs on the Coronado National Forest and private lands, but is excluded from Fort Huachuca. The damage from livestock grazing on spring ecosystems can alter or remove springsnail habitat, resulting in restricted distribution or extirpation of springsnails. Cattle trampling at a spring in Owens Valley, California, reduced banks to mud and sparse grass, limiting the occurrence of the endangered Fish Slough springsnail (*Pyrgulopsis pertubata*)(Bruce and White 1998). Poorly managed livestock use of springs can directly negatively affect springsnails through contamination of aquatic habitat from feces and urine, habitat degradation of the spring by trampling of substrate and loss of aquatic and riparian vegetation, and crushing of individual springsnails. A population

of Chupadera springsnail (*Pyrgulopsis chupaderae*) endemic to a spring in Socorro County, New Mexico, was extirpated due to the impacts of livestock grazing on its habitat (76 FR 46218; USFWS 2011b). Huachuca springsnail sites on Fort Huachuca are susceptible to adverse effects from human recreational activities, such as vehicle use, incidental human-caused fire, and disturbance from trampling (U.S. Army 2006). However, military training and testing are limited in the Huachuca Mountains and seldom occur in known springsnail localities (U.S. Army 2006). Timber harvest could impact Huachuca springsnails through complete removal of appropriate habitat or increasing sedimentation due to lack of vegetation. Because populations of Huachuca springsnail are isolated, once extirpated, sites are unlikely to be recolonized without active management. Small populations are also subject to genetic deterioration and demographic variability, which increases the likelihood of local extirpation and extinction.

Few Federal actions have been analyzed for their effects on the springsnail, because it is a candidate species. However, there have been 2 intra-service section 7 consultations that have considered the impacts proposed actions on the Huachuca springsnail.

**Gila Chub**

The Gila chub was listed as endangered with critical habitat on November 2, 2005 (70 FR 66664; USFWS 2005a). A draft recovery plan was released in November, 2015 (USFWS 2015b). The draft recovery plan contains the most recent information on the conservation status and threats to the species. It is hereby incorporated by reference. The species is also identified as a Species of Greatest Conservation Need (tier la) in the Arizona State Wildlife Action Plan (AGFD 2006). In Mexico, the Gila chub is listed as endangered by SEMARNAT (2010). There is no designated critical habitat within the action area.

Several Federal actions affect this species every year that require formal section 7 consultation. There have been 42 biological opinions that have included the Gila chub. A complete list of all consultations affecting this species can be found here: https://www.fws.gov/southwest/es/arizona/Biological.htm. Survey work and recovery projects also occur periodically, and are summarized in the recent draft recovery plan (USFWS 2015b)."

**Sonora tiger salamander**

Description, Legal Status, and Recovery Planning

The Sonora tiger salamander was listed as an endangered species in 1997 (62 FR 665; USFWS 1997). The listing covered the entire historical range in the United States and Mexico. Critical habitat was not designated for the salamander. A recovery plan for the species was completed in 2002 (USFWS 2002a). Loss of natural standing water habitat; predation by non-native fish, bullfrogs, and crayfish; disease; and potential genetic swamping by the introduced, non-native barred tiger salamander (*A. m. mavortium*) have contributed to the current endangered status of the species. A recent update to the taxonomy of this subspecies is provided by Crother (2008); therefore, common and scientific names used herein follow Crother (2008). Additional background information can be found in the 2014 Fort Huachuca Biological Opinion (22410-2112-R-O 173) and the species' recovery plan (USFWS 2002a, 2014b).

Distribution and Abundance

All sites where tiger salamanders have been found are located in the Santa Cruz and San Pedro river drainages, including sites in the San Rafael Valley and adjacent parts of the Patagonia and Huachuca mountains in Arizona and Mexico. All confirmed historical and extant aquatic populations are found in cattle tanks or impounded cienegas within 40 km of Lochiel, Arizona. Salamanders collected in the early 1990's from a cienega at Rancho Los Fresnos in the San Rafael Valley, Sonora, may have been *A. m. stebbinsi* (Varela-Romero et al.1992). Surveys during 2006 to 2008 at Rancho Los Fresnos failed to locate additional salamanders and most waters on the ranch are now occupied by non-native bullfrogs, crayfish, green sunfish, and black bullhead (USFWS 2006a, b, and files). A single metamorph tiger salamander was found just west of the ranch in a drying tank during a survey in 2009, but was not verified as *A. m. stebbinsi* (USFWS files). Environmental DNA surveys in Mexico in 2014 detected about 10 sites with Sonora tiger salamander DNA (Service files).

A larval aquatic salamander was captured in 2014 in the Santa Cruz River near the Lochiel Bridge during fish surveys (Timmons 2014). It is likely it was a Sonora tiger salamander.

The Sonora tiger salamander is known from at least 90 aquatic localities, although not all are currently occupied (Collins and Jones 1987, Collins 1996, Abbate 1998, USFWS 2007a and files). During intensive surveys in 1997, from one to 150 Sonora tiger salamanders were found at 25 stock tanks (Abbate 1998). Populations and habitats are dynamic, thus the number and location of extant aquatic populations change over time, as exhibited by the differences between survey results in 1985 and 1993 to 1996 (Collins and Jones 1987; Collins 1996; J. Collins, ASU, 1996, pers. comm.). In 1999, the lab of Dr. James Collins, Arizona State University, found Sonora tiger salamanders at 17 localities (Collins 1999). During surveys by AGFD from 2001 to 2006, Sonora tiger salamanders were found at 37 of 139 stock tanks, which were sampled from 1 to 7 times each. At 23 of 29 tanks where salamanders were found, and which were sampled more than once, salamanders were not found on at least one visit. The 5-year review acknowledges that there is no current information that clearly defines the abundance or population trends for this species (USFWS 2007a), but does state that the current survey data are consistent with population levels discussed in the recovery plan (USFWS 2002a).

Habitat

Historically, the Sonora tiger salamander probably inhabited springs, cienegas, and possibly backwater pools of the Santa Cruz River and streams in the San Rafael Valley where permanent or nearly permanent water allowed survival of mature branchiates. The grassland community of the San Rafael Valley and adjacent montane slopes, where all extant populations of Sonora tiger salamander occur, may represent relictual grassland and a refugium for grassland species. Tiger salamanders in this area might have become isolated and, over time, genetically distinct from ancestral *A. m. mavortium* and *A. m. nebulosum* (Jones et al. 1995, Storfer et al. 2004). The Sonora tiger salamander apparently has opportunistically taken advantage of available stock tank habitats as natural habitats disappeared (Hendrickson and Minckley 1984) or were invaded by non-native predators with which the salamander cannot coexist (USFWS 2007a).

Although most records for Sonora tiger salamanders occur at stock tanks where breeding occurs, terrestrial metamorphs potentially may wander considerable distances from these aquatic habitats, and are occasionally encountered in upland habitats. A Sonora tiger salamander was captured in a pit fall trap at Oak Spring in Copper Canyon, Huachuca Mountains, by AGFD personnel. The nearest known breeding site is about 0.6 mi to the south, suggesting the salamander may have moved at least that far. Capture in a pit fall trap also confirms that the individual was surface active. On Fort Huachuca, S. Stone (pers. comm., Ft. Huachuca, 1998) reported finding terrestrial tiger salamanders (probably *A. m. mavortium*) l.9 to 2.5 mi from the nearest known breeding pond. Referring to conservation of the California tiger salamander, *A. califomiense,* Petranka (1998) finds that based on studies of movements of other *Ambystoma* species, conservation of a 650 to 1,650 ft radius of natural vegetation around a breeding pond would protect the habitat of most of the adult terrestrial population. Adults of *A. mavortium* subspecies typically live in or about mammal burrows (Petranka 1998), although metamorphs may construct their own burrows as well (Gruberg and Stirling 1972, Semlitsch 1983). Some species of salamanders exhibit migrations of up to several miles each way from breeding sites to upland habitats (Stebbins and Cohen 1995). If such migrations occur in the Sonora tiger salamander, we have no information about migration corridors or non-breeding habitat. Because of the arid nature of the environments where the subspecies occurs, if salamanders move very far from breeding ponds, they likely do so during more mesic times of year, such as during the monsoon.

Threats

Before the 20th century, the San Rafael Valley contained many more cienegas and vernal pools than it does today. Erosion and arroyo cutting in the late 19th and early 20th centuries caused the San Rafael Valley water table to drop and many natural standing water habitats to disappear (Hendrickson and Minckley 1984, Hadley and Sheridan 1995). However, at the same time natural standing water habitats were disappearing, cattle ponds were built. Many of the remaining springs and cienegas were converted into impoundments at this time, so most of the small standing water habitats remaining in the San Rafael Valley are cattle ponds. Currently, Sonora tiger salamanders breed exclusively in these cattle ponds. The fact that Sonora tiger salamanders breed in human-constructed cattle ponds instead of natural habitats does not necessarily threaten persistence of the taxon. Sonora tiger salamanders have successfully bred in cattle ponds for decades, but salamanders are now dependent on humans to maintain the habitat. In particular, cattle ponds require occasional re-excavation because they fill in with silt, and pond dams also require occasional maintenance. Cattle pond habitats are also vulnerable to extreme weather conditions. Long-term drought could dry many of the ponds, and if ponds remained dry for several years, lack of breeding could lead to local extirpation of the salamander population.

There are reports of introduced non-native fish occurring in the San Rafael Valley as early as the 1950s, and various introduced fish species now occur in San Rafael Valley ponds, including mosquitofish, green sunfish, bluegill sunfish, black bullheads, and largemouth bass. Bullfrogs have also been in the valley since at least the early 1970s. Laboratory and field experiments have shown that metamorphosed bullfrogs and all of the fish species listed above quickly eat salamander larvae, and even adult Sonora tiger salamanders have been found in the stomachs of

adult bullfrogs (Snyder et al. 1998). In addition, whenever non-native fish are introduced to a pond, the salamanders almost always disappear within the next few years, and do not reappear unless all fish are removed (Snyder et al. 1998). Given the observation that bullfrogs eat salamanders and the effect of bullfrogs on other native western herpetofauna populations (Rosen et al. 1996a, Kiesecker and Blaustein 1997, Kupferberg 1997), bullfrogs should be considered a threat to Sonora tiger salamanders. Occasional drying of cattle ponds due to drought or siltation has limited the number of ponds occupied by non-native fish and bullfrogs, because both taxa are vulnerable to drying. Crayfish are potential predators on salamanders as well, but have only been found in a few San Rafael Valley ponds, and those did not contain salamanders (USFWS 2002a). Crayfish are in several San Rafael Valley streams (Stefferud and Stefferud 2004); however, and if they are introduced to ponds with salamanders, it is likely they will harm Sonora tiger salamanders, much as they have harmed other western herpetofauna populations (Fernandez and Rosen 1996, Gamradt and Kats 1996).

Tiger salamander populations in the western United States and Canada, including populations of the Sonora tiger salamander, exhibit frequent epizootics (Collins et al. 200 l). Sonora tiger salamander populations experience frequent disease-related die-offs (about 8% of populations are affected each year) in which almost all salamanders and larvae in the pond die. *Ambystoma tigrinum* virus (ATV) is the pathogen believed to be primarily responsible for these die-offs (Jancovich et al. 1997). ATV may be spread by bullfrogs, birds, cattle, or other animals that move among tanks (Jancovich et al. 1997); however, the viral life cycle appears to be restricted to tiger salamanders - no other syntopic hosts have been identified (Jancovich et al. 2001). In the laboratory, Sonora tiger salamanders exhibited lower survival and growth rates when exposed to the disease as compared to Arizona tiger salamanders from the White Mountains of Arizona (Collins et al. 2003). Animals that survive ATV exposure may harbor transmissible infection for more than six months. Dispersing metamorphosed salamanders have been found carrying ATV, and when they return to a pond to breed, they may reinfect the aquatic population (Collins et al. 2003). ATV is a relatively new pathogen (Storfer 2003), and genetic analysis suggests a single introduction and recent spread over a large geographic area from Arizona to Saskatchewan (Jancovich et al. 2005). ATV may have switched from sport fishes to salamanders or was introduced with water dogs (*A. m. mavortium*) imported for use as fish bait in Arizona and elsewhere (Jancovich et al. 2005). Collins et al. (2003) identified ATV in waterdogs obtained from a Phoenix bait shop. Sonora tiger salamanders also contract chytridiomycosis, a fungal disease associated with global declines of frogs and toads (Berger et al. 1998, Longcore et al. 1999, Speare and Berger 2000, Davidson et al. 2003). However, compared to anurans, infected salamanders exhibit only minimal symptoms (Davidson et al. 2000). In the laboratory, infected Sonora tiger salamanders did not die from the disease and are capable of ridding themselves or much reducing chytrid infections by frequent sloughing of the skin (Davidson et al. 2003).

Illegal collection of salamanders for bait has been reported from the San Rafael Valley although there are no data on the number of Sonora tiger salamanders that are collected for bait (Collins and Jones 1987, USFWS 2002a). If large numbers of salamanders are collected for bait, it could threaten the persistence of Sonora tiger salamander populations. Given the popularity of other salamanders as bait, it is reasonable to assume that illegal collection of salamanders will continue to occur. Collecting Ambystoma in the San Rafael Valley is prohibited under Arizona Game and Fish Commission Orders 40 and 41, except under special permit. Furthermore, transport and

stocking of live bullfrogs and fishing with live bait fish or *Ambystoma* within the range of the Sonora tiger salamander in Arizona are prohibited (R l-316). Sale of live waterdogs at Parker Canyon Lake is prohibited under the same regulation. In the San Rafael Valley, live crayfish can be used as bait, but only at the place of capture. Transported crayfish must be dead. Arizona Game and Fish Department includes Sonora tiger salamander in Arizona's Species of Greatest Conservation Need (AGFD 2012); however, this designation affords the species and its habitat no legal protection. State of Arizona Executive Order Number 8-16 (Streams and Riparian Resources), signed on June 10, 1989, directs state agencies to evaluate their actions and implement changes, as appropriate, to allow for restoration of riparian resources.

Sonora tiger salamanders also face the threat of genetic swamping by introduced barred tiger salamanders which are often sold as large larvae or branchiate adults for fishing bait or to anglers trying to establish a population that could be harvested at a later date. However, the data are inconclusive. Genetic analysis was conducted between the gene loci of Sonora tiger salamanders and the gene loci of rosy salamanders (*A. rosaceum*), barred tiger salamander, and Arizona tiger salamanders (Jones et al. 1988). Based on distinctive reticulate color patterns, low heterozygosity, and apparent geographic isolation, subspecific designation of Sonora tiger salamander was considered warranted by Collins and Jones (1987) and Jones et al. (1988). Further analysis of mitochondrial DNA reaffirmed subspecific designation (Collins et al. 1988). In more recent genetic analysis, Storfer et al. (2004) concluded that barred salamanders (*A. m. mavortium*) or hybrids between barred salamanders and Sonora tiger salamanders may be present at seven stock tanks along Highway 83 and near Parker Canyon Lake in the San Rafael Valley (Storfer et al. 2004). Storfer et al. (2004) reported six microsatellite loci that had alleles that were diagnostic for the hybrids of *A. m. stebbinsi* and *A. m. mavortium*. A salamander population in Upper Garden Canyon Pond on Fort Huachuca, near the crest of the Huachuca Mountains, may also be putative hybrids of *A. m. mavortium* and *A. m. stebbinsi* (Storfer et al. 1999). In 2009, Andy Baldwin of the Arizona Sonora Desert Museum sampled tissues of five salamanders collected from Peterson Ranch Pond in Scotia Canyon (USFWS files). He concluded that two individuals appear to be *A. m. stebbinsi* and three appear to be *A. m. nebulosum* based on one microsatellite locus (USFWS files). One of these samples still needs to be redone (T. Jones, 2014, pers. comm.). The data are certainly suggestive of hybridization, but only one microsatellite locus is not particularly conclusive and further analysis is needed (T. Jones, AGFD, pers. comm., 2014). An additional difficulty is that we do not know which microsatellites were which in recent analyses; as both Storfer et al. (1999) and Andy Baldwin did not report them.

With the exception of Bog Hole in the San Rafael Valley, Upper Garden Canyon Pond on Fort Huachuca, and Rancho Los Fresnos in Sonora, Mexico, cattle grazing occurs throughout the range of the Sonora tiger salamander. Cattle can degrade habitat at stock tank breeding sites and improper grazing can cause loss of cover and erosion that can threaten the integrity of stock tanks used by the salamander. However, the salamander has coexisted for about 250 years with grazing and because of its current use of livestock tanks for breeding, is now dependent upon maintenance of cattle waters by ranchers (USFWS 2002b). For further information on the ecology, taxonomy, range, and threats to this subspecies, refer to Lowe (1954), Gehlbach (1967), Collins and Jones (1987), Snyder et al. (1998), and Crother (2008).

Recovery Planning

The conservation and recovery of Sonora tiger salamanders requires the presence of secure breeding populations throughout the landscape and protection of adequate available habitat that supports viable populations in the long term. About 75 percent of the of the lands that fall within the range of the Sonora tiger salamander is managed by Federal agencies, so that many activities that might affect the salamander or its habitat are also subject to Section 7 consultation. A total of 21 Section 7 consultations on Sonora tiger salamanders included programmatic efforts for Forest Land Management Plans that address watershed management and multiple uses (livestock grazing, and wildfire and prescribed burns), fire suppression activities, military base operations, Department of Homeland Security infrastructure, sportfish stocking, and conservation actions for the species. Biological opinions on actions potentially affecting Sonora tiger salamanders may be found at our website www.fws.gov/southwest/es/arizona in the Section 7 Biological Opinion page of the Document Library. Consultations with the Coronado National Forest in the late 1990's resulted in the development of a Stock Pond Management and Maintenance Plan" addressing cattle pond maintenance guidelines to minimize incidental take of salamanders associated with cleaning out ponds (USFWS 1999A). The "Stock Pond Management and Maintenance Plan" was later included as an appendix to the species recovery plan. Consultations with the Coronado National Forest also provided measures to reduce the possibility that salamanders might be unintentionally killed or moved among cattle ponds by fire suppression activities (USFWS 1999a; 2002b). A recent consultation regarding the effects of sportfish stocking provided conservation measures to reduce the risks from introduction of non-native tiger salamanders and non-native predatory organisms into Sonora tiger salamander habitat (USFWS 2011c). At least 17 of the 81 sites where salamanders have been detected in the U.S. are on private lands to the west of Fort Huachuca (USFWS files). These private lands are used primarily for grazing, and most are protected by conservation easements, and thus cannot be subdivided or developed. Compliance with the Act for activities on private lands that may affect the Sonora tiger salamander, but are not addressed by section 7 consultation, could occur through section 10(a)(1)(B) of the Act. Survey work and recovery projects also occur periodically, and are summarized in the five-year review (USFWS 2007a).

Since completion of the Sonora Tiger Salamander Recovery Plan in 2002, conservation actions ongoing for the salamander throughout its range include surveys and monitoring of populations, improvements to stock tanks that provide habitat, and when documented, enforcement of prohibition of illegal stocking of barred tiger salamanders in the habitat of the salamander. From 2003 through 2013, AGFD conducted monitoring of the salamander with a goal of estimating the proportion of area occupied, or fraction of actual habitat occupied by the species out of all available habitat that could be occupied. This methodology has allowed researchers to make inferences about the overall population and potential changes in abundance of a species across the greater landscape (MacKenzie and Kendall 2002, MacKenzie and Nichols 2004). Sampling is achieved by randomly conducting presence-absence surveys on a subset of all available habitats selected by a probability based sampling technique (Bailey et al. 2004). We are currently seeking funding to analyze the proportion of area occupied monitoring data, and use results to determine further needs for recovering the species. The USFWS also conducted a 5-year review of the species in 2007 per requirements of the Act. This 5-year review emphasizes

the threat of introgression to the species with barred tiger salamanders and recommends adaptive management for mixed populations of Sonora and barred tiger salamanders, including eliminating such populations to reduce potential introgression. The overall recommendation of this five-year review was to leave the species status as endangered (USFWS 2007a).

**Northern Mexican Gartersnake**

The Federal Register notice listing the northern Mexican gartersnake as threatened under the Act was published on July 8, 2014 (79 FR 38678; USFWS 2014d). As part of this rulemaking, a 4(d) rule was also established which allows for construction, continued use, and maintenance of stock tanks on non-Federal lands. Please refer to this rule for more in-depth information on the ecology and threats to the species, including references. Critical habitat was proposed on July 10, 2013 (78 FR 41500, USFWS 2013) and has not yet been designated. We expect to publish a modified re-proposal for critical habitat and an accompanying Notice of Availability announcing the draft Environmental Assessment and draft Economic Analysis in 2016. Details on critical habitat are provided below. The final listing and proposed critical habitat rules are incorporated herein by reference.

Throughout its rangewide distribution, the northern Mexican gartersnake occurs at elevations from 130 to 8,497 ft (Rossman et al. 1996) and is considered a "terrestrial-aquatic generalist" by Drummond and Marcias-Garcia (1983). The northern Mexican gartersnake is often found in riparian habitat, but has also been found hiding under cover in grassland habitat up to a mile away from any surface water (Cogan 2015). The subspecies has historically been associated with three general habitat types: 1) source-area wetlands (e.g., cienegas or stock tanks); 2) large-river riparian woodlands and forests; and 3) streamside gallery forests (Hendrickson and Minckley 1984, Rosen and Schwalbe 1988). Emmons and Nowak (2013) found this subspecies most commonly in protected backwaters, braided side channels and beaver ponds, isolated pools near the river mainstem, and edges of dense emergent vegetation that offered cover and foraging opportunities. In the northern-most part of its range, the northern Mexican gartersnake appears to be most active during July and August, followed by June and September.

The northern Mexican gartersnake is an active predator and is thought to heavily depend upon a native prey base (Rosen and Schwalbe 1988). Northern Mexican gartersnakes forage along vegetated stream banks, searching for prey in water and on land, using different strategies (Alfaro 2002). Primarily, its diet consists of amphibians and fishes, such as adult and larval (tadpoles) native leopard frogs, as well as juvenile and adult native fish (Rosen and Schwalbe 1988), but earthworms, leeches, lizards, and small mammals are also taken. In situations where native prey species are rare or absent, this snake's diet may include non-native species, including larval and juvenile bullfrogs, western mosquitofish (Holycross et al. 2006, Emmons and Nowak 2013), or other non-native fishes. In northern Mexican gartersnake populations where the prey base is skewed heavily towards harmful non-native species, recruitment of gartersnakes is often diminished or nearly absent.

The northern Mexican gartersnake historically occurred in every county and nearly every subbasin within Arizona, from several perennial or intermittent creeks, streams, and rivers as well as lentic wetlands such as cienegas, ponds, or stock tanks (Rosen and Schwalbe 1988,

Rosen et al. 2001, Holycross et al. 2006). In New Mexico, the gartersnake had a limited distribution that consisted of scattered locations throughout the Upper Gila River watershed in Grant and western Hidalgo Counties (Price 1980, Fitzgerald 1986, Degenhardt et al. 1996, Holycross et al. 2006). Within Mexico, northern Mexican gartersnakes historically occurred in the Sierra Madre Occidental and the Mexican Plateau, comprising approximately 85 percent of the total rangewide distribution of the subspecies (Rossman et al. 1996).

The only viable northern Mexican gartersnake populations in the United States where the subspecies remains reliably detected are all in Arizona: l) The Page Springs Hatchery and Aquatic Resource Conservation Center along Oak Creek; 2) lower Tonto Creek; 3) the upper Santa Cruz River in the San Rafael Valley; 4) the Bill Williams River; and, 5) the middle/upper Verde River. In New Mexico and elsewhere in Arizona, the northern Mexican gartersnake may occur in extremely low population densities within its historical distribution; limited survey effort is inconclusive to determine extirpation of this highly secretive species. The status of the northern Mexican gartersnake on tribal lands, such as those of the White Mountain or San Carlos Apache Tribes, is poorly understood. Less is known about the current distribution of the northern Mexican gartersnake in Mexico due to limited surveys and limited access to information on survey efforts and field data from Mexico.

We have concluded that in as many as 23 of 33 known localities in the United States (70%), the northern Mexican gartersnake population is likely not viable and may exist at low population densities that could be threatened with extirpation or may already be extirpated. Only five populations of northern Mexican gartersnakes in the United States are considered likely viable where the species remains reliably detected. Harmful non-native species are a significant concern in almost every northern Mexican gartersnake locality in the United States and the most significant reason for their decline. Harmful non-native species can contribute to starvation of gartersnake populations through competitive mechanisms, and may reduce or eliminate recruitment of young gartersnakes through predation. Other threats include alteration of rivers and streams from dams, diversions, flood-control projects, and groundwater pumping that change flow regimes, reduce or eliminate habitat, and favor harmful non-native species; and effects from climate change and drought (79 FR 38678, USFWS 2014d).

Critical Habitat

Critical habitat for the northern Mexican gartersnake has been proposed in 14 units in portions of Arizona and New Mexico totaling 421,423 acres (USFWS 2013). The upper Santa Cruz River basin subunit includes the permit area and action area. Within these areas, the primary constituent elements (PCEs) of the physical and biological features essential to northern Mexican gartersnake conservation are:

1. Aquatic or riparian habitat that includes:
    a. Perennial or spatially intermittent streams of low to moderate gradient that possess appropriate amounts of in-channel pools. off-channel pools, or backwater habitat, and that possess a natural, unregulated flow regime that allows for periodic flooding or, if flows are modified or regulated, a flow regime that allows

for adequate river functions, such as flows capable of processing sediment loads; or

b. Lentic wetlands such as livestock tanks, springs, and Cienegas; and

c. Shoreline habitat with adequate organic and inorganic structural complexity to allow for thermoregulation, gestation, shelter, protection from predators, and foraging opportunities (e.g., boulders, rocks, organic debris such as downed trees or logs, debris jams, small mammal burrows, or leaf litter); and

d. Aquatic habitat with characteristics that support a native amphibian prey base, such as salinities less than 5 parts per thousand, pH greater than or equal to 5.6, and pollutants absent or minimally present at levels that do not affect survival of any age class of the gartersnake or the maintenance of prey populations;

2. Adequate terrestrial space (600 ft lateral extent to either side of bank full stage) adjacent to designated stream systems with sufficient structural characteristics to support life-history functions such as gestation, immigration, emigration, and brumation.

3. A prey base consisting of viable populations of native amphibian and native fish species.

4. An absence of non-native fish species of the families Centrarchidae and Ictaluridae, bullfrogs, and crayfish (*O. virilis, P. clarki*, etc.), or occurrence of these non-native species at low enough levels such that recruitment of northern Mexican gartersnakes and maintenance of viable native fish or soft-rayed, non-native fish populations (prey) is still occurring.

Activities that may destroy or adversely modify critical habitat include those that alter the primary constituent elements to the extent that the value of critical habitat for both the survival and recovery of umbel northern Mexican gartersnake is appreciably diminished. Such activities are also likely to jeopardize the continued existence of the species.

Several Federal actions affect this species every year that require formal section 7 consultation. There have been 14 biological opinions that have included the northern Mexican gartersnake. A complete list of all consultations affecting this species can be found here: https://www.fws.gov/southwest/es/arizona/Biological.htm. Survey work and recovery projects also occur periodically, and are summarized in the listing document (USFWS 2014d).

**ENVIRONMENTAL BASELINE**

The environmental baseline includes past and present impacts of all Federal, State, or private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation process. The environmental baseline defines the current status of the species and its habitat in the action area to provide a platform to assess the effects of the action now under consultation.

The project area is where the proposed action will occur. The action area is that area in which effects of the action will occur. The project area and action area are one and the same for our analysis in this BCO, as we do not believe there will be any affects outside the actual footprint of the proposed action.

The SRRHCP covers a total of 22,060 acres, including 18,375 acres of rangeland and 125 acres of irrigated pasture owned by the SRCC. In addition, the SRRHCP also covers 3,560 acres of grazing preference on the Arizona State Parks, SRSNA, consistent with any lease terms. The Santa Cruz River bisects the action area, flowing from its headwaters in the San Rafael Valley south into Mexico. Spring-fed perennial surface water in the Santa Cruz River flows for much of the length of the SRR. Springs and cienegas also provide natural water sources in tributaries to the Santa Cruz River, mostly within 0.25 miles of the river. There are currently 23 active wells in the action area that provide water for domestic use, livestock, and irrigation (Ross Humphreys, SRCC in litt., 2008). Three farm fields are irrigated with ground water to grow annual and perennial forage plants that are grazed and harvested mechanically. The SRR is fenced into 29 pastures each of which contains one or more water sources that provide water for cattle and may serve as habitat for covered species. There are two pastures on SRSNA.

With the arrival of Europeans, major alterations began in the Gila River Basin (Rea 1983). As a result of these changes, the riverine communities of the Gila Basin, including the San Pedro and Santa Cruz, became fragmented, and connectivity was substantially reduced. Populations of fish, amphibians, and other aquatic species eradicated by perturbation were not replaced by colonization. Habitat fragmentation contributes to the genetic isolation of populations. Population fragmentation can reduce genetic variation and viability. This, in turn, can increase the risk of extirpation and extinction by reducing survival, reproduction, and dispersal. Isolation also precludes re-colonization should one or more populations be eliminated. When an inhospitable environment that imposes a high degree of threat on the remnant habitat surrounds isolated populations, these risks are compounded.

The SRR has been grazed continuously since at least 1823 (Brewster 1966, Hadley and Sheridan 1995). Since purchasing the SRR in 2000, the SRCC has implemented grazing practices that have improved range and habitat conditions, added six new water sources and improved existing water sources that serve as habitat for listed species, and contributed to conservation of federally-listed species through participation in recovery planning and implementation in and around the action area.

The SRSNA (SRSNA) lies at the southern end (downstream) of the permit area. The SRSNA contains the Santa Cruz River and adjacent springs that also provide habitat for species covered under the SRRHCP.

**Climate and drought**

An important growing threat to all native aquatic and riparian life in the southwest United States is global climate change. There is model evidence now that global climate change is likely to result in significant reductions in streamflow in the southwest due to warmer average temperatures, further exacerbating threats to Huachuca water umbel, Canelo Hills ladies'-tresses, Huachuca springsnail, Gila chub, Sonora tiger salamander, northern Mexican gartersnakes and their habitat (Seager et al. 2007, U.S. Climate Change Science Program 2008). The U.S. Census predicts that Arizona will be the second fastest growing state in the country through 2030.adding an additional 5.6 million people (U.S. Census Bureau 2005). If these predictions hold true,

already severe threats to these species and their habitat will worsen, primarily due to increased human demand for surface and ground water and decreased supply.

Virtually all climate change scenarios predict that the American southwest will get warmer during the 21st century (IPCC 2001, 2007; Overpeck et al. 2012, Garfin et al. 2013). Precipitation predictions show a greater range of possibilities, depending on the model and emissions scenario, though precipitation is likely to be less (USGCRP 2001, Seager et al. 2007). To maintain the present water balance with warmer temperatures and all other biotic and abiotic factors constant, precipitation will need to increase to keep pace with the increased evaporation and transpiration caused by warmer temperatures.

That southeastern Arizona and much of the American southwest have experienced serious drought recently is well known (CLIMAS 2013, Garfin et al. 2013). Almost 68 percent of Arizona was experiencing drought conditions during December 2013 (CLIMAS). What is known with far less certainty is how long droughts last. State-of-the-art climate science does not yet support multi-year or decadal drought predictions. However, instrumental and paleoclimate records from the Southwest indicate that the region has a history of multi-year and decadal drought (Hereford et al. 2002, Sheppard et al. 2002, Jacobs et al. 2005). Multi-decade drought in the Southwest is controlled primarily by persistent Pacific Ocean-atmosphere interactions, which have a strong effect on winter precipitation (Brown and Comrie 2004, Schneider and Cornuelle 2005); persistent Atlantic Ocean circulation is theorized to have a role in multi-decadal drought in the Southwest, particularly with respect to summer precipitation (Gray et al. 2003, McCabe et al. 2004, Wang et al. 2013). Given these multi-decade -regimes of ocean circulation, and the severity and persistence of the present multi-year drought, there is a fair likelihood that the current drought will persist for many more years (Stine 1994, Seager et al. 2007), albeit with periods of high year-to-year precipitation variability characteristic of Southwest climate. There is high confidence the Southwest will experience exceptional droughts that are more frequent, more intense, and longer lasting, and they will be hotter than historical droughts (Overpeck et al. 2012, Garfin et al. 2013).

Many of the predictions about the impacts of climate change are based on modeling, but many modeled predictions have already occurred (Udall 2013). In addition, many models have underestimated the increase in greenhouse gasses. The tree die-offs and fires that have occurred in the southwest early in this century show the impacts of the current drought. In addition, the basin's rivers, streams, and springs continue to be degraded (Overpeck et al. 2012), or lost entirely. Climate change trends are highly likely to continue (Overpeck et al. 2012), and the impacts on species will likely be complicated by interactions with other factors (e.g., interactions with non-native species and other habitat-disturbing activities). Drought and climate change will also impact watersheds and subsequently the water bodies in those watersheds. Drought and especially long-term climate change will affect how ecosystems and watersheds function. These changes will cause a cascade of ecosystem changes, which may be hard to predict and are likely to occur non-linearly (Seager et al. 2007).

Studies have shown that since 1950, the snowmelt season in some watersheds of the western U.S. has advanced by about 10 days (Dettinger and Cayan 1995, Dettinger and Diaz 2000, Stewart et al. 2004). Such changes in the timing and amount of snowmelt are thought to be

signals of climate-related change in high elevations (Smith et al. 2000, Reiners et al. 2003). The impact of climate change is the intensification of natural drought cycles and the ensuing stress placed upon high-elevation montane habitats (Cook et al. 2004, Breshears et al. 2005, Mueller et al. 2005, IPCC 2007). The increased stress put on these habitats is likely to result in long-term changes to vegetation, invertebrate, and vertebrate populations within coniferous forests and canyon habitats that affect ecosystem function and processes (Fleishman et al. 2013).

The Assessment of Climate Change in the Southwest United States (Garfin et al. 2013) looked at 16 Global Climate Models (GCMs) and nine dynamical downscaled regional simulations (Mearns et al. 2009, as cited in Garfin et al. 2013) to assess temperature projections in the southwest. All of the GCMs and regional simulations showed progressive warming in the southwest through 2100. Average range of temperature increase from 15 GCM models by the end of the century is 2 to 6° F for the low emissions scenario (BI ) and 5 to 9° F for the high emissions scenario (A2)(Nakicenovic and Swart 2000; Mearns et al. 2009, as cited in Garfin et al. 2013). The largest temperature increases are in the summer, though there is great variability among the GCMs (Garfin et al.2013). Additionally, the freeze-free season is modeled to increase in southeastern Arizona by 17 to 24 days in the period 2041 to 2070 (Mearns et al. 2009, as cited in Garfin et al. 2013).

The discussion of precipitation change in the southwest U.S. in Garfin et al. (2013) reveals the large uncertainty regarding if and how regional precipitation may change. However, there is general agreement among the models that spring precipitation will decrease (Cayan et al. 2013). In addition, there is presently no model consensus on how the summer monsoon regime in the Southwestern U.S. will change. This is of particular importance for the Action Area, as it receives the majority of its annual precipitation from the summer monsoon, although recharge is thought to be greater in the winter (Serrat-Capdevila et al. 2007, Cayan et al. 2013).

Increased occurrence of extreme events

Extreme events such as drought, fires, heat waves, storms, and floods are predicted to occur more frequently and be more intense because of climate change (IPCC 2007, Overpeck et al. 2012, Gershunov et al. 2013). It is anticipated that an increase in extreme events will most likely affect populations living at the edge of their physiological tolerances. The predicted increases in extreme temperature and precipitation events may lead to dramatic changes in the distribution of species or to their extirpation or extinction (Parmesan and Matthews 2006).

Decreased streamflow

Kundzewicz et al. (2007) state that of all ecosystems, freshwater ecosystems will have the highest proportion of species threatened with extinction due to climate change. Species with narrow temperature tolerances will likely experience the greatest effects from climate change and it is anticipated that populations located at the margins of species hydrologic and geographic distributions will be affected first (Meisner 1990). Current models suggest a decrease in precipitation in the Southwest (Kundzewicz et al. 2007, Seager et al. 2007) which would lead to reduced stream flows. Streamflow is predicted to decrease in the Southwest even if precipitation were to increase moderately (Nash and Gleick 1993, State of New Mexico 2005, Hoerling and

Eischeid 2007). Winter and spring warming causes an increased fraction of precipitation to fall as rain, resulting in a reduced snow pack, an earlier snowmelt, and decreased summer base flow (Christensen et al. 2004, Stewart et al. 2004, Regonda et al. 2005, Stewart et al. 2005). Earlier snowmelt and warmer air temperatures can lead to a longer dry season. Warmer air temperatures lead to increased evaporation, increased evapotranspiration, and decreased soil moisture. These three factors would lead to decreased streamflow even if precipitation increased moderately (Garfin 2005, Seager et al. 2007). The effect of decreased streamflow is that streams become smaller, intermittent or dry, and thereby reduce the amount of habitat available for water-dependent species.

An example of using downscaled analysis from global climate models to regions was the analysis of annual average precipitation projections from 17 global climate models to estimate recharge in the San Pedro Basin (Serrat-Capdevila et al. 2007). While the models used in this analysis were older versions evaluated in the IPCC Third Assessment (2001), their results were similar to those generated by the next generation of models in the IPCC Fourth Assessment (2007): 12 of 17 models predicted drier conditions for the San Pedro Basin, whereas five predicted slightly wetter conditions. The study estimated that recharge in the San Pedro Basin would decrease 4 to 6 percent by 2020, 6 to 8 percent by 2030, and 17 to 30 percent by the end of the 21st century (based upon the range of IPCC GHG emission scenarios considered).

Change in the hydrograph

In a warmer world an enhanced hydrologic cycle is expected; flood extremes could be more common (Meyer et al. 1999, Coe et al. 2012); and droughts may be more intense, frequent, and longer-lasting (Seager et al. 2007). Stewart et al. (2005) show that timing of spring streamflow in the western U.S. during the last five decades has shifted; the major peak now arrives 1 to 4 weeks earlier, resulting in less flow in spring and summer. They conclude that almost everywhere in North America, a 10 to 50 percent decrease in spring-summer streamflow will accentuate the seasonal summer dry period with important consequences for warm-season water supplies, ecosystems, and wildfire risks (Stewart et al. 2005). Rauscher et al. (2008) suggest that with air temperature increasing from 37 to 41° F, snowmelt driven runoff in the western U.S. could occur as much as two months earlier.

Fire

Since the mid- l980s, wildfire frequency in western forests has nearly quadrupled compared to the average of the period 1970 to 1986 (Westerling et al. 2006). The total area burned is more than six and a half times the previous level (Westerling et al. 2006). In addition, the average length of the fire season during 1987 to 2003 was 78 days longer compared to 1970 to 1986 and the average time between fire discovery and control increased from about 8 to 37 days for the same time (Westerling et al. 2006). McKenzie et al. (2004) suggest, based on models, that the length of the fire season will likely increase and fires in the western U.S. will be more frequent and severe. In particular, they found that fire in New Mexico appears to be acutely sensitive to summer climate and temperature changes and may respond dramatically to climate warming (McKenzie et al. 2004). The summer temperatures in the southwest are predicted to increase more than any other season (Garfin et al. 2013).

Furthermore, drought and climate change will cause changes in fire regimes in all southeastern Arizona vegetation communities (Kitzberger et al. 2006). The timing, frequency, extent, and destructiveness of wildfires are likely to increase (Westerling et al. 2006) and may facilitate the invasion and increase of nonindigenous plants. These changed fire regimes will change vegetation communities, the hydrological cycle, and nutrient cycling in affected watersheds (Brown et al. 2004). Some regional analyses conservatively predict that acreage burned annually will double with climate change (MacKenzie et al. 2004). Such watershed impacts could cause enhanced scouring and sediment deposition, more extreme flooding (quicker and higher peak flows), and changes to water quality due to increases in ash and sediment within stream channels. Severe watershed impacts such as these, when added to reductions in extant aquatic habitats, may restrict sites available for the conservation of aquatic species and make management of extant sites more difficult.

Severe wildfires capable of decimating large areas are relatively recent phenomena and result from the cumulative effects of historical or ongoing grazing, which removes the fine fuels needed to carry fire, and fire suppression (Madany and West 1983, Savage and Swetnam 1990, Touchan et al. 1995, Swetnam and Baisan 1996, Belsky and Blumenthal 1997). Historical wildfires in the southwest were primarily cool- burning understory fires with return intervals of 3 to 7 years in ponderosa pine (Swetnam and Dieterich 1985). Cooper (1960) concluded that before the 1950s; crown fires were extremely rare or nonexistent in the region. Effects of fire may be direct and immediate or indirect and sustained over time (Gresswell 1999).

## A. STATUS OF THE SPECIES IN THE ACTION AREA

### Canelo Hills Ladies'-tresses

Canelo Hills ladies'-tresses has been documented at the cienega around Sheehy Spring since 1980, and an informal survey of the Sheehy Spring location in 1999 turned up 731 blooming plants (Sheviak 1990, AGFD 2000). Based on the 1999 count, Sheehy Springs currently may be the largest colony of Canelo Hills ladies'-tresses. Since 2006, casual observations by USFWS personnel and the land owner have continued to find ladies'-tresses, although none were observed in 2014 or in 2015.

### Huachuca Water Umbel

The Huachuca water umbel occurs or has been observed in the action area along the perennial stretches of the Santa Cruz River, and at Sheehy, Sharp, and Heron Springs (USFWS 2014a). Surveys in 2007 and 2008 documented 39 patches of umbel within the SRSNA (Stingelin, et al. 2009). Current status of these populations is unknown, and were not found recently (USFWS 2014a), though umbel was seen on the river in 2016 (Service files).

In 2013, botanists surveyed for water umbel at all four sites mentioned above. Suitable habitat was found at each location; however, water umbel was only found at the Santa Cruz River, and only a few plants were observed. The botanists concluded that all four locations likely still support Huachuca water umbel in small quantities, but water umbel was undetectable due to the

density of competing understory vegetation and possibly due to the time of year when the survey was conducted.

**Huachuca Water Umbel Critical Habitat**

Unit 2 of critical habitat for the Huachuca water umbel occurs in the action area including about 2.7 miles of the Santa Cruz River on the SRR. Specifically, the area designated as critical habitat includes that portion of the Santa Cruz River beginning at about 31˚22’30” N latitude and 110 ˚35'45" W longitude and traveling about 2.7 miles downstream to the south boundary of section 14, T. 24 S., R. 17. E (USFWS 1999a). There are also 1.9 miles of an unnamed tributary that includes Sharp Spring on the SRSNA.

**Huachuca Springsnail**

The Huachuca springsnail is known to occur in the action area only in Sheehy Spring on the SRR. There have been no recent surveys at Sheehy Spring for this species. Recent surveys by AGFD in the Santa Cruz River on the SRSNA and at Sharp Springs found no Huachuca springsnails (Sorensen 2015).

**Gila Chub**

A population of Gila chub currently inhabits the action area at Sheehy Spring on the SRR (USFWS 2015b). Sheehy Spring has been consistently sampled since 1977 (Table 1). The USFWS considers this population to be unstable and threatened; potential threats include small population size, fire, fire suppression, and non-native species. There is no critical habitat for Gila chub in the action area.

Table 1. History of fish sampling at Sheehy Spring, Arizona.

| Sample year | Catch/unit effort (effort/chub) | # of Gila chub |
|---|---|---|
| 1939 | | ? |
| 1940 | | ? |
| 1977 | | ? |
| 1977 | | 107 |
| 1979 | | ? |
| 1980 | | present |
| 1980 | | ? |
| 1985 | | ? |
| 1986 | | present |
| 1988 | | ? |
| 1988 | | ? |

| | | |
|---|---|---|
| 1989 | | 9 |
| 1989 | | 1 |
| 1990 | | 4 |
| 1991 | | ? |
| 1991 | | 1 |
| 1992 | | ? |
| 1993 | 2.5/$m^2$ | 2 |
| 1993 | | 3 |
| 1994 | 5/$m^2$ | ? |
| 1995 | 0.7/$m^2$ | 6 |
| 1998 | 9/$m^2$ | ? |
| 1999 | 160/$m^2$ | 1 |
| 2001 | | - |
| 2002 | 106/$m^2$ | Present |
| 2005 | ? | 0<br>64<br>2 |
| 2006 | 0 | |
| 2007 | 0.4 chub/100 trap hrs | 40 |
| 2008 | 4.9 “ | 0?<br>14? |
| 2009 | 0.2 “ | 138Ad<br>209juv<br>43? |
| 2010 | 1.7 “ | 44 |
| 2011 | 4.3 “ | 30 |
| 2012 | 5.8 “ | 15 |
| 2013 | 6.4 “ | 30 |
| 2013 | 3.3 “ | 58 |
| 2014 | 2.6 “ | 64 |
| Surveys in the 1970s and 80s were focused on Gila topminnow. | | |

**Sonora Tiger Salamander**

Sonora tiger salamander populations occupy stock ponds and ephemeral waters adjacent to drinkers on the covered area, and are also known to occur at drinkers near areas of water leakage from the drinker and pipelines. Sonora tiger salamander populations are not known to occur in any other types of aquatic habitats on the ranch, such as Sheehy Spring or the Santa Cruz River, though an unknown salamander was captured in the river in 2014. The status of the species

within the action area is virtually identical with the range of the species. Surveys have documented Sonora tiger salamanders at multiple locations on the SRR (USFWS files).

**Northern Mexican Gartersnake**

The northern Mexican gartersnake occurs in the perennial portions of the Santa Cruz River in the lower San Rafael Valley from the headwaters to the International Border, as well as area springs, seeps, and tanks on an intermittent basis. Currently, the northern Mexican gartersnake is present in the action area, having been found at Bog Hole Wildlife Management Area, Santa Cruz River, Sharp Spring, Upper 13 Reservoir, Forest Service 799 Tank, and Sheehy Spring. In August 2010, a large (-0.8 m) northern Mexican gartersnake was identified (with photo vouchers) on the concrete apron of the road that crosses the Santa Cruz River (Jim Rorabaugh, USFWS, in litt. 2010). During fish monitoring in 2014, we captured a northern Mexican gartersnake just north of the bridge, and north of the SRSNA. Also, in July 2015, another large northern Mexican gartersnake was captured near the corrals on the SRR (USFWS files). There also has been an observation of a gartersnake at Sheehy Spring (Jim Rorabaugh, USFWS, pers. comm. 2009). There is a fairly robust population in the main stem of the Santa Cruz River on the SRSNA (Lashway 2014, 2015; USFWS 2014d).

Monitoring for gartersnakes has been conducted on SRSNA on the Santa Cruz River in 2008, and 2012 to 2015. In 2008, 55 individual snakes were found, including three neonates (Stingelin et al. 2009). The later surveys found a total of 82 snakes, though an unknown number of those were recaptures. They found that recaptured snakes rarely moved from more than 50 m to approximately 200 m, from their original capture site (Lashway 2014, 2015).

**Northern Mexican gartersnake Critical Habitat**

The upper Santa Cruz River subbasin unit of proposed critical habitat for the Northern Mexican gartersnake occurs in the entire San Rafael Valley, including the permit and action areas, and including the SRR and SRSNA.

## B. FACTORS AFFECTING THE SPECIES AND CRITICAL HABITAT IN THE ACTION AREA

**Huachuca Water Umbel, Canelo Hills Ladies'-tresses**

Canelo Hills ladies'-tresses and Huachuca water umbel and designated critical habitat have likely been affected by loss and degradation of springs and cienega habitats in the action area as a result of groundwater withdrawal, water development and diversion, and past improper livestock grazing in the action area. Currently, competition with non-native plants, as well as reductions in streamflow at Sheehy Spring and the Santa Cruz River are the primary threat to the remaining populations of these species in the action area. The two plant species have been affected by competition with aggressive non-native plants. A suite of non-native plant species has invaded wetland habitats in southern Arizona (Stromberg and Chew 1997, USFWS 2014a), and likely threaten the Huachuca water umbel and Canelo Hills ladies'-tresses in the action area (Arizona Department of Water Resources 1994, Stingelin et al. 2009). Non-native plants have

outcompeted Canelo Hills ladies'-tresses in some areas, but effects of non-native plants on the Huachuca water umbel is currently unknown. Huachuca water umbel seems to do best along the stream courses where flooding and scouring periodically remove competing vegetation while the Huachuca water umbel persists due to its rhizomes. Bermuda grass (*Cynodon dactylon*) grows in the action area and may outcompete Huachuca water umbel. Watercress (*Rorippa nasturtium-aquaticum*) is another non-native plant now abundant along perennial streams in Arizona. Undocumented immigration of people to the United States, and border enforcement and management, particularly where this co-occurs with the presence of non-native species are also threats that exist in the action area.

Although the SRCC is committed through conservation easements to protect rare and unique native plants and their habitats, including maintaining perennial base flow that supports these plants, significant reductions in stream flow due to warmer average temperatures predicted by climate models are likely to occur in the action area during the permit period. Not only would this threaten remaining aquatic and cienega habitats, but it would also create a more favorable environment for non-native plant species in remaining habitats of both Huachuca water umbel and Canelo Hills ladies'-tresses. In addition, both species exist in small populations that are subject to genetic drift and demographic variability. Extirpation of a population of either of these species could occur as a result of major storms, drought, fire, disease, or other forms of environmental stochasticity or anthropogenic stressors. This would increase the likelihood of extinction when coupled with existing threats. Because all populations of both species are isolated, including those in the action area, extirpated sites are unlikely to be recolonized without active management. Although both plant species have co-existed with grazing since they were documented in the action area, unintentional improper grazing remains a potential threat to both plant species.

Very few actions have affected either species in the action area. The few known actions have been largely on the Coronado National Forest, and have had little impact on the action area. Previous actions that may have affected either species within the action area are considered in the environmental baseline.

**Huachuca Springsnail**

Huachuca springsnail has likely been affected by loss and degradation of springs and cienega habitats in the action area as a result of water development and diversion, and past improper livestock grazing. The primary threats to the species currently are climate change and livestock grazing and watering in Sheehy Spring. Climate change is likely to reduce the amount of water available at Sheehy Spring. Although the SRCC is committed through conservation easements to protect rare and unique native animals and their habitats, including maintaining perennial base flow that supports the Huachuca springsnail, significant reductions in stream flow due to warmer average temperatures predicted by climate models are likely to occur in the action area during the permit period. Extirpation of the Huachuca springsnail population at Sheehy Spring could occur as a result of major storms, drought, fire, disease, or other forms of environmental stochasticity or anthropogenic stressors which increases the likelihood of extinction when coupled with existing threats. Although Huachuca springsnail has co-existed with grazing since it was documented in the action area, unintentional improper grazing remains a threat to the

species at Sheehy Spring. Access by livestock to occupied Huachuca springsnail habitat at the spring source is likely limited by topography; however, no monitoring of the springsnail or its habitat has occurred to verify this. Watering and grazing at Sheehy Spring may also affect water quality. Because all populations are isolated, including the one in the action area, once they are extirpated, they are unlikely to be recolonized without active management.

Very few actions have affected this species in the action area, other than those that may have affected the species within the action area considered in the environmental baseline. The only consultation considering this species in the action area was the AGFD Safe Harbor Agreement for topminnow and pupfish (AGFD 2008).

**Gila Chub, Sonora Tiger Salamander, and Northern Mexican Gartersnake**

In the action area, Gila chub, Sonora tiger salamander, and northern Mexican gartersnake (and proposed critical habitat) primarily have been affected by loss and degradation of aquatic and cienega habitats as a result of dewatering and poorly managed livestock grazing, as well as predation by introduced non-native predators. The primary threat to these species in the action area is currently predation by and competition with non-native species, and potential reductions in stream flow. American bullfrogs, large-mouth bass, and green sunfish are common in the Santa Cruz River in the action area and likely prevent Gila chub and Sonora tiger salamander from inhabiting the main-stem of the river. The AGFD surveys on the SRSNA show a good population of adult northern Mexican gartersnakes. Neonate snakes have been found, but only one juvenile snake has been found, indicating that recruitment may be limited on the river (Stingelin et al. 2009; Lashway 2014, 2015). Undocumented immigration of people to the United States, and International Border enforcement and management, particularly where this co- occurs with the presence of non-native predators exacerbates this threat in the action area.

Although the SRCC is committed through conservation easements to conserve habitat for wildlife, including maintaining perennial base flow that supports aquatic species, significant reductions in stream flow due to warmer average temperatures predicted by climate models are likely to occur in the action area during the permit period. Not only would this threaten remaining aquatic and cienega habitats, but it would also create a more favorable environment for non-native predators in remaining aquatic habitats. In addition, there is an increased probability of extirpation of small populations of these species in the action area due to local random events, such as high intensity wildfire, drought, or disease. Unintentional improper grazing still remains a minor threat to Gila chub, Sonora tiger salamander, and northern Mexican gartersnake in the action area. The Sonora tiger salamander also faces the potential threat of interbreeding with barred tiger salamanders currently found around Parker Canyon Lake, in the watershed upstream from the action area.

Since 2000, SRCC has constructed stock tanks and other impoundments for cattle in the action area that have also benefited Sonora tiger salamanders and may serve as habitat for northern Mexican gartersnakes and Gila chub. The stock tanks serve as habitat for the species where cienegas are now absent and many of the stock tanks are fed by wells that are considered a permanent water source. However, these stock tanks also allow movement of non-native fish and bullfrogs throughout the action area. Of the 27 stock tanks seined during annual Sonora

tiger salamander surveys between 2008 and 2011, bullfrogs were detected in three stock tanks (USFWS files). Conservation actions that have been implemented by the SRCC in the action area may provide future habitat for the northern Mexican gartersnake, Gila chub, and Sonora tiger salamander. Such actions include installing bullfrog fencing around Pasture 9 Tank to prevent ingress of bullfrogs and livestock, and partial fencing of Pasture 15 Tank to limit livestock grazing to only a portion of the tank (USFWS files).

Several actions have affected these species in the action area. Four consultations covering actions by AGFD may affect species in the action area. Three of the consultations should be beneficial for aquatic species, as they cover the Chiricahua leopard frog Safe Harbor (USFWS 2006c), the topminnow and pupfish Safe Harbor (USFWS 2008b), and FWS funded conservation actions for aquatic species (22410-2011-F-0290, USFWS 2011d). The last consultation covers the AGFD's fish stocking program, which could cause problems for native aquatic species, but the only site that is stocked with non-native sport fish in the area is Parker Canyon Lake. The problematic species stocked there already occur in the lake, below the Lake in Parker Canyon, and elsewhere in the valley (22410-2008-F-0486, USFWS 2011e).

The other consultations that could impact the action area have been largely on the Coronado National Forest, and have had little impact on the action area, due to the intervening reaches of ephemeral stream. Several grazing consultations covering most of the Forest and nearby allotments have been completed. The main concern with these consultations is how stock tanks are managed regarding aquatic species management (mostly for salamanders). Conservation measures included in the proposed action of those consultations, especially the stock pond guidance, minimize the impacts to listed aquatic species (02-21-98-F-399, USFWS 1999b; 02-21-98-F-399R1, USFWS 2002b; 02-21-04-F-0489, USFWS 2005b; 02-21-05-F-0847, USFWS 2006d).

The other consultation in the area, which covers the entire valley, was Border Patrol's Tactical Infrastructure Maintenance and Repair Program. Extensive best management practices and conservations measures included in the proposed action of the 2012 consultation (02EAAZ00-2012-F-0170, USFWS 2012) and 2016 reinitiation (02EAAZ00-2012-F-0170R001, USFWS 2016b), greatly reduce and minimize effects to the species. There are specific best management practices and conservations measures for the Sonora tiger salamander and Gila chub. General and specific best management practices and conservations measures for other species also reduce impacts to Sonora tiger salamander and Gila chub, in addition to the northern Mexican gartersnake. Indeed, the only reasonable and prudent measure for these three species was a requirement to photograph northern Mexican gartersnakes (and similar snakes).

## EFFECTS OF THE ACTION

Effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action which will be added to the environmental baseline. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration.

Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

**Direct and Indirect Effects**

The proposed action is the issuance of a section 10(a)(1)(B) ITP to SRCC for the incidental take of the covered species from implementation of the covered activities in the SRRHCP. No direct effects are expected from the issuance of the permit on any covered species. All effects of implementing the covered activities proposed in the SRRHCP are indirect effects of the permit issuance and are discussed below.

The section 9 prohibitions in the Act differ between animals and plants; however, for simplicity the following discussion of effects of covered activities to Huachuca water umbel and Canelo Hills ladies'-tresses is analogous to the discussion of the effects of take on the covered animal species.

Watering by cattle in stock tanks and riparian habitats, and grazing all areas, including herding of cattle within pastures and between pastures

Watering and grazing by cattle on the SRR and SRSNA are likely to affect all covered species and designated and proposed critical habitat. Because of the 4(d) rule covering gartersnakes, any activity at stock tanks affecting individual gartersnakes is not included in the discussion below. Although the time cattle spend in riparian pastures is limited annually, cattle are known to spend a disproportionate time in the wetted areas of these pastures and stock tanks, and therefore have the potential to impact all covered species and the quality of their habitats. Two of the covered species (salamander, gartersnake) also periodically occur in upland habitats. Livestock watering and grazing in occupied habitats of covered species in the action area may result in trampling of: 1) Huachuca water umbel; 2) Canelo Hills ladies'-tresses; 3) eggs, veliger larvae, or adult Huachuca springsnails; 4) eggs or fry of Gila chub; 5) eggs, larvae, and adult Sonora tiger salamanders, and 6) neonates, juveniles, or adults of northern Mexican gartersnakes. Adult Gila chub are expected to swim away when livestock are watering. Cattle may also forage on Canelo Hills ladies'-tresses and Huachuca water umbel. In addition, there is the possibility that livestock could transport amphibian chytrids or other diseases from one stock tank to another and harm Sonora tiger salamanders. For transport of amphibian chytrid to occur there would need to be a microclimate that could sustain the fungus for the trip from one water to another, such as in the hair, mud on the animal, or in the hoof keratin. This is also true of all wildlife species that may travel from one aquatic site to another, such as white-tailed deer, javelina, pronghorn, waterfowl, and aquatic insects (Johnson and Speare 2005). Implementation of the conservation measures (#2, #5, #8, #10) will minimize trampling of all covered species and spread of chytrids to Sonora tiger salamanders.

The effects of livestock management on the landscape are related to numerous factors (Holechek et al. 1998). Environmental parameters such as precipitation, temperature regimes, vegetation types, and growing season provide the basics upon which a grazing program is developed

(Schmutz 1977). Abiotic factors include soils, climate, geography, and topography. Stocking rates, season of use, utilization levels, class of livestock, and rotation patterns comprise livestock management choices. The SRRHCP has a good discussion of the general ecological effects of grazing.

Cattle watering and grazing riparian vegetation in the action area may cause disruption of the food chain, diminish habitat, or increase predation of Huachuca Springsnail, Gila chub, Sonora tiger salamander, and northern Mexican gartersnake. Shoreline habitat is an element of proposed critical habitat for the northern Mexican gartersnake (PCE 1c). Short-term effects to shoreline habitat are expected from grazing, but will be temporally and spatially intermittent. Riparian plant communities with rooted plants retard streambank erosion, filter sediments out of the water, build and stabilize stream banks and streambed, and provide shade and nutrients for aquatic species. Functional riparian areas act as "sponges" during high water periods and raise water tables maintaining stream water during dry seasons, resulting in more flow throughout the year (Kauffman and Krueger 1984, Belsky et al. 1999). Therefore the loss of riparian vegetation can result in a negative feedback loop where conditions continue to break down until active management is needed to repair degraded areas.

Streamside vegetation along the Santa Cruz River, around the cienega at Sheehy Spring, and along the perimeter of some stock ponds provides both allochthonous (produced outside stream system) and autochthonous (produced within stream ecosystem) food sources for macroinvertebrates. The quantity and quality of these food sources play a critical role in regulating the macroinvertebrate assemblage that is present in these systems (Gregory et al. 1991). Macroinvertebrates are a primary food source for aquatic vertebrates such as native fish and amphibians including Gila chub and Sonora tiger salamander. Alterations to the food web at the lower levels would have repercussions for higher-level consumers and negatively affect PCE3 of proposed northern Mexican gartersnake proposed critical habitat; but will not adversely modify this PCE.

Loss of riparian vegetation and bank erosion caused by livestock grazing and trampling in riparian areas may also alter channel morphology which reduces pool habitats required by the Gila chub, and a loss of shallow side and backwater habitats used by larval chub (Kauffman and Krueger 1984, Belsky et al. 1999). Livestock grazing of streamside and in-stream vegetation may also reduce available cover, which may have adverse effects on water quality and temperature, and may increase predation of Gila chub by non-native fish and northern Mexican gartersnakes by non-native fish and bullfrogs. Livestock may also diminish water quality for all species and critical habitats by increasing sedimentation in livestock tanks and riparian areas via trampling (increased turbidity), defecation, and year-round herding between pastures. Sediment can alter primary productivity and fill interstitial spaces in streambed materials with fine particulates that impede water flow, reduce oxygen levels, and restrict waste removal (Chapman 1988). While short-term depletion in riparian vegetation and water quality will likely occur under the covered activities included in the SRRHCP, the proposed grazing management and conservation measures (#1, #2, #5, #7, #10) will ensure that the effects are minimized and that the existing riparian vegetation will be maintained or enhanced. This includes, but is not limited to, managing trespass cattle so that grazing of riparian pastures is limited to the non-growing season, and monitoring impacts to riparian vegetation by livestock through repeat photography at

established photo points in occupied habitat of covered species, as outlined in the SRRHCP (Harlow 2015). Vegetation surveys conducted by the Arizona Game and Fish Department from 2005 to 2008 on SRSNA showed declining canopy coverage of native perennial grasses; but this was compounded by dry years, a fire, and variable precipitation (Stingelin et al. 2008). Rangeland monitoring by NRCS in 2012 on the SRR in three key areas showed two of the key areas with an upward trend (compared to 2011), and one key area being stable (NRCS files).

For the Huachuca water umbel, occasional trampling or periodic disturbance of bank and stream channels by livestock may mimic natural forms of disturbance that recreate early successional stages favorable for population maintenance and expansion. However, continual or frequent disturbance, or severe damage to stream morphology, such as head cuts and downcutting would likely reduce populations or eliminate them from areas, and impair PCE 2 of critical habitat for the species. Additional information exists suggesting reduced levels of grazing can benefit the water umbel and its critical habitat. Monitoring of umbel populations at Cottonwood Spring near Patagonia occurred before and after livestock was removed. Within two years following removal of cattle, the area became wetter and the riparian area expanded. The area occupied by the umbel increased, although it was becoming less dense in areas that were growing over with cattails and other wetland plant species (D. Gori and P. Warren, pers. comm., *in* Falk 1998). While watering and grazing in pastures along the Santa Cruz River and in Sheehy Spring, cattle have access to almost all occupied and potential habitat for the Huachuca water umbel and Canelo Hills ladies'-tresses in the action area. However, both species have co- existed with disturbance caused by grazing practices in the action area, and we believe implementation of the SRRHCP, including conservation measures, will provide conditions for the continued existence of these species and protect critical habitat for the Huachuca water umbel.

While livestock grazing in uplands is not likely to have immediate effects on any of the covered species, excessive and prolonged removal of vegetation through herbivory has the potential to increase invasive shrubs and alter the watershed hydro-period with loss of soil productivity and increased soil compaction. Reduction in soil productivity can lead to less precipitation that is taken up by plants. Increased soil compaction decreases the amount of water infiltration into the soil. Both of these factors may lead to higher surface runoff and higher flood pulses in stream channels. The erosive energy of floods can cause stream channel downcutting resulting in lower ground water tables and subsequent narrowing or loss of riparian vegetation. The Santa Cruz River downcut in the late 1800s and early 1900s (Webb et al. 2014). Lower water tables could alter or eliminate spring flows required to support habitat for Canelo Hills ladies' -tresses, Huachuca springsnail, Gila chub, and northern Mexican gartersnake at Sheehy Spring and habitat for Huachuca water umbel and northern Mexican gartersnake on the Santa Cruz River. Lower water tables could also alter or eliminate PCE l of critical habitat for Huachuca water umbel and the northern Mexican gartersnake. Additionally, with less water entering drainages and riparian soils, less water is available to provide base flows.

The effects of flow regime alterations may result in deleterious effects to aquatic biota as lower water tables reduce or eliminate riparian vegetation and affect macroinvertebrate communities (Belsky et al. 1999). Disruption of macroinvertebrate communities may then further affect Gila chub, Sonora tiger salamander, and northern Mexican gartersnake (and critical habitat), as previously discussed. These impacts are typical of livestock operations where no active

management is applied to the movement of livestock. The SRCC is managing livestock under a grazing management plan, developed with NRCS, in accordance with conservation easements for the SRR. Livestock management is geared toward light to moderate grazing pressures in the action area, which reduces some of the adverse effects of grazing and should therefore minimize flow regime alteration and its subsequent effects to covered species and critical habitats (USFWS files).

Grazing of uplands could affect gartersnake proposed critical habitat element 4, terrestrial space next to stream systems. Impacts are expected to be limited in areal extent next to the farm and corrals.

The amount of livestock use (animal-unit-months) is tracked annually for each pasture by the SRCC, and compared to the amount of forage available for livestock. From 2009 to 2013, an average of 21 pastures were grazed in one year. About 14 percent of those had utilization rates greater than the reference use. In relation to measure "a" of incidental take in this BCO, only two pastures ever exceeded the maximum use guideline by 50 percent in one year, and no exceedances were recorded in any one pasture two years in a row. For incidental take measure "b," the number of pastures with utilization greater than 25 percent of the guideline was never more than 11 percent of the pastures. It is important to note that many of the actual exceedances are a reporting artifact, where the reported utilization may actually be for two seasons, rather than just one season as specified in the incidental take statement.

Maintenance of stock tanks, wells, waterlines, fences, roads and utility lines

Stock tank maintenance is likely to affect the Sonora tiger salamander, Huachuca water umbel, and Gila chub. The only other covered species known to occur in stock tanks within the permit area, is the northern Mexican gartersnake, which has a 4(d) rule covering stock tank use and maintenance. Stock tanks have been developed throughout the Southwest for livestock and wildlife use. In many areas, including the SRR, they have both indirect beneficial and detrimental effects on aquatic ecosystems.

The potential effects of stock tank maintenance on Sonora tiger salamanders, Huachuca water umbel, and Gila chub, include: disturbance, mortality, harm, and harassment from emptying and drying stock tanks; mortality or harm as a result of heavy equipment use in stock tank maintenance; and harm to Sonora tiger salamanders from spread of amphibian chytrid from equipment involved in maintenance. Even when dry, Sonora tiger salamanders may still be present in cracks in the mud or rodent burrows on the edge of a stock tank. These salamanders could be killed or injured when heavy equipment is used in and around the stock tank. Stock tank maintenance activities will follow the guidelines in Appendix B of the SRRHCP, and are based on the Sonora Tiger Salamander Recovery Plan (USFWS 2002a) and the Chiricahua Leopard Frog Recovery Plan (USFWS 2007b). Minimization measures proposed in Appendix B of the SRRHCP, such as salvage efforts, should minimize injury or mortality associated with maintenance of livestock tanks on the Sonora tiger salamander and Gila chub, and lessen impacts to Huachuca water umbel, should it occur. Amphibian chytrid can be spread to Sonora tiger salamanders through moving wet or dirty equipment from one site to another, especially if there are wetted soils or aquatic sites in these locations. These effects will be minimized through

proper cleaning and drying of all vehicles and tools before moving to new locations, as proposed in the SRRHCP (Harlow 2015). Little effects to Huachuca water umbel critical habitat and proposed northern Mexican gartersnake critical habitat are expected.

Stock tank maintenance activities, while potentially resulting in some mortality of the three vertebrate species, occur at each livestock tank once in a 20 year period on average, and provide a benefit in maintaining aquatic sites on the landscape. Stock tanks capture surface water and precipitation, and thus decrease the flashiness of a stream during a storm and allow water to percolate into the soil, providing some recharge of the aquifer and potentially adding to stream base flows. They also benefit aquatic systems by limiting and trapping excess sediment that otherwise would continue down ephemeral channels into perennial streams. They benefit species in the action area, including Sonora tiger salamander, Gila chub, and northern Mexican gartersnake, by providing habitat that is needed for the species recovery and survival. Stock tanks are detrimental to aquatic systems if the sediment berms that are built to capture overland flow fail and cause acute sediment pulses into aquatic systems. Maintenance of stock tanks in the action area will prevent such failures. However, maintenance of stock tanks may also provide the means for nonindigenous predators, such as bullfrogs, non-native fish, and crayfish, to move across landscapes that would otherwise serve as a barrier to their movement. These non-native species can negatively affect native aquatic species that may occur within or nearby stock tanks, and the non-native species can be transported downslope to other stock tanks or perennial aquatic systems during high flow events. Periodically maintaining and drying stock tanks may also remove non-native aquatic species.

Maintenance of wells, waterlines, fences, roads, and utility lines may affect all covered species and critical habitat in the action area. Maintenance of these facilities can result in road mortality of dispersing Sonora tiger salamanders or northern Mexican gartersnakes and trapping of dispersing salamanders in water and utility line trenches. In addition, erosion and short-term watershed degradation can occur from increased run-off carrying sediment into all covered aquatic species' habitats. The actual amount of erosion and resultant potential sediment discharge into drainages and perennial waters is highly variable, depending on the scope of the maintenance project and the intensity, timing, and duration of precipitation events. The potential increase in sediment could result in mortality and injury to all life history stages of the covered species from physical trauma with debris and burying of individuals. However, increased runoff and sediment transport may have a beneficial effect on Huachuca water umbel and its critical habitat through scouring and deposition of sediments that would provide nutrients, growth media, disperse plants downstream, and provide new areas to colonize. Gila chub could be affected through short-term reduction or loss of prey base and suitable habitat, as pools are filled in and cover vegetation is buried or removed through scouring. Excessive suspended sediment can also negatively influence breeding activities of chub (Clark Barkalow and Bonar 2015). Adult Sonora tiger salamanders and northern Mexican gartersnakes would likely avoid these effects by leaving the water and waiting until the debris flows pass, although the forage base of these species, including fish and aquatic invertebrates , may be reduced temporarily, negatively affecting these species.

Fence line and pipeline maintenance usually will result in only small, temporary increases in sediment transport, but roads may result in a long-term increase in sediment transport depending

on original road design, extent of maintenance, and erosion control implemented with maintenance project. Native vegetation that is removed as a result of facility maintenance activities is anticipated to establish quickly in treatment areas and would return soil stability to pre-treatment conditions, as evidenced by vegetation re-growth in the action area within a year of ground disturbance for fence installation around Pasture 9 tank (USFWS files). Effects of sediment transport are most likely to occur in occupied Sonora tiger salamander habitat because stock tanks are present throughout the action area. These effects to the Canelo Hills ladies'-tresses, Huachuca springsnail, Gila chub, and northern Mexican gartersnake would currently only occur if maintenance is required on the few such facilities in the Sheehy Spring watershed. The Huachuca water umbel and its critical habitat, and potentially Gila chub and northern Mexican gartersnake could be affected if facilities located upstream of and in the Santa Cruz River corridor require maintenance. The potential effects from spread of amphibian chytrids from facility maintenance activities will be reduced through minimization measures in the SRRHCP as described previously. Maintaining integrity of fencing within the action area will also aid in minimizing impacts to the Huachuca water umbel and PCEs 2 and 3 of its critical habitat, Canelo Hills' ladies tresses. Gila chub, and northern Mexican gartersnake by keeping cattle out of riparian pastures except as specified in the proposed action.

Management of brush and invasive plants

Mechanical control of invasive plants would have effects similar to those described for linear facilities maintenance from sediment transport downstream. Because the distribution of most invasive plants proposed for treatment in the action area are away from water's edge at present (non-native upland grasses and invasive shrubs), mechanical treatments in the immediate future are not likely to result in harm to covered species. However, removal of the blackberry at Sheehy Spring may cause impacts to Gila chub, Sonora tiger salamander, Huachuca water umbel, northern Mexican gartersnake, and Huachuca springsnail. Mechanical treatments such as pulling plants or digging out roots may be used to remove non-native grasses and invasive shrubs that establish at or near aquatic habitats activities, and will have minor effects to covered species or their habitat. Disturbance to soil may result in more indirect deposition into adjacent waters during rainfall events, decreasing water quality, as described for facilities maintenance. Control of aquatic invasive plants is not proposed in the action area.

Effects to covered species from herbicide application to non-native grasses and invasive shrubs in the action area will vary depending on type of herbicide, amount applied, and location and timing of application. Currently, areas with invasive shrubs are limited to one acre in size and are far removed from covered species and their habitats (except at Sheehy Spring), so that mobility of herbicides through soil is unlikely to occur to the extent that it will reach water and affected covered species. However, future location and extent of non-native grasses and invasive shrubs are unknown so that use of herbicides during the permit period may result in downstream mobilization of sediments or chemical pollutants in herbicides, which ultimately may find their way into aquatic environments. This mobilization could negatively impact any covered species present by decreasing water quality, harming aquatic and riparian vegetation, and harming all covered species present. Mobilization of pollutants would also impair PCEs le, 1d, 1e, and 1f of proposed critical habitat for northern Mexican gartersnake. Herbicides applied upstream from stock tanks occupied by covered species have a higher likelihood of entering the aquatic

environment due to surrounding topography and lack of vegetation buffers around stock tanks that can capture and retain pollutants. In accordance with White (2007) herbicides applied around stock tanks or in riparian areas will be approved for use around water, and care will be taken to minimize the usage in this area to avoid harm to covered species. No herbicides will be used in habitats of Huachuca water umbel or Canelo Hills ladies'-tresses. However, herbicide use in surrounding uplands may have greater impacts to Huachuca water umbel and PCE 3 of its critical habitat due to the potential number and cumulative size of treatment areas upstream from Huachuca water umbel habitat along the Santa Cruz River.

Hay Production

Hay production occurs along a portion of the San Rafael River at the south end of the SRR. It is possible that northern Mexican gartersnakes or Sonora tiger salamanders could occur in the hay fields. Individuals could be killed or injured during haying, but that occurrence is extremely unlikely. In addition, fertilizer used on crops has the potential to enter the Santa Cruz River, resulting in harm to northern Mexican gartersnake and Gila chub and impact northern Mexican gartersnake proposed critical habitat PCE 1 and Huachuca water umbel critical habitat PCE 1, through water quality degradation.

Hay production is not likely to have immediate effects on any of the covered species, but prolonged pumping of groundwater to irrigate these crops has the potential, though unlikely, to reduce flows in the Santa Cruz River. This can result in a drop in the water table or periodic curtailment of flow in the Santa Cruz River and, consequently, impair habitat for all of the covered species. However, we expect these groundwater effects will be minimal because conservation easements on the entire action area include stipulations to prevent any use of the SRR that will significantly impair or interfere with the conservation values of the SRR and its natural resources and ecosystem, conserve habitat for wildlife, and protect rare and unique native plants and animals currently known or later identified. According to an undated Arizona Department of Water Resources Report, no long-term changes in groundwater levels have been observed, suggesting that groundwater discharge and groundwater recharge are in balance. According to Freethey and Anderson (1986), natural estimated annual recharge in the basin is about 5,000 AF annually. The Grazing Management Plan for the SRR incorporates these stipulations. The conservation easements give the SRCC the right to drill for water on the SRR and make available water wells for existing permitted uses, including hay production, provided that the wells and pumping do not significantly adversely affect wildlife habitat on the SRR, significantly reduce perennial stream flow at springs or along the Santa Cruz River, or impair conservation values on the SRR.

Recovery and Conservation Potential and Critical Habitat

We have based our analysis on the SRCC commitment to implement the proposed action as described in the SRRHCP and to work with the USFWS to use adaptive management to quickly respond to changing environmental conditions. If the action is carried out as described, in cooperation with species and effectiveness monitoring and recovery actions in the covered area, we believe that the proposed action would result in long-term maintenance and recovery of the

watershed and the overall effect of the proposed action on the covered species and critical habitats should be mostly beneficial.

Even though impacts to Huachuca water umbel critical habitat will occur, the establishment and management of riparian pastures along the Santa Cruz River, combined with stocking rates that should maintain and improve riparian condition, and the managed grazing of the pasture containing Sharp Spring, will assure that the primary constituent elements are maintained and improved through time.

The northern Mexican gartersnake proposed critical habitat primary constituent elements include: (l) aquatic or riparian, including perennial or intermittent streams; lentic wetlands such as livestock tanks, springs, and cienegas; shoreline habitat; and aquatic habitat that can support native amphibian prey; (2) adequate terrestrial habitat (600 feet) adjacent to designated stream systems with sufficient structural characteristics to support life-history functions; (3) a prey base consisting of viable populations of native amphibian and native fish species; and (4) an absence of harmful non-native fish species, bullfrogs, or crayfish; or occurrence of these species at low enough levels that recruitment of northern Mexican gartersnakes and maintenance of native fish or soft-rayed non-native fish populations is still occurring. Within this Upper Santa Cruz Subbasin Unit, the USFWS believes primary constituent elements 1, 2, and 3 are generally met, but element 4 (absence or low level of harmful non-native species) is deficient (USFWS 2013). Like conditions for the water umbel critical habitat, implementation of winter grazing only in riparian pastures along the Santa Cruz River, and managed grazing of upland pastures will likely assure maintaining or improving primary constituent elements 1, 2, and 3. The periodic maintenance of stock tanks and management of waters are a part of the conservation actions of this plan, and will help to address some non-native predator populations (element 4) found in this proposed critical habitat unit by periodic drying of ponds that the non-native predators depend on. Additional management against non-native species is not within the applicant's authority.

*Conservation Measures*

A primary goal of the SRRHCP is to promote the conservation of the covered species while allowing for a viable livestock grazing operation. The maintenance of cattle watering sources is not only essential to the cattle operations, but also currently provides habitat for two covered species and could provide habitat for two more. Maintaining and managing stock tanks that are occupied by Sonora tiger salamander and northern Mexican gartersnake and may be occupied by Huachuca water umbel and Gila chub is a benefit to these species, although there are likely to be short-term adverse impacts from maintenance activities. The SRCC has added 21 watering sources to improve distribution and lessen impacts of grazing on the covered area. Also, fencing of many dirt tanks has led to improved cover conditions that likely benefit the northern Mexican gartersnake and Sonora tiger salamander and could benefit Gila chub and Huachuca water umbel. Maintaining fencing and managing trespass cattle so that grazing of riparian pastures is limited to the non-growing season also lessens impacts to covered species. As a result of the conservation actions noted above, the SRRHCP is expected to promote the conservation and recovery of the covered species.

Additionally, brush and invasive plant management activities using best management practices should prevent associated sediments and herbicides from entering aquatic habitats (White 2007). Plant management should help maintain the natural plant communities that still largely exist in the San Rafael Valley. Effects to covered species and critical habitats from use of herbicides will be minimized by following the USFWS's guidelines outlined in Recommended Protection Measures for Pesticide Applications in Region 2 of the U.S. Fish and Wildlife Service (White 2007), or the most current version of this document. This includes, but is not limited to, development of standard operating procedures into a work plan that is approved by USFWS before application of pesticide in or adjacent to occupied habitat of listed species (White 2007).

The development of an educational program to provide information to those associated with the SRRHCP regarding the unique species and habitats found on the SRR should reduce the chance that inappropriate actions occur. Personnel will not knowingly engage in the release of non-native fish, amphibian, or invertebrate species within the covered area.

The SRR will report dead individuals of the covered species and include, when possible, the specific action taken, the covered activity under which the specific action was taken, how many of each species was taken, and the extent of species' habitat affected. The SRR will also conduct effectiveness monitoring through the establishment of permanent photo plots. Photo monitoring will be designed in cooperation with the USFWS to address habitat condition and changes in habitat availability. Photo plots will document the integrity of aquatic habitats, the integrity of fencing, vegetation cover, and presence of non-native species. The SRR will meet with the USFWS annually to establish a plan for species monitoring, and the SRR will conduct species specific monitoring when partners cannot. These conservation measures minimize and mitigate to the maximum extent possible, the impacts of anticipated incidental take, and impacts to designated and proposed critical habitat.

**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 BCO. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Activities that are reasonably certain to occur in the action area include the following: water developments and groundwater pumping from the Santa Cruz River basin; conservation actions in the area, illegal immigration and smuggling, and wildfire. The above activities and livestock grazing, farming, and limited development may occur in the San Rafael Valley outside of the action area. Park development at SRSNA is also likely to occur during the 30-year life of the permit. Mining in Mexico (Mercator Minerals 2013) just south of the San Rafael Valley may have localized dust and aerial pollutants, in addition to groundwater pumping which could affect groundwater in the U.S.

Conservation actions in the covered area may be undertaken in cooperation with the USFWS, AGFD, NRCS, and others. Such projects might include removal of non-native aquatic species, creation of new stock tanks, addition of wells, upgrading of existing wells, and additional

fencing around stock tanks. These projects are not covered by the SRRHCP as they would most likely be funded through sources such as the Partners for Fish and Wildlife Program or Farm Bill programs and addressed under corresponding ESA Section 7 consultations or covered by l0(a)(l)(A) permits. These activities might result in short-term harm, harassment, and direct mortality of covered species, but these impacts would be minor during the life of the permit through exclusion of livestock from portions of occupied habitat, protection for riparian vegetation development, and decreased competition with and predation by non-native species.

Activities such as illegal immigration and smuggling along the U.S. and Mexico border, as well as trespass from recreationists will likely continue in the covered area during the life of the SRRHCP. Impacts from these activities include increases in human traffic, deposition of trash, new trails from human traffic, soil compaction and erosion, fire risk from human traffic, water contamination, introduction to and spread of non-native species. Soil compaction and erosion can result in increased sediment transport in run-off and, consequently, cause harm to Sonora tiger salamander, northern Mexican gartersnake, Huachuca spring snail, and Gila chub through water quality degradation. Fires could have catastrophic effects to watersheds with potential for ash and sediment flow into habitats of all covered species, and associated erosion of channels. The introduction and spread of non-native species could harm all covered species.

Natural events such as floods, the effects of which may be exacerbated by human activities, are also expected and have the potential to spread non-native species or significantly affect the species within the natural wetland areas. The potential for such flooding increases should fires occur within or next to the action area, removing protective vegetation and increasing the amount of debris associated with flood events.

## CONCLUSION

### Listed Species

After reviewing the current status of the Canelo Hills ladies'-tresses, Huachuca water umbel, Gila Chub, northern Mexican gartersnake, and Sonora tiger salamander; the environmental baseline for the action area including additional effects from actions in the baseline that would occur over the period covered by this consultation; the effects of issuing an ITP; effects of the other Federal actions including implementation of the SRRHCP; and cumulative effects; it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of these five species. Designated critical habitat for the Huachuca water umbel and proposed critical habitat for the northern Mexican gartersnake are not likely to be destroyed or adversely modified. In making these determinations, we considered the following:

Canelo Hills Ladies'-tresses

l. Livestock grazing will be limited in duration within Canelo Hills ladies'-tresses habitat, reducing direct effects to Canelo Hills ladies'-tresses.

2. Though some effects are anticipated from the covered activities, Canelo Hills ladies'.-tresses persist in the action area and reflect the fluctuations in habitat and population levels that

are expected for this species. In addition, Canelo Hills Ladies'-tresses benefit from periodic disturbance.

3. Most of the covered activities will be implemented outside of Canelo Hills ladies'-tresses habitat.

Huachuca Water Umbel

1. Livestock grazing will be limited in duration within Huachuca water umbel habitat, reducing direct effects to Huachuca water umbel.

2. Though some effects are anticipated from the covered activities, Huachuca water umbel persists in the action area and reflects the fluctuations in habitat and population levels that are expected for this species.

3. Proper livestock grazing can potentially benefit the persistence of Huachuca water umbel by reducing competition and providing appropriate levels of habitat disturbance that allow for establishment and expansion of Huachuca water umbel populations.

4. Because the proposed action will not result in improper grazing, the effects of the proposed action will not significantly alter any of the critical habitat PCEs to the extent that adverse modification or destruction of critical habitat would occur. Therefore, the value of critical habitat to support survival and recovery of the species will not be compromised.

Gila Chub

1. Few direct effects from permitted livestock to chub are expected in Sheehy Spring because livestock grazing will occur for only a short period of time, and will not occur in some years.

2. Other than potential direct effects to eggs (trampling), few direct effects are anticipated in Sheehy Spring due to the fact that most fry and adult Gila chub can avoid trampling by livestock.

3. Watershed effects to Sheehy Spring will be minimal to the Gila chub because livestock management objectives are to improve the health and function of the ecosystem.

Sonora Tiger Salamander

1. Impacts and incidental take may also occur from the use of heavy equipment and vehicles associated with the covered activities, but this is expected to occur rarely because of the localized and sparse distribution of this species.

2. The use and maintenance of stock tanks will negatively impact individual Sonora tiger salamanders. The conservation measures for stock tank maintenance will minimize impacts to the salamander. The presence and maintenance of stock tanks in the valley has allowed, and will continue to allow, the Sonora tiger salamander to persist in the San Rafael Valley.

3. Effects may also occur from livestock through trampling, although these impacts are likely to be minimal, rare, and of short duration, given the mobility of Sonora tiger salamanders.

Northern Mexican Gartersnake

1. The action area is a small portion of the overall range of this species.

2. Short-term effects of the SRRHCP may result in incidental take of northern Mexican gartersnake from implementation of covered activities, particularly those related to maintenance of linear facilities.

3. Incidental take may also occur from the use of heavy equipment and vehicles associated with the covered activities, but this is expected to occur rarely because of the localized and sparse distribution of this species and the short distance this species is usually found from water.

4. Incidental take may also occur from livestock through trampling, although this source of incidental take is likely to be minimal due to the mobility of northern Mexican gartersnakes.

5. Participation in the SRRHCP will encourage the permittee to maintain stock tanks that provide habitat for northern Mexican gartersnakes and promote conservation.

6. Conservation measures implemented at Sheehy Spring will limit the potential for direct effects to northern Mexican gartersnakes. For example, few direct effects from permitted livestock to northern Mexican gartersnakes are expected in Sheehy Spring because livestock grazing will occur for only a short period of time, and will not occur in some years.

7. Proposed critical habitat will not be adversely affected or destroyed.

Critical habitat

After reviewing the current status of designated Huachuca water umbel critical habitat, the environmental baseline for the action area, the effects of the proposed actions, and cumulative effects, it is our biological opinion that the action, as proposed, is not likely to adversely modify or destroy critical habitat. In making this determination, we considered the following:

1. Because the proposed action will minimize impacts to aquatic and riparian habitat, the effects of the proposed action will not significantly alter all PCEs of designated critical habitat in a manner that results in adverse modification or destruction of critical habitat.

2. The recovery potential of critical habitat will not be compromised by implementation of any of the covered activities under the SRRHCP.

Proposed Critical Habitat

After reviewing the current status of the proposed northern Mexican gartersnake critical habitat, the environmental baseline for the action area, the effects of the proposed actions, and cumulative effects, it is our conference opinion that the action, as proposed, is not likely to adversely modify or destroy proposed critical habitat. Upon final designation of critical habitat for this species, USFWS should request reinitiation of intra-service consultation to convert this conference opinion to a biological opinion. In making this determination, we considered the following:

l. Because the proposed action will minimize potential effects from livestock grazing, the effects of the proposed action will not significantly alter PCE 1 of proposed critical habitat in a manner that results in adverse modification or destruction of critical habitat.

2. Short-term effects from implementation of stock tank maintenance may result in temporary negative impacts to PCEs 1 a, 1b, 3, but will have a long-term benefit and will not significantly alter these PCEs in a manner that results in adverse modification or destruction of critical habitat.

3. Effects from implementation of linear facility maintenance and invasive plant management may result in temporary negative impacts to PCE 1 e, 1 d, 1 e, and 1 f, but these effects will not significantly alter any of the proposed critical habitat PCEs in a manner that typically results in adverse modification or destruction of critical habitat.

4. Because the proposed action will not result in improper grazing, the effects of the proposed action will not significantly alter any of the critical habitat PCEs to the extent that adverse modification or destruction of critical habitat would occur. Therefore, the value of critical habitat to support survival and recovery of the species will not be compromised.

Candidate Species

After reviewing the current status of the candidate Huachuca springsnail, the environmental baseline for the action area, the effects of the proposed actions, and cumulative effects, it is our conference opinion that the action, as proposed, is not likely to jeopardize the continued existence of this unlisted species. Incidental take coverage under the section 10(a)(1)(B) permit can be extended upon the listing of this species as threatened or endangered. Upon listing of this species, USFWS should request reinitiation of intra-service consultation for this species to convert the conference opinion into a biological opinion. In making this determination, we considered the following:

Huachuca Springsnail

1. Huachuca springsnails are currently only known from Sheehy Spring within the action area.

2. The action area is a small portion of the overall range of this species.

3. Implementation of the SRRHCP may result in incidental take of Huachuca springsnails from the performance of covered activities, particularly grazing and watering of livestock in Sheehy Spring, but the effects will be minimal and temporary.

4. Participation in the SRRHCP will encourage the permittee to maintain Sheehy Spring; this spring provides habitat for Huachuca springsnails.

5. Conservation measures implemented at Sheehy Spring will limit the potential for direct effects to Huachuca springsnails. For example, few direct effects from permitted livestock to Huachuca springsnails are expected in Sheehy Spring because livestock grazing will occur for only a short period of time, and may not occur in some years.

The conclusions of this biological opinion and conference opinion are based on full implementation of the project as described in the Description of the Proposed Action section of this document and in the SRRHCP, including any Conservation Measures that were incorporated into the project design.

**INCIDENTAL TAKE STATEMENT**

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened 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 (50 CFR 17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is defined (50 CFR 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior 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 intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by USFWS so that they become binding conditions of any grant or permit issued, as appropriate, for the exemption in section 7(o)(2) to apply. We have a continuing duty to regulate the activity covered by this incidental take statement. If we (1) fail to assume and implement the terms and conditions or (2) fail to require the (applicant) to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the applicant must report the progress of the action and its impact on the species to the USFWS as specified in the incidental take statement [50 CFR §402.14(i)(3)].

Sections 7(b)(4) and 7(o)(2) of the Act generally do not apply to listed plant species. Therefore, no incidental take coverage of the Huachuca water umbel or the Canelo Hills' ladies-tresses is

included in this BCO. However, limited protection of listed plants from take is provided to the extent that the Act prohibits the removal and reduction to possession of federally-listed endangered plants from areas under Federal jurisdiction, or for any act that would remove, cut, dig up, or damage or destroy any such species on any other area in knowing violation of any regulation of any State or in the course of any violation of a State criminal trespass law.

**AMOUNT OR EXTENT OF TAKE**

The FWS anticipates that implementation of the proposed action will result in the harm, harassment, and death of an indeterminate number of Huachuca springsnails, Gila chub, Sonora tiger salamanders, and northern Mexican gartersnakes at each occupied aquatic site during the 30-year permit period. We believe that the implementation of the SRRHCP will reduce and minimize the extent of take of these species, and that the extent of take associated with the activities covered under the SRRHCP will not jeopardize the existence of or preclude recovery for any of these species. Therefore, any incidental take associated with the covered activities during the implementation of the SRRHCP will be covered by the associated incidental take permit. Take of species currently not listed under the Act will be covered after listing of these species should it occur during the life of the incidental take permit, provided the SRRHCP is being completely implemented.

We recognize that providing a numerical estimate of incidental take is the preferred method of measuring take. For some animals this method is biologically defensible as the ecology of the animal lends itself to them being more detectible (e.g., long-lived, easier to find territorial species such as the desert tortoise). But for many other species, dead or impaired individuals are almost impossible to find (and are readily consumed by predators) and losses may be masked by seasonal fluctuations in environmental conditions, and the status of the species is changing over time through immigration, emigration, and natural loss or active creation of habitat through management. In addition, aquatic animals are often difficult to sample or even observe.

Population levels of the covered species can be described with existing information and techniques. However, the level of effort required to determine population size and understand population dynamics of the covered species has not been expended on the SRR, and the effort is unlikely to occur. If we are unable to provide a reliable, predictive number of individuals at a site (particularly since it changes each year due to emigration, immigration, and mortality), it follows logically that we would be unable to provide a numerical estimate of the number of individuals incidentally taken as a result of the proposed action. Since we cannot estimate the number of individuals that will be incidentally taken for the reasons listed above, the USFWS is providing a mechanism to quantify when take would be considered to be exceeded as a result of implementing the proposed action.

Under the new regulations [50 CFR 402.12(i)(l )(i)] regarding the use of surrogate measures for incidental take, the USFWS must show a causal link between the surrogate and take of the listed species, explain why it is not practical to express the amount or extent of anticipated take or to monitor take-related impacts in terms of individuals of the listed species, and set a clear standard for determining when the level of anticipated take has been exceeded. For all covered species in

the HCP we utilize a surrogate measure of incidental take. Grazing utilization of forage is the surrogate measure that we will use.

Grazing utilization as measured on the SRR (NRCS 2001) follows the definition of Stoddart and Smith (1955:138): "Utilization of a (livestock) range means the degree to which animals have consumed the usable forage production expressed in percentage. This production should be based on animal-months consumed compared to animal-months available when the range is correctly used." Utilization is based on the production measured for the ranch management plan and how much forage may be consumed during one year in each pasture. The impacts of livestock grazing on ecosystems, watersheds, and on certain species have been thoroughly documented, and are summarized in this opinion. Also, because grazing utilization is a long-standing and common measure of the impact of livestock (Smith et al. 2005), and utilization is already measured annually on the SRR, it is therefore an appropriate surrogate measure of incidental take. Utilization also provides a clear standard for when grazing is too heavy on the landscape. To summarize, individuals of covered species subject to incidental take is a measure that is extremely difficult to enumerate, there is a demonstrated link between grazing utilization and impacts to the covered species and their habitats, and because grazing utilization is expressed as a percent of allowable use, this surrogate measure provides a clear standard for when incidental take may be exceeded.

**Gila Chub**

In the action area, the Gila chub is currently known to only occur in Sheehy Spring, but may be reestablished in the perennial portion of the Santa Cruz River, its tributaries, or stock tanks during the life of the SRRHCP. It is possible, that take of Gila chub in the form of harassment, harm, or killing could occur throughout the year. Take of Gila chub is anticipated to occur in the form of harm due to bank trampling and to diminished water quality resulting from increased sedimentation in livestock tanks and aquatic habitats via livestock trampling (increased turbidity) and defecation while grazing in occupied habitat. Livestock grazing of streamside vegetation may also decrease cover available to Gila chub to hide from predators and improper grazing can disrupt the invertebrate food assemblage; this may result in take from increased predation or decreased food availability in Sheehy Spring and along the Santa Cruz River. Maintenance of fences within riparian habitat along the Santa Cruz River may result in take through contact with equipment, or harm through the loss of habitat, if occupied by the Gila chub during the permit period. Take of Gila chub is also possible, although unlikely, in the form of harm or killing due to diminished water quality resulting from mechanical control of non-native grasses and invasive shrubs.

We anticipate incidental take of the Gila chub resulting from livestock watering, grazing and watering, hay production, movement of livestock, facility maintenance, and mechanical brush control will be difficult to detect and quantify for the following reasons: this species is small during all life stages, dead animals are difficult to find due to size of species and complexity of habitat, cause of death may be difficult to determine, dead or impaired individuals are almost impossible to find (and are readily consumed by predators), losses may be masked by seasonal fluctuations in numbers or other causes (e.g., oxygen depletion for aquatic species), we do not know the number of Gila chub in the action area, and the number of chub likely vary

dramatically over time due to unknown factors. Therefore, whether incidental take has exceeded the take authorized under the incidental take permit for covered actions will be determined indirectly based upon presence of livestock in habitat occupied by Gila chub as follows:

a) In any pasture where Gila chub occur (Sheehy, Santa Cruz River, stock tanks), livestock grazing utilization may not exceed the allowable maximum by 50 percent in two successive years for any one pasture;

OR

b) In all pastures where Gila chub occurs (Sheehy, Santa Cruz River, stock tanks), livestock grazing utilization may not exceed the allowable maximum by 25 percent in any year for 25 percent of the pastures with Gila chub. This measure does not apply if there are fewer than four pastures which contain Gila chub.

In addition, we anticipate incidental take in the form of injury or mortality as a result of chemical control of non-native grasses and invasive shrubs located in or immediately upstream of stock ponds or the Santa Cruz River, if occupied by the Gila chub during the permit period. Incidental take will be exceeded if standard operating procedures are not developed and incorporated into a work plan approved by the USFWS before application of chemicals in or adjacent to occupied habitat of Gila chub. The work plan shall be developed following the "Recommended Protection Measures for Pesticide Applications in Region 2 of the U.S. Fish and Wildlife Service" (White 2007), or the most current version of this document. The USFWS will approve or comment on the work plan within 30 days of receipt from the permittee.

Finally, we anticipate incidental take from stock pond excavation could result in up to 100% loss of the Gila chub in stock tanks that serve as reestablishment sites. Incidental take will be exceeded if more than one occupied stock pond is cleaned out in any given year without being restocked with Gila chub, if deemed suitable. We acknowledge that this take can occur and it is covered under SRR's Section 10 permit; however, if restocking is deemed undesirable by USFWS and AGFD for conservation and recovery purposes, then the loss of that tank does not count specifically towards an exceedance of incidental take.

**Sonora Tiger Salamander**

Take of Sonora tiger salamanders is anticipated to occur occasionally in the form of injury or mortality from trampling of adults, eggs, and metamorphs in stock ponds where cattle have access. Livestock grazing and watering in all stock tanks also may result in take in the form of harm and harassment to Sonora tiger salamanders by the destruction or removal of aquatic or emergent vegetation, or shoreline vegetation. Movement of livestock between pastures and tanks, upland grazing, as well as facilities-maintenance activities may result in take in the form of harm or killing of Sonora tiger salamanders from trampling of estivation habitat. Movement of livestock between pastures may also result in take in the form of harm or killing by increased potential for spread of chytridiomycosis. Take in the form of injury and mortality is anticipated to occur as a result of hay production, from crushing or cutting of dispersing individuals. Take of Sonora tiger salamanders is also possible, although unlikely, in the form of harm or killing due

to diminished water quality resulting from mechanical control of non-native grasses and invasive shrubs.

We anticipate that incidental take of Sonora tiger salamander resulting from livestock grazing and watering in occupied stock tanks, hay production, movement of livestock between pastures, facility maintenance, and mechanical brush control will be difficult to detect for the following reasons: the species is small and cryptic, remaining hidden within aquatic sites, subterranean burrows and in moist refugia (e.g. downed logs) for much of its life; finding a dead or impaired specimen is unlikely; losses may be masked by seasonal fluctuations in numbers or other causes (e.g., oxygen depletion for aquatic species, transmission of disease by wildlife or humans). Identifying take as a result of livestock grazing and other causes is difficult to differentiate from loss by other means or reasons.

We recognize that providing a numerical estimate of incidental take is the preferred method of measuring take and that for some animals this method is biologically defensible as the ecology of the animal lends itself to them being more detectible (e.g., long-lived, territorial species such as the desert tortoise). Therefore, whether incidental take has exceeded the take authorized under the incidental take permit for livestock watering and grazing will be determined indirectly based upon the presence of livestock in habitat occupied by Sonora tiger salamander as follows:

a) livestock grazing utilization may not exceed the allowable maximum by 50 percent in two successive years for any one pasture;

OR

b) livestock grazing utilization may not exceed the allowable maximum by 25 percent in any year for 25 percent of the pastures. This measure does not apply if there are fewer than four pastures which contain Sonora tiger salamander.

Take in the form of injury and mortality is anticipated to occur as a result of periodic stock tank maintenance conducted following the guidelines in Appendix B of the SRRHCP that are based on the Sonora Tiger Salamander Recovery Plan (USFWS 2002a) and the Chiricahua Leopard Frog Recovery Plan (USFWS 2007b). Although salvage of salamanders may occur following these guidelines, small salamanders and salamander eggs that cannot be salvaged and are harmed or killed incidental to stock pond excavation will be difficult to detect. Based on past excavation of occupied stock ponds in the San Rafael Valley, we anticipate that each excavation will result in the following maximum incidental take when conducted following the guidelines in Appendix B of the SRRHCP: (l) loss of all eggs and small larvae (< 1.18 in total length) that cannot be salvaged, (2) 50 percent mortality of salamanders from 1.18 to 4.33 in in length, and (3) less than 10 percent mortality of salamanders over 4.33 in total length. Salamanders over 4.33 in in total length can be successfully salvaged and held in captivity or holding ponds. Take of salamanders from salvage operations via seining and other capture methods, as well as temporary holding of salamanders, will be authorized by a 10(a)(l )(A) recovery permit held by the USFWS, AGFD, or any other qualified and permitted entity approved by the permittee. Excavation of each stock pond may occur every 20 to 25 years, or no more than twice during the original permit period.

Incidental take will be exceeded if any periodic stock maintenance is not conducted following Appendix B of the SRRHCP.

- We acknowledge that this take can occur and it is covered under SRR's Section10 permit; however, if the USFWS and Department agree that a population is not necessary to maintain for conservation and recovery purposes, then the maintenance of that tank does not count specifically towards an exceedance of incidental take.

Take in the form of injury or mortality is anticipated to occur as a result of chemical control of non-native grasses and invasive shrubs located in or immediately upstream of occupied stock ponds or other habitats. Incidental take will be exceeded if standard operating procedures are not developed and incorporated into a work plan approved by the USFWS before application of pesticide in or adjacent to occupied habitat of the Sonora tiger salamander. The work plan shall be developed following "Recommended Protection Measures for Pesticide Applications in Region 2 of the U.S. Fish and Wildlife Service" (White 2007), or the most current version of this document.

In no case is any salamander population on the SRR expected to be extirpated due to implementation of the SRRHCP. It is anticipated that over the period of the permit, the number of occupied stock tanks will remain stable at a minimum, taking into account the natural changes in which stock tanks are occupied across the landscape, and should increase as a result of implementation of conservation measures included in the SRRHCP.

**Northern Mexican Gartersnake**

Although trampling of northern Mexican gartersnakes is unlikely due to the snake's ability to avoid livestock, the USFWS points out in its 12-month finding (73 FR 71788, USFWS 2008a) that it could occur. The use and maintenance of stock tanks is covered by a 4(d) rule; thus, there is no incidental take from those actions. Thus, take of the northern Mexican gartersnake is anticipated to occur in the form of injury or mortality from possible trampling by cattle of juveniles or adults at occupied springs, riparian areas, or uplands, including debris piles or other cover used by snakes during cold periods. Livestock grazing in riparian vegetation may also decrease cover available to northern Mexican gartersnakes to hide from predators; this may result in take from increased predation. Maintenance of fences within riparian habitat may result in take through crushing by equipment, or harm through the temporary loss of habitat. Hay production may also lead to take of gartersnakes.

We anticipate that incidental take of northern Mexican gartersnakes resulting from livestock grazing and watering in occupied aquatic habitats, movement of livestock between pastures, upland grazing, facility maintenance, hay production, and mechanical brush control will be difficult to detect and difficult to quantify for the following reasons: dead animals are difficult to find due to size of species and complexity of habitat, cause of death may be difficult to determine, and losses may be masked by seasonal fluctuations in numbers, or other causes (e.g., oxygen depletion for aquatic species). Further, the status of the species could change during the permit period due to immigration, emigration, and loss or creation of habitat. Maintenance of fences within riparian habitat along the Santa Cruz River and waterlines adjacent to stock tanks

may result in take through contact with equipment, or harm through the loss of habitat, even though maintenance of range projects is largely beneficial in the long-term.

We recognize that providing a numerical estimate of incidental take is the preferred method of measuring take and that for some animals this method is biologically defensible as the ecology of the animal lends itself to them being more detectible (e.g., long-lived, territorial species such as the desert tortoise). Therefore, whether incidental take has exceeded the take authorized under the incidental take permit for livestock watering and grazing will be determined indirectly based upon the presence of livestock in habitat occupied by northern Mexican gartersnakes as follows:

a) livestock grazing utilization may not exceed the allowable maximum by 50 percent in two successive years for any one pasture;

OR

b) livestock grazing utilization may not exceed the allowable maximum by 25 percent in any year for 25 percent of all pastures. This measure does not apply if there are fewer than four pastures which contain northern Mexican gartersnake.

Livestock tanks may be occupied by the northern Mexican gartersnake during the permit period. There is no take associated with the normal use of stock ponds under the 4(d) rule. Take in the form of injury and mortality is anticipated to occur as a result of periodic stock tank maintenance conducted following the guidelines in Appendix B of the SRRHCP that are based on the Sonora Tiger Salamander Recovery Plan (USFWS 2002a) and the Chiricahua Leopard Frog Recovery Plan (USFWS 2007b). Although salvage of gartersnakes may occur, neonates and juveniles that cannot be salvaged and are harmed or killed incidental to stock pond excavation will be difficult to detect. Any salvage of gartersnakes before stock tank maintenance will be jointly determined by the USFWS and the Department and conducted within 30 days of scheduled maintenance of the stock tank. Removal of gartersnakes from salvage operations, as well as temporary holding of gartersnakes, will be authorized by a 10(a)(l)(A) recovery permit held by the USFWS or the AGFD. Excavation of each stock pond may occur every 20 to 25 years, or no more than twice during the permit period.

Finally, we anticipate incidental take in the form of injury or mortality as a result of chemical control of non-native grasses and invasive shrubs located in or immediately upstream of stock ponds, the Santa Cruz River, or other appropriate habitat. Incidental take will be exceeded if standard operating procedures are not developed separately into a work plan and approved by the USFWS before application of pesticides in or adjacent to occupied habitat of northern Mexican gartersnake. The work plan shall be developed following ”Recommended Protection Measures for Pesticide Applications in Region 2 of the U.S. Fish and Wildlife Service" (White 2007), or the most current version of this document.

**Huachuca Springsnail**

In the action area, the Huachuca springsnail is known only from Sheehy Spring, and it is unlikely that this species will occur at other locations in the action area during the permit period.

Therefore, take is anticipated to occur in the form of harassment, harm, or killing of eggs, velifer, or adult snails when this pasture is grazed. Take of Huachuca springsnail is also anticipated to occur in the form of harm due to habitat degradation from livestock trampling and defecation resulting in increased sedimentation and turbidity or disruption of forage availability in Sheehy spring. Barbed-wire fences do not keep cattle where they are intended all of the time, so it is possible, although unlikely, that take of Huachuca springsnail as described above could occur at Sheehy Spring throughout the year. Take of Huachuca springsnail is also possible, although unlikely, in the form of harm or killing due to diminished water quality resulting from infrastructure maintenance or mechanical control of non-native grasses and invasive shrubs. Mechanical control of blackberry at Sharp Spring could also cause take though harassment, harm, or killing.

We anticipate incidental take of the Huachuca springsnail from the SRRHCP will be difficult to detect for the following reasons: (1) dead or impaired individuals are almost impossible to find (and are readily consumed by scavengers and predators) and losses may be masked by seasonal fluctuations in environmental conditions; (2) the status of the species will change over time through disease, natural population variation, natural habitat loss, or the active creation of habitat through management; and (3) the species is small-bodied, well camouflaged, and occurs under water of varying clarity.

We recognize that providing a numerical estimate of incidental take is the preferred method of measuring take and that for some animals this method is biologically defensible as the ecology of the animal lends itself to them being more detectible (e.g., long-lived, territorial species such as the desert tortoise). Therefore, whether incidental take has exceeded the take authorized under the incidental take permit for livestock watering and grazing will be determined indirectly based upon an incursion of livestock into habitat occupied by the Huachuca springsnail as follows:

a) livestock grazing utilization may not exceed the allowable maximum by 50 percent in two successive years for any one pasture;

OR

b) livestock grazing utilization may not exceed the allowable maximum by 25 percent in any year for 25 percent of the pastures. This measure does not apply if there are fewer than four pastures which contain Huachuca springsnail.

Incidental take is not anticipated to occur as a result of chemical control of non-native grasses and invasive shrubs, as this action will not occur in the pasture containing Sheehy Spring.

**EFFECT OF THE TAKE**

In this biological opinion, the FWS determines that this level of anticipated take is not likely to result in jeopardy of the Huachuca springsnail, Gila chub, Sonora tiger salamander, or northern Mexican gartersnake. The implementation of the proposed action, along with the conservation measures, will ensure that, while incidental take may still occur, it is minimized to the extent that

habitat quality and quantity will be maintained in the planning area and the species will be conserved.

## REASONABLE AND PRUDENT MEASURES AND TERMS AND CONDITIONS

All mitigation, minimization, avoidance, survey, monitoring, and reporting measures described in the proposed SRRHCP, together with the terms and conditions described in the section 10(a)(1)(B) permit issued with respect to the proposed SRRHCP, are hereby incorporated by reference as reasonable and prudent measures and terms and conditions within this incidental take statement pursuant to 50 CFR 402.14(1). Such terms and conditions are non-discretionary and must be undertaken for the exemptions under section 10(a)(1)(B) and section 7(o)(2) of the Act to apply. No additional reasonable and prudent measures were identified during the consultation. As long as the reporting requirements to document the implementation of reasonable and prudent measures and terms and conditions are included in Section 5.7 of the SRRHCP are met, the requirements of this incidental take statement will be met. If the permittee fails to adhere to these terms and conditions, the protective coverage of the section 10(a)(1)(B) permit and section 7(o)(2) may lapse.

The incidental take coverage for the three listed animal species included in the SRRHCP becomes effective upon the signing of the section 10(a)(1)(B) permit. For the one unlisted animal species covered by the SRRHCP, the incidental take statement or permit will become effective upon the listing of that species as threatened or endangered under the Act.

### Disposition of Dead or Injured Listed Species

Upon locating a dead, injured, or sick listed species, initial notification must be made to the USFWS's Law Enforcement Office, 4901 Paseo del Norte NE, Suite D, Albuquerque, New Mexico, 87113; 505-248-7889 within three working days of its finding. Written notification must be made within five calendar days and include the date, time, and location of the animal, a photograph if possible, and any other pertinent information. The notification shall be sent to the Law Enforcement Office with a copy to this office. Care must be taken in handling sick or injured animals to ensure effective treatment and care and in handling dead specimens to preserve the biological material in the best possible state.

## CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of listed species. Conservation recommendations are discretionary agency activities to minimize or avoid effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information Sonora.

1. The USFWS should continue to work with SRCC, the AGFD, ASP, and other entities to evaluate and implement conservation actions within the permit area, including invasive, non-native species control, habitat enhancements, and reestablishment or population augmentation for the covered species, as well as the Gila topminnow and Chiricahua leopard frog.

2. The USFWS should continue to work with SRCC and other entities to implement recovery plans for the covered species, as well as for the Gila topminnow and Chiricahua leopard frog.

**REINITIATION NOTICE**

This concludes formal consultation on the proposed issuance of a section 10(a)(1)(B) permit associated with the SRRHCP to allow incidental take of Gila chub, Sonora tiger salamander, and northern Mexican gartersnake. 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 maintained (or is authorized by law) and if: (l ) 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 later modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

We may confirm the conference opinion as a biological opinion issued through formal consultation if the Huachuca springsnail is listed or critical habitat is designated. The request must be in writing. If we review the proposed action and find that there have been no significant changes in the action as planned or in the information used during the conference, we will confirm the conference opinion as the biological opinion on the project and no further section 7 consultation will be necessary.

After listing as threatened or endangered and any subsequent adoption of this conference opinion, the FWS shall request reinitiation of consultation if: 1) the amount or extent of incidental take is exceeded; 2) new information reveals effects of the agency action that may affect the species in a manner or to an extent not considered in the conference opinion; 3) the agency action is subsequently modified in a manner that causes an effect to the species that was not considered in this opinion; or 4) a new species is listed or critical habitat designated that may be affected by the action.

The incidental take statement provided for, the Huachuca springsnail does not become effective until the species is listed and the conference opinion is adopted as the biological opinion issued through formal consultation. At that time, the implementation of the SRRHCP will be reviewed to determine whether any take of the Huachuca springsnail has occurred. Modifications of the opinion and incidental take statement may be appropriate to reflect that take. No take of the Huachuca springsnail may occur between the listing and the adoption of the conference opinion through formal consultation, or the completion of a subsequent formal consultation. Should you require further assistance or if you have any questions, please contact Doug Duncan (520-670-6150 x236) or Scott Richardson (x242).

/s/ Steven L. Spangle

cc: Scott Richardson, Acting Assistant Field Supervisor, Fish and Wildlife Service, Tucson, AZ

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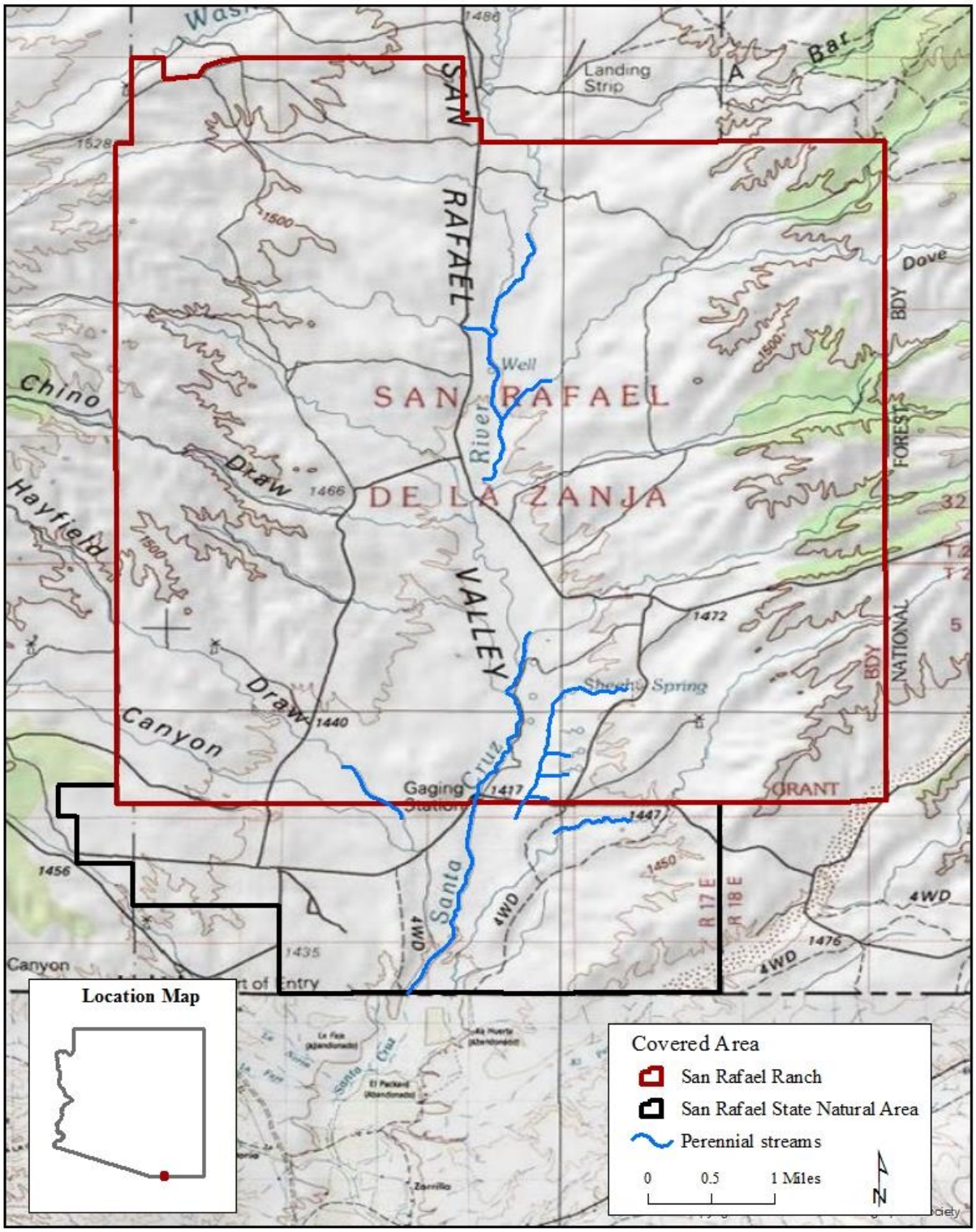
FIGURE 1.Action Area



## APPENDIX A: Concurrences

This Appendix contains all concurrences with "may affect, not likely to adversely affect" determinations.

### Northern Aplomado Falcon

The northern aplomado falcon has been observed in the San Rafael Valley and may well occur again as a migrant or winter inhabitant. However, the covered ranching activities will not adversely affect the northern aplomado falcon, as the San Rafael Valley does not support suitable nesting habitat, and any occurrence of the falcon is likely to be temporary. A goal of the SRRHCP is to improve ecosystem health and function and nesting habitat may develop at some point in the future. If populations of northern aplomado falcons expand, nesting may occur within the action area. Only if this happens would there be the potential for covered activities to disturb nesting northern aplomado falcons. In addition, the northern aplomado falcon is an experimental non-essential population under Section 10(j) of the Act and, therefore, the SRRHCP does not need incidental take authorization for this species, although intra-service section 7 consultation may need to be reinitiated.

Conclusion

After reviewing the status of the northern aplomado falcon, the environmental baseline for the action area, and the effects of the covered activities, we concur that the proposed action may affect, but is not likely to adversely affect the northern aplomado falcon, based upon the following:

- Currently, there are no known breeding pairs of northern aplomado falcons nesting in the permit or action area or within Arizona;

- Northern aplomado falcon are covered by a 10(j) designating them as a nonessential experimental population and exempting them from take prohibitions of section 9 of the Act for any non-Federal activities.

### Lesser long-nosed bat

The lesser long-nosed bat was listed as endangered in 1988 (53 FR 38456, USFWS 1988). No critical habitat has been designated for this species. A recovery plan was completed in 1997 (USFWS 1997a). Loss of roost and foraging habitat, as well as direct taking of individual bats during animal control programs, particularly in Mexico, have contributed to the current endangered status of the species. The five-year review has been completed and recommends downlisting to threatened (USFWS 2007). The USFWS is conducting a 12-month finding analysis in 2016. The lesser long-nosed bat recovery plan, listing document, and the 5-year review for the lesser long-nosed bat, all discuss the status of the species and threats, and are incorporated by reference. Refer to these three documents for further status details.

There are no known lesser long-nosed bat roosts in the action area and no known mines, adits, and caves that might serve as night or maternity roosts in the action area. The greatest potential for the proposed action to impact lesser long-nosed bats is through adverse effects to forage plants, particularly paniculate agaves. The lesser long-nosed bat may forage on agaves in the action area, since the SRR is within 40 miles of known active roost sites in the Huachuca, Patagonia, and Santa Rita mountain ranges. Numerous mines, adits, and caves exist in the these three mountain ranges which provide potential roost sites for this species, and significant roosts are known to exist at all three mountain ranges (USFWS 2007).

The primary food source for the lesser long-nosed bat in southeastern Arizona from mid-summer through fall is Palmer's agave, which is scattered within the desert grassland and oak woodland communities in the action area within the elevation range of 3,000 to 6,000 ft (Gentry 1982). Parry's agave extends from grasslands into oak woodland, chaparral, pine and oak forests, and mixed conifer with an elevation range of approximately 4,900 to 8,200 ft (Gentry 1982). Both of these paniculate agave typically occur in rocky, shallow soils of hills and ridges (Gentry 1982). Palmer's and Parry's agaves are also found scattered in areas of deep, heavy soils within grasslands or where there may be thick stands of shrubs, mesquite, oak, and other trees. The action area just reaches into the elevational range of Parry's agave.

Impacts to forage plants through implementation of the SRRHCP may occur through direct herbivory and trampling by livestock, and alteration of the vegetation community. Because agaves are patchily distributed throughout the action area, with a low to moderate grazing regime, relatively few individual plants are likely to suffer effects from the proposed covered actions in the SRRHCP. In addition, management of non-native grasses will decrease the probability of increased competition with these plants as well as decrease fire frequency and intensity that can reduce densities of paniculate agaves. Agaves in desert grasslands have evolved with fire, but unnatural, high fire frequency can lead to decline or elimination of agave populations (Howell 1996). Howell (1996) also noted a negative relationship between the proportion of agave seedlings and ramets and the amount of Lehmann lovegrass. She suggested that Lehmann lovegrass appears to suppress agave recruitment independent of these fire effects.

Conclusion

After reviewing the status of the lesser long-nosed bat, the environmental baseline for the action area, and the effects of the covered activities, we concur that the proposed action may affect, but is not likely to adversely affect the lesser long-nosed bat, based upon the following:

- No lesser long-nosed bat roost sites are located within the action area and, therefore, effects to lesser long-nosed bat roost sites are discountable as a result of implementing the SRRHCP;

- The covered activities within the SRRHCP will avoid or result in an insignificant impact to lesser long-nosed bat forage species. Therefore, effects to lesser long-nosed bat forage resources will be insignificant.

**Jaguar and Ocelot**

The jaguar was listed as endangered from the U.S. and Mexico international border southward to include Mexico and Central and South America under the Endangered Species Conservation Act of 1969. Endangered status was extended to the jaguar in the U.S. in 1997 (62 FR 39147; USFWS 1997b). On March 4, 2014, the USFWS designated critical habitat (as defined under the ESA) in the U.S. for the jaguar (79 FR 12572; U.S. Fish and Wildlife Service 2014a). In total, approximately 309,263 hectares (ha) [764.207 acres (ac)] in Pima, Santa Cruz, and Cochise Counties, Arizona, and Hidalgo County, New Mexico, fall within six critical habitat units. The jaguar was addressed in Listed Cats of Texas and Arizona Recovery Plan (with Emphasis on the Ocelot) (USFWS 1990), but only general information and recommendations to assess jaguar status in the U.S. and Mexico, and protect and manage occupied and potential habitat in the U.S. were presented. No specific recovery recommendations or objectives for the jaguar were presented. Therefore, a recovery outline specifically for the jaguar was completed in 2012 (USFWS 2012a) and a draft recovery plan for the species will published in 2016. Historically, as the listing rule (62 FR 39147; USFWS l997b) discusses, jaguars in the U.S. occurred in California, Arizona, New Mexico, Texas, and possibly Louisiana. The last jaguar sightings in California, Texas and Louisiana were documented in the late 1800s or early 1900s. Sightings in the U.S in the late 20th century to the present have occurred mainly close to the U.S. and Mexico international border. A number of threats contributed to or continue to affect the status of jaguars rangewide, including habitat loss, persecution, poaching of prey, and fragmentation of populations across portions of the range (Caso et al. 2009). Increased illegal and consequent law enforcement actions along the Mexico-U .S. international border may be limiting jaguar movement across the border. Refer to the Secure Border Initiative Tucson West Tower Project BCO (#22410-2008-F-0373, USFWS 2008a) for a complete status of the species. The action area does not include designated critical habitat for the jaguar.

Jaguars have been documented since 1980 in the general area from the Peloncillo Mountains west to the Baboquivari Mountains in Sky Island mountain ranges and from the international boundary north to Interstate 10. This general area includes the action area for the SRRHCP and associated permit area. However, no jaguars have been documented within the action area for the SRRHCP. One jaguar is known to occur in the Santa Rita Mountains; this cat was also previously detected in the Whetstone Mountains. Some portions of the action area may provide habitat for the jaguar, especially for travel between mountain ranges. Some of the action area may also provide foraging habitat.

The ocelot was listed as endangered in 1972 under the authority of the Endangered Species Conservation Act of 1969 (37 FR 2589; USFWS 1972). Endangered status was extended to the U.S. portion of the ocelot's range with a final rule published July 2 1, 1982 (47 FR 31670; USFWS 1982). Critical habitat is not designated for this species. Recovery for the ocelot was originally addressed in Listed Cats of Texas and Arizona Recovery Plan (with Emphasis on the Ocelot)(USFWS 1990). A revised draft recovery plan was made available for public comment on August 26. 2010. The ocelot is found in every mainland country south of the U.S. except Chile, and 11 subspecies have been described (Pocock 1941, Cabrera 1961, Hall 1981, Eizirik et al. 1998). Two of the 11 subspecies occur in the U.S: the Texas-Tamaulipas ocelot (*L. pardalis albescens*) and the Arizona/Sonora ocelot (*L. p. sonoriensis*)(Hall 1981). The ocelot uses a wide

range of habitats throughout its range in the Western Hemisphere (Tewes and Schmidly 1987). Despite this, the species does not appear to be a habitat generalist. Ocelot spatial patterns are strongly linked to dense cover or vegetation, suggesting it uses a fairly narrow range of micro-habitats (Emmons 1988, Home 1998). Ocelots in Sonora appear to be primarily associated with tropical or subtropical habitats, namely subtropical thornscrub, tropical deciduous forest and tropical thornscrub (Lopez Gonzalez et al. 2003); however, they are also associated with other vegetation types such as temperate oak woodland and pine-oak forest (Lopez Gonzalez et al. 2003) and Madrean evergreen woodland (Avila-Villegas and Lamberton-Moreno 2012). Based on limited records, in Arizona ocelots appear to be associated with semidesert grassland, Madrean evergreen woodland, and Great Basin grassland biotic communities (Culver et al. 2015).

Many of the threats to the ocelot are common to all Latin American countries and generally include habitat loss, habitat fragmentation, subsequent isolation and genetic repercussions of such isolation, and illegal killing of the ocelot and overharvest of its prey. Some ocelot populations have rebounded since the decline of the fur trade. However, poverty, urban and rural development, subsistence hunting, poaching, logging, and extraction of forest products present current challenges to the ocelot. Human population growth and development continue throughout the ocelot's range. Connectivity among ocelot populations or colonization of new habitats is discouraged by the proliferation of highways and increased road mortality among dispersing ocelots. Increased illegal and law enforcement actions along the U.S./Mexico international border could limit ocelot movement across the border, but it is uncertain if and how much this is affecting that movement (USFWS 2010).

The Arizona/Sonora ocelot subspecies occurs in southern Arizona and northwestern Mexico (Sonora and northern Sinaloa)(Murray and Gardner 1997, Lopez-Gonzalez et al. 2003). In Sonora, Mexico, many records of ocelots exist, including documented breeding populations. Lopez Gonzalez et al. (2003) obtained 36 verified ocelot records for Sonora, 21 of which were obtained after 1990. A population of 2,025 ± 675 ocelots in Sonora was estimated by Lopez Gonzalez et al. (2003) based on the distribution of these records and the availability of potential habitat. Gomez-Ramirez (2015) estimated a population of 1,421 ocelots in Sonora.

Avila-Villegas and Lamberton-Moreno (2013) documented six ocelots, including a female with one kitten, from 2007 to 2011 in in the Sierra Azul of Sonora, located about 48 km (29 mi) south of Arizona. Additionally, with the use of trail cameras, two ocelots have been documented (one in 2009 and one in 2013) in the Sierra de Los Ajos, about 48 km (29 mi) south of the U.S.-Mexico border near Naco, Sonora, Mexico (USFWS 2010; Rosa Elena Jimenez Maldonado, pers. comm., 2013). Apart from the detection of two kittens in the Sierra Azul, the northernmost breeding population occurs about 200 km (120 mi) south of the Arizona-Sonora border.

In Arizona since 2009, a total of five ocelots have been detected, including four detected by trail cameras and hunting dogs, and one dead ocelot that had been struck by a vehicle. A description of these detections follows. In November 2009, a live ocelot (sex unknown) was documented in the Whetstone Mountains in Cochise County, Arizona, with the use of camera-traps (Avila-Villegas and Lamberton-Moreno 2013). In April 2010, a second ocelot was found dead on a road near Globe, Arizona. A genetic analysis was conducted and all data indicated the young

male ocelot was not of captive but wild origin (Holbrook et al. 2011). Origin of the ocelot recovered in Globe is still unclear due to a lack of comparative samples from Arizona or Sonora although in the DNA analysis, it clustered with samples from Mexico. A two-year camera-trap study in the area near Globe, Arizona, did not photograph any additional ocelots (Featherstone et al. 2013). In February 2011, a third male ocelot was treed by a hunting dog and photographed in the Huachuca Mountains. He was subsequently detected multiple times by trail cameras, including once in the Patagonia Mountains in May 2012 (Culver et al. 2015), and was also treed by hunting dogs again (in the Huachuca Mountains). After being detected in the Patagonia Mountains he returned to the Huachuca Mountains, meaning that he traveled an approximate round trip distance of 84 km (52 mi)(Culver et al. 2015). He was most recently detected in May 2013. In May 2012, a fourth male ocelot was detected in the Huachuca Mountains via trail camera. He has been detected many times via trail cameras, most recently in November 2015, and treed by hunting dogs once. In April 2014, a fifth male ocelot was detected in the Santa Rita Mountains via trail camera. He was photographed several times over a two-month period and has not been detected since. Additionally, an ocelot was detected in December 2013 in the Santa Rita Mountains however it is unknown if this was the same as the fifth ocelot described above or a different ocelot. Before these five recently-known individuals, the last known ocelot in Arizona was a male that had been run over near the town of Oracle in 1967 (Lopez Gonzalez et al. 2003).

Recent ocelot locations are located just east of the action area, but there are no documented locations of ocelots in the action area of the SRRHCP. Small portions of the action area support dense vegetation for the ocelot, especially for travel between mountain ranges. Some portions of the action area may also provide habitat for foraging and hiding.

The effects of implementing the covered activities on the jaguar and ocelot are expected to occur by altering foraging cover and prey availability, and not through any direct effects. However, covered activities are not anticipated to result in significant changes to habitat quality or quantity because management objectives of the SRRHCP include improved health and function of the ecosystem and habitats within the action area. This management will not result in clearing of habitat, destruction of riparian and other habitat areas, or habitat fragmentation. Any changes to prey habitat are likely to be localized, and livestock management is not expected to significantly change prey availability throughout the areas in which jaguars or ocelots may occur. It is extremely unlikely that covered activities will result in disturbance to jaguars and ocelots or increased risk of being struck by vehicles. These effects on jaguar and ocelot foraging and travel cover, and on prey habitat, are expected to be small, not measurable, and insignificant.

Conclusion

After reviewing the status of the jaguar and ocelot, the environmental baseline for the action area, and the effects of the covered activities, we concur that the proposed action may affect, but is not likely to adversely affect, the jaguar and its critical habitat or ocelot based upon the following:

- The covered activities are not anticipated to result in significant changes to habitat quality or quantity because the SRR will be managed to improve ecosystem health and function, which

will not result in clearing of habitat, destruction of riparian or other habitat areas, or fragmentation of habitat linkages;

- Any changes to prey habitat are likely to be localized, and not expected to significantly change prey availability throughout the areas where jaguars or ocelots may occur;

- No predator control is included in the proposed action;

- It is extremely unlikely that covered activities will result in disturbance to jaguars and ocelots or increased risk of being struck by vehicles;

- Long-term benefits to jaguars and ocelots as a result of the conservation activities of the SRRHCP are possible, especially related to increased water availability and improved riparian habitats; and

- Jaguar critical habitat occurs nearby, but not within the action area, thus critical habitat will not be affected by the proposed action.

**Western yellow-billed cuckoo**

The yellow-billed cuckoo usually nests in structurally complex, large patches of riparian habitat throughout Arizona (79 FR 5991, USFWS 2014b). Surveys conducted by the Arizona Breeding Bird Atlas reported 68 percent of the yellow-billed cuckoo observations were in lowland riparian woodlands, often containing a variable combination of Fremont cottonwood, willow, velvet ash, Arizona walnut, mesquite, and tamarisk (Corman and Wise-Gervais 2005). Narrow bands of riparian woodland can contribute to the overall extent of suitable habitat. These types of large patches of contiguous riparian habitat do not occur in the action area. Known breeding populations occur not far from the San Rafael Valley along Sonoita Creek, the San Pedro and Santa Cruz Rivers, and numerous other areas supporting complex riparian habitat.
Small patches and relatively narrow strips of riparian woodland are common in the action area, particularly on the Santa Cruz River. Thus, it is likely that the yellow-billed cuckoo occurs on occasion as a transient, but nesting now or in the future is unlikely, even with continued improvement in riparian woodlands resulting from grazing management of riparian pastures. There is no proposed critical habitat in the action area.

Adjacent habitat on terraces or in the upland (such as mesquite) can enhance the value of riparian woodlands for cuckoos. Habitat adjacent to the Santa Cruz River in the action area is virtually all grassland, with a few medium shrubs (e.g. *Ericameria* spp., *Vachellia* spp., *Mimosa* spp.).

In southeastern Arizona, cuckoos are often found nesting along intermittent drainages with dense stands of velvet mesquite and netleaf hackberry (Corman and Wise-Gervais 2005, AGFD 2011). Dense understory foliage appears to be an important factor in nest site selection (USFWS 2001). Drainages entering the action from the Huachuca and Patagonia mountains contain xeroriparian stringers of woodland vegetation, largely composed of oak (*Quercus* spp.). Western yellow-billed cuckoos may forage in this habitat, but it is unlikely that they nest there.

Yellow-billed cuckoo sightings reported by birders between 15 June and 31 August, 1998 to 2012, in more than one year in southeastern Arizona mountain ranges include Walker, Madera, and Montosa canyons in the Santa Rita Mountains; Carr Canyon, Ash Canyon, Garden Canyon, Ramsey Canyon, and Miller Canyon in the Huachuca Mountains; Scotia Canyon and Sycamore Canyon in the Atascosa/Pajarito Mountains; French Joe Canyon in the Whetstone Mountains; Kitt Peak on Baboquivari Mountain; Harshaw Canyon and Paymaster Spring in the Patagonia Mountains; and a few locations in the Chiricahua Mountains (Cornell Laboratory of Ornithology 2012).

Western yellow-billed cuckoos reach their breeding range later than most other migratory breeders, often in June (Rosenberg et al. 1982), Yellow-billed cuckoos should not be present when the Santa Cruz River riparian pasture would be grazed (November 15 through March 31). Thus, the SRRHCP does not seek incidental take authorization for the yellow-billed cuckoo.

Conclusion

We concur that the proposed action is not likely to adversely affect the western yellow-billed cuckoo for the following reasons:

- There are no known breeding records for western yellow-billed cuckoo in the action area;

- Livestock grazing in riparian pastures along the Santa Cruz River occurs when the western yellow-billed cuckoo is not present;

- The riparian woodland habitat along the Santa Cruz River is not suitable nesting habitat due to the small blocks of riparian trees, and lack of adjacent foraging habitat;

- The xeroriparian stringers of oaks that enter the action area from adjacent mountains, do not likely provide nesting habitat, and provide marginal foraging habitat; and

- Livestock grazing as proposed in the SRRHCP is unlikely to negatively impact the species in the action area.

**Mexican spotted owl**

A complete description of the biology of the Mexican spotted owl (MSO) appears in our Mexican Spotted Owl Recovery Plan, First Revision (USFWS 2012b). The rangewide status of the species, including critical habitat, appears in our 2015, Biological Opinion on the Flagstaff Watershed Protection Plan (USFWS 2015; File number 02EAAZ00-2013-F-0190). This information is incorporated herein via reference. No protocol-level surveys for Mexican spotted owls have been conducted in the action area, and the species has not been detected there. It is unlikely the owl occurs in the action area except for movement between mountain ranges.

Seasonal movement patterns of Mexican spotted owls are variable. Some individuals are year-round residents; some remain in the same general area but show shifts in habitat-use patterns, and some move considerable distances [20 to 50 km (12-31 mi)] during winter, generally

migrating to more open habitats at lower elevations (Ganey and Balda 1989, Willey 1993, Ganey et al. 1998a, b). Little is known about habitat use by juveniles during natal dispersal. Ganey et al. (1998a, b) found dispersing juveniles in a variety of habitats ranging from high-elevation forests to pinyon-juniper woodlands and riparian areas surrounded by desert grasslands. Some juveniles remained in forests similar to typical owl breeding habitat.

Montane vegetation preferred by MSO includes interior chaparral, encinal woodlands, and Madrean pine-oak woodlands at lower and middle elevations; with ponderosa pine, mixed conifer, and spruce-fir forests at higher elevations (USFWS 2012b). MSO occupies a wide range of habitat types in this RU. Most owls occur in isolated mountain ranges where they inhabit encinal oak woodlands, mixed conifer and pine-oak forests, and rocky canyons. MSO is found primarily on Forest Service lands, with the majority of them on the Coronado National Forest in southeastern Arizona.

Spotted owls in southern Arizona are typically found in Madrean woodlands (Ganey and Balda 1989, Duncan and Taiz 1992). Canyons from 1,130 to 2,290 m (3,700-7,500 ft) are also used by owls (Ganey and Balda 1989).

MSO are known to occur on the National Forest Lands in the Huachuca and Patagonia mountains that surround the San Rafael Valley, with known Protected Activity Centers. There are Madrean oak woodlands on SRR. These woodlands are known to be part of Protected Activity Centers elsewhere, but only when preferred conifers (pine/spruce/fir) are present. There are no conifers on the SRR [except maybe some Mexico pinyon (*Pinus cembroides*)]. The Madrean oak woodlands can also provide movement corridors for owls, especially dispersing juveniles. Stringers of woodland vegetation that follow drainages are thought to be important dispersal and movement corridors between areas of nesting habitat (mountain ranges).

Properly managed grazing in key owl foraging areas that consistently maintains herbaceous biomass of forage species, sufficient to allow for individual plants to recover and reproduce during most growing seasons, should provide cover and food sources for some prey species (especially during drought periods)(USFWS 2012b). The grazing regime on the SRR is considered properly managed.

Conclusion

We concur with your determination that the proposed action may affect, but will not likely adversely affect, the Mexican spotted owl. We base our concurrence on the following:

- The proposed action will not directly affect the key habitat components of Mexican spotted owl nest and roost habitat, as none is present in the action are. The project and action areas do contain Madrean encinal woodlands, and also lack the canyons in which nesting and roosting typically occurs (USFWS 2012b);

- The action area is located more than 10 miles from the nearest PAC. The project will not result in noise disturbance to Mexican spotted owls in those PACs during the breeding season (March 1 through August 31) or at any other time;

- The effects are insignificant and discountable and will not reduce the potential to achieve recovery of the Mexican spotted owl;

- There are no known breeding records for MSO in the action area;

- The riparian woodland habitat along the Santa Cruz River is not suitable nesting habitat;

- The xeroriparian stringers of oaks that enter the action area from adjacent mountains, do not likely provide nesting habitat, and provide marginal foraging habitat; and

- Livestock grazing as proposed in the SRRHCP is unlikely to negatively impact the species in the action area.

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