



United States Department of the Interior

FISH AND WILDLIFE SERVICE
10711 Burnet Road, Suite 200
Austin, Texas 78758
512 490-0057
FAX 490-0974



Memorandum

To: Regional Director, Region 2, Albuquerque, New Mexico

Through: Assistant Regional Director, Ecological Services, Region 2, Albuquerque,
New Mexico

From: Field Supervisor, Austin Ecological Services Field Office, Austin, Texas

Subject: Biological Opinion for the Amended Barton Springs Pool Habitat Conservation
Plan – Permit TE-839031-1 (Consultation # 02ETAU00-2013-F-0197)

Enclosed is the biological opinion for the amended Barton Springs Pool Habitat Conservation Plan (BSP HCP) that describes the actions that the City of Austin (Applicant) has proposed to avoid, minimize, and mitigate adverse effects to the endangered Barton Springs salamander (*Eurycea sosorum*) and the endangered Austin blind salamander (*Eurycea waterlooensis*) over a period of 20-years. We appreciate your staff's assistance throughout this consultation. If you have any questions regarding this biological opinion, please contact Tanya Sommer at 512-490-0057, extension 222.

The biological opinion is based on the amended Barton Springs Pool HCP dated July 2013 and the associated Environmental Assessment dated July 2013 pursuant to the National Environmental Policy Act of 1969; U.S. Fish and Wildlife Service (Service) files; discussions with species experts; published and un-published literature on the species of concern and related impacts; and other sources of information available to the Service. A complete administrative record of this consultation is on file at the Austin Ecological Services Field Office.

Attachment



BIOLOGICAL OPINION

This document transmits our biological opinion for the issuance of a U.S. Fish and Wildlife Service (Service) 10(a)(1)(B) permit (ITP) for the amended Barton Springs Pool Habitat Conservation Plan (BSP HCP) to the City of Austin (City) (Applicant).

The City will minimize and mitigate, to the maximum extent practicable, adverse effects from covered activities to the endangered Barton Springs salamander (*Eurycea sosorum*) and the endangered Austin blind salamander (*Eurycea waterlooensis*) pursuant to the Endangered Species Act of 1973, as amended (Act) (16 U.S.C. 1531 et seq.). The issuance of an ITP to authorize incidental take associated with HCP implementation and is the action for this intra-Service consultation pursuant to section 7 of the Act. Critical habitat for the Barton Springs salamander has not been designated; therefore, none will be affected. Critical habitat for the Austin blind salamander has been designated and effects to the critical habitat as a result of the covered activities have been analyzed within the opinion.

Other species listed as threatened or endangered pursuant to the Act, specifically Travis County karst species (*Texella reddelli*, *Texella reyesi*, *Texamaurops reddelli*, *Rhadine persephone*, *Tartarocreagris texana*, *Leptoneta myopica*, and *Cicurina wartoni*), have not been detected within the action area. Habitat for listed bird species (*Dendroica chrysoparia*, *Vireo atricapillus*, and *Grus americana*) and one additional threatened salamander species (*Eurycea tonkawae*) does not occur within the action area. Therefore, these species will not be discussed further in this biological opinion.

Consultation History

- | | |
|--------------------|---|
| March 16, 1998 | The Service published in the <i>Federal Register</i> a Notice of Availability of a draft Environmental Assessment (dEA) and application for an Incidental Take Permit for the City for the Operation and Maintenance of Barton Springs Pool and the Adjacent Springs. |
| July 15, 1998 | The Service published in the <i>Federal Register</i> a reopening of the comment period for the dEA and HCP for the City. |
| October 2, 1998 | The Service issued a Section 10 permit (PRT-839031) to the City for incidental take of Barton Springs salamander associated with operations and maintenance of Barton Springs Pool and adjacent springs. |
| September 12, 2012 | The City submitted a draft amended HCP and an application for an amended ITP to the Service. The major amendment application included take of the Barton Springs salamander over an additional 20 year period and a request to add the Austin Blind salamander as a covered species under the permit. |
| April 22, 2013 | The Service posted a Notice of Availability of a dEA and a draft HCP with a 60-day public comment period, and a request for comments in the <i>Federal Register</i> (78 FR 23780). |

- May 18, 2013 The City hosted an informational meeting for the public at Barton Springs Pool to discuss the draft amendment to the HCP and the permit renewal process.
- June 21, 2013 Public comment period for the dEA closed.
- July 15, 2013 The City submitted a final amended HCP to the Service.

Proposed action

Section 7 of the Act requires that all Federal agencies consult with the Service to ensure that Federal actions authorized, funded, or carried out by such agencies do not jeopardize the continued existence of any threatened or endangered species or result in the destruction or adverse modification of designated critical habitat. This biological opinion does not rely on the regulatory definition of “destruction or adverse modification of critical habitat” at 50 CFR 402.02. Instead, we have relied on the statutory provisions of the Endangered Species Act to complete the analysis with respect to critical habitat.

The Federal action requiring consultation is issuance of a section 10(a)(1)(B) permit for incidental take of listed species resulting from the Applicants’ otherwise lawful, non-Federal activities, including recreation, operations, maintenance, and habitat restoration at Barton Springs Pool (Pool or Parthenia Spring), Old Mill Spring, Eliza Spring, and Upper Barton Spring, and activities necessary to manage potential habitat for the covered species within the plan area.

The BSP HCP submitted by the Applicants as part of the incidental take permit application is hereby incorporated by reference.

The BSP HCP describes a conservation program intended to avoid, or minimize, and mitigate to the maximum extent practicable, the adverse effects of authorized take of the Barton Springs salamander and the Austin blind salamander (collectively the covered species) in the plan area. The plan area is defined as property owned by the City within Zilker Park that encompasses subterranean and surface aquatic environments and supporting riparian terrestrial habitat around Upper Barton Spring, Old Mill Spring, Eliza Spring, and Barton Springs Pool (Figure 1 of the HCP).

The BSP HCP describes covered activities; including:

1. Public use of Barton Springs Pool and Upper Barton Spring for recreation, including, but not limited to, wading, swimming, and snorkeling (section 4.1 in the HCP).
2. Routine cleaning of spring sites, including the removal of nuisance algae, excess sediment, and other natural materials from Barton Springs Pool, Eliza Spring, Old Mill Spring, and Upper Barton Spring (section 4.2 in the HCP).

3. Up to 4 full drawdowns and up to 8 partial drawdowns of the water level per year in Barton Springs Pool and Eliza Spring for routine pool cleaning when Barton Springs discharge is 54 cubic feet per second (cfs) or greater (section 4.3 in the HCP).
4. As needed, drawdowns of water level in Barton Springs Pool and Eliza Spring for post-flood pool cleaning (section 4.4 in the HCP).
5. Regular removal of flood-debris from Barton Springs Pool by vacuum dredging (section 4.5 in the HCP).
6. Removal of up to 6,006,000 gallons per year of spring water from Barton Springs Pool for irrigation of pool grounds and routine cleaning (section 4.6 in the HCP).
7. Maintenance of manicured lawns along the riparian corridor of Barton Springs Pool, Eliza Spring, and Old Mill Spring (section 4.7 in the HCP).
8. Maintenance of historic structures and anthropogenic flow regime alterations, including the historic amphitheaters around Eliza Spring and Old Mill Spring and the concrete dams and walls of Barton Springs Pool (section 4.8 in the HCP).
9. Salamander habitat reconstruction within Barton Springs Pool, Eliza Spring, Old Mill Spring, and Upper Barton Spring and surrounding areas to include connections between the spring sites (section 4.9 in the HCP).

This activity includes:

- a. Restoration (daylighting) of the outflow stream from Eliza Spring which currently travels underground and flows into the bypass structure.
- b. Removal of the concrete floor in Eliza Spring and restoration of the natural substrate in the spring pool.
- c. Replacement of a portion of masonry wall in Old Mill Spring with adjustable gates to improve outflow from the spring pool.
- d. Removal of excess rock, trash, and debris from Old Mill Spring to restore the natural elevation of the spring pool and enhance the directional flow of water from the springs.
- e. Removal of concrete over the upstream fissure area in Barton Springs Pool to enhance flow of water from the springs.

Proposed conservation measures

The BSP HCP also describes measures intended to minimize and mitigate impacts; and those intended to contribute to the recovery of covered species. These proposed conservation measures differ from those included in the 1998 Barton Springs Pool HCP (1998 HCP) and have been modified based on fifteen years of implementation of the 1998 HCP. A comparison of measures proposed in the BSP HCP with the 1998 HCP is presented in Table 22 in the amended BSP HCP. Discussion of rationale and evidence supporting removal or amendment of measures in the 1998 HCP is presented in Appendix B of the BSP HCP.

Proposed conservation measures in the amended BSP HCP (section 6.0) include:

1. City monitoring, maintenance, and improvement of salamander habitat within Barton Springs Pool, Eliza Spring, Old Mill Spring and Upper Barton Spring (section 6.1.1 in the HCP) including:
 - a. Visual inspections of all protected habitat areas (spring sites when flowing) at least four days a week.
 - b. Development of written habitat management plans for each spring site.
 - c. Re-drawing of protected salamander habitat in Barton Springs Pool, with Service approval, to include more habitat that is and can be maintained as suitable for salamander residence and exclude unsuitable habitat based on monitoring data and habitat condition (Figure 16 in the HCP).
 - d. Improvement and maintenance of suitable substrates in salamander habitat including replacement of rocky substrate with limestone gravel or cobble in order to maintain the natural groundwater buffering of karst aquifers.
 - e. Prohibiting the following activities within the spring sites to reduce harassment of salamanders:
 - Unauthorized, deliberate disturbance of salamander habitat, including substrate, aquatic vegetation, algae, and leaf litter or woody material from terrestrial vegetation.
 - Unauthorized, deliberate disturbance or alteration of flow regime,
 - Introduction of non-native flora or fauna into any salamander habitat or Barton Springs Pool.
 - Unauthorized SCUBA in salamander habitat or Barton Springs Pool.
 - f. Cleaning salamander habitat with the spring water of Barton Springs as necessary to keep the upper 2-3 inches of habitat from becoming embedded with sediment.
 - g. Removing woody debris from aquatic habitat if necessary by hand or by any other method approved by the Service.
 - h. Ensuring that sediment, algae and debris disturbed or collected during routine cleaning of Barton Springs Pool will not be disposed of within, allowed to settle within, or otherwise adversely affect aquatic habitat.
2. City reduction and mitigation of the impacts of detrimental anthropogenic pollutants that may enter Barton Springs Pool and Eliza, Old Mill, and Upper Barton springs (section 6.1.2 of the HCP) through:
 - a. Reduction in loadings of petroleum hydrocarbons, heavy metals and sediments to Barton Springs from current development and other activities located within the Barton Springs Zone in areas subject to the City's jurisdiction, and;
 - b. Control of local surface water runoff around Barton Springs Pool, Eliza Spring, Old Mill Spring, and Upper Barton Spring.
3. City restoration and/or maintenance of the natural flow regime within the four spring sites, including variation in water depth, velocity and turbulence within the channel associated with variation in aquifer discharge, surface water floods, and base flows (section 6.1.3 of the HCP). To accomplish this the City will:

- a. Allow floodwater to pass through Barton Springs Pool as unimpeded as is feasible.
 - b. Develop and implement a plan for routine silt and gravel removal from the deep channel of Pool, with Service concurrence.
 - c. Create and maintain a Drawdown Plan, which will provide standard operating procedures for use when Pool water elevation is drawn down.
 - d. Not conduct a full drawdown of the water level in Barton Springs Pool if the combined discharge of the Barton Springs complex is less than 54 cubic feet per second (cfs) without concurrence from the Service.
 - e. Receive approval from a City Salamander Conservation Program salamander biologist before the water level in Barton Springs Pool may be drawn down under any flow conditions.
 - f. Visually inspect all exposed habitat during drawdowns for stranded salamanders before cleaning and maintenance activities in those areas begin. Any stranded salamanders will be moved to permanent water.
 - g. Visually inspect water level in Eliza Spring during drawdowns to ensure that water is retained in surface habitat of the spring pool.
 - h. Ensure that a minimum of two City salamander biologists will be present when a full drawdown is conducted for cleaning and maintenance.
 - i. Ensure that a minimum of one City salamander biologist will be present when a partial drawdown is conducted for cleaning and maintenance.
4. City modification, removal, or replacement of existing infrastructure to restore more natural flow regimes and habitats within Barton Springs Pool, Eliza Spring, and Old Mill Spring, including those listed under covered activity number nine, measures a-e above (section 6.1.4 of the HCP).
 5. Protection of the evolutionary potential of wild and captive populations of Barton Springs salamander and Austin blind salamander through maintenance and/or enhancement of genetic variation and gene flow among populations of each species, and maintenance of natural selection characteristic of wild environments. Maintenance of evolutionary potential may include artificial selection for adaptations to future environmental conditions in the wild (section 6.1.5 in the HCP).
 6. Adoption of benign cleaning methods by the City for the maintenance of Barton Springs Pool to reduce the harassment and/or harm of Barton Springs and Austin blind salamanders (section 6.1.6 of the HCP), including:
 - a. Manually trimming and removing aquatic vegetation (macrophytes, bryophytes and algae) as necessary.
 - b. Designating specific areas at least 25 feet away from the water for the fueling and maintenance of equipment and vehicles used in maintaining the springs and surrounding areas, including absorbent pads underneath to contain any toxins.
 - c. Cleaning the shallow end of Barton Springs Pool without full drawdown of water level in the entire Pool.
 - d. Utilizing spring water for maintenance, and to provide water over fissures during drawdown.

- e. Prohibiting the use of toxic chemicals for cleaning of Barton Springs Pool.
7. City collection and distribution of salamander monitoring data (section 6.1.7 of the HCP) including:
 - a. Development and maintenance of a written City monitoring plan.
 - b. Completion of salamander population surveys at perennial Parthenia, Eliza, and Old Mill springs and at intermittent Upper Barton Spring, when flowing, at least bimonthly throughout the year or another interval sufficient to determine the status of the species and population dynamics as deemed appropriate by a City salamander biologist and approved by the Service.
 - c. Use of Eliza Spring and Old Mill Spring as outdoor educational facilities for the study of the biology and ecology of Central Texas springs.
 8. Training of City employees, staff, and volunteers about protected salamander species (section 6.1.7 of the HCP) including:
 - a. Yearly training of Barton Springs Pool lifeguards, maintenance staff, and seasonal employees about the protected salamanders, resident aquatic wildlife, and flora and the ecology of Edwards Aquifer springs.
 - b. Training of all people conducting salamander and habitat monitoring.
 - c. Ensuring that all monitoring and surveys are conducted under the terms and conditions of a current federal Endangered Species Act 10(a)(1)(A) scientific permit issued to the City.
 9. Additional measures that contribute to recovery (sections 6.1.7.5, 6.2, and 6.3 of the HCP):
 - a. The City will form the Barton Springs Scientific Advisory Committee, which will include local and regional experts. The Advisory Committee will meet at least annually to discuss and refine Barton Springs' maintenance and environmental management activities and will also be responsible for helping identify potential revisions to the Plan and suggest adaptive management strategies.
 - b. Access to Eliza Spring and Old Mill Spring will be restricted to ensure no unauthorized disturbance of salamander habitat and/or its supporting riparian habitat.
 - c. The City will maintain a plan and necessary equipment and training for responding to, and mitigating the effects of catastrophic contaminant spills that threaten protected salamanders or their habitat.
 - d. The City will maintain viable, evolutionarily fit captive breeding populations of Barton Springs salamander and Austin blind salamander. The City will designate a staff biologist and dedicate a minimum of \$28,000 annually to the development and maintenance of this program.
 - e. Under conditions when decreased dissolved oxygen concentrations may be harmful to salamanders, the City may supplement dissolved oxygen in Eliza, Old Mill, and Parthenia springs using air pumps, water recirculation, or other method approved by the Service.
 - f. The City will create a fund for conservation and research efforts for Barton Springs salamander and Austin blind salamander. The City will deposit \$53,000 annually (for the term of the permit) into this fund from the revenues generated by Barton Springs Pool.

- g. The City will continue to support research projects designed to gather and evaluate data applicable to wild or captive populations of the Barton Springs Salamander, and the Austin Blind Salamander.
- h. The City will continue to provide educational programs to enhance public awareness and community support for Barton Springs salamander, Austin blind salamander, Barton Springs, and the Edwards Aquifer. The SPLASH! Into the Edwards Aquifer Exhibit at Barton Springs Pool will continue to be a major focus of this effort.
- i. The City will cooperatively develop a memorandum of understanding with the Barton Springs Edwards Aquifer Conservation District within one year of permit issuance.
- j. The City will participate in regional water resource planning efforts to protect Barton Springs salamander and Austin blind salamander.

10. Reporting and Adaptive Management (section 6.4 and 6.5 of the HCP):

- a. The City will submit an annual report on February 1 of each calendar year, or other date approved by the Service, to the Service's Austin Ecological Services Field Office and Southwest Regional Office – Permits Division, the City Manager, and the City Council. The annual report will include assessments of the status of the protected salamander species, analysis of biological data, and review of Barton Springs Pool maintenance and management activities during the year. In the annual report, each point of the amended HCP will be addressed.
- b. The City has proposed an extensive adaptive management program to inform changing proposed actions or conservation measures in the HCP based on data gathered during the implementation of the HCP.

Description of the Action Area

Area Affected

Section 7(a)(2) of the Act's implementing regulations defines the action area as all areas affected directly or indirectly by the Federal action and not merely the immediate area affected by the project (50 CFR § 402.02). For the purposes of this biological opinion, the action area includes the Habitat Conservation Plan area and an additional surrounding 100-foot buffer area within Zilker Park, Travis County, Texas. This includes property owned by the City within Zilker Park that encompasses subterranean and surface aquatic environments and supporting riparian terrestrial habitat around Upper Barton Spring, Old Mill Spring, Eliza Spring, and Barton Springs Pool (Figure 1 of the HCP). The action area coincides with the study area described in the EA, and is illustrated in EA Figure 3-5.

Status of the species

Barton Springs salamander

For more detailed information please see the Service's recovery plan for the Barton Springs salamander.

Species Description and Life History

The Barton Springs salamander was federally listed as an endangered species on May 30, 1997 (62 FR 23377-23392). The Barton Springs salamander is a member of the Family Plethodontidae (lungless salamanders) within the genus *Eurycea*, and inhabits springs, spring-runs, and water-bearing karst formations of the Edwards Aquifer (Chippindale 1993). They are aquatic and neotenic, meaning they retain larval, gill-breathing morphology throughout their lives. Neotenic salamanders, including the Barton Springs salamander, do not metamorphose and leave water. Instead, they live in water throughout their life cycle where they become sexually mature and eventually reproduce.

Adults reach about 2.5 to 3 inches (63-76 mm) in total length. Adult body morphology includes reduced eyes and elongate, spindly limbs that are indicative of a semi-subterranean lifestyle. The head is relatively broad and deep in lateral view, and the snout appears somewhat truncate when viewed from above. On either side of the base of the head is a set of three feathery gills that are bright red. The coloration on the salamander's upper body varies from light to dark brown, purple, reddish brown, yellowish cream, or orange. The tail is relatively short with a well-developed dorsal (upper) fin and poorly developed ventral (lower) fin. The upper and lower mid-lines of the tail usually exhibit some degree of orange-yellow pigmentation.

Gravid females, eggs, and larvae are typically found throughout the year in Barton Springs, which suggests that the salamander can reproduce year-round. Juveniles closely resemble adults (Chippindale *et al.* 1993). Newly hatched larvae are about 0.5 inch (12 mm) in total length and may lack fully developed limbs or pigment (Chamberlain and O'Donnell 2003). Information obtained from captive-raised Barton Springs salamanders indicates that females can develop eggs within 11 to 17 months after hatching.

Barton Springs salamanders appear to be opportunistic predators of small, live invertebrates. Chippindale *et al.* (1993) found amphipod remains in the stomachs of wild-caught salamanders. The gastro-intestinal tracts of 18 adult and juvenile Barton Springs salamanders and fecal pellets from 11 adult salamanders collected from Eliza Springs, Barton Springs Pool, and Sunken Garden Springs contained ostracods, copepods, chironomids, snails, amphipods, mayfly larvae, leeches, and adult riffle beetles. The most common organisms found in these samples were ostracods, amphipods, and chironomids (CoA, unpublished data). A recent study found that planarians (flatworms) are the primary food source for Barton Springs salamanders, and amphipods only become part of the diet when planarians and chironomids are rare (Gillespie 2013, p. 5).

Historic and Current Distribution

The Barton Springs salamander has one of the smallest geographic ranges of any vertebrate species in North America (Chippindale *et al.* 1993, Conant and Collins 1998). The species was first collected from Barton Springs in 1946 (Brown 1950, Texas Natural History Collection specimens 6317-6321), was formally described in 1993 (Chippindale *et al.* 1993), and has been found at the four spring outlets that make up Barton Springs. Barton Springs, located in Zilker Park near downtown Austin, Texas, is an aquifer-fed system consisting of four hydrologically connected springs: (1) Main Springs (also known as Parthenia Springs or Barton Springs Pool); (2) Eliza Springs (also known as the Elks Pit); (3) Sunken Garden Springs (also known as Old

Mill or Walsh Springs); and (4) Upper Barton Springs (Pipkin and Frech 1993). The salamander was first observed in Barton Springs Pool and Eliza Springs in the 1940s, Sunken Garden Springs in 1993 (Chippindale *et al.* 1993), and the intermittent Upper Barton Springs in 1997 (CoA 1998). Recent searches have documented salamanders at other springs in the Barton Springs Segment of the Edwards Aquifer including Cold Springs and Blowing Sink Cave. Mitochondrial DNA analysis suggests that these salamanders are closely related to one of two haplotypes found in the Barton Springs salamander (Chippindale 2012).

The extent of the Barton Springs salamander's range within the Barton Springs Segment of the Edwards Aquifer, and thus the degree of subsurface connection among these spring populations, is unknown. Sweet (1978) suggested the species was troglobitic (cave-adapted) and that the salamanders observed from the surface were discharged from the springs. However, City biologists have observed Barton Springs salamanders swimming directly into various spring outlets, including Main Springs in Barton Springs Pool (Dee Ann Chamberlain and Lisa O'Donnell, CoA, pers. comm. 2004). Chippindale *et al.* (1993) characterized the species as a predominately surface-dwelling salamander capable of living underground. Reproduction of the Barton Springs salamander is believed to occur inside the Edwards Aquifer since salamander larvae are found in surface water year-round, but very few eggs (which are white and very visible) have been observed in the wild (Chamberlain and O'Donnell 2003). The City initiated salamander surveys in (1) Barton Springs Pool in 1993, (2) Sunken Garden Springs and Eliza Springs in 1995, and (3) Upper Barton Springs in 1997. Monthly surveys conducted since 1993 have resulted in a number of salamander observations within each spring ranging from 1 to over 1,200. Numbers have remained fairly constant within each survey location, with a noticeable spike in Barton Springs salamander numbers in Eliza Spring and Barton Springs Pool in late 2005 and early 2006 (CoA 2007). Severe drought in 2006 caused flow within all the springs to drop and remain at less than 40 cfs through December 2006 with a corresponding drop in salamander numbers. This cycle was repeated in 2008 and 2009 with Barton Springs salamander numbers peaking in early 2008 and dropping down again during the drought of 2009 (Appendix A in the HCP).

Reasons for Decline and Threats to Survival

The primary threat to the Barton Springs salamander is the degradation of the quality and quantity of water that feeds Barton Springs as a result of urban expansion over the watershed. The species' restricted range makes it vulnerable to both acute and chronic groundwater contamination. The salamander is also vulnerable to catastrophic hazardous materials spills, increased water withdrawals from the Edwards Aquifer, and impacts to the surface habitat.

An analysis of spring discharge data by the City (2000) indicated that degradation of water quality parameters has occurred at Barton Springs over the years. Dissolved oxygen has decreased while conductivity, sulfates, turbidity, nitrate-nitrogen, and total organic carbon have increased. The magnitude of these changes in water quality at Barton Springs has been variable and is dependent on flow conditions (CoA 2000, 2005). Changes in water quality at Barton Springs may be related to cumulative impacts of urbanization, including increased groundwater use. Variations in the quality of discharge at Barton Springs may also be related to seasonal changes in the amount of precipitation (CoA 1997). The extent to which these water quality changes have affected the Barton Springs salamander or its habitat is unknown.

Salamander habitat may also be affected by excessive deposition of sediment within Barton Springs. Deposition of sediment can physically reduce the amount of available habitat and protective cover for salamanders. Once deposited in large volumes, sediment can become devoid of oxygen and clog the interstitial spaces of the substrates surrounding the spring outlets that offer protective cover, rendering the habitat unsuitable for salamanders.

Range-wide Survival and Recovery Needs

Based on the Barton Springs Salamander Recovery Plan (USFWS 2005) protection and improvement in water quality within the Barton Springs watershed are necessary to provide for the survival of the species. Comprehensive regional plans are needed to address water quality and quantity threats. A number of interested parties are working on comprehensive regional approaches to aid in the conservation of this species; however, these approaches have yet to be fully implemented.

The potential for a catastrophic spill to occur at or near Barton Springs, or within the recharge zone of the Barton Springs Segment of the Edwards Aquifer, is of particular concern due to the limited range of this species. There continues to be a need for a comprehensive regional spill response and remediation plan to address the potential impacts of on-site and off-site spills.

The extremely limited range of this species makes captive breeding an important tool to help guard against extinction while other conservation measures are being put in place. Captive breeding, habitat improvement, and other efforts to increase numbers of existing viable populations is critical to the survival and recovery of this species, particularly as expanding urbanization continues to threaten habitat quality. Efforts to protect, manage, and restore surface salamander habitat at the four spring sites, followed by consistent and effective monitoring of Barton Springs salamander populations, continues to yield valuable information regarding the recovery needs of this species.

Austin blind salamander

Species Description and Life History

The Austin blind salamander was proposed for listing as an endangered species with proposed critical habitat on August 22, 2012 (77 FR 50768) and was listed as endangered with designed critical habitat on August 20, 2013 (78 FR 51278). The Austin blind salamander is a member of the family Plethodontidae (lungless salamanders) within the genus *Eurycea*, and inhabits springs, spring-runs, and water-bearing karst formations of the Edwards Aquifer (Chippindale *et al.* 2000). They are aquatic and neotenic, meaning they retain larval, gill-breathing morphology throughout their lives. Neotenic salamanders, including the Austin blind salamander, do not metamorphose and leave water. Instead, they live in water throughout their life cycle where they become sexually mature and eventually reproduce.

The Austin blind salamander has a pronounced extension of the snout, no external eyes, 12 costal grooves, and weakly developed tail fins. In general appearance and coloration, the Austin blind salamander is more similar to the Texas blind salamander (*Eurycea rathbuni*) that occurs in the Southern Segment of the Edwards Aquifer than its sympatric species (occurring within the same range), the Barton Springs salamander. The Austin blind salamander has a reflective, lightly

pigmented skin with a pearly white or lavender appearance (Hillis *et al.* 2001). Before the Austin blind salamander was formally described, juvenile salamanders were sighted occasionally in Barton Springs and thought to be a variation of the Barton Springs salamander. It was not until 2001 that enough specimens were available to formally describe these juveniles as a separate species using morphological and genetic characteristics (Hillis *et al.* 2001). Given the reduced eye structure of the Austin blind salamander and the fact that it is rarely seen at the water's surface (Hillis *et al.* 2001), this salamander is thought to be more subterranean than the surface-dwelling Barton Springs salamander.

Historic and Current Distribution

The Austin blind salamander occurs in Barton Springs in Austin, Texas. These springs are fed by the Barton Springs Segment of the Edwards Aquifer. This segment covers roughly 155 square miles (mi) [401 square kilometers (km)] from southern Travis County to northern Hays County, Texas (Barton Springs/Edwards Aquifer Conservation District, 2004). It has a storage capacity of over 300,000 acre-feet. The contributing zone for the Barton Springs Segment of the Edwards Aquifer that supplies water to the salamander's spring habitat extends into both Travis and Hays counties, Texas.

The Austin blind salamander is found in three of the four Barton Springs outlets in the City's Zilker Park, Travis County, Texas: Main (Parthenia) Springs, Eliza Springs, and Sunken Garden (Old Mill or Zenobia) Springs. The designated critical habitat for the Austin blind salamander is divided into surface and subterranean components for each of the three springs. Critical habitat at the surface includes each of the three spring outlets, including outflow up to the high water line, and 262 feet (80 meters) of downstream habitat. The subterranean critical habitat includes underground features in a circle with a radius of 984 feet (300 meters) around the spring outlets. The primary constituent elements of flowing groundwater, rocky substrate with interstitial spaces, aquatic invertebrates for food, and access to the subsurface water table are all found within each of the three springs.

The Main Springs form the Barton Springs Pool, which is operated by the City as a public swimming pool. These spring sites have been significantly modified for human use. The area around Main Springs was impounded in the late 1920s to create Barton Springs Pool. Flows from Eliza and Sunken Garden Springs are also retained by concrete structures, forming small pools on either side of Barton Springs Pool (CoA 1998, USFWS 2005). The Austin blind salamander has not been observed at the fourth Barton Springs outlet, known as Upper Barton Springs (Hillis *et al.* 2001).

From January 1998 to December 2000, there were only 17 documented observations of the Austin blind salamander. During this same time frame, 1,518 Barton Springs salamander observations were made (Hillis *et al.* 2001). Although the technology to safely and reliably mark salamanders for individual recognition has recently been developed (O'Donnell *et al.* 2008), population estimates for this species have not been undertaken because surveying within the Edwards Aquifer is not possible at the current time. However, population estimates are possible for aquifer-dwelling species using genetic techniques, and one such study is planned for Austin blind salamander in the near future. When they are found, Austin blind salamanders appear to occur in relatively low numbers (CoA 2011, unpublished data). Most of the Austin blind

salamanders that were observed during these surveys were juveniles [less than 1 in (2.5 cm) in total length].

Reasons for Decline and Threats to Survival

The primary threat to the Austin blind salamander is the degradation of the quality and quantity of water that feeds Barton Springs as a result of urban expansion over the watershed. The species' restricted range makes it vulnerable to both acute and chronic groundwater contamination. The salamander is also vulnerable to catastrophic hazardous materials spills, increased water withdrawals from the Edwards Aquifer, and impacts to the surface habitat.

An analysis of spring discharge data by the City (2000) indicated that degradation of water quality parameters has occurred at Barton Springs over the years. Dissolved oxygen has decreased while conductivity, sulfates, turbidity, nitrate-nitrogen, and total organic carbon have increased. The magnitude of these changes in water quality at Barton Springs has been variable and is dependent on flow conditions (CoA 2000, 2005). Changes in water quality at Barton Springs may be related to cumulative impacts of urbanization, including increased groundwater use. Variations in the quality of discharge at Barton Springs may also be related to seasonal changes in the amount of precipitation (CoA 1997). The extent to which these water quality changes have affected the Austin blind salamander or its habitat is unknown.

Austin blind salamander habitat may also be affected by excessive deposition of sediment within Barton Springs. Deposition of sediment can physically reduce the amount of available habitat and protective cover for salamanders. Once deposited in large volumes, sediment can become devoid of oxygen and clog the interstitial spaces of the substrates surrounding the spring outlets that offer protective cover, rendering the habitat unsuitable for salamanders.

Range-wide Survival and Recovery Needs

As this species occurs in and around three of the spring sites that are also known to support the endangered Barton Springs salamander, recommended conservation measures follow those outlined for the Barton Springs salamander in the Barton Springs Salamander Recovery Plan (USFWS 2005). Such conservation efforts should include implementing comprehensive regional plans to address water quality and quantity threats. A plan to protect or enhance water quality should include measures for projects constructed over contributing and recharge zones of the Barton Springs Segment of the Edwards Aquifer. Such measures should include impervious cover limits, buffer zones for streams and other sensitive environmental features, low-impact developments, structural water quality controls and other strategies to reduce pollutant loads. Land preservation through acquisition, conservation easements, or deed restrictions also can provide permanent protection for water quality and quantity. Programs should be developed to reduce pollutant loading from already existing development and other potential sources of pollutants such as golf courses and transportation infrastructure. The City should continue their efforts to protect the salamander's habitat. The Austin blind salamander is also a high priority species in the Texas Parks and Wildlife Department's Wildlife Action Plan of Texas. This may help in securing State funds for both research and recovery efforts for this species.

The potential for a catastrophic spill to occur at or near Barton Springs, or within the recharge zone of the Barton Springs Segment of the Edwards Aquifer, is of particular concern due to the

limited range of this species. There continues to be a need for a comprehensive regional spill response and remediation plan to address the potential impacts of on-site and off-site spills.

The extremely limited range of this species means that captive breeding is an important tool to help guard against extinction while other conservation measures are being put in place. Captive breeding, habitat improvement, and other efforts to increase numbers of existing viable populations is critical to the survival and recovery of this species, particularly as expanding urbanization continues to threaten habitat quality. Efforts to protect, manage, and restore surface salamander habitat at the three spring sites, followed by consistent and effective monitoring of Austin blind salamander populations, continues to yield valuable information regarding the recovery needs of this species.

Environmental Baseline

Status within the Action Area- Barton Springs salamander

Barton Springs Pool

Although surveys have been conducted for Barton Springs salamanders within the Pool since 1993 and within Eliza Spring since 1995, changes in survey method and survey effort make it difficult to compare numbers of salamanders between years. To account for differences in survey effort, the City has calculated the density of Barton Springs salamanders per square foot (#/sq. ft.) within the Pool and within Eliza Spring.

Barton Springs salamanders in the Pool are found primarily in the immediate area of the spring outlets. From 1993 to 2010, the highest percentage of Barton Springs salamanders found within the Pool occurred in and around the caves and fissures from which the groundwater emanates regardless of survey method (Table 13 in the HCP). The mean density of Barton Springs salamanders ranges from 0.003/sq. ft. near the fissures to 0.016/sq. ft. near the spring mouths.

Barton Springs salamanders have also been found in the “beach” area, which is a gravel bench lying underwater immediately adjacent to the walkway, on the north side of the Pool. Surveys within the beach have primarily focused on beach area 1, with only one recent survey within beach areas 2 and 3 (Table 13 in the HCP). Much of the beach habitat is unsuitable for high densities of salamanders primarily due to sediment cover (CoA, unpublished data). In general, 90-100% of the available substrate is covered by sediment that exceeds 1-2 inches deep. In 1999, the beach was lowered under the 1998 HCP and the City’s section 10(a)(1)(B) permit. Since the lowering of the substrate along the beach, plant cover has shifted from species found in more rapidly flowing water (e.g., *Ludwigia repens*, *Bacopa monnieri*, *Vallisneria americana*) to dense stands of *Sagittaria platyphylla* and *Sagittaria graminea*, which prefer slow water flow. This appears to be consistent with the reduction in flow velocity that would have occurred after increasing the water depth. Within the beach the mean density of Barton Springs salamanders ranges from 0.0003/sq. ft. in beach area 1, to zero in beach area 3 (Table 13 in the HCP).

Eliza Spring

Eliza spring has been surveyed roughly every month beginning in 1995 and harbors the highest numbers of Barton Springs salamanders recorded for a single site, 1,234 salamanders in 2008 (Table 13 in the HCP).

Two factors likely influence the greater numbers of salamanders found during surveys of this site. First, the smaller size of this spring (approximately 800 sq. ft.) allows the entire surface habitat to be searched during each survey, and second, a concrete floor below the surface substrate limits salamander access to sub-surface habitat allowing for increased detection of salamanders. Although density numbers cannot be calculated for 1998-2002 due to lack of an exact area surveyed, Barton Springs salamander abundance increased significantly within Eliza Spring following habitat reconstruction of the Eliza Spring pool in 2003 (Appendix A in the HCP). The reconstruction included restoring shallow water depth, removal of rocks buried in sediment, and excavation of water flow paths along the substrate. Mean density of Barton Springs salamanders within Eliza Spring from 2003-2010 was 0.43/sq. ft. Outflow from Eliza Spring currently flows through a pipe into the concrete bypass (Figure 16 in the HCP).

Old Mill Spring

Old Mill Spring has been surveyed roughly every month beginning in 1997, although survey methodology prior to 2001 varied greatly. Surveys from 2001 to the present were completed under a more consistent methodology, although it should be recognized that water level at this site can vary widely and therefore surveyed area may also change from one month to the next. Old Mill Spring has a mean abundance of 15.4 Barton Springs salamanders per survey with the total abundance ranging from zero to 97 Barton Springs salamanders found within a single survey in 2008 (Table 13 in the HCP). However the mean density of 0.01/sq. ft. Barton Springs salamanders within Old Mill Spring is low compared to both Eliza Spring and Barton Springs Pool (please Table 3 in Appendix A of the HCP). This is likely due to relatively poor habitat conditions within Old Mill Spring, especially during low flow conditions. This site frequently requires supplemental dissolved oxygen during the summer months through air pumps or water recirculation.

Water elevation in the Old Mill Spring pool varies temporally with discharge and elevation decreases approximately 1 foot when combined Barton Springs discharge is 20 cubic feet per second (ft^3/s) or less. Water depth in the outflow stream from Old Mill Spring to Barton Creek varies geographically and temporally from 0 to 2 feet. The outflow stream is typically dry when site-specific discharge is $0.1 \text{ ft}^3/\text{s}$ or less, which also corresponds with a Barton Springs' discharge of $20 \text{ ft}^3/\text{s}$ or less. Habitat reconstruction in Old Mill Spring and the outflow stream began in 2005 including the lowering of the stream bed and capping of an old concrete pipe below the stream bed. Additional habitat reconstruction and habitat improvements at this site have been included as a mitigation measure under the amended HCP.

Upper Barton Spring

Upper Barton Spring is located within the southeast bank of Barton Creek upstream of the upper Barton Springs Pool dam and is located along a recreational walking trail. Upper Barton Spring has been surveyed roughly every month beginning in 1997 after Barton Springs salamanders were first discovered there. This site is an intermittent spring and frequently goes dry during the

summer months and therefore fluctuations in wetted area due to discharge may account for some variation in overall counts. Upper Barton Spring has a mean abundance of 6.1 Barton Springs salamanders per survey with the total abundance ranging from zero to 100 Barton Springs salamanders found within a single survey in 2010 (Table 13 in the HCP). The mean density of 0.02/sq. ft. Barton Springs salamanders within Upper Barton Spring is consistent with the mean density of Old Mill Spring, which is also heavily influenced by low flow conditions.

Status within the Action Area- Austin blind salamander

Barton Springs Pool

Since the Austin blind salamander resides in subterranean habitat of the perennial springs, Eliza, Parthenia, and Old Mill, it is difficult to infer the status of the population and the species. Lack of information on life history characteristics in wild populations further hampers assessment of reproduction and recruitment. Within the Pool, Austin blind salamander mean density from 2003-2010 was 0.0001/sq. ft. (Table 13 in the HCP). The maximum number of Austin blind salamanders found in the pool during a single survey in 2010 was five (Table 11 in the HCP). Surface critical habitat for the Austin blind salamander in Barton Springs Pool includes the spring outlets including outflow up to the high water line, and 262 feet (80 meters) of downstream habitat. Subterranean critical habitat in Barton Springs Pool includes underground features in a circle with a radius of 984 feet (300 meters) around the spring outlets.

Eliza Spring

The Austin blind salamander was not found regularly in Eliza Spring until after 2002. From 2003 to 2010 the mean density of Austin blind salamanders in Eliza Spring was 0.001/sq. ft. (Table 13 in the HCP). The maximum number of Austin blind salamanders found in Eliza Spring during a single survey was twelve in 2006. No Austin blind salamanders were recorded in Eliza Spring in 2010. Surface critical habitat for the Austin blind salamander in Eliza Spring includes the spring outlet, including outflow up to the high water line, and 262 feet (80 meters) of downstream habitat. Subterranean critical habitat in Eliza Spring includes underground features in a circle with a radius of 984 feet (300 meters) around the spring outlet.

Old Mill Spring

The Austin blind salamander has been found consistently in Old Mill Spring since 1998 with the highest numbers recorded in 2001-2004. The maximum number of Austin blind salamanders found in Old Mill Spring during a single survey was 43 in 2003, however only one Austin blind salamander was recorded in 2010 (Table 11 in the HCP). The mean density of Austin blind salamanders within Old Mill Spring is 0.003/sq. ft., which is the highest density for this species within any of the three spring sites that it inhabits. Surface critical habitat for the Austin blind salamander in Old Mill Spring includes the spring outlet including outflow up to the high water line, and 262 feet (80 meters) of downstream habitat. Subterranean critical habitat in Old Mill Spring includes underground features in a circle with a radius of 984 feet (300 meters) around the spring outlet.

Prior consultations completed

Three previous salamander consultations have been completed for actions within the Barton Springs Pool complex:

1. Final environmental assessment/habitat conservation plan for issuance of a section 10(a)(1)(B) permit for incidental take of the Barton Springs salamander (*Eurycea sosorum*) for the operation and maintenance of Barton Springs Pool and adjacent springs. Austin, Texas 1998, (Service Permit TE-839031);
2. Biological Assessment, Barton Springs Flood Debris Removal, Austin, Texas dated April 21, 2010, (Service File 21450-2010-F-0359).
3. Biological Assessment, Barton Springs Bypass and Dam Repairs, Austin, Texas dated July 15, 2011, (Service File 21450-2010-F-0150).

The 1998 10(a)(1)(b) permit issued in conjunction with the 1998 HCP covers incidental take of Barton Springs salamander for operation and maintenance of the Barton Springs Pool complex including the Pool, Eliza Spring, Old Mill Spring, and Upper Barton Spring. The amount of incidental take covered under that permit was presented as a range from 0-1904 Barton Springs salamanders. The 2010 biological opinion issued for the debris removal project covered incidental take of Barton Springs salamanders for a one time removal of debris deposited in the deep end of the Pool during flooding. The amount of incidental take covered under that opinion was three Barton Springs salamanders. The 2012 biological and conference opinion issued for the bypass and dam repair project covered incidental take of Barton Springs salamanders and provided avoidance and minimization measures for Austin blind salamanders. The project description included the reconstruction of the bypass tunnel that diverts Barton Creek around Barton Springs Pool and minor repairs needed to the downstream dam in Barton Springs Pool. The amount of incidental take covered under that opinion was 385 Barton Springs salamanders and 10 Austin blind salamanders.

The City is currently implementing the 1998 HCP to avoid, minimize, and mitigate incidental take of the Barton Springs salamander resulting from the continued operation and maintenance of Barton Springs Pool and adjacent springs (CoA 1998). The proposed amendment to the HCP will benefit Austin blind salamander by adding it as a covered species under the plan and providing specific protections for the species. However, many of the provisions of the existing plan also have benefitted the Austin blind salamander over the fifteen year period that the plan has been in place. Such provisions include: (a) training lifeguard and maintenance staff to protect salamander habitat, (b) controlling erosion and preventing surface runoff from entering the springs, (c) ecological enhancement and restoration, (d) monthly monitoring of salamander numbers, (e) public outreach and education, and (f) establishment and maintenance of a captive breeding program, which includes the Austin blind salamander.

Effects of the Proposed Action

The actions proposed in the amended BSP HCP have the potential to adversely affect both Barton Springs salamander and Austin blind salamander by directly injuring or harassing salamanders found within Barton Springs Pool, Eliza Spring, Old Mill Spring, and Upper Barton

Spring. Actions that are expected to cause incidental take can be categorized as either recurrent actions or discrete and finite actions. Recurrent actions occur multiple times over the duration of the permit and may occur multiple times each year. Recurrent actions included in the BSP HCP include cleaning of salamander habitat within all four spring sites, maintenance and flood related drawdowns within Barton Springs Pool, and recreational use of Barton Springs Pool and Upper Barton Spring. No incidental take from recreation is expected at Eliza Spring or Old Mill Spring as these sites were closed under the 1998 HCP and remain closed to public access. Finite actions include habitat restoration projects within Barton Springs Pool, Eliza Spring, and Old Mill Spring.

Recreation

The use of Barton Springs Pool and Upper Barton Spring for recreation is anticipated to result in harassment of salamanders due to direct and indirect disturbances to salamander habitat. Recreational users may pick up and move rocks, remove vegetation or algae, or alter substrate within salamander habitat in Barton Springs Pool and Upper Barton Spring. Individual salamanders may be exposed to predation or have their normal feeding, breeding, and sheltering behavior interrupted if their habitat is altered due to recreational use within these spring sites. Salamanders may also be crushed or injured by large rocks being moved or dropped on them or salamanders may be stepped on within Upper Barton Spring as this area is open to hiking and wading. The magnitude of these effects varies with the intensity and frequency of recreational use within Barton Springs Pool and Upper Barton Spring with the highest intensity of use being during the summer months. Within Barton Springs Pool the possibility of lethal take of salamanders is much lower due to the deeper water present over much of the fissure habitat within the pool.

Conservation measures in the BSP HCP for recreation include prohibition of deliberate disturbance of salamander habitat, routine cleaning of salamander habitat to remove excess non-natural materials, training of lifeguards and seasonal employees about protected salamander species, and continued educational programs to enhance public awareness of salamander species and habitat within the Barton Springs Pool complex, including the SPLASH! exhibit.

Routine Cleaning

Routine cleaning of salamander habitat within Barton Springs Pool, Eliza Spring, and Old Mill Spring is necessary due to the unnatural accumulation of sediment and nuisance algae as a result of human alteration of all three sites. Routine cleaning of Upper Barton Spring has not been necessary to date as this spring has a natural intermittent condition and it is adjacent to the stream bed of Barton Creek. However, the City has included take for this site as it may require routine cleaning during the 20 year life of the permit. The method used to remove sediment and algae is to re-circulate spring water through submersible pumps and direct the flow towards substrate areas to flush out unwanted material. Cleaning is accomplished mechanically using underwater buffers, power-washers, and brooms. Toxic chemicals have not been applied directly onto substrate since the issuance of the 1998 HCP and will not be applied under the amended BSP HCP.

Routine cleaning is anticipated to result in harm and harassment of salamanders, including salamander eggs and salamander larvae, due to direct and indirect disturbances to salamander habitat. Cleaning techniques such as the use of buffers, power-washers, and brooms could

dislodge individual salamanders or salamander prey from areas within Barton Springs Pool or other spring sites exposing them to predation, injuring, or killing them. Salamander feeding, breeding, or sheltering may also be indirectly affected by the noise and vibration of equipment used to clean habitat.

Although there may be adverse effects to salamanders as a result of routine cleaning of habitat, it is also necessary due to human alteration of the spring sites. Excess sediment deposition in salamander habitat also has direct and indirect effects on salamanders, including reduction in food availability, filling of interstitial spaces salamanders use for cover, and reduction in dissolved oxygen concentrations critical for salamander survival. Sediment can also carry organic pollutants into habitat areas. Routine cleaning of salamander habitat is therefore critical to the long term maintenance of high quality surface habitat within the spring sites.

Conservation measures in the BSP HCP for routine cleaning include development of written habitat management plans for each spring site, redrawing of protected habitat to include more habitat that can be maintained as suitable within Barton Springs Pool, improvement and maintenance of suitable substrates in salamander habitat, cleaning of salamander habitat as necessary to keep the upper 2-3 inches from becoming embedded in sediment, cleaning using spring water of Barton Springs at pressures not to exceed 30 pounds per square inch (lb./sq. in.), disposal of sediment, algae, and debris from routine cleaning outside of salamander habitat, maintenance of the natural flood regime (as unimpeded as feasible) to encourage natural scouring of the Barton Springs Pool bottom, development and implementation of a routine silt and gravel removal plan, designated fueling areas at least 25 feet away from the water and absorbent pads underneath to contain any toxins) for equipment needed to maintain the springs, cleaning of the shallow end of Barton Springs Pool without full drawdown of water, and prohibition on the use of toxic chemicals during cleaning.

Drawdowns

Drawdowns of the water level in Barton Springs Pool are used to facilitate routine cleaning and are also used to prepare the Pool for flooding by allowing the flood waters to pass through the Pool area as unimpeded as possible. In the event of a contaminant spill a drawdown would also reduce the potential effects of a spill by allowing the contaminated water to flow out of the Pool more quickly. Drawdowns are accomplished by opening the gates in the downstream dam of the Pool and allowing water to flow downstream into Barton Creek, which lowers the water elevation within the Pool. Depending on the amount of water released shallower areas within the upstream (shallow) end of the Pool may be exposed. During drawdowns water levels in Eliza Spring also drop due to the direct connection between Eliza Spring and the Pool. Water levels in Old Mill Spring may recede a few inches during drawdowns, but surface habitat is not exposed. The water level in Upper Barton Spring is not affected by drawdowns when Barton Springs' discharge is 54 cfs or higher.

Drawdowns are anticipated to result in harm and harassment of salamanders due to direct and indirect disturbances to salamander habitat. As water recession during drawdowns occurs more rapidly than natural expansion and contraction of water levels, salamanders may become exposed or stranded in shallower areas of the Pool or within Eliza Spring. Exposed or stranded salamanders are unable to breathe and could die due to exposure or may be eaten by birds or other animals.

However, the City's data gathered during implementation of the 1998 HCP shows that from 2003-2010 there were no individuals of either salamander species stranded or observed during flood debris removal or drawdowns for floods. During drawdowns for cleaning Barton Springs salamanders were observed and relocated within both Barton Springs Pool and Eliza Spring with the range of salamanders relocated from 0-5 and 0-1 in each spring respectively (Table 14 in the BSP HCP). No Austin blind salamanders were observed or relocated during drawdowns for cleaning in either spring. Although drawdowns for cleaning and drawdowns for floods were completed over 50 times during the existing permit there was no observed lethal take from either of these activities. This indicates that the majority of take from this activity is likely to be in the form of harassment as salamanders follow the receding water into subsurface habitat and do not have access to the surface habitat until the drawdown has been completed, or harassment by City salamander biologists as they monitor drawdowns and relocate exposed or stranded salamanders to wetted habitat areas within the Pool. This represents a significant success of the City's habitat conservation plan as stranding and mortality of salamanders due to drawdown of Barton Springs Pool for cleaning was a significant concern leading to the development of the 1998 HCP.

Conservation measures in the BSP HCP for drawdowns include the development of a drawdown plan, not conducting a full drawdown in the Pool if the discharge of the Barton Springs complex is less than 54 cfs without the concurrence of the Service, approval from a City salamander biologist before the water level in the Pool may be drawn down under any flow conditions, visual inspection of all exposed habitat for stranded salamanders during drawdowns and before maintenance or cleaning activities begin, a minimum of two City salamander biologists present when a full drawdown is conducted, and a minimum of one biologist present when a partial drawdown is conducted, limiting full drawdowns to four per year, and limiting partial drawdowns to eight per year.

Flood Debris Removal

Floods that overtop the upstream dam of the Pool deposit flood debris and reduce water depth in the deep channel in the downstream end of the Pool. This is an undesirable condition for swimmers and Pool staff. It may also create an unsafe condition as lifeguard stands at the Pool are 8-10 feet above the water surface and entry into the Pool from that height is more dangerous when the water below the stand is shallow. The BSP HCP includes the ability to remove flood debris as necessary using a vacuum dredge. This technique has been successful in the past and consists of a vacuum pump anchored to a floating platform within the Pool. An intake hose is lowered into the water and suction is used to remove the deposited material and water into holding tanks.

Flood debris removal is anticipated to result in harassment of salamanders due to indirect disturbances to salamander habitat in the form of noise from the vacuum dredge. Flood debris removal is not conducted within salamander habitat areas within the Pool, but may be conducted adjacent to salamander habitat within the downstream areas of the Pool. Noise from the vacuum dredge may harass salamanders and disrupt feeding, breeding, and sheltering during flood debris removal. The effect of this activity would be short-term and regular removal of accumulated flood debris will improve flow conditions within the Pool by reducing turbulence and multi-directional water flow at the downstream dam. An increase in laminar flow would help to inhibit deposition of sediment and other material during future floods. A single flood debris removal accomplished through vacuum dredging in 2006 under the 1998 HCP did not result in detrimental effects on salamanders or their habitat within the Pool or within Eliza Spring.

Conservation measures in the BSP HCP for flood debris removal include restoration and maintenance of more natural flow regimes within the spring sites, and development and implementation of a plan for silt and gravel removal within the Pool.

Spring Water for Cleaning and Irrigation

The BSP HCP proposes to use spring water for routine cleaning and to irrigate the Pool grounds immediately adjacent to Barton Springs Pool and Eliza Spring. A pump would be installed on the north bank of the Pool near the downstream dam and the intake would be placed over 100 feet downstream of salamander habitat.

Use of spring water for routine cleaning within the Pool has a long term beneficial effect to salamanders by eliminating the use of chlorinated drinking water during cleaning. Use of spring water for irrigation has the potential to create long-term detrimental effects to salamanders and salamander habitat if withdrawal of this water deprives salamanders and other aquatic life of a sufficient quantity of water to support feeding, breeding, and sheltering. The BSP HCP proposes to withdraw no more than 6,006,000 gallons of water per year and all irrigation will follow the City's conservation regulations. This amount of water is equivalent to 0.2% of the total annual discharge from Barton Springs using the lowest recorded instantaneous discharge value of 9.6 cfs applied for an entire year. Irrigation of areas adjacent to the Pool and Eliza Spring are beneficial in both the short-term and the long-term by ensuring healthy vegetation along the riparian corridors, which provides organic inputs into salamander habitats.

Conservation measures included in the BSP HCP for use of spring water for cleaning and irrigation include minimization of the impacts of removal of spring water by locating the pump outside of salamander habitat and limiting the amount water that may be removed annually, management of riparian habitats of all four spring sites, and participation by the City in regional water resource planning. Management of riparian habitats at all four spring sites is especially important within an urban park such as Zilker Park where all four spring sites are located. The riparian zone around each spring site contributes nutrient inputs that serve as food sources for salamander prey as well as providing shade to keep water temperature low and dissolved oxygen high.

Habitat Restoration

The BSP HCP includes several habitat restoration projects that are designed to improve flow regime and remove habitat modifications that fragment surface salamander habitat and also prohibit connections between surface and subsurface salamander habitat. These modifications are the result of man-made structures and impoundments around spring sites originally constructed to enhance public use at Barton Springs Pool, Eliza Spring, and Old Mill Spring. Habitat restoration at each site focuses on removal or modification of these structures and is described in detail in Appendix B of the BSP HCP.

Habitat restoration projects are anticipated to result in harm (injured or killed) and harassment of salamanders due to direct and indirect disturbances to salamander habitat. Individual salamanders may be harassed, injured, or killed when present within the proposed restoration areas in the Pool, Eliza Spring, or Old Mill Spring. This can be through unintentional trapping of salamanders within construction isolation devices such as cofferdams, stranding of salamanders during dewatering of cofferdams, and contact with construction equipment or construction materials that may injure or kill salamanders. Additionally, the introduction of construction

equipment into and adjacent to salamander habitat is likely to subject salamanders to noise and vibration over the course of the restoration project. Although these projects will have short-term detrimental effects to salamanders while habitat is being restored, the long-term effect to individual salamanders and populations of both species will be beneficial. Habitat restoration will restore a more natural flow regime to spring sites and improve the connection between surface and subsurface habitats which will allow salamanders more opportunity to retreat to subsurface habitat when surface habitat conditions are poor. This improved access to subterranean habitat directly enhances a primary constituent element of the designated critical habitat for the Austin blind salamander

Conservation measures in the BSP HCP for habitat restoration including a commitment to complete proposed restoration projects within Eliza Spring and Old Mill Spring, respectively, within three years of permit issuance, supplementing low dissolved oxygen conditions in the Pool, Eliza Spring, and Old Mill Spring when necessary, maintaining a captive breeding program for both species within City facilities, and continuing the Barton Springs Scientific Advisory Committee.

Effects to Critical Habitat for Austin Blind salamander

Each of the actions described above occurs within designated surface and either directly above, or in the case of habitat restoration within, subsurface critical habitat for the Austin blind salamander. The primary constituent elements of flowing groundwater, rocky substrate with interstitial spaces, aquatic invertebrates for food, and access to the subsurface water table are all likely to be detrimentally impacted in the short-term either through disturbance as a result of the proposed actions. Effects of each action is likely to be detrimental in the short-term as surface habitat including rocky substrate with interstitial spaces for the Austin blind salamander will be disturbed by recreation within spring sites, routine cleaning of salamander habitat, surface habitat may be exposed for short durations during drawdowns in both the Pool and Eliza Spring, and rocky substrate in the Pool, Eliza Spring, and Old Mill Spring may be temporarily unavailable to salamanders during restoration projects. However, several of these actions would be beneficial in the long-term and would improve the quantity and quality of critical habitat for the Austin Blind salamander. Interstitial spaces within the rocky substrate will be maintained and improved by removing sediment from salamander habitat areas through routine cleaning. Access to flowing groundwater is improved through flow regime improvement within the spring sites, and access to the subsurface water table is improved through removing concrete fill or floors within the Pool, Eliza Spring, and Old Mill Spring. The removal of concrete through habitat restoration is extremely important within these critical habitat areas as it increases the connection between surface and subsurface habitat for both species. In addition, the BSP HCP proposes to restore the Eliza Spring outflow to a functioning surface stream that will create additional surface habitat for both species.

Take calculations

The City has incorporated data gathered during the prior 15 years that the 1998 HCP has been implemented in their incidental take estimated for the amended BSP HCP. This data has yielded both a salamander density for the various spring sites, broken down by area within the spring, as well as effectiveness of conservation measures for various recurrent activities.

The amount of take for both recurrent actions and discrete actions is calculated based on the area of salamander habitat within each spring that will be affected by the proposed action, multiplied by the calculated average Barton Springs salamander or Austin blind salamander density within each area, plus one standard deviation and rounded up to the next whole number (Tables 15-21 in the BSP HCP). For recurrent actions the number of salamanders calculated from the area of habitat multiplied by the density is then multiplied by the maximum number of that particular action, annually (for example 4 full drawdowns within Barton Springs Pool) to arrive at a total number of salamanders of each species that may be affected annually. The incidental take numbers are then further broken down into lethal and non-lethal take estimates based on the assumed effectiveness of conservation measures included in the BSP HCP. Example calculations are provided in Sections 5.2.1 and 5.2.2 of the BSP HCP. It is important to note that this take estimate is extremely conservative as adding one standard deviation to the density numbers may increase the calculated salamander density per square foot by a factor of two or more.

Table 1. Annual Incidental Take estimate from recurrent actions by spring site and salamander species anticipated from the BSP HCP.

Spring Site	Barton Springs Salamander	Austin Blind Salamander	Total by Spring Site
BSP	1121	31	1152
Eliza Spring	624	3	627
Old Mill Spring	54	16	70
Upper Barton Spring	66	0	66
Total By Species	1865	50	1915
20 year Total	37300	1000	

Table 2. One time Incidental Take estimate from discrete actions by spring site and salamander species anticipated from the BSP HCP.

Spring Site	Barton Springs Salamander	Austin Blind Salamander	Total by Spring Site
BSP	14	1	15
Eliza Spring	997	8	1005
Old Mill Spring	54	16	70
Upper Barton Spring	0	0	
Total By Species	1065	25	1090

It is anticipated that up to 1865 Barton Springs salamanders and up to 50 Austin blind salamanders may be taken annually as a result of recurrent actions proposed within the BSP HCP. It is further anticipated that up to 1065 Barton Springs salamanders and up to 25 Austin blind salamanders may be taken as a result of one-time discrete actions proposed within the BSP HCP. This results in a total of up to 38,365 Barton Springs salamanders and up to 1,025 Austin Blind salamanders that may be taken over the anticipated 20 year life of the permit. Up to 5 percent of the total estimated take of each species may be in the form of lethal take. The City has proposed numerous conservation measures, refined as a result of 15 years of implementation of the 1998 HCP, to minimize the amount of salamanders affected by proposed activities within the action area.

The temporal extent of the BSP HCP is 20 years, representing roughly 20-100 generations for these salamander species. The incidental take numbers estimated by the City do not represent the mortality of this number of salamanders, but rather the potential that salamanders present within habitat areas may be harassed once, multiple times, or not at all as a result of covered activities within the action area. The City of Austin has included multiple conservation measures for each activity to avoid and minimize the effect to the covered species. They have also included large scale habitat restoration projects to help mitigate for the potential loss and/or harassment of salamanders due to operations and maintenance of Barton Springs Pool. Harassment of this number of salamanders within each spring site is not anticipated to have a long-term effect on salamander abundance and population size as implementation of the 1998 HCP has shown that salamanders continue to feed, breed, and shelter within these spring sites after disturbance due to human activities.

Cumulative Effects

Cumulative effects include the effects of future State, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

An undetermined number of future land use conversions and habitat conversions that are not subject to Federal authorization or funding and may alter the habitat or increase incidental take of species covered by this opinion and are, therefore, cumulative to the proposed project. These additional cumulative effects include: (1) increased pumping demands due to urbanization within the Edwards Aquifer; (2) increased impervious cover due to urbanization, (e.g., roads); (3) increased recreational activities; (4) contaminated runoff from agriculture and urbanization; (5) aquatic habitat modification (e.g., dams, bank stabilization, flood control); and, (6) habitat alteration by invasive exotic / non-native species.

Groundwater withdrawal from the Barton Springs area is regulated by the Barton Springs Edwards Aquifer Conservation District (BSEACD) according to Texas state law and a separate 10(a)(1)(B) permit and HCP for take of Barton Springs' *Eurycea* salamanders resulting from future groundwater withdrawal is in development by the BSEACD. The City's amended HCP includes the commitment to develop a memorandum of understanding with the BSEACD to formalize conservation efforts for both salamander species within the first year of permit issuance.

Conclusion

After reviewing the current status of the Barton Springs salamander, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Barton Springs salamander or the Austin blind salamander and is not likely to destroy or adversely modify critical habitat for the Austin blind salamander. No critical habitat has been designated for the Barton Springs salamander; therefore, none will be affected.

The amended BSP HCP would allow for incidental take of salamanders from recreation, operations, maintenance, and habitat restoration at Barton Springs Pool, Eliza Spring, Old Mill Spring, and Upper Barton Spring. The majority of the authorized take will be non-lethal harassment of salamanders from full and partial drawdowns within Barton Springs Pool and habitat cleaning, recreation, and restoration within all four spring sites. In addition several restoration activities are proposed as a one-time incidental take of salamanders due to the need to remove concrete from the floor of Eliza Spring and from the fissures in Barton Springs Pool. These restoration activities will improve the connection between surface and sub-surface habitat for both the Barton Springs salamander and the Austin blind salamander. Critical habitat for Austin blind salamander will continue to serve its intended conservation role for the species and the primary constituent elements of flowing groundwater, rocky substrate with interstitial spaces, aquatic invertebrates for food, and access to the subsurface water table will remain unchanged or will be improved within the action area as a result of implementation of the HCP and 10(a)(1)(B) permit.

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 by the Service as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harass is further defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to a listed species by annoying it to such an extent as to significantly disrupt normal behavioral patterns, which include, but are not limited to, breeding, feeding and sheltering (50 CFR §17.3). Harm is also further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by impairing behavioral patterns, including breeding, feeding, and sheltering. Incidental take is defined by the Service as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act, provided that such taking is in compliance with this Incidental Take Statement.

The BSP HCP and its associated documents clearly identify anticipated impacts to affected species likely to result from the proposed taking and the measures that are necessary and appropriate to minimize and mitigate these impacts. All conservation measures described in the proposed HCP, together with the terms and conditions described in any associated Implementing Agreement and any Section 10(a)(1)(B) permit or permits issued with respect to the HCP 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(i). 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. If the permittees fail 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 amount or extent of incidental take anticipated under the BSP HCP, associated reporting requirements, and provisions for disposition of dead or injured animals are as described in the HCP and its accompanying section 10(a)(1)(B) permit.

Amount or Extent of Take

The Service anticipates incidental take of Barton Springs salamanders and Austin blind salamanders will occur as a result of the proposed action. Individual Barton Springs and Austin blind salamanders are difficult to detect unless they are observed, undisturbed, in their environment. For both salamander species, incidental take, from covered activities are expected to occur in the form of harm and harassment through direct loss of habitat and adverse effects resulting from the issuance of an incidental take permit under Section 10(a)(1)(B) of the Act.

The following amount of incidental take will be authorized by the permit:

1. No more than 38,365 Barton Springs salamanders.
2. No more than 1,025 Austin blind salamanders.

Some City personnel are currently authorized for take by their individual section 10(a)(1)(A) permits. Any work conducted pursuant to valid permits will be covered for incidental take as prescribed in the individual permit conditions.

Effect of the Take

In the accompanying biological opinion, the Service has determined that this level of anticipated take is not likely to result in jeopardy of the Barton Springs salamander or the Austin blind salamander or destruction or adverse modification of designated critical habitat for the Austin blind salamander due to the limited effects associated with the proposed actions and the commitment to long term monitoring and adaptive management by the City. The BSP HCP is anticipated to benefit the Barton Springs salamander and Austin blind salamander in the long-term by promoting less obtrusive cleaning methods, continuing the existing protection for Eliza Spring and Old Mill Spring and proposing additional habitat restoration to these areas, and continuing the long term population monitoring and the captive management program for these species.

Reasonable and Prudent Measures

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize incidental take of covered species. The Service shall:

1. Require the Applicant to fully implement the BSP HCP and comply with all terms and conditions of the issued section 10(a)(1)(B) incidental take permit; and avoid and minimize harassment and harm of Barton Springs salamanders and Austin blind

salamanders during covered activities within Barton Springs Pool, Old Mill Spring, Eliza Spring, and Upper Barton Spring.

Terms and Conditions

To be exempt from the prohibitions of section 9 of the Act, the Service must ensure compliance with the following terms and conditions, which implement the reasonable and prudent measures, described above and outline required reporting and monitoring requirements. The Applicant shall be responsible for complying with these terms and conditions, which are non-discretionary.

The following terms and conditions implement the first reasonable and prudent measure:

1. The authorization granted by the permit is subject to compliance with all terms and conditions contained in the permit.
2. Ensure that the City minimizes incidental take of Barton Springs salamanders and Austin blind salamanders, in the form of harm (injure or kill) or harassment by fully implementing the *Barton Springs Pool Habitat Conservation Plan* dated July 2013; and,
3. Ensure that the City fully mitigate the effects of the taking of Barton Springs salamanders and Austin blind salamanders from Covered Activities, as described in the *Barton Springs Pool Habitat Conservation Plan*.

The following term and condition implements the second reasonable and prudent measure:

1. Require the City to limit drawdowns within Barton Springs Pool to no more than 4 full drawdowns per year and eight partial drawdowns per year exclusive of floods when the combined Barton Springs complex discharge is equal to or greater than 54 cfs; and,

Permit terms and conditions:

- A. General conditions set out in subpart d of 50 CFR 13, and specific conditions contained in federal regulations cited in block #2, above, are hereby made a part of this permit. All activities authorized herein must be carried out in accordance with and for the purposes described in the application submitted. Continued validity, or renewal, of this permit is subject to complete and timely compliance with all applicable conditions, including the filing of all required information and reports.
- B. The validity of this permit is also conditioned upon strict observance of all applicable state, local, tribal, or other federal law.
- C. Valid for use by permittee named above.
- D. Acceptance of the permit serves as evidence that the Permittee (City of Austin) agrees to abide by all conditions stated. Terms and conditions of the permit are inclusive. Any activity not specifically permitted is prohibited. Please read through these conditions carefully as violations of permit terms and conditions could result in your permit being suspended or revoked. Violations of your permit terms and conditions that contribute to a violation of the Endangered Species Act (ESA or Act) could also subject the Permittee to criminal or civil penalties.

- E. The authorization granted by this Permit will be subject to full and complete compliance with, and implementation of, the Barton Springs Pool Habitat Conservation Plan, dated July 2013, and all specific conditions contained therein. These Permit terms and conditions shall supersede and take precedence over any inconsistent provisions in the Habitat Conservation Plan or other program documents.
- F. If, during the tenure of this permit, the project design and/or the extent of the habitat impacts is altered, such that there may be an increase in the anticipated take of the covered species, the Permittee is required to contact the Service's Austin Ecological Services Office and obtain an amendment to the permit before commencing any construction or other activities that might result in take beyond that authorized by the permit. If authorized take is exceeded, all activities that are shown to cause take must immediately cease and any take above that authorized shall be reported to the Austin Ecological Services Field Office (512/490-0057) within 48 hours.
- G. If actions associated with implementation of the Barton Springs Pool Habitat Conservation Plan are shown to result in incidental take of listed species not covered by the permit, those activities that are shown to cause take must immediately cease and any take that has occurred shall be reported to the Austin Ecological Services Field Office (512/490-0057) within 48 hours.
- H. The City will redraw the footprint of protected salamander habitat in Barton Springs Pool to include more habitat that is and can be maintained for salamander residence and exclude unsuitable habitat based on monitoring data and habitat condition for Service approval. The total square footage of protected habitat in Barton Springs Pool will not be less than that delineated in the 1998 Habitat Conservation Plan (14,500 ft²) and will be consistent with the habitat area as delineated by the July 2013 HCP.

CONSERVATION MEASURES

- I. The City will develop habitat management plans for each spring site and submit them to the Service for approval.
- J. The City will restrict access to Eliza and Old Mill springs. Eliza Spring and Old Mill Spring may be used as outdoor educational facilities for the study of covered salamanders and the biology and ecology of Central Texas springs.
- K. The City will continue public use of Barton Springs Pool and Upper Barton Spring for recreation, including, but not limited to, wading, swimming, and snorkeling.
- L. The City is authorized to remove up to 6,006,000 gallons per year of spring water from Barton Springs Pool for irrigation of pool grounds and routine cleaning.
- M. The City is authorized to maintain manicured lawns along the riparian corridor of Barton Springs Pool and Eliza Spring.

- N. The City will maintain historic structures and anthropogenic flow regime alterations, including the historic amphitheaters around Eliza Spring and Old Mill Spring and the concrete dams and walls of Barton Springs Pool.
- O. The City will inspect habitat at least 4 days per week. If problems are discovered, the City will take appropriate action to protect salamanders and their habitat. Appropriate actions may include but are not limited to repairing damage from vandalism, removal of trash, and removal of introduced exotic fish or animals.
- P. The City will prohibit unauthorized, deliberate disturbance of salamander habitat.
- Q. The City will not allow unauthorized SCUBA in Barton Springs.
- R. The City will conduct routine cleaning of spring sites, which may include the removal of nuisance algae, excess sediment, and other natural materials from Barton Springs Pool, Eliza Spring, Old Mill Spring, and Upper Barton Spring.
- S. No more than 4 full drawdowns and no more than 8 partial drawdowns of Barton Springs Pool will be conducted annually for maintenance and cleaning.
- T. The City will not conduct full drawdowns if the combined discharge of the Barton Springs complex is less than 54 ft³/s. The City will maintain a written plan with protocols for conducting Barton Springs Pool drawdowns. The 54 ft³/s threshold may be revised with the approval of the Service if habitat restoration or changes in substrate elevation allow maintenance of wetted surface habitat at lower discharges.
- U. During drawdowns, trained and permitted City salamander biologists and staff under their direct supervision will visually inspect all exposed habitat for stranded salamanders before cleaning and maintenance activities in those areas begin. Any stranded salamanders will be moved to permanent water by permitted City salamander biologists.
- V. A minimum of 2 City biologists will be present during full drawdowns and a minimum of 1 City biologist will be present at all partial drawdowns.
- W. During drawdowns, water level in Eliza Spring will be inspected to ensure that water is retained in surface habitat of the spring pool.
- X. Spring water will be used for cleaning and maintenance of Barton Springs Pool to the maximum extent feasible. Only spring water will be used to clean salamander habitat and to provide water over fissures during drawdowns to prevent stranding of salamanders.
- Y. The City is authorized to clean the shallow end of Barton Springs Pool without full drawdown of water in the entire Pool.
- Z. The City may clean sediment and debris from habitat as necessary with low-pressure spring water. Salamander habitat will be cleaned using low pressure (not to exceed 30 lb/in²) spring water to keep at least 2 inches of habitat from becoming embedded with

sediment. Water for cleaning may be obtained by recirculation through submersible pumps, or other methods approved by the Service. Material removed during routine cleaning will not be disposed of in salamander habitat.

- AA. The City is authorized to manually trim and remove submerged vegetation as necessary. Only permitted City biologists are authorized to manage vegetation in salamander habitat. Vegetation removed from salamander habitat will be inspected for salamanders prior to removal.
- BB. The City may remove woody debris as necessary. Only permitted City biologists are authorized to remove debris in salamander habitat. Debris removed from salamander habitat will be inspected for salamanders prior to removal.
- CC. Barton Springs Pool may be drawn down in advance of a flood with approval of City biologist according to Service approved drawdown plan.
- DD. As needed, the City may conduct drawdowns of the water level in Barton Springs Pool and Eliza Spring for post-flood pool cleaning.
- EE. The City may remove flood-debris from Barton Springs Pool by vacuum dredging or other Service-approved method.
- FF. The City will develop a plan for routine silt and gravel removal from the deep end of Barton Springs Pool within one year of permit issuance and submit it to the Service for written approval.
- GG. The City will control local surface water runoff into salamander habitats to the maximum extent feasible. Polluted stormwater may be diverted away from Barton Springs Pool or treated using structural best management practices prior to entering Barton Springs Pool. These controls do not include stormwater runoff collecting in Barton Creek that causes basin-wide flooding that can inundate the springs.
- HH. The City will reconstruct or restore salamander habitat within Barton Springs Pool, Eliza Spring, Old Mill Spring, and Upper Barton Spring to the maximum extent feasible. This activity includes:
 - 1. Restoration (daylighting) of the outflow stream from Eliza Spring, which currently travels underground and flows into the bypass structure.
 - 2. Removal of the concrete floor in Eliza Spring and restoration of the natural substrate in the spring pool.
 - 3. Replacement of a portion of masonry wall in Old Mill Spring with adjustable gates to improve outflow from the spring pool.
 - 4. Removal of excess rock, trash, and debris from Old Mill Spring to restore the natural elevation of the spring pool and enhance the directional flow of water from the spring.

5. Removal of concrete over the upstream fissure area in Barton Springs Pool to enhance flow of water from the springs.
 6. The City will improve and maintain suitable substrate in habitat areas and will only use limestone gravel or cobble if substrate is added.
- II. The City will not allow introduction of exotic plants or animals in any spring in the Barton Springs Complex.
- JJ. Barton Springs Pool lifeguards and maintenance staff will be trained and knowledgeable about the protected aquatic salamander species.
- KK. The City will maintain a catastrophic spill response plan and will provide yearly spill response training and maintain an inventory of necessary containment and remediation equipment.
- LL. The City will reduce contaminant loadings to Barton Springs through a Texas Pollutant Discharge Elimination System Municipal Separate Storm Sewer System Discharge Permit.
- MM. Specific areas will be designated for fueling and maintenance of equipment and vehicles at least 25 feet away from habitat. Absorbent pads will be used underneath or around all equipment, supplies, and vehicles containing toxic components during all operations, fueling and maintenance activities.

INCIDENTAL TAKE

- NN. The permit only authorizes incidental take of the following 2 species (covered species):

<u>Common Name</u>	<u>Scientific Name</u>	<u>ESA Status</u>
Barton Springs salamander	<i>Eurycea sosorum</i>	Endangered
Austin blind salamander	<i>Eurycea waterlooensis</i>	Endangered

- OO. Incidental take authorized for the 20 year duration of this permit:
1. No more than 1,865 Barton Springs salamanders in any one year and no more than 37,300 for the duration of this permit for recurrent activities specified in the July 2013 HCP.
 2. No more than 50 Austin blind salamanders in any one year and no more than 1,000 for the duration of this permit for recurrent activities specified in the July 2013 HCP.
 3. No more than 1,065 Barton Springs salamanders for the duration of this permit for discrete restoration activities specified in the July 2013 HCP.

4. No more than 25 Austin blind salamanders for the duration of this permit for discrete restoration activities specified in the July 2013 HCP.
5. Total take authorized by this permit is 38,365 Barton Springs salamanders and 1,025 Austin blind salamanders.
6. Lethal take for each species will not exceed 5% of the total take authorized by this permit.

PP. The City will move salamanders between sites or reintroduce captive salamanders to the wild only according to a Service approved plan.

REFUGIUM AND CAPTIVE BREEDING PROGRAM

QQ. The City will maintain a captive refugium population of salamanders and develop a captive-breeding program. The City will ensure that all people working with captive endangered salamanders are properly trained and supervised by permitted City biologists. All activities at the refugium and with the captive breeding program will be conducted under the terms and conditions of a current federal Endangered Species Act 10(a)(1)(A) scientific permit issued to the City of Austin.

1. The City will develop and maintain written plans for population management, reintroduction, and husbandry. These plans will be updated as necessary.
2. The City will designate a staff biologist and dedicate a minimum of \$28,000 annually to the development and maintenance of this program.
3. The program will provide captive salamanders suitable for reintroduction into the wild if catastrophic events occur.
4. The program may provide a refugium facility for salamanders collected in response to contaminant spills or other immediate threat that could cause extirpation of the species in the wild.
5. The program will also support research that contributes to elucidation of biology, life history and natural history of both species.

COVERED AREA (PLAN AREA)

RR. The permit only authorizes incidental take of covered species within property owned by the City of Austin within Zilker Park that encompasses subterranean and surface aquatic environments and supporting riparian terrestrial habitat around Upper Barton Spring, Old Mill Spring, Eliza Spring, and Barton Springs Pool.

CHANGED CIRCUMSTANCES

SS. The Barton Springs Pool HCP provides measures for the following changed circumstances (Section 8.3 of the HCP):

1. Catastrophic events leading to temporary loss of habitat (hazardous material spills, temporary dewatering).
2. Permanent loss of habitat or habitat degradation from global climate change.
3. Covered species become de-listed.
4. Covered species become extinct.
5. Unintentional introduction of invasive plants that modify salamander habitat or conditions in the Pool.
6. Unintentional introduction or increase in population of non-native predators in habitat areas.
7. Unintentional failure of dams or floodwater bypass altering water levels of Barton Springs Pool.
8. New information published in scientific literature establishes detrimental effect levels for *Eurycea* salamanders or appropriate surrogate amphibians resulting from exposure to sunscreen products or other personal care products introduced to Barton Springs Pool from recreational activities.

MONITORING REQUIREMENTS

- TT. The City of Austin shall monitor the covered activities and ensure appropriate and relevant information (as specified below) on the covered activities is provided to the Service.
1. The Permittee will monitor compliance with the HCP and provide an annual report as described below.
 2. The Permittee will develop a monitoring program to determine if progress is being made toward meeting the long-term biological goals and objectives.
- UU. The City will develop and maintain a written monitoring plan to be approved by the Service.
- VV. The City will continue to regularly monitor salamander populations bi-monthly, or on another Service approved schedule.
- WW. The City will ensure that all people conducting salamander and habitat monitoring are properly trained and supervised by permitted City biologists. All monitoring and surveys will be conducted under the terms and conditions of a current federal Endangered Species Act 10(a)(1)(A) scientific permit issued to the City of Austin.

REPORTING REQUIREMENTS

XX. The City of Austin will provide an annual report, due on February 1 of each year, to:

U.S. Fish and Wildlife Service
Austin Ecological Services Field Office
10711 Burnet Road, Suite 200
Austin, Texas 78758

U.S. Fish and Wildlife Service, Region 2
Habitat Conservation Plans and Research Permits
P.O. Box 1306, Room 6034
Albuquerque, New Mexico 87103

1. The report will document the activities and City of Austin's permit compliance for the previous year, thus documenting progress toward the goals and objectives of the HCP and demonstrating compliance with the terms and conditions of the incidental take permit. The annual report will include (Section 6.4 in the BSP HCP):
 - a. Number of drawdowns conducted per year and associated cfs level.
 - b. Assessments of the status of both salamander species.
 - c. Analysis of biological data collected during surveys of spring sites and through captive refugium management.
 - d. Review of Barton Springs Pool maintenance and management activities during the year.
 - e. Number of flood events and outcome of any debris removal completed.
 - f. Changes to any habitat management or drawdown plans.
 - g. Assessments and timing of any proposed or completed restoration projects within any of the spring sites.
2. The report will document BSP HCP Management activities, including:
 - a. Adaptive management activities undertaken during the year.
 - b. Expenditures by the City of Austin on restoration activities.
 - c. Proposed restoration activities for the next year.
 - d. Report on the status of implementation of minimization and mitigation measures and their effectiveness.
 - e. Interim updates and final copies of any research, thesis or dissertation, or published studies accomplished in association with the BSP HCP.

- f. Any changes to the objectives for the monitoring program.
 - g. Effects on the Covered Species or Permit Area.
 - h. Any recommendations regarding actions to be taken.
3. Information provided in the annual report will be used to determine what, if any, adaptive management strategies should be implemented to most effectively implement the conservation program outlined in the BSP HCP and to ensure that management changes in response to new, appropriate data are implemented in a timely fashion.

FUNDING

- YY. At least \$45,000 will be provided annually to salamander education efforts. Educational signs will be installed to enhance public awareness of the salamander and the aquifer.
- ZZ. The City will provide \$53,000 annually for the conservation fund. A committee of technical representatives will determine the allocation of money from this fund. At a minimum, the committee will consist of one technical representative from the City and one technical representative from the Service that are knowledgeable and experienced in salamander biology. The City and the Service would both retain “veto” power in deciding how the money is allocated and may be used for the study of salamander biology, captive breeding, refugium development, reintroduction, watershed related research, improved cleaning techniques for natural water bodies, education and/or land acquisition.
- AAA. The City will provide \$28,000 annually to the development and maintenance of the refugium and captive breeding program.
- BBB. The City biologists and Barton Springs staff are employees of the Watershed Protection and Parks and Recreation departments, respectively, and are funded by the City of Austin.

GENERAL TERMS AND CONDITIONS

- CCC. The City will cooperatively develop a memorandum of understanding with the Barton Springs Edwards Aquifer Conservation District to formalize collaborative efforts to protect the covered species and the Barton Springs Segment of the Edwards Aquifer.
- DDD. The City will participate in regional water resource planning that may affect the Barton Springs Segment of the Edwards Aquifer and advocate for protection of water quality and quantity adequate to protect the covered species.
- EEE. Upon locating a dead, injured, or sick individual of the covered species, or any other endangered or threatened species, the Permittee is required to contact the Service's Law Enforcement Office in Austin, Texas, (512) 490-0948 for care and disposition instructions. Extreme care should be taken in handling sick or injured individuals to

ensure effective and proper treatment. Care should also be taken in handling dead specimens to preserve biological materials in the best possible state for analysis of cause of death. In conjunction with the care of sick or injured endangered/threatened species, or preservation of biological materials from a dead specimen, the Permittee has the responsibility to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

- FFF. Conditions of the permit shall be binding on, and for the benefit of, the Permittee and any successors and/or assignees. If the permit requires an amendment because of change of ownership, the Service will process it in accordance with regulations (50 CFR 13.23). The new Permittee must meet issuance criteria per regulations at 50 CFR 13.25. The covered activities proposed or in progress under the original permit may not be interrupted provided the conditions of the permit are being followed.

Conservation Recommendations

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

1. Assist with efforts to monitor and improve the water quality of runoff from the Austin area to the Barton Springs system including but not limited to stormwater associated with roads, and residential and commercial development.
2. Assist with restoration and protection of native riparian vegetation near Barton Springs Pool, Eliza Spring, Old Mill Spring, and Upper Barton Spring.
3. Assist with efforts to further reduce the likelihood of traffic accidents and contaminant spills near Barton Creek and its tributaries.
4. Assist with the implementation of recovery tasks identified in the Barton Springs Salamander Recovery Plan.

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

Review Requirements

The reasonable and prudent measures, with their implementing terms and conditions, are designed to avoid, minimize, and mitigate effects of incidental take that might otherwise result from the issuance of the permit and implementation of the associated BSP HCP. If, during the course of the authorized activities, the level of incidental take is exceeded prior to the annual review, such incidental take represents new information requiring review of the reasonable and prudent measure provided. The Austin Ecological Services Field Office must immediately provide an explanation of the causes of the taking and review the need for possible modification of the reasonable and prudent measures with the Chief of Endangered Species, Southwest

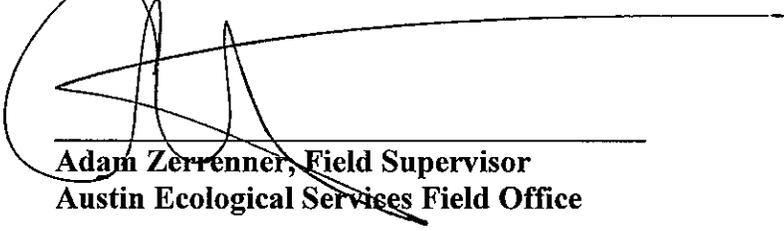
Regional Office. This biological opinion will expire at the expiration of the incidental take permit issued to implement the BSP HCP.

Reinitiation Notice

This concludes formal consultation on the issuance of a Service 10(a)(1)(B) permit for the amended BSP Habitat Conservation Plan that minimizes and mitigates, to the maximum extent practicable, adverse effects to the endangered Barton Springs salamander and endangered Austin blind salamander from covered activities described in the HCP over a period of 20 years. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this consultation; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any activities causing such take must cease pending reinitiation.

If you have any questions regarding this biological opinion, please contact Tanya Sommer at 512/490-0057, extension 222.

Approved:



Adam Zerrenner, Field Supervisor
Austin Ecological Services Field Office

Aug. 26, 2013

Date

Concur:



Assistant Regional Director
Ecological Services, Region 2

9/12/13

Date

Non-concur:

Assistant Regional Director
Ecological Services, Region 2

Date

Literature Cited

- Brown, B. C. 1950. An annotated checklist of the reptiles and amphibians of Texas. Baylor University Press, Waco, Texas, USA.
- Chamberlain, D. A. and L. O'Donnell. 2003. City of Austin's captive breeding program for the Barton Springs and Austin blind salamanders (January 1-December 31, 2002). City of Austin Watershed Protection and Development Review Department annual permit (PRT-839031) report.
- Chippindale, P. T. 1993. Evolution, phylogeny, biogeography, and taxonomy of Central Texas spring and cave salamanders, *Eurycea* and *Typhlomolge* (Plethodontidae: Hemidactyliini). Dissertation, University of Texas at Austin, Austin, Texas, USA.
- Chippindale, P. T., A. H. Price, and D. M. Hillis. 1993. A new species of perennibranchiate salamander (*Eurycea*: Plethodontidae) from Austin, Texas. *Herpetologica* 49:248-259.
- Chippindale P.T., Price A.H., Wiens J.J., Hillis DM. 2000. Phylogenetic relationships and systematic revision of central Texas hemidactyliine plethodontid salamanders. *Herpetological Monographs* 14: 1-80.
- Chippindale, P.T. 2012. Status of newly discovered cave and spring salamanders (*Eurycea*) in southern Travis and northern Hays Counties. Final Section 6 Report, Texas Parks and Wildlife Department, Austin, Texas. 31 pp.
- City of Austin (CoA). 1997. The Barton Creek report. Austin, Texas, USA.
- _____. 1998. Final environmental assessment/habitat conservation plan for issuance of a section 10(a)(1)(B) permit for incidental take of the Barton Springs salamander (*Eurycea sosorum*) for the operation and maintenance of Barton Springs Pool and adjacent springs. Austin, Texas, USA.
- _____. 2000. Update of Barton Springs water quality data analysis. Austin, Texas, USA.
- _____. 2005. Update of Barton Springs water quality data analysis. Austin, Texas, USA.
- _____. 2007. Endangered Species Act section 10(a)(1)(B) permit for the incidental take of the Barton Springs Salamander (*Eurycea sosorum*) for the operation and maintenance of Barton Springs Pool and adjacent springs permit #PRT-839031. Annual Report 1 October 2006 - 30 September 2007. Austin (TX): City of Austin Watershed Protection and Development Review Department.
- Conant, R. and J. T. Collins. 1998. A field guide to reptiles and amphibians of eastern and central North America. Third edition expanded. Houghton Mifflin Company, New York, New York, USA.
- Gillespie, J.H. 2013. Application of stable isotope analysis to study temporal changes in foraging ecology in a highly endangered amphibian. *PLoS ONE* 8(1): e53041.

- Hillis D.M., Chamberlain D.A., Wilcox T.P., Chippindale P.T. 2001. A new species of subterranean blind salamander (Plethodontidae: Hemidactyliini: *Eurycea: Typhlomolge*) from Austin, Texas, and a systematic revision of central Texas paedomorphic salamanders. *Herpetologica* 57: 266-280.
- O'Donnell, L. A. Gluesenkamp, C. Herrington, M. Schlaepfer, and M. Turner. 2008. A comparison of two survey methods to estimate Jollyville Plateau salamander populations using surface counts and mark-recapture. City of Austin. March 2008. Austin, Texas, USA. _
- Pipkin, T. and M. Frech, editors. 1993. Barton Springs eternal. Softshoe Publishing, Austin, Texas, USA.
- Sweet, S. 1978. The evolutionary development of the Texas *Eurycea* (Amphibia: Plethodontidae). Dissertation, University of California, Berkeley, California.
- U.S. Fish and Wildlife Service (USFWS). 2005. Barton Springs Salamander (*Eurycea sosorum*) Recovery Plan. U.S. Fish and Wildlife Service, Albuquerque, NM.