

**Annual Report October 1, 2004 — September 30, 2005**  
**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**

**Table of Contents**

Summary of Compliance	2
Summary of Salamander Status/ Biological Data	11
Pool Maintenance and Management Activities	15

## Summary of Compliance

Compliance Status	HCP Measure
<p><b>6.1.1</b> The City of Austin will coordinate the management of salamander habitat areas and be responsible for maintaining information and scientific data on the Barton Springs salamander. The City of Austin will also be responsible for the timely transmittal of information and data to the Service. The City of Austin will submit an annual report to the U.S. Fish and Wildlife Service, Austin Ecological Field Services Office, 10711 Burnet Road, Suite 200, Austin, Texas, 78758. The annual report will address the status of the salamander, provide an analysis of biological data, and review pool maintenance and management activities during the year. The City of Austin will be responsible for all measures in the HCP. In the annual report, each point of the HCP will be addressed. The permit and HCP will be for a period of 15 years. Copies of the annual report will also be submitted to the City Manager and City Council.</p>	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed <input type="checkbox"/> Measure Needs Amendment Notes:
<p><b>6.1.2</b> The City of Austin will make daily visual inspections of all habitat areas (spring sites) and note any problem conditions such as vandalism, trash and debris, introduction of exotic fish or animals, or disturbance of habitat.</p>	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed <input type="checkbox"/> Measure Needs Amendment Notes:
<p><b>6.1.3</b> When the pool is lowered for cleaning and maintenance, trained City of Austin staff will visually inspect all of the exposed areas of the pool for stranded salamanders. This visual inspection will also include Eliza Spring, Old Mill Spring (Sunken Garden), and Upper Barton Spring. Any stranded salamanders will be moved to permanent water. This measure will be in place upon the issuance of this permit. Until the dam or comparable water control device is installed in the shallow end of the pool, a minimum of four biologists will be present at drawdown to search for stranded salamanders. After installation of the water control device, a minimum of two biologists will be present when the pool is lowered.</p>	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed <input type="checkbox"/> Measure Needs Amendment Notes: Adjustable gates in the dam serve as water control devices during draw downs of the water level in the pool. See 6.1.4 below.
<p><b>6.1.4</b> The City of Austin will modify the existing gate system for the drawdown of the pool. The new gate system will be designed to control the rate of drawdown and the level of water in the pool. The current system is an all or nothing approach that does</p>	<input type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input checked="" type="checkbox"/> Measure Completed <input type="checkbox"/> Measure Needs Amendment Notes:

<p>not allow control or manipulation of the drawdown process, which is most critical during low aquifer conditions. The new gate system will be in place within six month of the issuance of this permit. If low aquifer conditions (flows less than 54 cubic feet per second) occur during this one-year period, the City of Austin will modify or suspend pool maintenance procedures (in consultation with the Service), to minimize and mitigate incidental take of salamanders.</p>	
<p><b>6.1.5</b> The City of Austin will install a pump system to provide spring water for pool maintenance. The pump system will also provide spring water for the fissures areas during pool drawdown. The pump would use spring water from the main pool. This measure will be in place within six months of issuance.</p>	<input type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input checked="" type="checkbox"/> Measure Completed <input type="checkbox"/> Measure Needs Amendment Notes:
<p><b>6.1.6</b> The City of Austin will clean the shallow end of Barton Springs Pool without drawdown of the entire pool. One option is to install a water control structure between the shallow and deep ends of the pool to create a permanent barrier between the cleaning operations and the main salamander habitat. The purpose of this water control structure is to eliminate the drawdown of the deep end during routine cleaning of the shallow end. This measure will be in place within six months of permit issuance. If the installation of the water control structure is not completed within the six-month deadline due to construction delays or adverse weather conditions, the City of Austin will modify or suspend pool maintenance procedures (in consultation with the Service), to minimize and mitigate incidental take of salamanders.</p>	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed <input checked="" type="checkbox"/> Measure Needs Amendment Notes: Proposed amendments will be submitted separately.
<p><b>6.1.7</b> The City of Austin will modify the beach areas in Barton Springs Pool. Portions of the beach areas will be replaced with walkways and wading areas made of exposed aggregate concrete, limestone or other hardened surface. The remaining beach area will be lowered to a minimum depth of 2 meters (6.5 ft.) and additional salamander habitat will be created to mitigate for any loss of habitat. This measure will be in place within six months of permit issuance.</p> <p><b>a)</b> The City may clean the walkway on an as needed basis (~ 1 per week) using pressure washers (underwater) or other agreed to means.</p> <p><b>b)</b> The salamander habitat would be cleaned using only low-pressure hoses or other agreed to means. This cleaning would be done quarterly or as needed to keep</p>	<input type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input checked="" type="checkbox"/> Measure Completed <input checked="" type="checkbox"/> Measure Needs Amendment Notes: Construction of walkways was abandoned in 1999 with the concurrence of the Service.  <b>a)</b> <input checked="" type="checkbox"/> Full Compliance  <b>b)</b> <input checked="" type="checkbox"/> Partial Compliance Notes: Appropriate equipment in use and additional cleaning is provided by substrate disturbance during

<p>the upper 2-3 inches of habitat from becoming embedded with sediment.</p> <p><b>c)</b> The City of Austin will maintain 11,000 square feet of “beach habitat” for the salamander. Gravel or cobble of appropriate size will be used to replace sections of the habitat that get washed out.</p> <p><b>d)</b> The City of Austin will clean non-salamander habitat areas in the deep end of the pool quarterly or as needed using a combination of high-pressure hoses and a vacuum system.</p>	<p>monthly surveys. Staff limitations prevent keeping upper layer of habitat in all four spring sites clean after floods.</p> <p><b>c)</b> <input checked="" type="checkbox"/> Partial Compliance  Notes: Beach habitat is available but not ideal salamander habitat due to accumulation of sediment resulting from lack of sufficient water flow over and through the substrate, and appropriate staff to conduct manual cleaning. The City is developing solutions to these problems as part of a revised habitat management plan.</p> <p><b>d)</b> <input checked="" type="checkbox"/> Full Compliance</p>
<p><b>6.1.8</b> The City of Austin will not drawdown the deep end of the pool if flow in the aquifer is lower than 54 cfs. This measure will minimize the impact of low aquifer levels at the adjacent spring sites, as well as conserve water in the aquifer during low flow conditions.</p>	<p><input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed  <input type="checkbox"/> Measure Needs Amendment  Notes:</p>
<p><b>6.1.9</b> The City of Austin will place thin limestone slabs over fissures in the shallow section of the fissures area to minimize impacts from recreational use.</p>	<p><input type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input checked="" type="checkbox"/> Measure Completed  <input checked="" type="checkbox"/> Measure Needs Amendment  Notes: Limestone slabs failed to maintain good quality habitat beneath; their use was abandoned in 2001.</p>
<p><b>16.1.10</b> The City of Austin will lower the water in the deep end of the pool, if necessary, for cleaning only with Service concurrence. The water in the deep end of the pool will not be lowered when the lowering would cause Eliza Spring to go dry. This measure will be in place after the water control structure is installed or an alternative is implemented.</p>	<p><input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed  <input type="checkbox"/> Measure Needs Amendment  Notes:</p>
<p><b>6.1.11</b> The City of Austin will maintain water over the fissure area during pool drawdown in order to minimize stranding of salamanders. The ability to retain water over the fissures will be in place at the time of permit issuance. The City of Austin will clean the fissure area quarterly or as needed, using a combination of low-pressure hoses and wire hand brushes or other agreed to means. In addition, until the water control structure is in place or the beach area is lowered, the City of Austin will use a spring water sprinkler system to keep the beach area wet during drawdown.</p>	<p><input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed  <input type="checkbox"/> Measure Needs Amendment  Notes:</p>
<p><b>6.1.12</b> The City of Austin will control surface water</p>	<p><input type="checkbox"/> Full Compliance</p>

<p>runoff around Barton Springs Pool, Eliza Springs, Old Mill Springs, and Upper Barton Springs. During heavy rains, storm water runoff can carry sediment and potential pollutants directly into Barton Springs, Eliza Springs, Old Mill, and Upper Barton Springs. Plans and schedules for the improvements, approved by the Service, will be complete within one year of the issuance of this permit. All of this work will be completed within two years of permit issuance. The City will also install temporary silt and erosion control measures in order to minimize adverse impacts due to surface water runoff. These measures will be in place upon issuance of the permit.</p>	<p><input checked="" type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed  <input type="checkbox"/> Measure Needs Amendment  Notes: All three perennial spring sites are protected from surface stormwater runoff. There are no artificial stormwater runoff protection structures at Upper Barton Spring at this time. The City is examining feasible methods for runoff control at this site.</p>
<p><b>6.1.13</b> The City of Austin will modify Old Mill Spring (Sunken Garden) to restore the natural surface spring flow into Barton Creek. The pipe that currently drains the spring will be capped. This improvement will be in place within one year of issuance of this permit.</p>	<p><input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input checked="" type="checkbox"/> Measure Completed  <input type="checkbox"/> Measure Needs Amendment  Notes: Additional work is necessary to better seal this pipe.</p>
<p><b>6.1.14</b> The City of Austin will improve the efficiency of the Barton Creek bypass. As currently designed, the cleaning grate at the upstream end of the bypass quickly becomes clogged during storms. The clogging of the grate decreases the efficiency of the bypass and increases the frequency of floods that affect Barton Springs Pool. A more efficient system will be in place within one year of issuance of this permit.</p>	<p><input type="checkbox"/> Full Compliance  <input checked="" type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed  <input type="checkbox"/> Measure Needs Amendment  Notes: The minor modifications in the bypass grate completed in 2000 appear to be inadequate under some conditions. The City is considering additional modifications.</p>
<p><b>6.1.15</b> The City of Austin will implement a program to increase public awareness and community support for the salamander and the Barton Springs portion of the Edwards Aquifer. The SPLASH! Exhibit at Barton Springs Pool will be a major focus of this effort.</p>	<p><input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed  <input type="checkbox"/> Measure Needs Amendment  Notes:</p>
<p><b>6.1.16</b> Access to Eliza Spring and Old Mill Spring (Sunken Garden) will be restricted to ensure no disturbance of salamander habitat at these spring areas. These sites will be used as outdoor educational facilities for the study of the biology and ecology of Central Texas springs. These measures will be in place within one year of permit issuance.</p>	<p><input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed  <input type="checkbox"/> Measure Needs Amendment  Notes:</p>
<p><b>6.1.17</b> Educational signs (kiosks) will be installed to enhance public awareness of the salamander and aquifer. Outdoor educational displays will highlight the biology and ecology of the Central Texas springs with emphasis on the Barton Springs Salamander. These</p>	<p><input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed  <input type="checkbox"/> Measure Needs Amendment  Notes:</p>

<p>measures will be in place within one year of permit issuance.</p>	
<p><b>6.1.18</b> The City of Austin will set up a fund for conservation and research efforts for the Barton Springs salamander. The City will deposit \$45,000 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 decide 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 experienced in salamander biology. Other committee members could include State, County, University, or other qualified biologists and karst aquifer hydrogeologists and swimmer/stakeholder representatives. The City and the Service would retain veto power in deciding how the money is allocated. The funds will be used for study of salamander biology, captive breeding and refugia, watershed related research, improved pool cleaning techniques, education, and/or land acquisition. The committee will decide how the money will best be spent. The funding will be in place within six months of permit issuance.</p>	<p><input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed  <input type="checkbox"/> Measure Needs Amendment</p> <p>Notes:  Two projects have been funded and are in progress. They are  1. Phylogeography of <i>Eurycea sosorum</i> populations  2. Toxicity of Coal-tar PAHs to <i>E. nana</i></p>
<p><b>6.1.19</b> The City of Austin will deposit \$10,000 (in addition to the \$45,000 mentioned above) into the conservation fund. This will mitigate for the incidental take that occurred as a result of cleaning the pool and operation from May 30, 1997 (listing effective date) to the date the permit is issued. The fund will be set up and the money deposited within 6 months of permit issuance.</p>	<p><input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input checked="" type="checkbox"/> Measure Completed  <input type="checkbox"/> Measure Needs Amendment</p> <p>Notes:</p>
<p><b>6.1.20</b> The City will prohibit the use of high-pressure hoses in salamander habitat.</p>	<p><input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed  <input checked="" type="checkbox"/> Measure Needs Amendment</p> <p>Notes: The text of the measure should be modified to more clearly prohibit use of high-pressure <i>water</i> not hoses.</p>
<p><b>6.1.21</b> The City of Austin may remove woody debris by any methods approved by the Service. All debris will be visually inspected for salamanders before and after removal.</p>	<p><input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed  <input type="checkbox"/> Measure Needs Amendment</p> <p>Notes:</p>

<p><b>6.1.22</b> In the event of a flash flood or potential flash flood, it is necessary to prepare Barton Springs Pool area to limit damage. To prepare for such an event, section of fence, trashcans, railings and other items are moved to higher ground. The endangered species biologist for the City of Austin will be notified before Barton Springs Pool is lowered. Barton Springs will not be lowered if flow is lower than 54 cfs or if the City of Austin endangered species biologist indicates that Barton Springs Pool should not be lowered.</p>	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed <input type="checkbox"/> Measure Needs Amendment Notes:
<p><b>6.1.23</b> The City of Austin may clean sediment and debris from the adjacent spring sites using low-pressure hoses or other agreed to means on an as needed basis.</p>	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed <input type="checkbox"/> Measure Needs Amendment Notes:
<p><b>6.1.24.</b> The City of Austin will not allow the introduction of exotic plants or animals in any springs in Zilker Park.</p>	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed <input type="checkbox"/> Measure Needs Amendment Notes:
<p><b>6.1.25.</b> The City of Austin will not move salamanders between spring sites.</p>	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed <input checked="" type="checkbox"/> Measure Needs Amendment Notes: Current small populations at each spring site are at severe risk of detrimental genetic effects (inbreeding, accumulation of deleterious mutations, reduced potential for evolutionary adaptation to environmental changes, etc.). Human mediated migration between sites may help prevent these population genetic effects. The results of a study funded under 6.1.18 will help determine if this measure needs amendment.
<p><b>6.1.26.</b> The City of Austin may manually trim aquatic vegetation that reaches the surface of the water.</p>	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed <input type="checkbox"/> Measure Needs Amendment Notes:
<p><b>6.1.27</b> The City of Austin will not allow unauthorized SCUBA in any springs in Zilker Park.</p>	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed

	<input type="checkbox"/> Measure Needs Amendment Notes:
<b>6.1.28</b> The City of Austin will prohibit the deliberate disturbance of substrate in the primary salamander habitat. This measure will be effective upon the issuance of this permit.	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed <input type="checkbox"/> Measure Needs Amendment Notes:
<b>6.1.29</b> Sediment and debris that is collected during routine cleaning of the pool will be removed from the pool and disposed of properly. This will be accomplished by pumping the material into a vacuum truck for disposal, irrigating the lawns or other agreed to means. The sediment and debris will not be dumped into Barton Creek as a means of disposal. This measure will be effective upon the issuance of this permit.	<input type="checkbox"/> Full Compliance <input checked="" type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed <input checked="" type="checkbox"/> Measure Needs Amendment Notes: Implementation of stated methods proved unfeasible. Full compliance is nearly impossible and not necessarily beneficial for the habitat. Development of more feasible methods of sediment control is in progress. However, amendment of the measure to allow the beneficial sedimentary layer to remain while controlling undesirable aspects should be considered.
<b>6.1.30</b> Since there is a seasonal rate of turnover in the staff involved in the pool cleaning process, the City of Austin will have professional supervisors direct and document all cleaning procedures at the pool. This measure will be in place upon the issuance of this permit.	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed <input type="checkbox"/> Measure Needs Amendment Notes:
<b>6.1.31</b> The City of Austin will ensure that all people working at the pool (lifeguards and other staff) are knowledgeable about the salamander. Yearly training will be given to teach staff about the salamanders and the ecology of the Edwards Aquifer springs. This measure will be in place upon the issuance of this permit.	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed <input type="checkbox"/> Measure Needs Amendment Notes:
<b>6.1.32</b> The City of Austin will ensure that all people surveying for salamanders are properly trained. The survey work should be done under the terms and conditions of a current scientific permit issued to the City of Austin. This measure will be in place upon the issuance of this permit.	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed <input type="checkbox"/> Measure Needs Amendment Notes:
<b>6.1.33</b> The City of Austin will provide yearly spill and response training for all staff that perform maintenance activities in and around the springs in Zilker Park. The annual training will address spill and response protocols, proper containment techniques, and remediation. An annual inventory of necessary	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed <input type="checkbox"/> Measure Needs Amendment Notes:

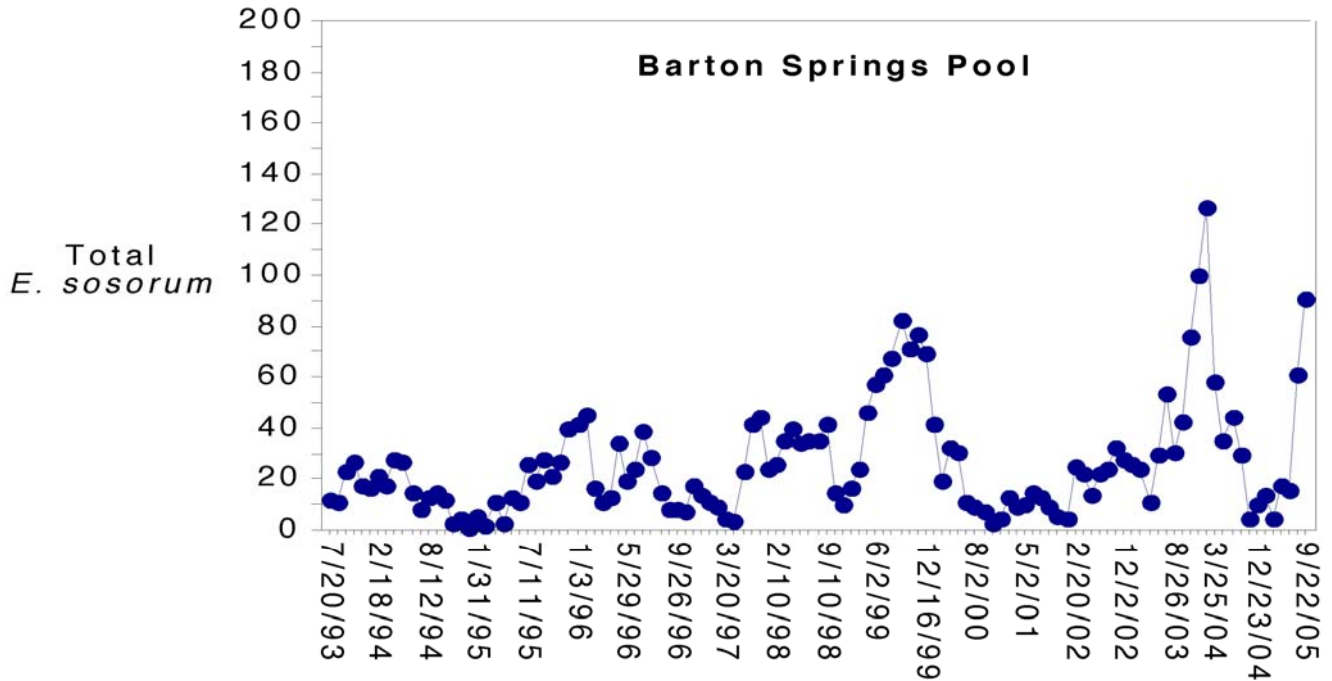
<p>containment and remediation equipment will be conducted during the training session, and after the use of the equipment in response to any spill. This measure will be in effect upon the issuance of this permit.</p>	
<p><b>6.1.34</b> Specific areas will be designated for the fueling and maintenance of equipment and vehicles used in maintaining the spring and areas around the springs. These areas should be selected away from the springs to avoid the chance of impacts to the spring habitats. Absorbent pads will be used during all operation, fueling, and maintenance activities. This measure will be in effect upon issuance of this permit.</p>	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed <input type="checkbox"/> Measure Needs Amendment Notes:
<p><b>6.1.35</b> The City, with concurrence of the Service, will develop a policy for silt and gravel removal in the deep end of the pool. In the past, removal in the deep end has been necessary after the pool has been flooded by Barton Creek, but the City does not have a policy that outlines when and how the removal of material should occur. The take estimate may change due to this policy but would probably be a minor amendment to the HCP. The new policy will be in place within one year of the issuance of this permit.</p>	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed <input type="checkbox"/> Measure Needs Amendment Notes:
<p><b>6.1.36</b> The City of Austin will, in concurrence with the Service, develop a catastrophic spill response plan for Barton Springs. The new plan will be in place within one year of the implementation of this permit. This plan will address spill prevention, containment, remediation, and salamander rescue.</p>	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed <input type="checkbox"/> Measure Needs Amendment Notes:
<p><b>6.1.37</b> Structural and habitat restoration will occur at Eliza Spring and Old Mill Spring. Habitat restoration will include enhancement of bottom substrate with clean cobble and gravel, and the establishment of native species of aquatic plants. Care will be taken to ensure that non-native invertebrates are not introduced. Old Mill Spring enhancement will include the restoration of full surface flow to the stream. All restoration efforts will be reviewed and approved by the Service before implementation. This work will be completed within two years of the issuance of this permit.</p>	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed <input checked="" type="checkbox"/> Measure Needs Amendment Notes: Habitat restoration is ongoing at all three perennial spring sites. However, the limited range of the species and the continued threat of habitat degradation indicate that habitat restoration must be ongoing. The measure should be amended to reflect this.
<p><b>6.1.38</b> The City of Austin will continue to conduct monthly surveys at all spring sites, in compliance with Federal and State Scientific Monitoring Permits.</p>	<input checked="" type="checkbox"/> Full Compliance <input type="checkbox"/> Partial Compliance <input type="checkbox"/> Measure Completed <input type="checkbox"/> Measure Needs Amendment Notes:
<p><b>6.1.39</b> The City of Austin will form an Advisory</p>	<input checked="" type="checkbox"/> Full Compliance

<p>Committee of local and regional experts that will meet at least annually to discuss and refine pool maintenance activities. A variety of interests including swimmers, biology and hydrogeology will be represented on this committee. In addition, this committee will review this HCP and make suggestions for needed amendments as deemed necessary. The Advisory Committee will also be responsible for refining the habitat conservation plan through adaptive management. Data collected will be used to adapt management actions. The City of Austin will be responsible for implementation of adaptive management changes.</p>	<p><input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed  <input type="checkbox"/> Measure Needs Amendment  Notes:</p>
<p><b>6.1.40</b> The City of Austin must reduce loadings of petroleum hydrocarbons, heavy metals and sediments to Barton Springs from current development and other activities located within the Barton Springs Zone, within the City limits, and subject to the City's jurisdiction. This reduction in loadings will be achieved through the measures set out in the NPDES storm water permit and its reasonable and prudent measures listed in Appendix A of the EA/HCP.</p>	<p><input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed  <input type="checkbox"/> Measure Needs Amendment  Notes:</p>
<p><b>6.1.41</b> The City of Austin will maintain a viable captive breeding population of Barton Springs salamanders. The City will designate a staff biologist and dedicate a minimum of \$20,000 annually to the development and maintenance of this program. The purpose of this program is to provide a contingency plan for the species if a catastrophic event were to occur. Funding and design of the new program will be in place within six months of the issuance of this permit.</p>	<p><input checked="" type="checkbox"/> Full Compliance  <input type="checkbox"/> Partial Compliance  <input type="checkbox"/> Measure Completed  <input type="checkbox"/> Measure Needs Amendment  Notes: A separate building housing captive salamander populations was completed in 2005 and will be occupied in 2006.</p>

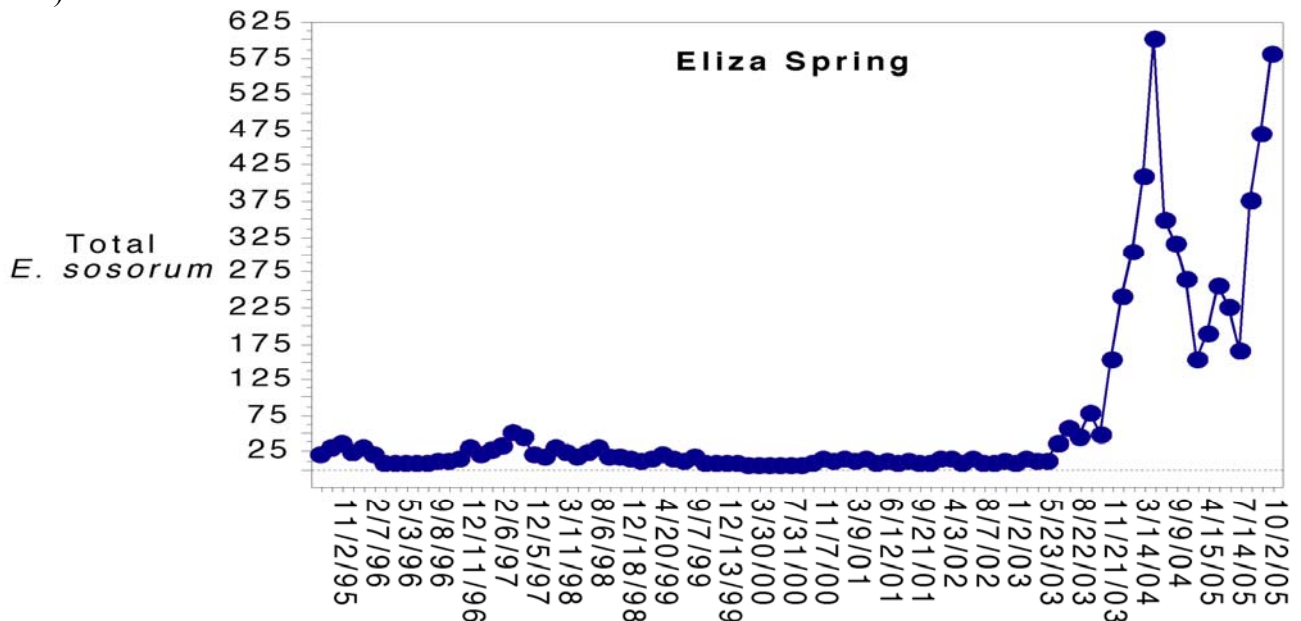
## Summary of Salamander Status/Biological Data

Monthly abundance of *Eurycea* salamanders is illustrated in the graphs below. Abundance is determined by censuses in the surface habitat at each spring site. Each graph shows salamander abundance for all years during which surveys occurred in A) Parthenia Spring, B) Eliza Spring, C) Zenobia Spring, D) Upper Barton Spring. Solid circles indicate the number of *E. sosorum*, open circles, *E. waterlooensis*. Zenobia Spring is the only site where *E. waterlooensis* are regularly found; one or two individuals are occasionally found in Eliza and Parthenia springs but are not included in the graphs. Periods of no surface water flow at Upper Barton Spring are indicated by the arrows.

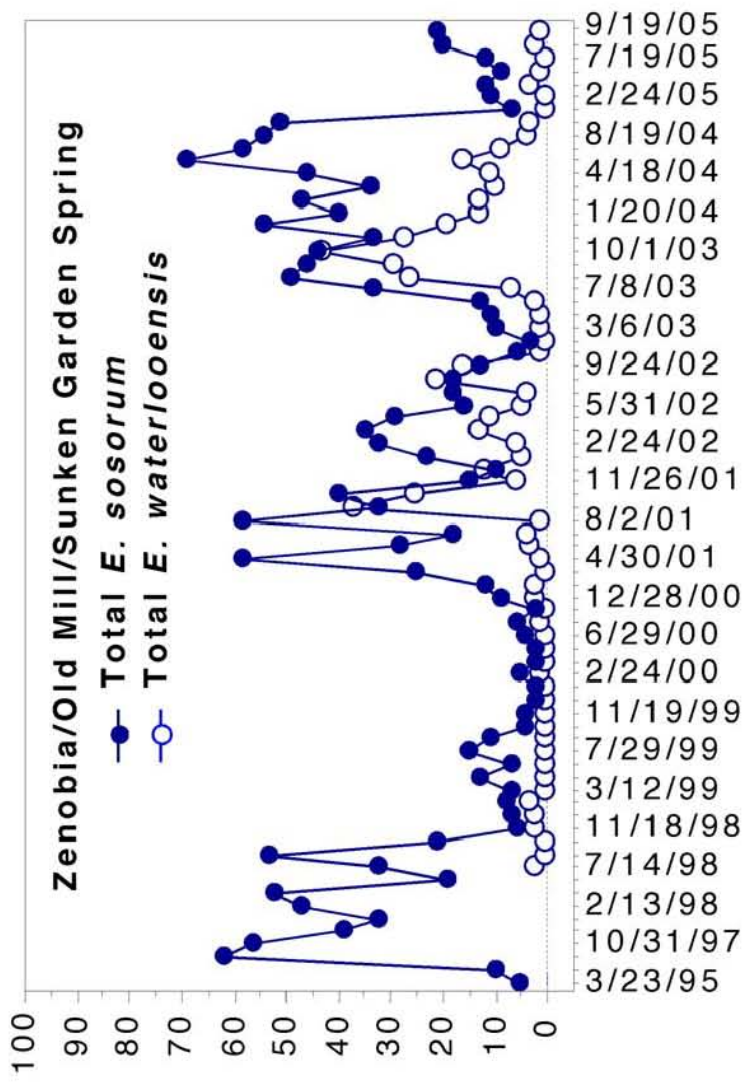
A)



B)



C)



D)

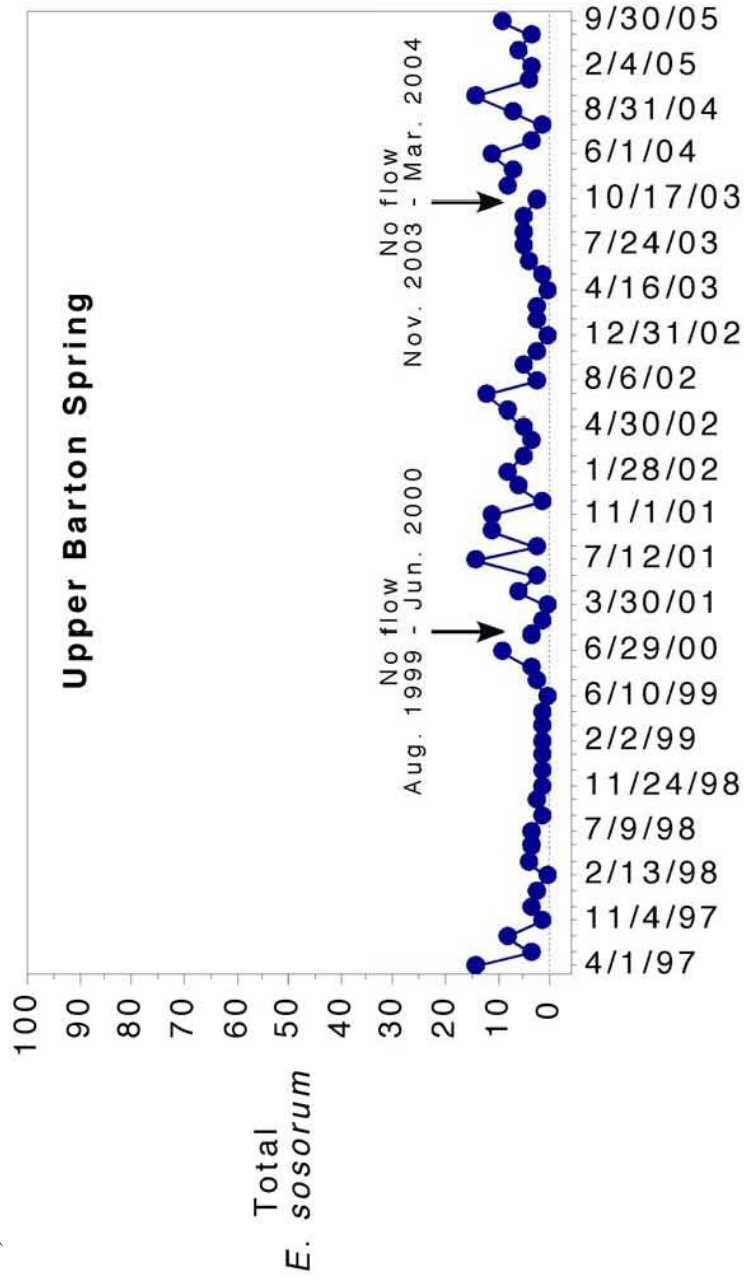


Figure 2. Density of *E. sosorum* from 2003 to the present is shown. A) Density of salamanders in all four spring sites is plotted on a scale from 1 – 10 per square meter, with mean and standard error in each spring site. Note the changes in Eliza Spring after habitat restoration in 2003. B) Detail of density of salamanders at Parthenia, Zenobia, and Upper Barton springs plotted on a scale of 0-1 per square meter. Densities of salamanders at sites with unrestored habitat are an order or magnitude smaller than at Eliza Spring.

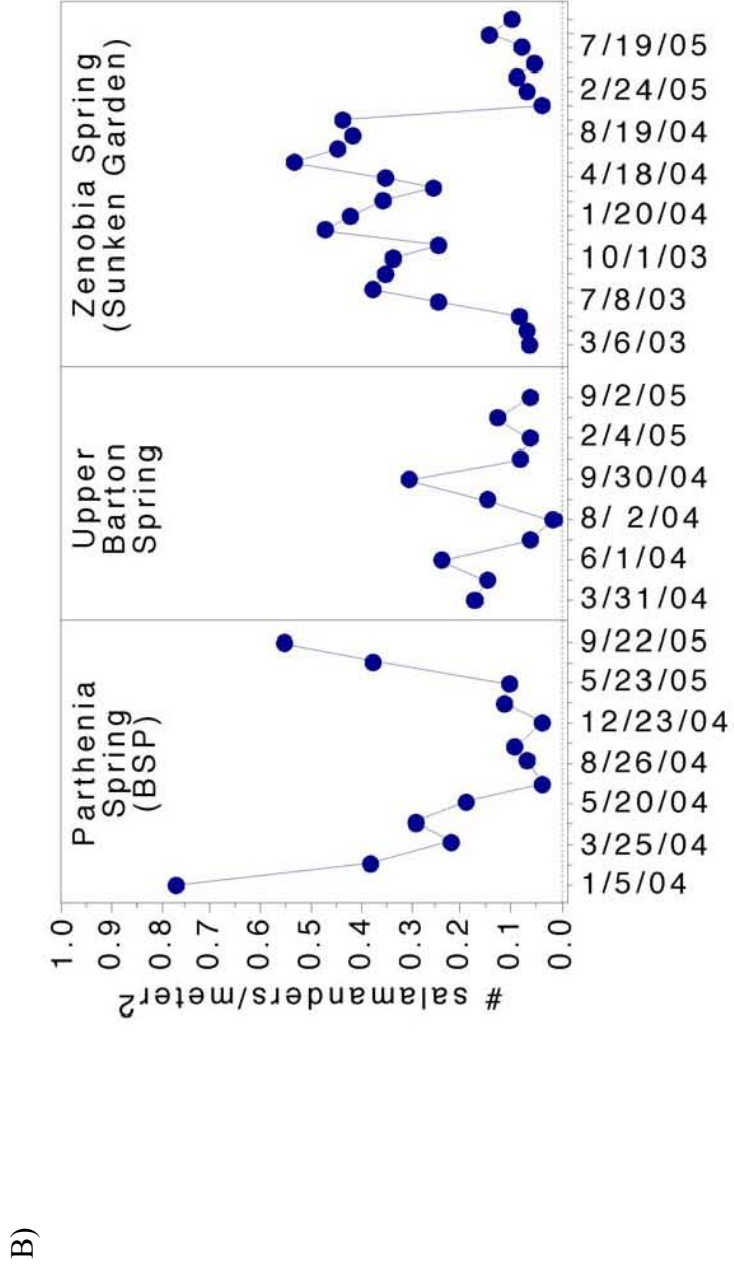
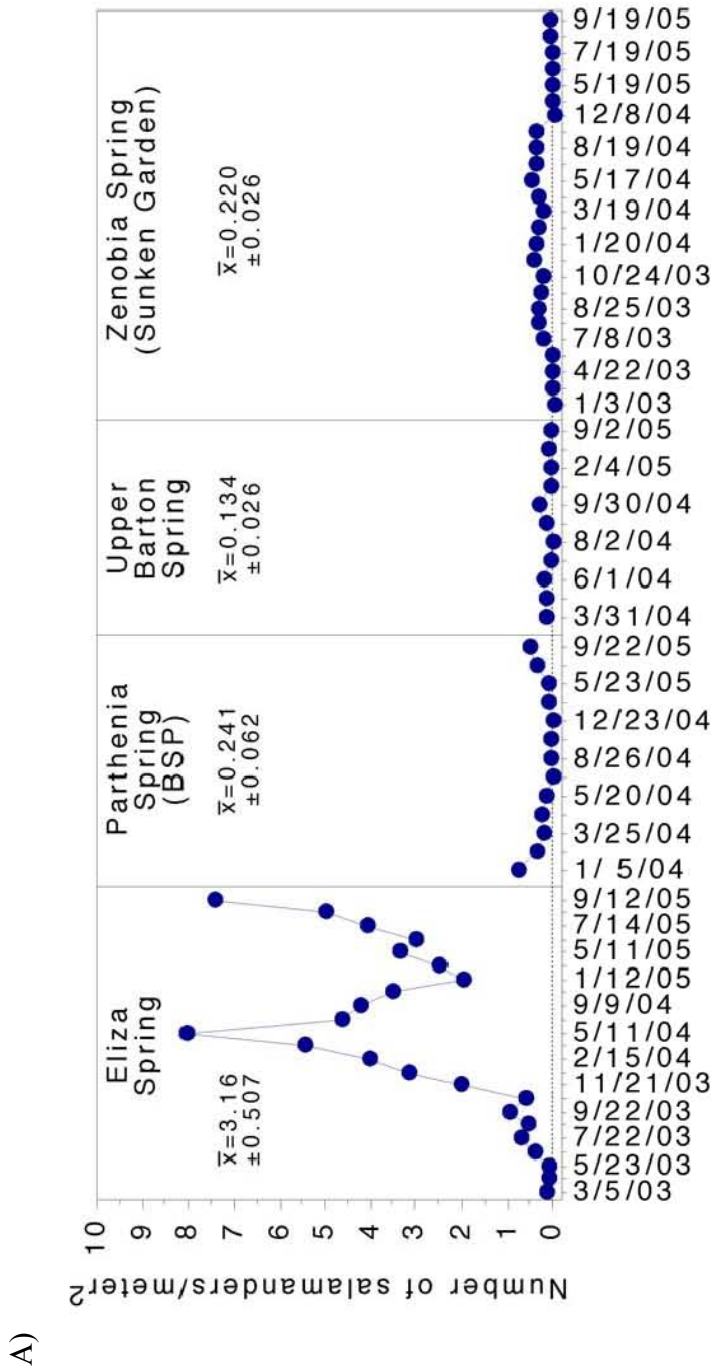
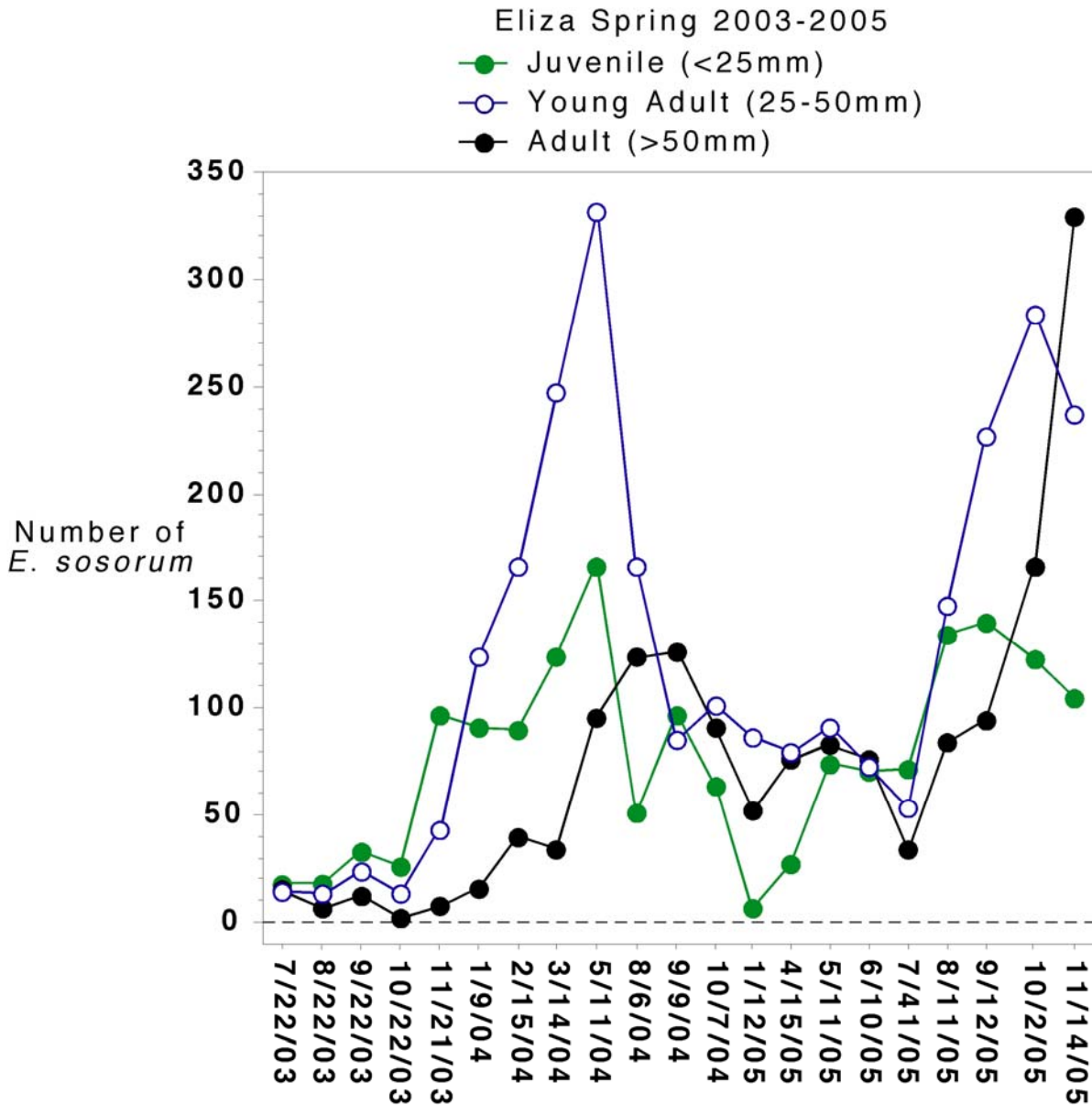


Figure 3. Recruitment in Eliza Spring. The graph below illustrates the abundance of *E. sosorum* of three size classes, juveniles (<1”), young adults (1-2”), and adults ( $\geq 2$ ”). These size classes are based on Chippindale et al. (1993). Juveniles were the highest proportion of salamanders from September through November of 2003. this period was followed by increases in young adults and adults in that order. These periods were followed by increases in new adults and adults. This pattern of increases of juveniles preceding similar increases of adults indicates that the changes in total salamander abundance were primarily a result of recruitment, not migration from subterranean areas or other spring sites.



## Pool Maintenance and Management Activities

### Drawdowns

The City continued monthly partial drawdowns of water level in Barton Springs Pool when spring discharge exceeded 54 cubic feet per second. The goal of this strategy is to enhance the natural flushing of excess sediment that maintains clean cobble and gravel in salamander habitat. The reduction in water level increases velocity of flow through the fissures in the shallow areas of salamander habitat and allows biologists to clean deeper areas of habitat with hand-held hoses attached to submersible pumps. This strategy also facilitates cleaning and controlling the nuisance algae that accumulates in the shallowest area of the pool. Full drawdowns were conducted following permit guidelines and are listed below in Table 1.

Table 1. Drawdowns of water level in Barton Springs Pool (BSP) are listed below. The attendant decrease in water level in Eliza Spring with outflow barriers in place. All stranded salamanders were *E. sosorum*, the Barton Springs Salamander, unless denoted by an asterisk (\*), which denotes *E. waterlooensis*, the Austin Blind Salamander.

Date	Site	Water Level Decrease	Purpose	Aquifer Discharge (cfs)	Number Stranded	Number Re-located	Number Collected Live	No. Died
11/17/04	BSP	48"	Flood	83	0	0	0	0
2/28/2005	BSP	48"	Cleaning*	100	1*	0	1	0
5/5/2005	BSP	50"	Cleaning	103	0	0	0	0
5/5/2005	Eliza	6"		103	0	0	0	0
6/9/2005	BSP	24"	Cleaning	94	0	0	0	0
6/9/2005	Eliza	4"		94	0	0	0	0
7/7/2005	BSP	23"	Cleaning	90	0	0	0	0
7/7/2005	Eliza	0"		90	0	0	0	0
8/7/2005	BSP	21"	Cleaning	76	0	0	0	0
8/7/2005	Eliza	0"		76	0	0	0	0
8/25/2005	BSP	55"	Cleaning/Tunnel Inspection	69	2	2	0	0
8/25/2005	Eliza	0"		69	0	0	0	0
10/6/2005	BSP	55.5"	Cleaning	54	0	0	0	0
10/6/2005	Eliza	6"		54	0	0	0	0

\*Repairs of the gates in the downstream dam were necessary after the adjustment threads were stripped during the drawdown on February 28. The screws and seals in the gates brackets were replaced and were tightened appropriately, allowing the gates move more easily. This also allows more water to escape when the gates are opened. Consequently, new data were collected and the regression equation for predicting extent of drawdown under different discharge conditions was recalculated (Figure 4). Data collection will continue with future drawdowns.

Figure 4. The results of logarithmic regression analysis are graphed below.

