




## MEMORANDUM

**TO:** Mayor and Council

**FROM:** Jorge L. Morales, P.E., CFM, Director  
Watershed Protection Department 

**DATE:** January 27, 2023

**SUBJECT:** Annual Report to U.S. Fish and Wildlife Service

The purpose of this memo is to notify Mayor and Council of our annual report to U.S. Fish and Wildlife Service in compliance with our permit to keep Barton Springs pool open. In September 2013, the U.S. Fish and Wildlife Service ("Service") amended the City of Austin's Endangered Species Act Section 10(a)(1)(B) Permit and renewed it for a period of 20 years. This permit covers incidental take of the federally protected Barton Springs and Austin Blind salamanders that may occur during operation and maintenance of Barton Springs Pool and the adjacent springs located in Zilker Park (Eliza, Old Mill/Sunken Garden, and Upper Barton springs).

In compliance with the measures set forth in the Barton Springs Pool Habitat Conservation Plan, the Watershed Protection Department (WPD) has submitted to the Service the report for year 2022. This report details the City's compliance with the 45 measures listed in the permit. A requirement of the annual reporting measure in the permit is to provide a copy of the annual report to the City Manager, Mayor and City Council.

If you need additional information, please contact Nathan Bendik, WPD Environmental Scientist Senior, at (512) 974-2040.

NB

Attachments: 10(a)(1)(B) Permit Report

**CC:** Spencer Cronk, City Manager  
Rey Arellano, Assistant City Manager  
Kimberly McNeeley, Director, Austin Parks and Recreation Department  
Katie Coyne, Assistant Director, Environmental Officer, Watershed Protection Department  
Donelle Robinson, U.S. Fish and Wildlife Service

**Annual Report January 2022 – December 2022**  
**Endangered Species Act Section 10(a)1(B) Permit for the Incidental Take of the Barton**  
**Springs Salamander (*Eurycea sosorum*) and Austin Blind Salamander (*Eurycea***  
***waterlooensis*) for the Operation and Maintenance of Barton Springs Pool and Adjacent**  
**Springs**  
**Permit # TE 839031-3**

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## Summary of Compliance

In Table 1 we specifically address each conservation measure as outlined in the Habitat Conservation Plan (HCP), note whether we were in compliance or not for 2022, and note any additional details where appropriate (see section 6.4 of the BSP HCP). This includes comments on proposed habitat restoration work as well as the status of various minimization and mitigation measures.

**Table 1.** Summary of compliance for each HCP measure.

Conservation Measure	Compliance Status
<b>6.1.1.1 The City will develop written habitat management plans for each spring site.</b> These plans will include ongoing activities to improve the quality of aquatic habitat and ecosystem health. This includes but is not limited to introduction of native aquatic plants and maintenance of adequate tree canopy cover. Habitat management plans will be provided to the Service for review within one year of permit issue. The City will revise these plans with the written or verbal approval of the Service as necessary.	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input checked="" type="checkbox"/> Measure Completed <input type="checkbox"/> Measure Needs Amendment Notes: Plans were submitted to the Service at the one-year anniversary of permit issuance.
<b>6.1.1.2 With the verbal or written approval of the Service, the City will redraw the footprint of protected salamander habitat in Barton Springs Pool</b> (Figure 16) 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. The total square footage of protected habitat in Barton Springs Pool will not be less than that delineated in the 1998 Habitat Conservation Plan.	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input checked="" type="checkbox"/> Measure Completed Notes: Figure 16 in HCP delimits the footprint.
<b>6.1.1.3 The City will be responsible for the management of aquatic and riparian habitats of:</b> <ol style="list-style-type: none"> <li>Barton Springs Pool and Parthenia Spring (fissures, springs, and Beach habitat; Figure 1),</li> <li>Eliza Spring (spring pool, outflow pipe and/or stream; Figure 1),</li> <li>Old Mill Spring (spring pool and outflow stream; Figure 1),</li> <li>Upper Barton Spring (spring and outflow streams; Figure 1).</li> </ol>	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed
<b>6.1.1.4 The City will continue improvement and maintenance of suitable substrates in salamander habitat.</b> If replacement of rocky substrate of salamander habitat is necessary, the City may use only limestone gravel or cobble in order to maintain the natural groundwater buffering of karst aquifers.	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed <input type="checkbox"/> Measure Needs Amendment See Table 3 below.

<p><b>6.1.1.5 The City will make visual inspections of all protected habitat areas (spring sites when flowing) at least four days a week.</b> City Parks and Recreation Department staff will be present at Barton Springs Pool when it is open and will visually inspect Parthenia Spring daily. Inspections will note any problem conditions such as vandalism, trash, debris, introduction of exotic fish or animals or disturbance of habitat. 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>	<p> <input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input checked="" type="checkbox"/> Measure Completed         </p> <p>Notes: Staff continues to remove trash and restore substrate to Upper Barton Spring following disturbances by park visitors. We have deployed floating signage to reduce disturbance in front of the springs at Barton Springs Pool.</p>
<p><b>6.1.1.6 The City will prohibit the following activities</b> to reduce harassment of <i>Eurycea sosorum</i> and <i>Eurycea waterlooensis</i> and protect associated habitat:</p> <ul style="list-style-type: none"> <li>(a) unauthorized, deliberate disturbance of salamander habitat, including substrate, aquatic vegetation, algae, and leaf litter or woody material from terrestrial vegetation,</li> <li>(b) unauthorized, deliberate disturbance or alteration of flow regime,</li> <li>(c) introduction of non-native flora or fauna into any salamander habitat or Barton Springs Pool,</li> <li>(d) unauthorized SCUBA in salamander habitat or Barton Springs Pool.</li> </ul>	<p> <input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed         </p> <p>Notes: Upper Barton Spring continues to see disturbances from recreating park visitors who build rock dams and leave trash at the site. A new sign was installed in this area in 2016 to give notice that these practices are prohibited. This year, a supplemental sign was added to discourage use of this spring as drinking water. We also regularly catch trespassers on our game cameras that are deployed at Sunken Garden and Eliza Spring and report them to authorities.</p>
<p><b>6.1.1.7 a. The City will clean salamander habitat as necessary</b> to keep at least the upper 2-3 inches of habitat from becoming embedded with sediment. Easily observable or measurable characteristics of physical habitat (<i>e.g.</i>, embeddedness, sediment depth or percent sediment cover) will be used as benchmarks for determining when to clean.</p> <p><b>b. All salamander habitats will be cleaned with the spring water of Barton Springs</b> at pressures not to exceed 30 lb/in<sup>2</sup> at the substrate and/or suspend rocks larger than 4 inches in diameter. Water for cleaning may be obtained by recirculation through submersible pumps, or other methods acceptable to the Service.</p>	<p> <input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed         </p> <p>Salamander habitat around the spring outlets are surveyed on a quarterly basis and the upper layer of habitat is searched and flushed of sediment during surveys to reduce embeddedness. Sedimentation continues to be a problem at Old Mill Spring, where the water depth and slow velocities make it very difficult to alleviate the embeddedness without destroying all habitat. Therefore, we have been allowing mosses and other plants to re-establish themselves in the hope that this provides adequate cover in lieu of non-embedded rocky substrate on the bottom of the pool. The shallow areas along the sides continue to be flushed of sediment during surveys where we frequently find salamanders.</p>

<p><b>6.1.1.8 The City may remove woody debris from aquatic habitat if necessary by hand</b> or any methods approved by the Service through verbal or written correspondence. All debris removed from salamander habitat will be visually inspected for salamanders and their prey before and after removal. Live salamanders will be noted and returned to the water. Live prey will be returned to the water as much as is feasible.</p>	<p> <input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed            No woody debris was removed from habitat during 2022.         </p>
<p><b>6.1.1.9 Sediment, algae and debris disturbed or collected during routine cleaning of the Pool will not be disposed of in, allowed to settle in, or otherwise adversely affect aquatic habitat.</b></p>	<p> <input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed            A temporary silt fence is placed within the pool to prevent excess sediment disturbed by cleaning activities from traveling into salamander habitat during drawdowns.         </p>
<p><b>6.1.1.10 The City will minimize the detrimental impacts of withdrawal of spring water from Barton Springs Pool for irrigation and aquatic habitat cleaning</b> by taking the following actions. The City will locate the intake for the pump inside Barton Springs Pool against the downstream dam but outside of habitat areas. The intake will be sufficiently baffled to reduce velocities and the likelihood of entrapment of salamanders on intake screens. Water withdrawn from Barton Springs Pool for irrigation will be used in a manner consistent with the other conservation measures of this plan, and irrigation water will not be allowed to runoff from the grounds back into the Pool. Withdrawal of water for irrigation will be limited to no more than 100 gallons/minute (0.2 ft<sup>3</sup>/s) and no more than 6,006,000 gallons will be withdrawn annually. This amount is equivalent to 0.2% of the total annual discharge from Barton Springs calculated using the lowest ever recorded instantaneous discharge value of 9.6 ft<sup>3</sup>/s applied for an entire year. Water withdrawn from Barton Springs Pool will be used for irrigation of only areas inside the fence surrounding Barton Springs Pool. The City will observe all watering restrictions applicable under City of Austin regulations when irrigating with water withdrawn from Barton Springs Pool.</p>	<p> <input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed            The Aquatic Division installed a second pump that has the capability to pump spring water during full drawdowns. The new system allows for full drawdowns as permitted in the plan.         </p>
<p><b>6.1.2.1 The City will reduce loadings of petroleum hydrocarbons, heavy metals and sediments to Barton Springs</b> from current development and other activities located within the Barton Springs Zone in areas subject to the City's jurisdiction. This reduction in loadings will be achieved through the measures set out in the City's Stormwater Management Plan as required by the City's Texas Pollutant Discharge</p>	<p> <input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed            Reports are available here:  <a href="https://www.austintexas.gov/departments/ms4-stormwater-permit-program">https://www.austintexas.gov/departments/ms4-stormwater-permit-program</a> </p>

<p>Elimination System (TPDES) storm water permit (report included in attachments). The City's TPDES Stormwater Management Plan includes specific monitoring and protection measures for the Barton Springs Zone to protect the water quality of Barton Springs.</p>	
<p><b>6.1.2.2 The City will control local surface water runoff around Barton Springs Pool, Eliza Spring, Old Mill Spring, and Upper Barton Spring to the maximum extent practical.</b> Runoff of storm water can carry sediment and potential pollutants directly into Barton Springs Pool and adjacent springs, which could adversely affect aquatic life. Stormwater may be diverted away from Barton Springs Pool or treated using structural best management practices prior to entering Barton Springs Pool. Runoff protection improvement projects will not have adverse effects on salamanders or their habitat. These controls do not include storm water runoff collecting in Barton Creek that causes basin-wide flooding that can inundate the springs.</p>	<p> <input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed         </p>
<p><b>6.1.3.1 The City will restore and maintain more natural flow regimes in Barton Springs Pool, Eliza Spring, and Old Mill Spring</b> by modifying, replacing or removing existing infrastructure. Restoration of free-flowing spring pools and overland streams at Eliza and Old Mill springs will improve and enlarge surface salamander habitat and improve habitat quality (see section 3.3.3). Restoration of a more natural flow regime in Barton Springs Pool by modification and/or replacement of dams, modification of the bypass culvert infrastructure, and suitable changes in management activities will improve aquatic habitat quality and ecosystem stability, as well as provide maximum operational flexibility. The City will develop plans for these restoration projects and, with concurrence of the Service, implement restoration. Flow regime improvements will not compromise water quality during baseflow.</p>	<p> <input type="checkbox"/> Full Compliance  <input checked="" type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed            Notes: See notes below for Eliza (6.1.4.1) and Old Mill (6.1.4.2) projects.         </p>

<p><b>6.1.3.2 The City will allow floodwater to pass through Barton Springs Pool as unimpeded as is feasible to restore or maintain a more natural disturbance regime</b>, which includes increased water velocities that inhibit excess settling of sediment and debris within the Pool confines. This will also reduce the need for dredging or other removal of accumulated flood debris from the Pool, thereby reducing potentially detrimental impacts of such projects on salamanders or their habitat. Some floodwater may continue to enter the bypass culvert and pass around the Pool. Prior to opening the gates in the downstream dam in preparation for potential flooding, Pool staff will confirm with City biologists that Eliza Spring is properly prepared according to the Drawdown Plan. In the event of a flash flood or potential flash flood, Pool staff will prepare the Pool grounds for flooding and coordinate with City salamander biologists in conducting flood-related drawdowns. The City may open dam gates for all floods according to procedures described in the Drawdown Plan.</p>	<p> <input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed  Please refer to Table 2 below. </p>
<p><b>6.1.3.3 The City, with concurrence of the Service, will develop and implement a plan for routine silt and gravel removal from the deep channel of the Pool</b> downstream of Parthenia Spring that does not compromise the continued survival of covered species. The Pool is bounded by upstream (southwest) and downstream (northeast) dams across Barton Creek. These dams cause accumulation of aquifer-borne silt as well as flood-borne silt and gravel within the Pool confines, altering flow regime and natural geomorphic processes. Removal of this material from the deep channel of the Pool has been and will continue to be necessary until the dams are modified, replaced, or removed. The plan will describe when the removal of material will occur and focus on vacuum dredging or other minimally invasive methods approved by the Service. The plan will be submitted to the Service within one year of the issuance of this permit and may be revised as necessary with the verbal or written approval of the Service.</p>	<p> <input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed  Notes: Plan was submitted to the Service at the one-year anniversary of issuance. PARD obtained permit SWF-2019-00344 from the Army Corps of Engineers in Ft. Worth, TX in 2019 which is valid for 5 years. A dredge was completed in 2022. Another dredging operation is planned to occur in March 2023. </p>

<p><b>6.1.3.4 The City will maintain a Drawdown Plan,</b> which will provide standard operating procedures for use when Pool water elevation is drawn down. This plan requires the approval of the Service and will be submitted to the Service prior to issuance of this permit. The Drawdown Plan will be updated as needed with concurrence of the Service.</p>	<p> <input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input checked="" type="checkbox"/> Measure Completed            Notes: A revised drawdown plan was submitted to the Service and approved July 16, 2016.         </p>
<p><b>6.1.3.5 The City will 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 ft<sup>3</sup>/s</b> without consultation and verbal or written concurrence of the Service. This measure is intended to prevent dewatering of surface habitat of Eliza Spring. When discharge is equal to or greater than 54 ft<sup>3</sup>/s, water can be maintained in surface habitat of Eliza Spring during a full drawdown, based on current substrate elevation. The 54 ft<sup>3</sup>/s threshold can be revised with the verbal or written approval of the Service if habitat restoration or changes in substrate elevation allow maintenance of wetted surface habitat at lower discharges.</p>	<p> <input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed         </p>
<p><b>6.1.3.6 Approval from a City Salamander Conservation Program salamander biologist is necessary before the water level in Barton Springs Pool may be drawn down</b> under any flow conditions.</p>	<p> <input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed         </p>
<p><b>6.1.3.7 When water level in Barton Springs Pool is drawn down for cleaning and maintenance, trained and permitted City salamander biologists and staff under their direct supervision will visually inspect all exposed habitat for stranded salamanders</b> before cleaning and maintenance activities in those areas begin. Any stranded salamanders will be moved to permanent water. Water level in Eliza Spring will be inspected to ensure that water is retained in surface habitat of the spring pool.</p>	<p> <input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed            Notes: see comments below on results of drawdown searches.         </p>
<p><b>6.1.3.8 A minimum of two City salamander biologists will be present when a full drawdown is conducted</b> for cleaning and maintenance, and a minimum of one City salamander biologist will be present when a partial drawdown is conducted for cleaning and maintenance.</p>	<p> <input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed         </p>



<p><b>6.1.3.9 The City may conduct 4 full drawdowns per year exclusive of floods, when the combined Barton Springs complex discharge is at least 54 ft<sup>3</sup>/s</b> at the time of drawdown. Exposed habitat will be kept wetted with spring water or creek water while staff searches for stranded salamanders. The City will maintain water over the fissures area during drawdown for cleaning in order to minimize the stranding of salamanders. After the fissures area has been searched for stranded salamanders, the area may be allowed to dry and be cleaned.</p>	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed
<p><b>6.1.3.10 The City may conduct eight partial drawdowns per year exclusive of floods when the combined Barton Springs complex discharge is equal to or greater than 54 ft<sup>3</sup>/s.</b> If the discharge is less than 54 ft<sup>3</sup>/s, partial drawdowns will only be conducted in consultation with the Service. The water depth over the beach will be maintained at greater than or equal to 12 inches and surface habitat in the adjacent perennial springs (Eliza and Old Mill) would not be allowed to go dry. This measure will minimize the impact of low aquifer levels at the adjacent perennial spring sites.</p>	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed
<p><b>6.1.4.1 Eliza Spring flow regime improvement will be implemented</b> to the maximum extent feasible to recreate historical salamander habitat by restoring the surface outflow stream. Presently, the outflow from the spring is routed through an underground pipe into the Barton Springs Pool bypass culvert and ultimately into Barton Creek downstream of Barton Springs Pool; there is no surface stream. The underground pipe is proposed to be “daylighted” and a natural surface stream created in its place. The new stream will be protected salamander habitat and access will be restricted. To fully recreate a free-flowing spring-fed stream system, the natural elevation and composition of the substrate in the spring pool will be restored to the maximum extent feasible. This will eliminate hindrance of aquifer flow to surface habitat and provide wetted surface habitat during low aquifer discharge conditions and drawdowns without hindering outflow from the spring pool. A natural substrate will also provide abundant avenues for movement to and from subterranean habitat, reducing the potential for stranding salamanders during drawdowns. The current outflow pipe may be repaired as necessary until the stream is restored. All restoration activities will be submitted to the Service and receive verbal or written approval before implementation. The City</p>	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input checked="" type="checkbox"/> Measure Completed <p>The project is complete, and salamanders have successfully colonized the stream (sometimes at greater densities than the spring pool itself; see the 10a1A permit report submitted Dec 15, 2022). WPD staff uses stones from the silt and gravel removal in the pool (6.1.3.3) for habitat improvement and maintenance at Eliza spring and stream.</p>

<p>will determine the feasibility of this restoration activity and submit an estimate of when construction activities may occur, if feasible, to the Service within 3 years of permit issuance.</p>	
<p><b>6.1.4.2 Old Mill Spring habitat restoration will be implemented</b> to the maximum extent feasible to eliminate permanent, immovable obstructions and hindrances to free outflow from the spring pool to its stream. Infrastructure associated with the plugged outflow pipe on the Tier 1 stone wall (immediately surrounding the spring pool) will be removed within 3 years of permit issuance if feasible. The elevation of the outflow streambed may be lowered to ensure free water flow from the spring pool to its stream. A community of native aquatic vegetation will be established, which will help mitigate effects of low spring discharge by releasing oxygen into the water. Canopy cover vegetation will be maintained or increased to provide shade over the spring pool and stream, which will help mitigate increased surface water temperature during seasonal periods of high air temperature. Remaining stone walls of the amphitheater outside of aquatic salamander habitat and the supporting riparian habitat (Tiers 2 – 4) may be rehabilitated or stabilized as necessary to ensure safety in publicly accessible areas. Plans will be submitted to the Service and receive verbal or written approval before implementation.</p>	<p> <input type="checkbox"/> Full Compliance  <input checked="" type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed         </p> <p>Notes: COA is currently reviewing the final preliminary engineering report for WPD’s portion of the Sunken Garden work, with design for the stream channel completed by January of 2024. Watershed Protection is currently working with the Parks and Recreation Department on the timeline for design and construction of the project, which will include stream restoration, historical, and interpretive elements.</p>
<p><b>6.1.4.3 The City will restore and permanently maintain groundwater flow and light penetration to the maximum extent feasible in salamander habitat of the fissures of Parthenia Spring.</b> The City will not artificially obstruct groundwater flow or artificially inhibit light penetration in the fissures habitat area. Restoration will include permanent removal of concrete in the natural fissures transmitting groundwater to the surface in Parthenia Spring. Small areas of concrete may be removed gradually using underwater hand tools. Large areas may be removed at one time during drawdown, which would allow use of larger construction tools and foster retreat of salamanders from work area. Removal methods will be chosen to minimize harassment of resident salamanders and subject to verbal or written approval of the Service</p>	<p> <input type="checkbox"/> Full Compliance  <input checked="" type="checkbox"/> Non-Compliance  <input type="checkbox"/> Measure Completed  <input checked="" type="checkbox"/> Measure Needs Amendment         </p> <p>Notes: City biologists have examined the concrete obstructions in the pool bottom and have concluded that viable habitat could not be created in these areas. Spring water does not appear to issue from these fissures and they are surrounded by unfractured bedrock without cover for salamanders. Most salamanders observed occur near the spring outlets and use gravel and cobble for cover. Because this area receives high velocities during floods, any cover added would be washed away. Therefore, COA believes it is not beneficial to proceed with removing concrete from these fissures.</p>

<p><b>6.1.5.1 The City may move salamanders among spring sites or release salamanders born in captivity</b> according to a Service-approved plan to maintain genetic diversity of the species. The four spring sites do not harbor genetically unique populations based on current genetic information. Transfer of individuals between sites will not adversely affect the genetic integrity of those populations and will maintain the genetic integrity of the species.</p>	<p> <input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed         </p> <p>Notes: This has not been implemented yet. The City continues to pursue necessary scientific investigations to facilitate development of a plan for submission to the Service for approval.</p>
<p><b>6.1.6.1 The City may manually trim and remove aquatic vegetation (macrophytes, bryophytes and algae) as necessary.</b> Vegetation management will not adversely affect habitat or compromise ecosystem health. Only City biologists listed under current federal Endangered Species Act 10(a)(1)(A) and state scientific permits are authorized to manage vegetation in salamander habitat areas.</p>	<p> <input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed         </p> <p>Please refer to Table 3 below.</p>
<p><b>6.1.6.2 Specific areas will be designated for the fueling and maintenance of equipment and vehicles used in maintaining the springs and surrounding areas.</b> Fueling and maintenance areas will be at least 25 feet away from the water to avoid the chance of detrimental impacts on the spring habitats or aquatic life. Absorbent pads will be used underneath or around all equipment, supplies, and vehicles containing toxic components during all operations, fueling and maintenance activities.</p>	<p> <input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed         </p>
<p><b>6.1.6.3 The City will clean the shallow end of Barton Springs Pool without full drawdown</b> of water level in the entire Pool. Adjustable gates in dams or similar water control devices may be used to conduct partial drawdowns that expose only the shallow end for cleaning.</p>	<p> <input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed         </p>
<p><b>6.1.6.4 The City will use spring water for cleaning</b> in Barton Springs Pool to the maximum extent feasible. The City will install an electrically powered pump system that provides spring water from Barton Springs Pool for cleaning of the Pool. The pump system may also be used to provide spring water for the fissures areas during Pool drawdown.</p>	<p> <input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed         </p>
<p><b>6.1.6.5 The City will prohibit use of toxic chemicals</b> for cleaning of the Pool.</p>	<p> <input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed         </p>

<p><b>6.1.7.1 The City will monitor salamander populations and habitat.</b> Salamander population surveys will be conducted at perennial Parthenia, Eliza, and Old Mill springs and at intermittent Upper Barton Spring when flowing at least bimonthly throughout the year or other 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. The City will develop and maintain a written monitoring plan. The City will ensure that all people surveying for salamanders are properly trained. Surveys can include methods to elucidate life history characteristics of both species. Methods will be evaluated by the Service and conducted under the terms and conditions of a valid federal Endangered Species Act 10(a)(1)(A) scientific permit issued to the City.</p>	<p> <input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed         </p> <p>Notes: Monitoring plans were emailed to the Service February 25, 2016. The City continues to survey all four spring sites on a quarterly basis, capturing as many salamanders as possible, and photographing them for individual identification. In 2018, the City ceased attempting to photograph individuals from Barton Springs Pool during dive surveys; these surveys seemed to have a higher mortality rate than other surveys and result in more individuals with gas bubble trauma. After a review of monitoring methods in 2020, there does not seem to be a more suitable alternative to capture-recapture for estimating abundance. Eliza Spring continues to serve as the bellwether for these populations.</p>
<p><b>6.1.7.2 Eliza Spring and Old Mill Spring will be used as outdoor educational facilities</b> for the study of the biology and ecology of Central Texas springs.</p>	<p> <input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed         </p> <p>WPD biologists facilitated tours and educational events with roughly 330 participants this year. We estimate over 1,200 school-aged children attended tours of the springs during the 2022 school year.</p>
<p><b>6.1.7.3 The City will ensure that Barton Springs Pool lifeguards and maintenance staff including seasonal employees are knowledgeable about the protected salamander species.</b> At a minimum, staff will be trained yearly about the protected salamanders, resident aquatic wildlife and flora and the ecology of Edwards Aquifer springs. Training will include contaminant spill and response protocols, proper containment techniques, and remediation. An inventory of necessary containment and remediation equipment will be conducted by Pool staff annually and after the use of equipment in response to any spill. City Parks and Recreation Department Aquatics supervisors will direct and document all cleaning procedures at the Pool.</p>	<p> <input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed         </p> <p>Two in-person lifeguard trainings and 1 in-person manager meeting were conducted this year. Additional training of the life guard temporary staff was completed virtually, with approximately 100 staff members viewing a training video put together by WPD. This training was presented to both the Barton Springs and Public Pools staff. The training was conducted as part of our virtual in-services training program.</p>
<p><b>6.1.7.4 The City will ensure that all people conducting salamander and habitat monitoring are properly trained.</b> 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.</p>	<p> <input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed         </p>

<p><b>6.1.7.5 The City of Austin will form the Barton Springs Scientific Advisory Committee</b>, which will include local and regional experts. The committee may be divided into subcommittees that focus on specific areas of expertise and will meet at least annually to discuss and refine Barton Springs' maintenance and environmental management activities. A variety of interests including swimming, biology, hydrogeology, and captive breeding may be represented on this committee. In addition, this committee will periodically review this Plan and make suggestions for needed amendments as deemed necessary. The Advisory Committee will also be responsible for helping identify potential revisions to the Plan and suggest adaptive management strategies. The City will be responsible for implementation of adaptive management strategies with verbal or written approval of the Service.</p>	<p> <input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed         </p> <p>We solicited feedback on funding priorities for the Barton Springs Salamander Conservation Fund and provided a copy of our recent publication. Staff did not meet in person.</p>
<p><b>6.2.1 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.</b> Unsupervised access to these sites is limited to individuals holding valid federal Endangered Species Act 10(a)(1)(A) and state scientific permits. Recreational access to Barton Springs Pool will continue to be permitted. Public access to Upper Barton Spring is not prohibited. Upper Barton Spring lies within the Barton Creek Greenbelt, and because of its location within the floodplain of Barton Creek it cannot be feasibly isolated from public access.</p>	<p> <input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed         </p> <p>Unauthorized access periodically occurs (documented on game camera) and we have reached out to authorities to help curb these incidents.</p>
<p><b>6.2.2 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.</b> Should a catastrophic spill threaten to extirpate <i>E. sosorum</i> or <i>E. waterlooensis</i> in the wild, the City may conduct a full or partial drawdown as necessary to rescue salamanders. The City will notify the Service in the event of a catastrophic spill. Trained and permitted City staff will search all exposed habitat area for salamanders.</p>	<p> <input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed         </p> <p>WPD's Spill Plan was activated on 7/8/2022 for a potable water line leak at 2100 Airole Way. Two samples were taken 12 hours apart at Eliza spring, chlorine levels did not exceed our thresholds and no additional response was required. The City is currently working in collaboration with USFWS SMARC staff to test chloramine toxicity in <i>Eurycea sosorum</i> in order to update the response tiers in the spill plan. For treated water spills, these tiers are currently based on free chlorine, and not chloramine, which is what Austin Water Utility uses to disinfect drinking water.</p>

<p><b>6.2.3 The City will maintain viable, evolutionarily fit captive breeding populations of <i>Eurycea sosorum</i> and <i>Eurycea waterlooensis</i>.</b> The City will designate a staff biologist and dedicate a minimum of \$28,000 annually to the development and maintenance of this program. This program may provide captive salamanders suitable for reintroduction into the wild if catastrophic events that compromise or cause extirpation of wild populations were to occur. This 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. The program will develop and maintain a captive population of each species that represents the genetic diversity of wild populations without compromising their size or fate by permanently removing individuals from the wild. This program is also intended to support research that contributes to elucidation of biology, life history and natural history of both species. The City will develop and maintain written plans for population management, reintroduction, and husbandry. These plans will be updated as necessary.</p>	<p> <input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed         </p> <p>WPD maintains a husbandry manual and the current population management plan, which also addresses reintroduction, was approved by the Service in 2019.</p>
<p><b>6.2.4 Under conditions when decreased dissolved oxygen concentrations may be harmful to salamanders, the City may supplement dissolved oxygen</b> in Eliza, Old Mill, and Parthenia springs using air pumps, water recirculation, or other method approved by the Service.</p>	<p> <input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed         </p> <p>Notes: This was not necessary during 2022.</p>
<p><b>6.3.1 The City of Austin will set up a for conservation and research efforts for <i>Eurycea sosorum</i> and <i>E. waterlooensis</i>.</b> The City will deposit \$53,000 annually (for the term of the permit) into this fund from the revenues generated by Barton Springs Pool. This fund will also be open to donations from any group or private individual. 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. These technical representatives must be knowledgeable and experienced in salamander biology. Other committee members could include state, county, university representative or other qualified biologists and karst aquifer hydrogeologists, and swimmer/stakeholder representatives. The City and the Service would both retain “veto” power in deciding how the money is allocated. The funds would be used for study of salamander biology, captive breeding, refugium</p>	<p> <input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed         </p> <p>WPD is now directly managing the conservation fund and has solicited applications both locally and nationally.</p>

development, reintroduction, watershed related research, improved cleaning techniques for natural water bodies, education and/or land acquisition.	
<b>6.3.2 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, <i>E. sosorum</i>, and the Austin Blind Salamander, <i>E. waterlooensis</i>.</b> These projects would be in addition to the regular monitoring already conducted under the permit and would be approved by the Service when applicable.	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed Please refer to the 10a1A report submitted Dec. 15, 2022 for detailed information about supported research.
<b>6.3.3 The City will continue to provide educational programs to enhance public awareness and community support for <i>Eurycea sosorum</i>, <i>Eurycea waterlooensis</i>, Barton Springs, and the Edwards Aquifer.</b> The SPLASH! Into the Edwards Aquifer Exhibit at Barton Springs Pool will continue to be a major focus of this effort. The mission of the SPLASH! Exhibit is to foster stewardship of the Barton Springs Segment of the Edwards Aquifer and Barton Springs through public education. The City of Austin Parks and Recreation Department will dedicate a minimum of \$10,000 annually from the revenues generated by Barton Springs Pool to the development and maintenance of this exhibit. The City of Austin Watershed Protection Department will make available at least \$35,000 annually for the support of exhibits and events, and maintaining museum operating hours at the SPLASH exhibit. Outdoor educational displays will emphasize the biology and ecology of Barton Springs and the Edwards Aquifer with an emphasis on the Barton Springs Salamander, <i>Eurycea sosorum</i> , and the Austin Blind Salamander, <i>Eurycea waterlooensis</i> .	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed The SPLASH! exhibit had 25,877 visitors in 2022. The Barton Springs Bathhouse Rehabilitation project will include a redesign of the SPLASH! exhibit. WPD and PARD are currently working on a new layout and educational materials, with a portion of the funding coming from the Salamander Conservation Fund.
<b>6.3.4 The City will cooperatively develop a memorandum of understanding with the Barton Springs Edwards Aquifer Conservation District</b> to formalize collaborative efforts to protect the Barton Springs Salamander, <i>Eurycea sosorum</i> , the Austin Blind Salamander, <i>Eurycea waterlooensis</i> , and the Barton Springs Segment of the Edwards Aquifer. The memorandum of understanding will be adopted by the City within one year of permit issuance.	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input checked="" type="checkbox"/> Measure Completed

<p><b>6.3.5 The City will participate in regional water resource planning</b> that may affect the Barton Springs Segment of the Edwards Aquifer and advocate for protection of water quality and quantity adequate to protect the Barton Springs Salamander, <i>Eurycea sosorum</i>, and the Austin Blind Salamander, <i>Eurycea waterlooensis</i>.</p>	<div data-bbox="824 91 1136 212"> <input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed </div> <div data-bbox="824 212 1409 510"> <p>Notes: The City continues to participate in regional water quality protection initiatives. This includes tracking wastewater discharge permits within the Barton Springs Zone, participating in a technical advisory group for aquifer storage and recovery, and planning the Kent Butler Summit, which was postponed due to the pandemic.</p> </div>
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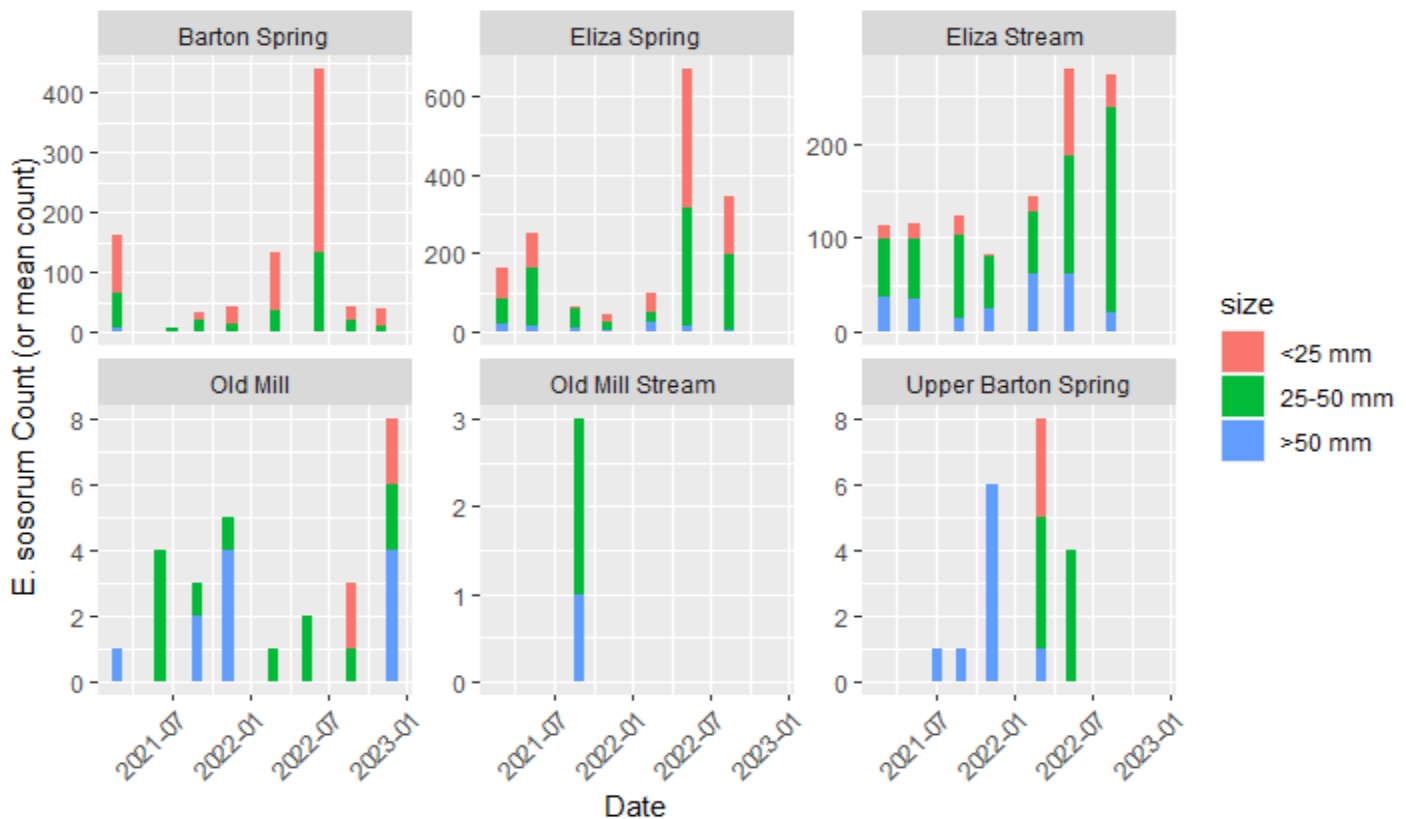
**a. Number of drawdowns conducted per year and associated spring discharge level.**

**Table 2.** Drawdown event details for Barton Springs Pool and number of observed salamanders.

Drawdown Start Date	Drawdown End Date	Drawdown level	Reason	Discharge USGS (cfs)	# stranded salamanders	Notes
2/28/2022 9:00	3/10/2022 12:00	Full	Spring Clean	67.6	1	One >2" TL salamander found on Bedicheck rock and moved to deeper water
4/14/2022 9:30	4/14/2022 17:00	Partial	Cleaning	46.8	0	Scheduled to do a full drawdown but discharge too low so just a partial.

## b. Assessments of the status of both salamander species.

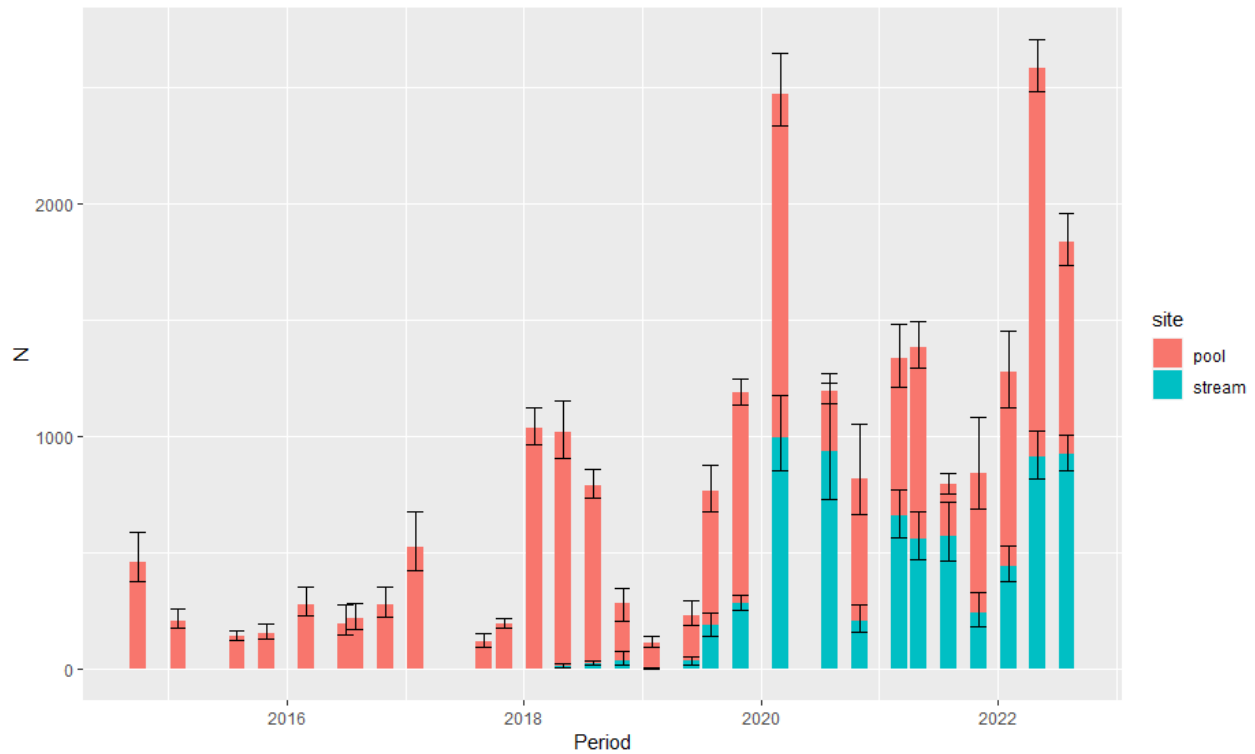
Assessments of species status are difficult for several reasons. Both *E. sosorum* and *E. waterlooensis* spend a considerable portion of their life underground (Hillis et al. 2001, Bendik et al. 2021). *Eurycea waterlooensis* are infrequently encountered at the surface, and comprise less than 2% of the total salamanders observed during drive surveys (Hillis et al. 2001, Bendik et al. 2019). Juveniles make up most of these observations, while increases in their abundances seem to be correlated to that of *E. sosorum* (Bendik et al. 2019). Therefore, the only assessment we can make is that *E. waterlooensis* continues to reproduce and appear at the surface. *Eurycea sosorum* continues to be frequently observed at the surface, often in high numbers at Eliza Spring and main Barton Spring (Parthenia Spring), but population dynamics can fluctuate widely (Bendik and Dries 2018). We observed large fluctuations in counts during the past year, which is typical (Figure 1). Robust estimates of population size at Eliza Spring from capture-recapture data suggest that patterns of abundance are correlated to count data—i.e., when counts go up, so does abundance (Figures 1 & 2). Pulses in abundance at the surface typically occur after large peaks lead to a recession in the discharge hydrograph (Figure 3).



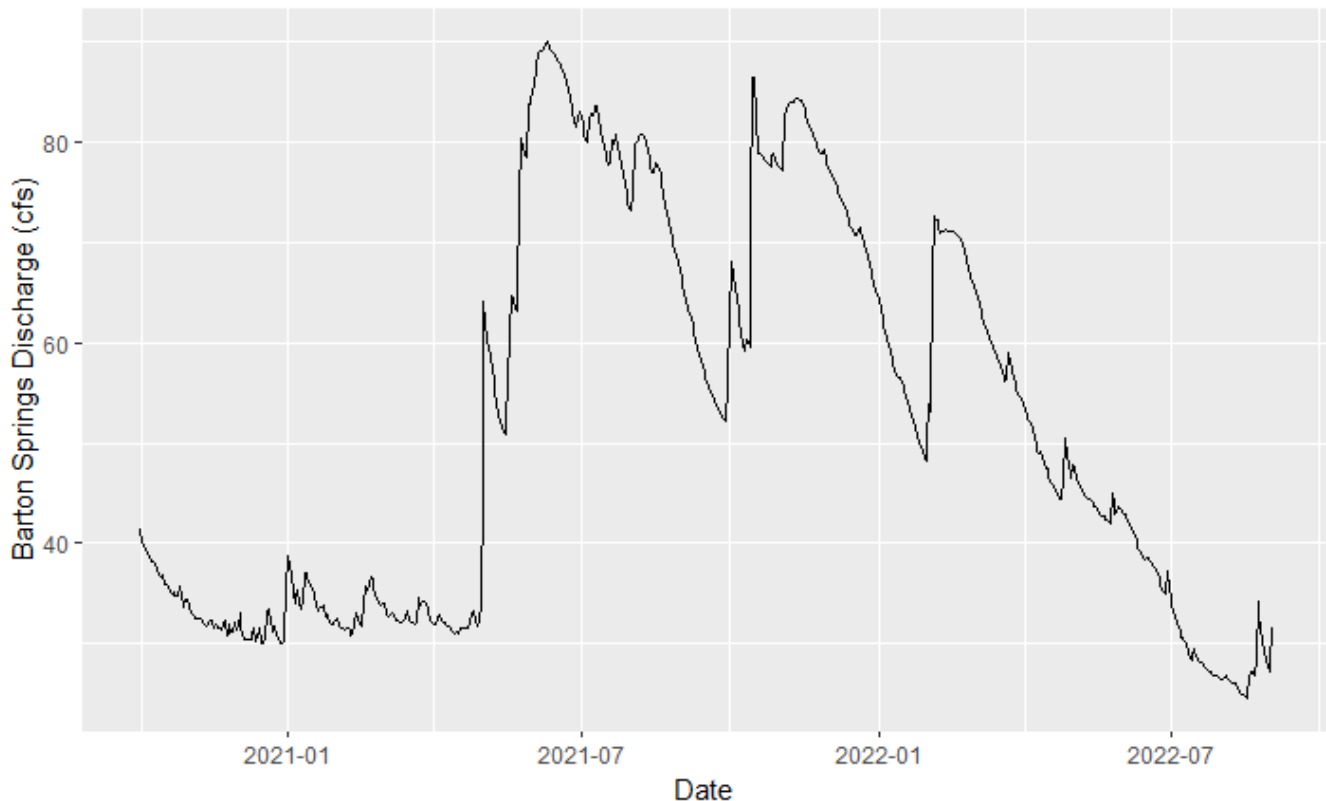
**Figure 1.** Counts by size class of *Eurycea sosorum* from 2020 through 2022. Quarterly surveys at Eliza are repeated three times within a week and are therefore shown as averages.

Abundances of *E. sosorum* remain low at Old Mill and Upper Barton Spring (Figure 1) and we can only speculate as to the potential causes. One possible explanation is that these sites may be low quality habitat—Upper Barton Spring because it frequently runs dry and incurs frequent disturbance from humans recreating; Old Mill because the outflow is constricted, and the deep pool conditions reduce flow velocity and encourage fine sediment deposition. Alternatively, or in conjunction with poor quality surface habitat, these sites may not receive enough immigration to maintain robust populations due to aquifer conditions particular to their associated recharge basins. Prior to habitat restoration at Eliza Spring in 2002, count surveys often indicated very low abundances of *E. sosorum*, although during some drawdowns, over 100 salamanders were observed. While these high abundances

were not maintained, this suggests that surface habitat may not have been adequate prior to restoration (either because it could not support them or was not attractive to them) even though periodic influxes of immigrants were high. In contrast, we have not counted more than a dozen individuals at Upper Barton Spring or Old Mill Spring within the past several years (Figure 1) although it is possible large influxes of abundance have periodically occurred but were not observed. Until we can improve habitat at Old Mill spring and directly test hypotheses about habitat quality and site colonization, we only have anecdotal explanations for the low observed abundances at this site.



**Figure 2.** Estimates of *E. sosorum* abundance ( $N$ ) at Eliza Spring's amphitheater pool and stream from October 2014 through August 2022. Error bars represent 95% credence intervals.



**Figure 3.** Discharge rates (cubic feet per second) at Barton Springs from 2020 through 2022.

Movement of *E. sosorum* between habitats is common, as individuals temporarily emigrate between the surface and the subsurface (Bendik et al. 2021). Abundance measured at the surface is often less than 50% of the abundance of the population associated with surface habitat. In other words, a large proportion of the salamander population of Eliza Spring is underground at any given time. Thus, a portion of the population dynamics observed in count data (e.g., Bendik and Dries 2018) and surface abundance estimates can be attributed to movements of individuals to and from the surface (Bendik et al. 2021). For this reason, short-term episodes of low surface abundance that we frequently observe are not, by themselves, cause for concern or necessarily an indication of imperilment of the local population as was once thought (e.g., City of Austin 1997).

**c. Analysis of biological data collected during surveys of spring sites and through captive refugium management.**

Additional data and analyses were included in the scientific permit report, submitted December 15, 2022.

**d. Review of Barton Springs Pool maintenance and management activities during the year.**

Routine and non-routine maintenance occurs at Barton Springs pool with assistance of the lifeguard team. Routine maintenance items include hosing the decks and pressure washing the stairs around the pool. Lifeguard teams also routinely use a fire hose with recirculated spring water to move sediment down the pool towards the dam gates.

Non-routine maintenance issues are resolved frequently at Barton Springs pools with various city representatives and contractors. Routine maintenance items covered this year were graffiti removal,

tree trimming, and pump maintenance which provides pool water for many of the routine cleaning items.

**e. Number of flood events and outcome of any debris removal completed.**

A dredging operation completed the removal of flood-deposited sediments from the downstream end of the pool during the spring clean. There were no flood events in 2022.

**f. Changes to any habitat management or drawdown plans.**

We decided that 30 cfs discharge rate at Barton Springs will now be our cutoff for routine drawdowns because the water level at Eliza spring became lower than we would like during a drawdown this past year. We did not make any other changes to habitat management or drawdown plans.

**g. Assessments and timing of any proposed or completed restoration projects within any of the spring sites.**

The expanded overland stream habitat at Eliza Spring has been colonized by *E. sosorum*, which may help boost the resilience of the local population. Abundances estimated within the stream were higher than those within the spring pool for the first time in the last two quarters of 2020 (Figure 2). Total abundance at Eliza Spring has been trending higher since the completion of the daylighting project, potentially indicating an increase in carrying capacity. Whether this translates to increased resilience of the species depends on the connectivity of these populations to those within the aquifer and throughout the range of *E. sosorum*.

Please refer to 6.1.4.2 for information on the timeline at Sunken Garden. A draft preliminary engineering report was recently completed for this project and is under review by City staff.

## Management Activities

### a. Adaptive management activities undertaken during the year.

We do not have any new adaptive management activities to report for 2022. Habitat management activities are presented below in Table 3.

**Table 3.** Habitat management log for 2022.

Date	Site	Description
3/2/2022	Eliza	Cleared out dead vegetation along the Eliza stream as well as trimmed vegetation back so that it was easier to walk along the stream.
3/4/2022	Pool and Old Mill	In an attempt to reduce the amount of large bass in the pool and reduce the amount of <i>Astyanax</i> and <i>Gambusia</i> in Old Mill, we caught two ~12 in. largemouth bass from the pool and released them in Old Mill.
3/4/2022	Eliza	Lowered Eliza to try and flush <i>Gambusia</i> down to keyway and catch them in a seine. Then with the lower water level, we seined the whole amphitheater twice. Removed ~180 <i>Gambusia</i> from the amphitheater and released into the main pool.
3/10/2022	Pool and Old Mill	Caught one bass (~ 1 foot long) and released it in Old Mill.
3/10/2022	Upper Barton	Moved some of the larger boulders to prevent people from being able to build dams and block water flow from the pool. Also tried to loosen up some of the cobble that was very imbedded but was not successful.
3/28/2022	Old Mill	Put fish trap out in the Old Mill pool for about an hour and a half and caught 20 <i>Gambusia</i> and 4 crayfish that were released downstream into Barton Creek.
3/29/2022	Old Mill	Put fish trap out in the Old Mill pool for a few hours and caught 40 <i>Gambusia</i> and 6 crayfish that were released downstream into Barton Creek.
4/14/2022	Eliza	Put fish trap out in Eliza amphitheater for about 8 hours although it did wash down into the stream by the gate at some point during the day. Caught ~50 <i>Gambusia</i> that were released into the main pool.
7/21/2022	Eliza	Pulled and trimmed vegetation growing in the cement of the amphitheater steps. Trimmed vegetation along the stream so that people can have better access.

Date	Site	Description
7/28/2022	Eliza	-During very low discharge period, algae had taken over about half of amphitheater and was creating anoxic sediment. We opened the gate to increase flow and then got in the water and manually flushed the algae and sediment from the pool and the stream into the bypass. Left water at a lower level to increase flow in amphitheater and reduce algae growth. -Put fish trap out for about an hour inside the Eliza amphitheater and caught ~30 <i>Gambusia</i> that were released into the main pool.
8/4/2022	Eliza	Put out one fish trap in the Eliza amphitheater for 6.5 hours and removed ~50 <i>Gambusia</i> and released them into the main pool.
8/8/2022	Eliza	Put out two fish traps in the Eliza amphitheater for a few hours and removed ~55 <i>Gambusia</i> and 1 crawfish and released them into the main pool.
8/17/2022	Eliza	Put out two fish traps while we did our quarterly survey (1 in the stream and 1 in the pool) and removed ~50 <i>Gambusia</i> total from Eliza and released them into the main pool.
8/19/2022	Eliza	Put out two fish traps while we did our quarterly survey (1 in the stream and 1 in the pool) and removed ~70 <i>Gambusia</i> total from Eliza and released them into the main pool.
9/7/2022	Eliza	-Added ~12 five-gallon buckets of cobble to the Eliza amphitheater near the top upstream end of the pool. The cobble came from the previous year's pool dredging. -Deployed two fish traps and left them for about 4 hours and removed ~70 <i>Gambusia</i> and 2 crawfish that were released into the main pool.
9/15/2022	Eliza	Pulled plants from amphitheater steps, trimmed back vines growing in and around amphitheater, and cut away ragweed growing along stream. We also cut back some trees that were growing through the fence along the stream so that we would be able to remove the fence in the event of a serious flood. Flushed some of the algae growing in the amphitheater pool to reduce the anoxic sediment and slow algal growth. Put out two fish traps for about 4 hours and caught ~40 <i>Gambusia</i> and 1 crayfish and they were released into the main pool.
10/20/2022	Eliza	Removed cattails that had started to grow on the upstream bank of the stream to prevent them from taking over.

**b. Expenditures by the City of Austin on restoration activities.**

The City did not implement any restoration activities and does not have any expenditures to report (beyond staff time for planning the Old Mill/Sunken Garden restoration).

The Barton Springs Salamander Conservation Fund balance through September 2022 was \$855,899.55. Expenses totaled \$26,042.38 and revenue totaled \$57,781.43. We estimate that around \$500,000 will be available for future disbursement based on commitments of \$354,000 in FY23.

**c. Proposed restoration activities for the next year.**

Please refer to 6.1.4.2 for information on the timeline for restoration activities at Sunken Garden.

**d. Report on the status of implementation of minimization and mitigation measures and their effectiveness.**

Please refer to Table 1.

**e. Interim updates and final copies of any research, thesis or dissertation, or published studies accomplished in association with the BSP HCP.**

We did not publish any new research in 2022.

**f. Any changes to the objectives for the monitoring program.**

In 2020, staff considered possible changes to our monitoring plan such as switching to an occupancy-based approach or repeated counts at Barton Springs. We concluded that these methods were not appropriate for these sites or for evaluating the status of populations, given the limited number of sites, size and accessibility of habitat, and the unique characteristics of each of the four outlet springs. Because the HCP was written prior to formal acknowledgement of *E. sosorum* inhabiting the aquifer beyond Barton Springs and documentation of new populations in the contributing zone (Devitt and Nissen 2018), consideration was not given to monitoring any of these populations. Now it may be prudent to consider whether periodic monitoring can be established at these additional sites, at least to generate some baseline information. Currently little is known about these smaller spring populations. Based on numerous field visits, abundance at the surface seems to be very low and the presence of salamanders is sporadic, although regular surveys have not been performed.

**g. Effects on the Covered Species or Permit Area.**

We have nothing to note regarding the effects on covered species or permit area.

**h. Any recommendations regarding actions to be taken.**

We do not have additional recommendations.



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