Balcones Canyonlands Preserve Karst Management
2001 Annual Report

Travis County Natural Resources
and the City of Austin Parks and Recreation Department

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CITY OF AUSTIN – 19 REPORTS
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ATTACHMENT C: ECOSYSTEM ROOTING DEPTH DETERMINED WITH CAVES AND DNA (A research paper with information on District Park and Cotterell Cave, done earlier but not submitted previously)

1.0 REGIONAL PERMIT

There are six species of endangered karst invertebrate and 25 karst species of concern covered by the Balcones Canyonlands Conservation Plan (BCCP) (the Regional Permit). If these 25 species of concern become listed as endangered in the future, no additional mitigation by the BCCP would become necessary to protect them if all of the karst protection outlined in the BCCP is fully implemented. Many of the species of concern may actually be as endangered, or more so than the currently listed species. Since these species are not formally listed, many of the Species of Concern (SOC) caves are severely threatened.

The Regional Permit requires protection of 35 endangered species caves and 27 caves additional caves that support species of concern that are not currently listed by the USFWS for a total of 62 karst features (60 caves, 1 mine and 1 karst spring).

The six species of endangered karst invertebrates in Travis County are:

Tooth Cave pseudoscorpion *Tartarocreagris texana*

Tooth Cave spider *Neoleptoneta myopica*

Tooth Cave ground beetle *Rhadine persephone*

Kretschmarr Cave mold beetle *Texamaurops reddelli*

Bee Creek Cave harvestman *Texella reddelli*

Bone Cave harvestman *Texella reyesi*

The 25 additional karst species of concern to be protected by the regional permit are:

FLATWORMS

Sphalloplana mohri

OSTRACODS

Candona sp. nr. *stagnalis*

SPIDERS

Cicurina bandida (#1)*

Cicurina cueva (#4)

Cicurina ellioti (#5)

Cicurina reddelli (#3)

Cicurina reyesi (#6)

Cicurina travisae (#7)

Cicurina wartoni (#9)

Neoleptoneta cocinna

Neoleptoneta devia

Eidmannella reclusa

MILLIPEDES

Speodesmus N. S.

PSEUDOSCORPIONS

Aphrastochthonius N. S.

Tartarocreagris comanche

Tartarocreagris reddelli

Tartarocreagris intermedia (#2)

Tartarocreagris N. S. 3

HARVESTMEN

Texella spinoperca (#2)

GROUND BEETLES

Rhadine s. subterranea

Rhadine s. mitchelli

Rhadine austinica

ISOPODS

Caecidotea reddelli

Trichoniscinae N. S.

Miktoniscus N. S.

- Numbers #1-9 correspond to species listing in the Final HCP-EIS, Section 2-66.

2.0 CAVE MANAGEMENT SUMMARY

In 2001, the Balcones Canyonlands Conservation Plan (BCCP) partners continued efforts to determine and track cave status of the 62 karst features covered by the BCCP 10(a) permit. The permit holders continued efforts to acquire, protect, and monitor the karst species in the caves included in the Permit. Many of the caves designated here as "protected" with the status of "good" in the following table do not have large enough buffer areas around the caves to be adequately protected to meet the new requirements listed in *the U.S. Fish and Wildlife Service Draft Recommendations for Karst Preserve Design, March, 2001 Version,* including many caves that were "protected" under USFWS individual 10a permits in years past. The new USFWS preserve design directs that the protected area surrounding the cave must be 59-89 acres in size to capture the majority the plant and animal community elements in viable numbers needed to support the cave species. The terms "protected" and "good" listed in this document refer to caves with *some* amount of setback around the entrance and *some* amount of protection over the footprint of the cave and do not necessarily provide this large protected area acreage.

Of these 42 combined Endangered Species and species of concern caves that are shown as "protected" on the charts that follow:

- 21 are "protected" by the City of Austin through ownership or private landowner agreements
- 3 are "protected" by other BCP partners (Travis County and The Nature Conservancy)
- 9 are "protected" by individual USFWS Section 10(a) or Section 7 permits
- 7 are "protected" by Texas System of Natural Laboratories (TSNL)
- 2 are "protected" by Texas Cave Management Association (TCMA)

  42 "protected" BCCP caves (leaving 20 Private "unprotected" caves)

For the 35 caves containing Endangered Species (out of the 62 total BCCP caves)

- 25 are "protected" by BCCP partners, 10a, or section 7 permits, TSNL, or TCMA.
- 10 are "unprotected" and privately owned.

Caves on Balcones Canyonlands Preserve (BCP) land generally have adequate buffer areas and are receiving adequate protection, however some are too close to adjacent development or the protected areas are not large enough to adequately protect the caves under the new criteria. Cave X and Get Down Cave are being "protected" under cave management agreements between the landowner and the City of Austin. Though the cave management agreements were finalized in 1999 and 2000, the implementation plans for these agreements

are still being developed. Though the TSNL caves have "protected" entrances, the areas around the caves are not large enough to adequately protect the footprint and drainage areas around the caves.

Threats to Specific BCCP Caves

- The entrance to Pennie's Cave has been covered for several years and this cave may be considered lost (though it may be possible to restore this cave entrance if given approval by the landowner).
- It is not clear the exact location of the entrance to Fossil Cave in the City of Austin's Schroeder Park. Upon examination, there are numerous karst features in the area and the most likely location of this small cave has been filled with rocks to protect it from trespass while still allowing invertebrate movement. Located in the park, the area around the cave continues to be protected. The exact cave entrance will need to be relocated.
- Caves in the McNeil Cluster (near Round Rock High School) are under threat of development. The owner was approached in both 2000 and 2001 about selling this area and was not interested.
- A hydrogeological study was completed in May 2000 for Flint Ridge Cave relating to possible impacts from the proposed extension of SH 45. In 2001, the roadway plans were still under review and no final route determined.
- Many "private" caves have not been surveyed or monitored in many years and their status is unknown. Though 2 BCCP caves are currently protected by private landowner agreements with the City of Austin, the BCCP partners need to put additional effort into creating more of these private agreements with other private cave owners. In general, threats to private caves continue, primarily due to development.

3.0 KARST FEATURE STATUS

The following table lists the names and status in 2001 of the 62 caves/karst features listed in the BCCP permit. The 35 endangered species caves are listed as ES and the 27 additional caves for species of concern are listed as SOC.

Cave Name	ES or SOC	Current tract/owner. On BCP Land or private	Cave Cluster	2001 Status
Adobe Springs Cave	SOC	BCP Lehmann/TNC		Good
Airman's Cave	SOC	BCP Barton Creek/COA		Good
Amber Cave	ES	BCP Jollyville/TC	4 Points Cl (Parke)	Good

Armadillo Ranch Sink	SOC	Private		Unknown
Arrow Cave	SOC	BCP Slaughter Cr. Pk./COA		Good
Bandit Cave	ES	Private		Unknown
Beard Ranch Cave	ES	BCP Ivanhoe/COA		Good
Bee Creek Cave	ES	Private		Unknown
Blowing Sink Cave	SOC	BCP COA		Good
Broken Arrow Cave	ES	BCP Lime Cr. Prs./COA		Good
Buda Boulder Spg.	SOC	BCP Shoal Creek Grblt./COA		Good
Cave X	SOC	Private/COA Protection Agreement		Unknown, New agreement not working smoothly yet
Cave Y	ES	BCP Barton Creek Grblt/COA		Good
Ceiling Slot Cave	SOC	Private		Unknown
Cold Cave	ES	Private	Northwood Cl.	Unknown
Cotterell Cave	ES	BCP Spicewood Spgs. Pk./COA		Good
Disbelievers Cave	ES	BCP Private 10(a)	4 Points Cl. (Perot)	Good
District Park Cave	SOC	BCP D.Nickols Pk./COA		Good
Eluvial Cave	ES	BCP Private 10(a)	4 Points Cl. (Perot)	Good
Flint Ridge Cave	SOC	Prop 2/COA		Good
Fossil Cave	ES	BCP Schroeter Pk./COA		Can't find entrance, area in park protected however, FWS thinks taken
Fossil Garden Cave	ES	Private	McNeil Cl.	Unknown
Gallifer Cave	ES	Private TSNL	4 Points Cl (Parke)	Good
Get Down Cave	SOC	Private/COA Protection Agreement		Good, implementing agreement, COA/TCMA managing
Goat Cave	SOC	BCP Goat Cave Karst Preserve/COA		Good
Hole-in-the-Road	ES	Private	Northwood Cl.	Unknown
Ireland's Cave	SOC	Private Circle C		Poor, watershed probs., golf course
Jack's Joint	SOC	Private		Unknown
Japygid Cave	ES	BCP Private 10(a)	4 Points Cl. (Perot)	Good
Jest John Cave	ES	BCP Forest Ridge/COA		Good
Jester Estates Cave	ES	Private (adj.COA Ivanhoe)		Unknown
Jollyville Plateau Cv.	ES	BCP Private 10(a)	4 Points Cl. (Perot)	Good
Kretschmarr Cave	ES	Private TSNL	4 Points Cl. (Parke)	Good
Kretschmarr Dble. Pit	ES	Private TSNL	4 Points Cl. (Parke)	Good
Lamm Cave	ES	BCP Private Section 7		Entrance OK, FWS considers taken
Little Bee Cr. Cave	ES	BCP Ullrich WTP/COA		Good
Lost Gold Cave	SOC	Private		Unknown, new owner
Lost Oasis Cave	SOC	Private TCMA		Good
M.W.A. Cave	ES	BCP Private 10(a)	4 Points Cl. (Perot)	Good
Maple Run Cave	SOC	BCP Goat Cave Karst Preserve/COA		Good
McDonald Cave	ES	BCP Jollyville/TC		Good
McNeil Bat Cave	ES	Private	McNeil Cl.	Unknown
Midnight Cave	SOC	BCP Slaughter Cr. Pk./COA		Good
Moss Pit	SOC	Private		Unknown
New Comanche Tr. Cave	ES	Private		Unknown
No Rent Cave	ES	Private	McNeil Cl.	Unknown

North Root Cave	ES	Private TSNL	4 Points Cl (Parke)	Good
Pennie's Cave	SOC	Private		Entrance covered, probably lost
Pickle Pit	SOC	BCP Private Sec. 7		Unknown
Pipeline Cave	SOC	Private		Unknown
Rolling Rock Cave	ES	BCP Lime Cr. Prs./COA		Good
Root Cave	ES	Private TSNL	4 Points Cl (Parke)	Good
Slaughter Creek Cave	SOC	BCP Slaughter Cr.Pk./COA		Good
Spanish Wells	SOC	Private		Unknown
Spider Cave	ES	BCP Park West/COA		Good
Stark's North Mine	SOC	Private		Unknown
Stovepipe Cave	ES	BCP Private Sec. 7		Good
Talus Springs Cave	SOC	Private/ possible pending to TC 10(a) permit		Only 50' setback from dev., entrance impact unknown
Tardus Hole	ES	Private TSNL	4 Points Cl (Parke)	Good
Tooth Cave	ES	Private TSNL	4 Points Cl (Parke)	Good
Weldon Cave	ES	Private	McNeil Cl.	unknown
Whirlpool Cave	SOC	Private TCMA		Good

4.0 ACCESS STATUS AND KARST EDUCATION

In the fiscal year 10/01/00-9/30/01, the total number of visitors in the City of Austin's BCCP caves for educational/recreational/rescue training that were issued access permits were: District Park Cave (101), Maple Run Cave (245), Midnight Cave (47), and Goat Cave (200). The City of Austin issued Scientific/Research permits to 3 people for Cotterell Cave.

Whirlpool Cave, which is owned and managed by the Texas Cave Management Association, was visited at least once a week during the late spring and summer of 2001 by one or more organizations and visited occasionally in the fall. It hosted a total of 889 registered visitors in 2001 (Attachment B).

Austin caving organizations and volunteers continue to play key and vital roles in researching, protecting and educating the public about BCCP and other caves in the Austin area.

The following table lists caves that are currently gated, fenced and/or open to the public.

Cave Name	ES or SOC	BCP Tract/owner	Gated/Fenced	Public Access
Amber Cave	ES	Pending TC (for 10(a)	Concrete/manhole cover [2]	
Airman's Cave	SOC	Barton Creek/COA		open
Bandit Cave	ES	Private	Gated	
Cave X	SOC	Private w/ COA Agreement	Gated	
Cotterell	ES	Spicewood Sprgs. Pk./COA	Fenced	
District Park Cave	SOC	D.Nickols Pk./COA	Gated after the 1st room.	1st room open, past the 1st room access by permit*
Gallifer Cave	ES	Private TSNL	Gated [2]	
Get Down Cave	SOC	Private	Gated	
Goat Cave	SOC	Karst Preserve/COA	Gated [1]	access by permit*

Jester Estates Cave	ES	Private, adj. COA Ivanhoe	Gated [2]	
Jollyville Plateau Cv.	ES	Private 10(a)	Gated [2]	
Kretschmarr Cave	ES	Private TSNL	Gated [2] and Fenced	
Lost Gold Cave	SOC	Private	Gated	
Lost Oasis Cave	SOC	Private TCMA	Gated and Fenced	controlled access**
Maple Run Cave	SOC	Karst Preserve/COA	Gated	access by permit*
Midnight	SOC	Slaughter Cr. Pk/COA	Fenced	access by permit*
Pickle Pit	SOC	Private	Gated	
Pipeline Cave	SOC	Private	Metal frame [2]	
Tooth Cave	ES	Private TSNL	Gated [2]	
Whirlpool Cave	SOC	Private TCMA	Gated	controlled access**

* Access by Permit - Permit may be issued by COA - PARD staff.
** Controlled Access - Private cave owners control the access
1 Future plans will remove the gate and install fence to encourage bats to return.

5.0 BIOLOGICAL MONITORING

The City of Austin's BCCP staff performed species surveys for Airman's, District Park, Goat, Maple Run and Cotterell Caves (Attachment A). The City of Austin's BCP staff has now completed 5 years of biannual cave faunal surveys for Airman's, District Park, Goat and Maple Run caves. These faunal survey's were completed in fiscal year (2001-2002). A final report will be included in the 2001-2002 annual report. Research for a paper entitled "Ecosystem Rooting Depth Determined With Caves and DNA" was conducted in Cotterell and District Park Caves (see Attachment D). Additional research on deep root functions continues in Cotterell Cave (see Karst Faunal Report: Cotterell Cave).

The Texas Cave Management Association (TCMA) performed a species survey in Whirlpool Cave on Dec. 22, 2001 (Attachment B) following a greatly increased rain event on November 15. This survey was designed to assess the cave biology in the least favorable environment possible, showing the effects of increased winter airflow and wetness. As expected under these conditions, there were a reduced number of karst species observed.

Texas System of Natural Laboratories (TSNL) monitored the surface near their caves but did not perform any species surveys in 2001 (Reddell, pers com). It is unknown is there were species surveys done in BCCP caves by the holders of Section 10a or Section 7 permits (to be reported to USFWS).

6.0 KARST MANAGEMENT ACTIVITIES

The BCP Land Management Plan outlined planned activities concerning the 62 BCCP karst features. The following table lists what was promised in the Plan and a summary of activities completed in 2001.

BCP 1999 Approved Land Management Plan (Proposed Activities)	2001 Management Activities or Comments
Adobe Springs Cave 1. May need gate, depending on access situation. The cave gate design should allow for the return of the bats	The Nature Conservancy The last cave faunal survey was conducted in 1999. The entrance to the cave continues to be undisturbed and is protected on Preserve tract.
Airman's Cave 1. Conduct a study to assess caving use and trash accumulation in the cave to see if it is adversely affecting the cave fauna. This ongoing study should continue to monitor these factors and determine if there is a need for cave gating. 2. Continue biological observations and map the locations of the rare species in the cave. 3. Work with volunteers in the caving community to police themselves and other cave users who use Airman's Cave . 4. Continue doing ongoing cave cleanups and graffiti removal. 5. Conduct studies on caver use and monitor effects on cave fauna .	City of Austin 1. Completed biannual cave faunal surveys. (See Attachment) Have now completed 5 years of biannual cave faunal surveys at this cave. (However, the last surveys completed this current fiscal year, October 2001). A final analysis of 5 years of faunal surveys will be prepared for the next annual report. 2. To date, have not noticed any significant increase in litter and any new graffiti. It appears that the caving community are policing themselves and so far no cave gate is warranted.
Amber Cave 1. Control of red imported fire ants . 2. Should be effectively gated as soon as possible in a manner that restricts access, yet allows the free passage of air, water and cave life. The present gate does not prevent access to the cave. Once a gate is installed, it should be regularly inspected to minimize any unrestricted traffic which may breach it 3. Surface and subsurface drainage basins are contained within an area extending from Amber Cave 40 ft. north to Wilson Parke Ave, south for 100 ft., and east and west for 50 ft. The drainage basins delimit the cave's critical area, the zone of greatest direct impact to its ecosystem. The critical area should be left in its natural state. 4. The high density of caves and karst features to the east of Amber Cave deserve serious consideration for equal protection. These features do not directly drain into Amber cave, but hydrologically they are interlinked with it at a lower level. A very large volume of water and nutrients are taken underground in this locale which support the cave ecosystem. A study is needed to access this nutrient area and its importance to the cave fauna. 5. The critical area should be bermed if any neighboring development might drain its runoff into it. 6. Establish a cooperative management plan with the organization that maintains the right-or-way for Wilson Parke Ave. near the cave to implement suggested techniques to protect the cave through modifications in mowing and non-toxic management techniques to protect the cave.	Travis County 1. This cave was acquired by Travis County in October 2001. 2. Planned 2002 activities include: control of red imported fire ants, improvement of the current cave gate, develop survey protocol and begin studying cave fauna, check on the possibility of berming the area and protecting the native vegetation.
Armadillo Ranch Sink 1. The entrance to the cave receives considerable run-off. The critical area should be bermed if any neighboring development might drain its runoff into it. 2. May need a cave gate, depending on access situation .	Private
Arrow Cave 1. The cave will need a gate, as it is located within a few hundred feet of a new subdivision and its entrance has temporarily been filled with three feet of loose rocks to protect the cave . 2. The cave receives drainage from only a small area . 3. A faunal survey is needed . 4. Monitor and control fire ants. 5. Need a map of the cave interior and sinks nearby.	City of Austin 1. Two site inspections (fall and spring) were conducted 2. The entrance was inspected to make sure that no human access had occurred. 3. The site was also inspected for RiFA infestations. On both visits fire ant mounds were observed in close proximity of the cave entrance, however, ants did not appear to be entering the cave. TCMA reports that the entrance has been covered by rocks to protect the cave from unwanted visitors. The heavy end of year rains did not appear to have disturbed the cover. Now the rocks are covered with leaves, which is even better in terms of camouflage.
Bandit Cave 1. Survey for fire ants . 2. Make landowner contact.	Private Water or Waste Water line was constructed within 50 feet of the cave without a hydrological study. A void was encountered within 100 feet of the cave, construction was halted and USFWS

	was consulted. (This was the first time USFWS were notified about this project). USFWS staff were concerned about this project because it was implemented without a hydrological study. TCMA reported that **c**avers surveyed the sewer alignment and it did not intersect known cave. Leakage from the sewer line could still be a problem. Landowner has excellent conservation ethics.
Beard Ranch Cave 1. Obtain Chock Woodruff's cave map, description and information on biological collection. 2. Do a current thorough faunal survey to determine the endangered species status (specifically Texella sp) 3. Monitor and control fire ants. Revised Management Needs (2001): 1. Map the cave.	City of Austin 1. The cave was inspected twice, Spring and Fall. 2. No evidence of vandalism was noted. 3. No red imported fire ants were found. A healthy population of native fire ants was found in close proximity to the cave.
Bee Creek Cave 1. The cave is partially protected by its isolation and bluff entrance. May need a cave gate, depending on the current access situation . 2. Need to confirm the location of the cave and do a biological assessment. 3. Make landowner contact.	Private
Blowing Sink Cave 1. Do hydrogeologic study to assist with management or acquisition, including ecological conditions, use study, and management needs. 2. During and after development, the area around and some distance upslope should be protected by setbacks. 3. Add a cave gate that does not interfere with recharge. 4. Coordinate planning for runoff and drainage with the developer. To maintain the quantity of good-quality water entering the aquifer, consideration should be given to connecting Blowing Sink to the drainage channel leading from the area to the north. Topography indicates a major drainage channel will be somewhere near the cave. After development, even small rains will produce more run-off than can flow through, and much of this water will be of poor quality. A gate on the connecting channel could allow poor-quality water to by-pass the sink and good-quality water to be channeled into the Aquifer. 5. Provisions should be made for continued biologic studies. 6. Provisions should be made for continued hydrologic studies. Eileen's River originates from a large recharge area and would be an ideal place to monitor the effects of urbanization on water quality . 7. Investigate the possible connection of the newly found cave with this cave. Revised Management Needs (2001): 1. Improve perimeter fence on preserve land to keep prevent illegal trespass.	City of Austin 1. This site was inspected twice and no signs of vandalism were found in the cave or to the cave entrance. 2. Fire ant mounds were present, (within 150' radius), but no activity at the cave entrance. 3. Mark Sanders met on site with Longhorn Pipeline officials on 8/28/01 to discuss their pipeline/leak/dye test. He and COA Watershed Protection Department (WSPD) staff had reservations on the methods they used for this study, however, their hands were tied on this issue. Problems with the dye test included: • The release of the dye from the tanks was via slow gravity leak, unlike a real life high pressure rupture. • The "test" sites were grouted with extreme care, lots of detail, more than likely, the actual grouting will not be as thorough or complete for the entire line which is being replaced. • WSPD had other problems with this study. COA did give access to Longhorn officials to monitor the on site well for the presence of this dye. David Johns informed Mark Sanders on 12/6/01that the initial test leaked10 to 12 gallons/hour (the dye disappeared from the trench via fractures/karst features) and so Longhorn reopened the test sites, and used a different and or more powerful sealant and now the test sites leak 1 gallon/hour which is acceptable (to USFWS ?) TCMA reported that cave appears in good shape despite recent flooding. There is minor erosion and blockage below the Kirschberg Hall. It doesn't appear that these flood events will have any biological consequences other than the lost traps that had not yet been collected from a previous PARD visit to Eileen's River.
Broken Arrow Cave 1. Monitor and control fire ants. 2. Yearly faunal survey in Spring .	City of Austin 1. This cave was inspected twice and no sign of human visitation was found. 2. Fire ant activity was found near the cave entrance, but there were no other colonies found within a 150' radius of the cave.
Buda Boulder Spring 1. Monitor water quality in this small spring which may be contaminated by sewage. There was heavy sewage pollution found there in 1992. Check into the source of the possible sewage contamination. A large transient camp immediately	City of Austin Was not surveyed.

above the spring may be the source 2. Monitor the site to see if this spring still harbors the SOC. 3. Coordinate protection efforts between Shoal Creek Park managers, COA Water and Wastewater and PARD/Natural Resources Department about protection strategies.	
Cave X 1. Do hydrogeologic study to assist with management or acquisition, including ecological conditions, use study, and management needs. 2. Will need a cave gate or a fence that will not interfere with recharge. 3. Development in the area needs to be closely coordinated. The cave is an important recharge feature, with most of the recharge originating from another property.	City of Austin: The City of Austin entered into a Private Landowner Agreement "Cave X, Management and Monitoring Plan, Covenants and Restrictions, (see attachment)", with the property owners (Regent's School) in Oct. 1999. The agreement sets aside a 4.5 acre area was set aside to protect the cave footprint. The USFWS was involved in the discussions on protection. The cave entrance is gated and also has a fence for added protection. There are still concerns about the implementation of Private Landowner Agreement. This site has had quite a lot of new development in close proximity of the cave.
Cave Y 1. May need a cave gate, depending on the access situation. It is relatively isolated and thus unlikely to attract numerous visitors until the surrounding park land is opened (Russell (undated). The COA is routing the access trail away from this cave. 2. Do yearly faunal survey in Spring and also make collections for James Reddell to determine the status of probable Texella. 3. Monitor and control fire ants.	City of Austin 1. 4 site visits were conducted to this cave and there was no sign of human visitation or vandalism. 2. No red imported fire ant activity was observed at or near the cave entrance, however, there were fire ant mounds within a 150' radius of the cave.
Ceiling Slot Cave 1. Do hydrogeologic study to assist with management or acquisition, including ecological conditions, use study, and management needs. 2. May need a cave gate, depending on the access situation	Private
Cold Cave 1. The surface and nonpoint drainage areas over the cave should be preserved in their natural state. This area should be considered the minimum for any preserve boundary that would be established and may need expansion 2. Any tunneling (as opposed to trenching) to place the proposed wastewater interceptor line should be done according to Veni and Associates recommendations 3. if any roads or facilities are built uphill of the drainage area, impermeable berms should be placed along the uphill margins to prevent the entry of runoff or spilled materials 4. The cave should be gated 5. Follow additional recommendations outlined in the Veni and Associates hydrologic study.	Private
Cotterell Cave 1. There is a high fence around the cave area installed by the City of Austin in 1995. Continue to monitor the condition of the fence and control access to the cave. 2. Continue to work to control red imported fire ants. 3. Do a yearly faunal survey in Spring. Revised Management Needs (2001): 1. On advice from James Reddell, this cave has an interior gate. The open portion of this cave has no troglobitic species and few speleotherms. An interior gate protects the species of concern and delicate formations. The City of Austin-PARD has controlled access by a permit system since 1995. 2. Continue semi-annual faunal survey in Spring and Fall and photomonitoring . 3. Work to control red imported fire ants 4. Survey the possible dangers and impacts of flooding on the cave. The cave may receives considerable drainage after heavy rains because of a new nearby flood retention facility which put the cave entrance in the 25 year flood plain.	City of Austin 1. Monthly site inspections were conducted, and no evidence of non-permitted access was found and no presence of the red imported fire ant at or near the cave. 2. Red imported fire ants were treated with boiling water, the ants were located at the parking lot, approximately 300 feet from the cave. 3. Rob Jackson, professor at Duke and Will Pockman, professor at the University of New Mexico continued their permitted access on water uptake of certain species of trees. (See attachments) 4. Conducted cave faunal survey. (See attachment) .
Disbelievers Cave 1. May need a cave gate, depending on the access situation.	Private 10a Permit: PRT-808694 (see FWS files for status)
District Park Cave Approved language: 1. On advice from James Reddell, this cave has an interior gate,	City of Austin 1. Completed biannual faunal survey at this cave. (See attachment)

blocking unpermitted access to the interior rooms, but not the first section of the cave. The cave has no true troglobitic species and few speleotherms due to heavy vandalism in 1996. The City of Austin-PARD has controlled access by a permit system since 1995. The COA should establish limits telling how many people can go into the first room and how often, and should also set limits for the number and frequency of visitation beyond the first room. 2. Continue semi-annual faunal survey in Spring and Fall and photomonitoring . 3. Work to control red imported fire ants 4. Survey the possible dangers and impacts of flooding on the cave. The cave receives considerable drainage after heavy rains <u>Revised Correct language (2001)</u>: 1. On advice from James Reddell, this cave has an interior gate. The open portion of this cave has no troglobitic species and few speleotherms. An interior gate protects the species of concern and delicate formations. The City of Austin-PARD has controlled access by a permit system since 1995. 4. Survey the possible dangers and impacts of flooding on the cave. The cave may receives considerable drainage after heavy rains because of a new nearby flood retention facility which put the cave entrance in the 25 year flood plain.	2. Conducted site surveys quarterly, and treated red imported fire ants with boiling water. No red imported fire ants were noted in the cave. 3. Permitted access to this cave was allowed. (See attachment) TCMA visited in the late summer and the entranceway to the gate was cleaned out to make the passage possible after late spring rains. The cave did not see much usage from the caver community this year.
<u>Eluvial Cave</u> 1. May need a cave gate, depending on the access situation	Private 10a Permit: PRT-808694 (see FWS files for status)
<u>Flint Ridge Cave</u> 1. Do hydrogeologic study to assist with management or acquisition, including ecological conditions, use study, and management needs. This is a major recharge feature. 2. Needs protection such as a cave gate or fence that does not interfere with recharge 3. Because the cave is located near the extension of the Outer Loop and planned development, continue coordinating with the City of Austin, Barton Springs/Edwards Aquifer Conservation District and the Texas Department of Transportation.	COA A hydrogeological study was completed in May 2000 on this cave. TCMA began a drip monitoring project in early 2001 to quantify the time it took rainfall to reach the cave's wetter passages. Heavy rainfall events in summer destroyed monitoring location and the project will resume in 2002. The COA flagged the surface area and TCMA flagged cave footprint on the surface. TCMA continues to work to get TxDOT to move proposed SH45 away from the cave.
<u>Fossil Cave</u> 1. This cave was previously filled with large rocks, and should be dug out, resurveyed to determine what exactly is there. i and James Reddell believe that the current rocks in the entrance do allow for small mammal access and are appropriate. George Veni has questions about whether the cave should be opened and gated to allow for access for monitoring and other future research needs 2. Need to confirm the existence of endangered species 3. Monitor and control fire ants. 4. interior needs to be mapped. 5. Coordinate protection efforts between Schroeter Park managers and PARD/Natural Resources Department about cave protection strategies (Schroeter Park is a low impact, minimally maintained park, consisting of nature trails near the caves, and managed much like a preserve).	City of Austin 1. The site was inspected once and no signs of vandalism or access were found, (the rocks had not been removed) on what is believed might be the cave. The other nearby karst features were in the same condition. 2. No red imported fire ant activity was observed at the cave entrance, however, mounds were found within a 150' radius of the cave.
<u>Fossil Garden Cave</u> 1. Do hydrogeologic study to assist with management or acquisition, including ecological conditions, use study, and management needs. 2. Especially needs red imported fire ant control. 3. Needs a cave gate	Private
<u>Gallifer Cave</u> 1. Needs red imported fire ant control. 2. improved gate needed 3. The area surrounding and atop the cave should be maintained in its natural condition. 4. The critical area should be bermed on the uphill side if any neighboring development might drain its runoff into it. 5. The Gallifer Cave gate should be regularly inspected to minimize any unrestricted traffic which may breach it.	TSNL
<u>Get Down Cave</u> 1. Continue efforts to work with the developer to protect the entrance and the surrounding area as a park or preserve	City of Austin 1. The City of Austin entered into a Private Landowner Agreement with Lumberman's investment Corporation in July

2. Monitor the area during construction to prevent the dumping of construction material and other contaminants. 3. Monitor and control fire ants. 4. Continue to monitor the possible effects on the cave of the Longhorn Pipeline, a former crude oil line being converted to a gas line located in the drainage area 1500' away. An emergency response plan should be written (with TNRCC, the COA, BS/EACD) to plan to reduce the impact of a spill. 5. Reconstruct the gate to make the feature look more like a sinkhole. 6. Construct a perimeter fence around the proposed karst preserve. 7. The karst preserve should be managed with an emphasis on karst education.	2000. The agreement sets aside an area to protect this cave and several others. The USFWS was involved in the discussions on protection area needed. 2. The cave is gated and fenced. 3. The implementation of the Private Landowner Agreement in underway and seems to be working well. 4. An educational kiosk is being constructed. The committee put a lot of time and effort in drafting educational information for kiosks at the new preserve. This preserve will go a long way educating the public about caves, cave fauna and their importance, etc. TCMA did a survey in Dec. 2001 and found very high level of use by raccoons. They recommend that the raccoon hole be blocked for a while.
<u>Goat Cave Karst Preserve</u> 1. The gate will be removed and a fence installed to allow for bat use. Following this, the cave will be monitored for bat use (the COA in consultation with Bat Conservation international) and the COA will take appropriate action if there are access problems 2. Do semi-annual faunal surveys and photo monitoring 3. Monitor and control fire ants.	City of Austin 1. Completed biannual faunal survey. (See Attachment) 2. Applied for and received a grant from Bat Conservation Intl' to remove the bat excluding gate and protect the cave with a install a gate (no climb chainlink fence). This project will be completed no later than 3/1/02. (See Attachment) Surveyed for and treated red imported fire ants with boiling water. 3. Conducted 6 site inspections frequently removing trash from the cave. 4. Allow permitted access to this cave. (See Attachment) TCMA reported Last usage by local cavers was March 2001 at that time all appeared normal.
<u>Hole-in-the-Road Cave</u> 1. Follow the recommendations in the hydrogeologic study by Veni and Associates 2. The surface and nonpoint drainage areas over the cave should be preserved in their natural state. This area should be considered the minimum for any preserve boundary that would be established and may need expansion 3. Any tunneling (as opposed to trenching) to place the proposed wastewater interceptor line should be done according to Veni and Associates recommendations 4. if any roads or facilities are built uphill of the drainage area, impermeable berms should be placed along the uphill margins to prevent the entry of runoff or spilled materials 5. Construction within a 100-m-radius o fthe caves may intersect related conduits and passages. Any such discoveries should be evaluated in consultation with USFWS1. The surface and nonpoint drainage areas over the cave should be preserved in their natural state. This area should be considered the minimum for any preserve boundary that would be established and may need expansion 6 Any tunneling (as opposed to trenching) to place the proposed wastewater interceptor line should be done according to Veni and Associates recommendations 7. If any roads or facilities are built uphill of the drainage area, impermeable berms should be placed along the uphill margins to prevent the entry of runoff or spilled materials 8. The cave should be gated	Private
<u>Ireland's Cave</u> 1. The cave is located on land planned for residential use adjoining a golf course. Meet with the developer to discuss possible protection measures 2. Needs a fence for protection and liability reasons 3. The cave receives considerable drainage and might qualify for TNRCC protection. Consult with TNRCC about this. Also the critical area should be bermed on the uphill side if any neighboring development might drain its runoff into it. 4. Educate researchers that this cave is a bad air cave (low O_2). Survey this during the winter months after a strong cold front 5. Survey to determine which bat species are using the cave.	Private 1. Members of the environmental board contacted the TCMA, COA (PARD and WSPD personnel) who met to locate the cave in relation to a recent finding of containers of pesticides on the outer edge of the Circle C golf course within the drainage area of the cave. The issue was resolved on site, the cave was not checked at that time.. The COA put together a verbal plan for the golf course manager to try to make sure that this does not occur in the future. 2. Need to do follow-up.
<u>Jack's Joint Cave</u> 1. May need a cave gate, depending on the access situation	Private

Japygid Cave 1. Needs red imported fire ant control. 2. May need a cave gate, depending on the access situation	Private 10a Permit: PRT-808694 (see FWS files for status)
Jest John Cave 1. Need up-to-date fauna list from J. Reddell. 2. Do a annual faunal survey in the Spring. Also do cricket counts when possible 3. Continue red imported fire ant control.	City of Austin 1. Conducted 2 site visits found and no signs of vandalism or human visitation. 2. No red imported fire ants were present at the cave entrance, however, there were mounds within a 150' radius of the cave entrance.
Jester Estates Cave 1. Biological inventory needed from J. Reddell. 2. Replace the gate which is currently unsatisfactory - having no mammal access hole and other design problems. 3. Need a map of the cave interior; the "Jester Cave" map by Warton probably is Jester Pit. 4. Check the actual size and configuration of the preserve area set aside around the cave (in relation to the subsurface profile) to determine how best to protect the cave from neighboring development. The critical area should be bermed on the uphill side if any neighboring development might drain its runoff into it. 5. Natural vegetation should remain undisturbed in the cave preserve area. 6. Contact the owner and discuss cave protection concerns of PARD/Natural Resources Department (the adjoining landowner).	Private
Jollyville Plateau Cave 1. Work to control the severe red imported fire ant infestation that was observed in July 1995. 2. Grid screens spaced over the entrance needs to be replaced by a proper gate	Private 10a Permit: PRT-808694 (see FWS files for status)
Kretschmarr Cave 1. Work to control the red imported fire ant infestation that was last treated in 1991 2. The critical area should be bermed on the uphill side if any neighboring development might drain its runoff into it. 3. The critical area is contained within the existing fence line and it should be maintained in its natural state. The cuts in the fence should be repaired. A new cave gate has recently been installed. 4. The Kretschmarr Sink should be kept open at least enough to drain its surface sinkhole. if the cave is sealed the sinkhole may pond and prevent water from reaching the cave fauna (Veni and Associates 1988). The sink should not be gated because the fence and entrance sign is adequate liability protection.	TSNL
Kretschmarr Double Pit 1. Needs a cave gate 2. The critical area should be bermed on the uphill side if any neighboring development might drain its runoff into it.	TSNL
Lamm Cave 1. Monitor the required 150' setback distance as the surrounding area is developed. 2. The critical area should be bermed on the uphill side if any neighboring development might drain its runoff into it. 3. May need a cave gate, depending on the access situation	Section 7 Permit 2-15-93-F-075 (see USFWS files) USFWS considers this cave "taken".
Little Bee Creek Cave 1. Protect the cave from visitors that build fires in the entrance (Russell (undated). 2. A gate across the entrance is not recommended, but one in the rear might be necessary . Because of the expense of building a conventional cave gate, perhaps large rocks could be used to partially block the entrance. 3. Construction for the expansion of the Ullrich Plant should avoid any activities that would cause harm to the cave or its species, such as erosion or run-off of contaminants. 4. A more thorough biological survey is needed 5. Periodically monitor the cave	City of Austin's Water and Waste Water Department Was not surveyed.

Lost Gold Cave 1. Do hydrogeologic study to assist with management or acquisition, including ecological conditions, use study, and management needs. 2. Obtain the recently produced cave interior map. 3. Monitor and control fire ants. 4. The loose rocks around the entrance should be removed to prevent vandalism to the wildlife entrance hole (Sanders and Reddell 1998). 5. Remove all trash, especially batteries from the cave .	Private
Lost Oasis Cave 1. Do hydrogeologic study to assist with management or acquisition, including ecological conditions, use study, and management needs. Reevaluate the need for a hydro study. 2. Continue biological survey and exploration to determine the full extent of the cave. 3. Try to obtain the existing map from Bill Russell or TCMA for addition to Travis County's BCP Caves File. 4. Monitor and control fire ants.	TCMA 1. Will plan to begin biological surveys in 2002.
Maple Run Cave 1. The BCCP 10(A) Permit requires that a hydrogeologic study be done to assist with management, including ecological conditions, use study, and management needs. This list of required caves is being reexamined and will require approval from USFWS to remove any caves from this list. i (1998) believes that a hydrogeologic study is not a high priority because most of the development near the cave has already occurred. 2. Frequently check cave gate and make needed repairs. 3. Work with Bill Russell to obtain a map of the cave .	City of Austin 1. Completed biannual faunal surveys. (See attachment) 2. Conducted 6 site visits, found no sign of unpermitted access, and on occasion, removed trash from the entrance. 3. Surveyed for red imported fire ants, found some activity at the entrance and treated the site with boiling water. 4. Permitted access to this cave is allowed. (See Attachment) TCMA reported that based on observation it doesn't appear that visits to the cave have negatively impacted the cave invertebrates.
McDonald Cave 1. Probably needs a bat gate or fence. The cave gate design should allow for the return of the bats	Travis County 1. Acquired by Travis County in Nov. 2001. 2. There is no plan for a cave gate because there is currently no access pressure. 3. Planned 2002 activities include: control of red imported fire ants, develop survey protocol and begin studying cave fauna, and protecting the native vegetation.
McNeil Bat Cave 1. Do hydrogeologic study to assist with management or acquisition, including ecological conditions, use study, and management needs. 2. Needs a bat gate or fence if the colony is being disturbed, unless it's a maternity colony, in which case a gate might cause problems	Private
M.W.A. Cave 1. Fire ant assessment and control needed. 2. Check if the cave is gated.	Private 10a Permit: PRT-808694 (see FWS files for status)
Midnight Cave 1. Do hydrogeologic study to assist with management, including ecological conditions, use study, and management needs. 2. Continue trash removal following a drought because the trash is currently under water . . 3. May need to improve the fence and add signs, depending on the access situation . 4. May want to include an educational signs since it would reach a wide audience	City of Austin 1. Conducted 6 site visits, found no sign of unpermitted access, and on occasion, removed trash from the entrance. 2. Surveyed for RIFA, found some activity at the entrance and treated the site with boiling water. 3. Permitted access is allowed at the cave. (See attachment) 4. No faunal surveys were performed in 2001.
Moss Pit Cave 1. Do hydrogeologic study to assist with management or acquisition, including ecological conditions, use study, and management needs. 2. Need more detailed location information. 3. Survey and map the cave interior . 4. May need a cave gate, depending on access situation. 5. Monitor and control fire ants. 6. Monitor for bats.	Private
New Comanche Trail Cave 1. Need an updated faunal survey. 2. Monitor the effects of runoff from the roadway and the surrounding area. 3. Survey, monitor, and control RiFA.	Private Owned by Joe Lucas who has been working to get a 10a permit.

No Rent Cave 1. Do hydrogeologic study to assist with management or acquisition, including ecological conditions, use study, and management needs. 2. May need a cave gate, depending on access situation .	Private
North Root Cave 1. Need to treat for the red imported fire ant problem that was last treated in 1991.	TSNL
Pennie's Cave 1. Do hydrogeologic study to assist with management or acquisition, including ecological conditions, use study, and management needs. 2. The entrance is filled. Need to find the entrance and reopen it . 3. Needs to be mapped. 4. May need a cave gate because of the amount of development planned nearby	Private The entrance is filled with rock, gravel and graded over and the cave may be lost. City Watershed Protection staff is aware of the issue and will require setbacks for its protection if/when development plans are submitted to the COA. The BCCP may still want to consider replacing this cave on the BCP list or begin work on a private landowner agreement to uncover /protect it. TCMA reported that Scott Heirs, COA Watershed Protection obtained accurate GPS coordinates to the filled cave entrance. It is the hope of TCMA that the BCCP will replace this covered cave with Grassy Cove or some other cave in need of BCCP protection.
Pickle Pit Cave 1. Needs to be mapped. 2. Monitor and control fire ants.	Section 7 Permit 2-15-93-F-075 (see USFWS files)
Pipeline Cave Because local drainage does enter and pass through the cave, but without distinct surface channels, the area contributing recharge to the cave is difficult to determine. Pending a more definitive determination of the drainage area, sources of organic input to the cave, and the type of construction anticipated in the vicinity, the following should be done: 1. Establish setbacks extending at least upslope to the pipeline and the area around the cave should remain undeveloped so that organic material will continue to enter the cave. 2. Prevent upslope erosion into the cave . 3. Replace the grate with a cave gate. 4. Meet with the developer to discuss possible protection measures . 5. Remove trash after rain events 6. Continue to monitor any effects on the cave by the "Rancho" crude oil pipeline. This cave is very near and in the drainage of this pipeline	Private TCMA had a meeting with the Stratus Development Group and has been assured that the cave will be set aside and that the previously planned large commercial development on that tract will likely be scaled down to accommodate the cave.
Rolling Rock Cave (The cave was supposed to be protected as part of a 10(a) to be located on the Austin Simon tract. However, the actual location of the cave was determined to be on the adjoining COA Lime Creek Preserve tract. It is possible that as part of the 10(a)agreement with USFWS, that the TPWF will work with the COA to assist with funding for protecting and monitoring this cave.) 1. Need to work out management agreement between the 10(a) holder to assist with management of the cave. 2. Do a annual faunal survey in the Spring . 3. Monitor and control fire ants.	City of Austin 1. This cave was inspected twice, and no sign of human visitation or vandalism was found. 2. Was inspected for red imported fire ants, none were present at or near the cave entrance, but did find several species of native ants. Red imported fire ant mounds were found within a 150' radius of the cave entrance.
Root Cave 1. Need to treat for the red imported fire ant problem that was last treated in 1991. 2. May need a cave gate, depending on access situation .	TSNL
Slaughter Creek Cave 1. The cave will need a gate because of its obvious location near a subdivision . 2. Since the cave receives considerable drainage, monitor runoff from surrounding development. 3. Need a map of the cave interior . 4. A cave gate is being constructed for this cave . 5. Need a thorough biological survey .	City of Austin 1. Two site inspections (fall and spring) were conducted. 2. The entrance was inspected to make sure that no human access had occurred. 3. The site was also inspected for RIFA infestations. On both visits fire ant mounds were found in close proximity of the cave entrance, however, ants did not appear to be entering the cave.

6. Monitor and control fire ants.	TCMA reported entrance has been covered by rocks to protect the cave from unwanted visitors. The heavy end of year rains did not appear to have disturbed the cover.
Spanish Wells Cave 1. Do hydrogeologic study to assist with management or acquisition, including ecological conditions, use study, and management needs. 2. Determine more precise location of the cave 3. Do faunal survey.	Private
Spider Cave 1. Need a map of the cave interior. 2. Monitor and control fire ants.	City of Austin 1. 2 site visits were conducted, and no sign of human access, or vandalism was found. 2. Surveyed for red imported fire ants, found no activity at or near cave entrance, but did find mounds within a 150' radius.
Stark's North Mine 1. Littered with junk and refuse left by neighborhood children and needs cleanup . 2. Needs a cave gate because it presents a potential safety hazard for neighborhood children.	Private Collections were made in early 2001 by TCMA and turned over to James Reddell for identification. The usual trash was observed in the cave along with the abundance of cave adapted critters. The mine was recently visited by the City of Austin Watershed Protection Department (WSPD). In order to help determine the actual owner of Stark's Mine, a site plan of current construction across the creek should be obtained.
Stovepipe Cave 1. Probably needs red imported fire ant control. 2. Developer or MUD has fenced the preserve with an inadequate 4 strand barbless wire fence. Check to see if the 55 acre karst preserve is being protected. Encourage them to place an adequate fence or cave gate to protect the cave. 3. Monitor the 10(a) holder's management of the cave that is required by their permit.	Section 7 Permit 2-15-93-F-075 (see USFWS files) James Reddell did a biological study of cave fauna and initial monitoring found the cave in good shape.
Talus Springs Cave 1. Do hydrogeologic study to assist with management or acquisition, including ecological conditions, use study, and management needs. 2. Need a map of the cave interior. 3. May need a cave gate, depending on access situation .	Private The 10a permit PRT 815447 mitigation requirement intended this cave to go to Travis County, however, the cave is located on private land just outside of the mitigation area. The developer Pulte Holmes is working to donate the land and cave to Travis County.
Tardus Hole Cave 1. Obtain faunal list and endangered species list from Reddell. 3. May need a cave gate, depending on access situation .	TSNL
Tooth Cave 1. improved gate needed (remove expanded metal on gate, roughen interior or animal access hole) . The cave gate design should allow for the return of the bats. 2. The hydrologically critical area of Tooth-Russell Cave should be maintained in its natural state 4. The critical area should be bermed on the uphill side if any neighboring development might drain its runoff into it. 5. Need to treat for the red imported fire ant problem that was last treated in 1991 .	TSNL
Weldon Cave 1. Do hydrogeologic study to assist with management or acquisition, including ecological conditions, use study, and management needs. 2. Determine the location more precisely. The cave reportedly has its entrance in Travis County and terminal room in Williamson county . 3. May need a cave gate, depending on access situation .	Private
Whirlpool Cave 1. Do hydrogeologic study to assist with management, including ecological conditions, use study, and management needs. 2. Prior to the construction of the present gate, the cave received large amounts of floodwater, acting as a major recharge site. Changes in gate design should follow the recommendations of the hydrogeologic study. One possibilities might include constructing a recharge shaft in the creek bed near the entrance. Water flowing into the cave could be controlled so that only good quality water would be recharged . 3. Monitor the cave to evaluate the effect or non-effect of human visitation. Continue doing faunal surveys .	TCMA 1. Conducted a biological survey in December 2001. 2. Controlled and monitored public access. 3. Planning to relocate the survey areas in 2002.

4. Monitor and control fire ants. 5. TCMA should complete the draft management plan which will include plans to monitor the effects on the cave of the development on the adjacent property, including utility trenches, a sewer line that crosses the property which may cause contamination and other excavations	

7.0 RECOMMENDATIONS

In addition to the specific cave actions listed above, the following are recommendations to assist the BCCP permit holders to meet the obligations of the permit.

1) Work on developing private landowner agreements to protect additional caves listed here as “private”.
2) Work with USFWS on determination of what defines adequate “protection” for the BCCP caves and assess caves listed here for their level of protection under the new FWS definition.
3) BCCP partners work with TCMA, TSNL and USFWS karst biologist to standardize monitoring and reporting procedures.
4) Provide training for staff of BCCP partners on karst species, karst monitoring, and karst management activities.

8.0 LITERATURE CITED

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Final Habitat Conservation Plan/ Environmental Impact Statement (Final HCP/EIS) Regional Environmental Consultants & U.S. Department of the Interior, Fish and Wildlife Service. 1996. Final environmental impact statement/habitat conservation plan for proposed issuance of a permit to allow incidental take of the golden-cheeked warbler, black-capped vireo, and six karst invertebrates in Travis Co., TX.

Jenkins, Julie, Texas Cave Management Association (TCMA), personal communication, 2001-2002.

Reddell, James, Texas System of Natural Laboratories (TSNL), Texas Cave Management Association (TCMA), personal communication, 2002.

Russell, Bill, Texas Cave Management Association (TCMA), personal communication, 2001-2002.

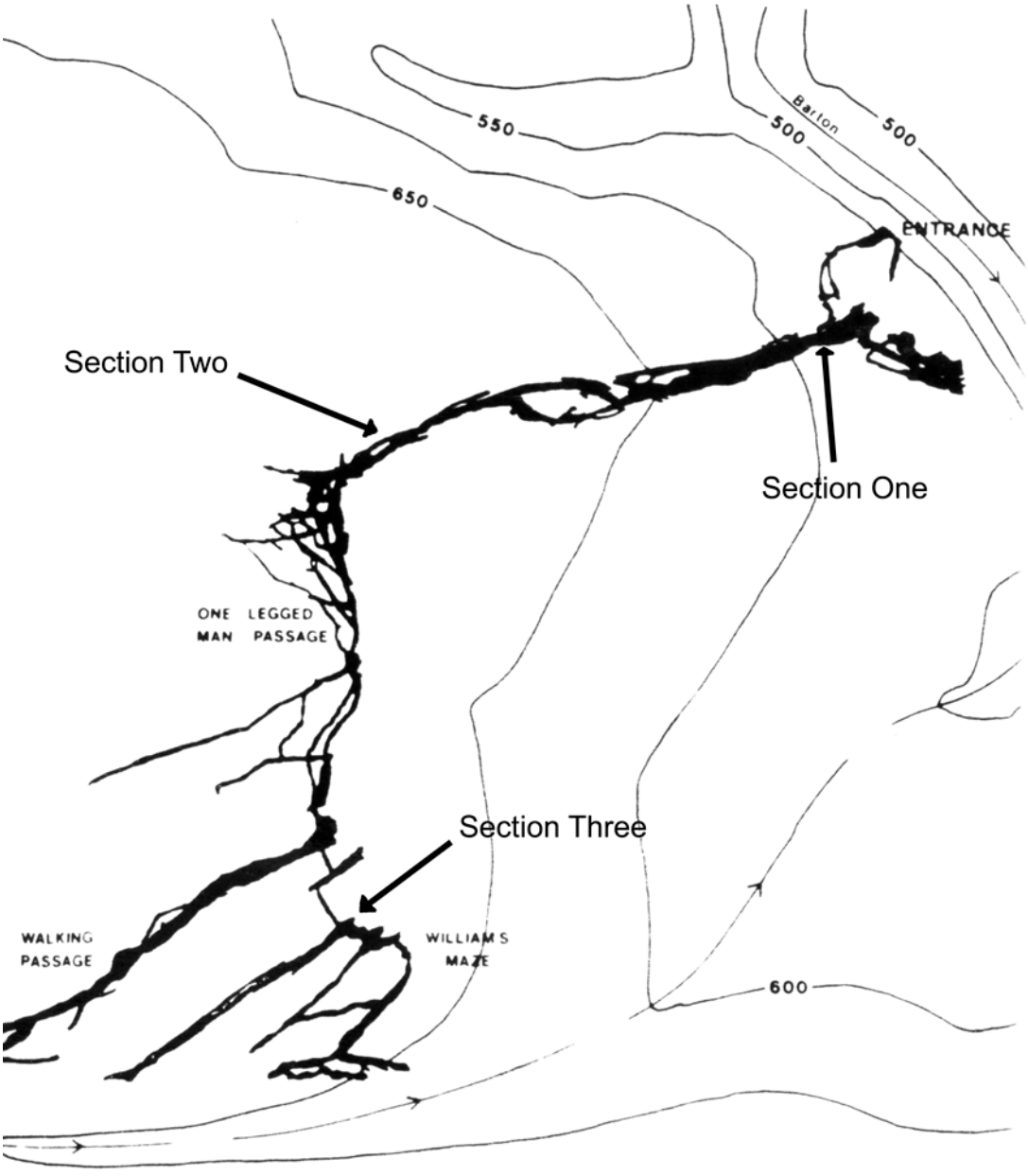
Sanders, Mark, City of Austin BCCP, personal communication, 2001-2002.

U.S. Fish and Wildlife Service Draft Recommendations for Karst Preserve Design, March, 2001 Version, USFWS, Austin, TX.

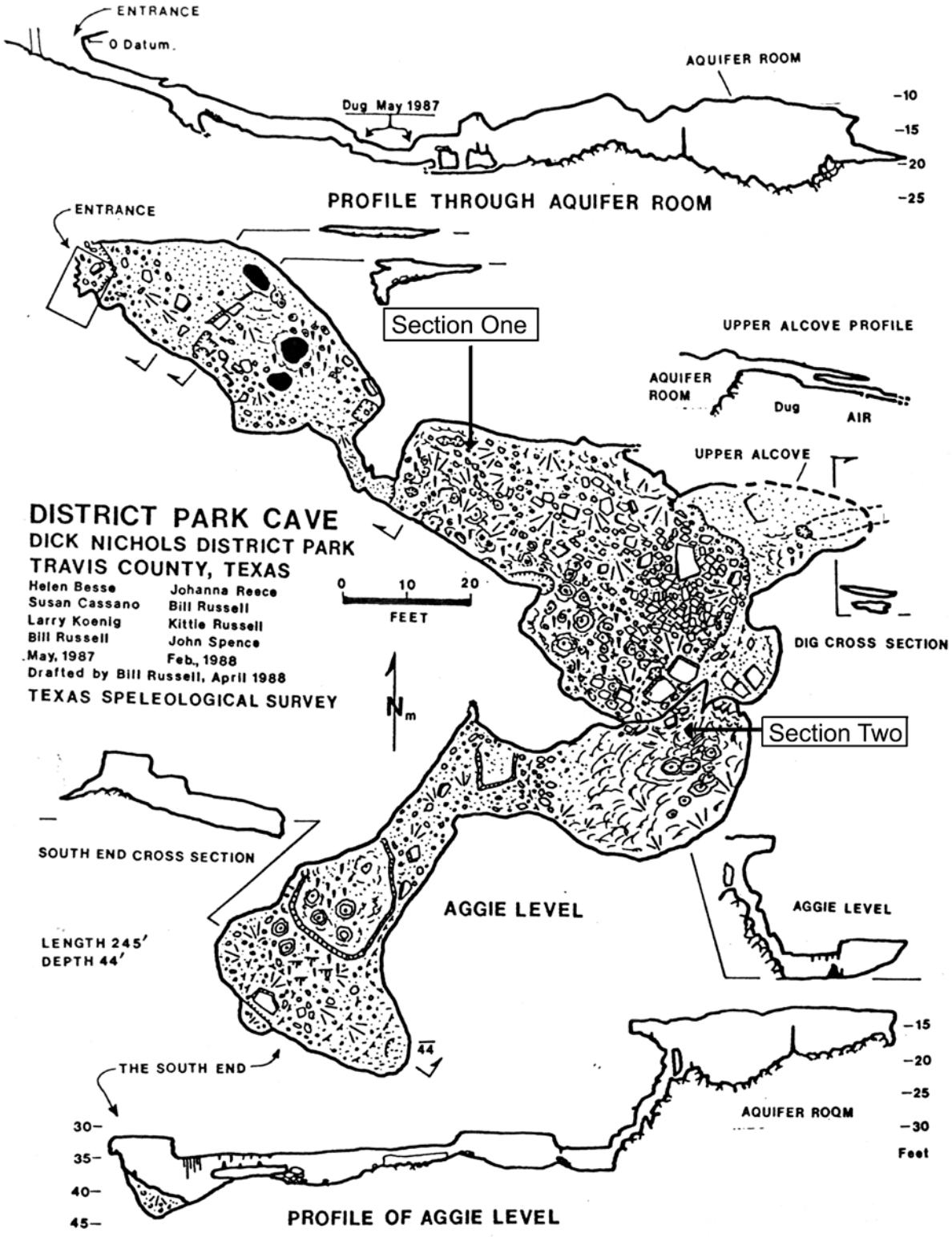
U.S. Fish and Wildlife Service. 1994. Endangered Karst Invertebrates (Travis and Williamson Counties): Recovery Plan.

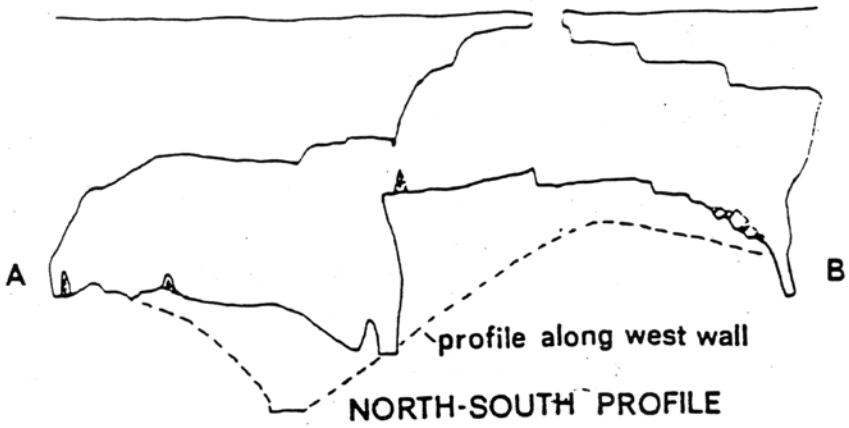
ATTACHMENT A:
KARST FAUNAL REPORTS:
CITY OF AUSTIN (19)
TEXAS CAVE MANAGEMENT ASSOCIATION (2)

Airman's Cave



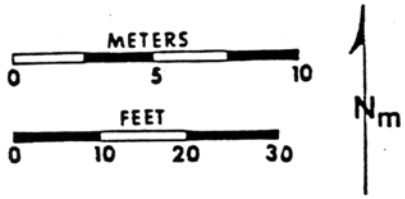
TOTAL SURVEYED LENGTH: 10,800 FEET


ENTRANCE
0 Datum.
AQUIFER ROOM
Dug May 1987
-10
-15
-20
-25
PROFILE THROUGH AQUIFER ROOM
ENTRANCE
Section One
UPPER ALCOVE PROFILE
AQUIFER ROOM
Dug
AIR
UPPER ALCOVE
DISTRICT PARK CAVE
DICK NICHOLS DISTRICT PARK
TRAVIS COUNTY, TEXAS
Helen Besse
Susan Cassano
Larry Koenig
Bill Russell
May, 1987
Johanna Reece
Bill Russell
Kittie Russell
John Spence
Feb., 1988
Drafted by Bill Russell, April 1988
TEXAS SPELEOLOGICAL SURVEY
0 10 20
FEET
DIG CROSS SECTION
Section Two
SOUTH END CROSS SECTION
AGGIE LEVEL
AGGIE LEVEL
LENGTH 245'
DEPTH 44'
44
THE SOUTH END
-15
-20
-25
-30
Feet
AQUIFER ROOM
30-
35-
40-
45-
PROFILE OF AGGIE LEVEL



NORTH-SOUTH PROFILE

GOAT CAVE

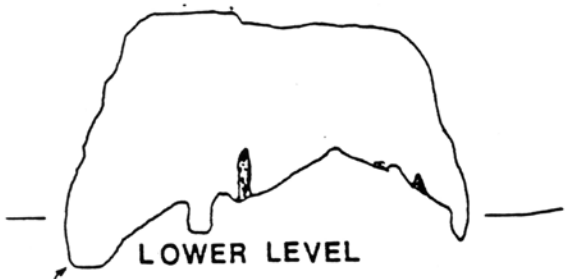


TRAVIS COUNTY, TEXAS

Craig Bittinger, Bill Russell Sept 10 83

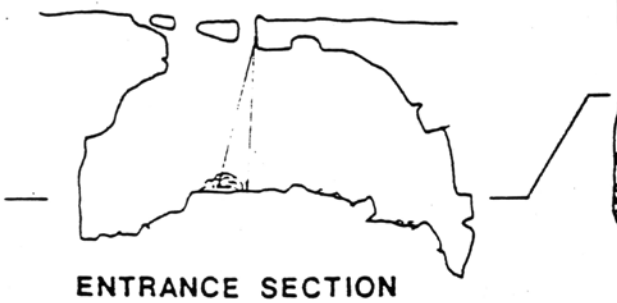
Original Survey: B. Bell, L. Larremore, J. Reddell, A. Weiss May 6 61

Drafted by Bill Russell



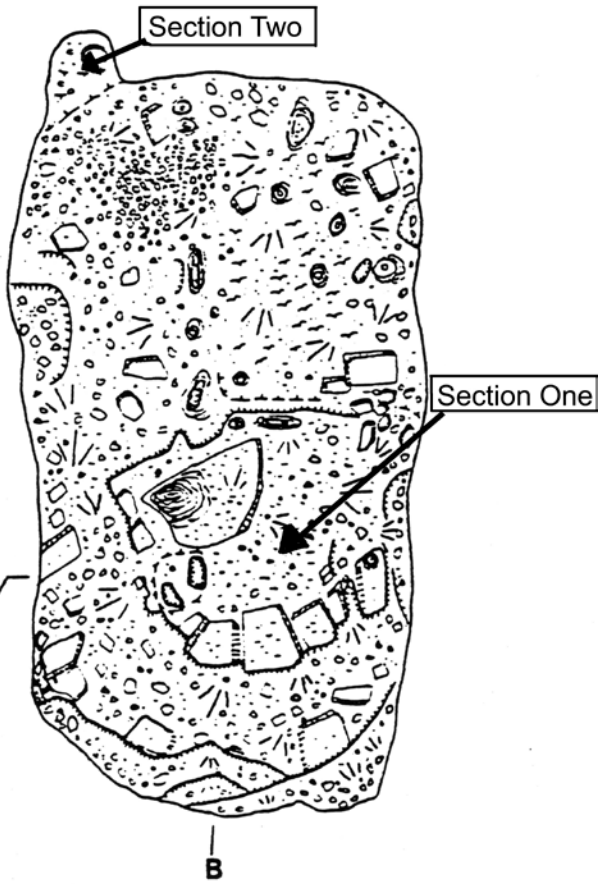
LOWER LEVEL

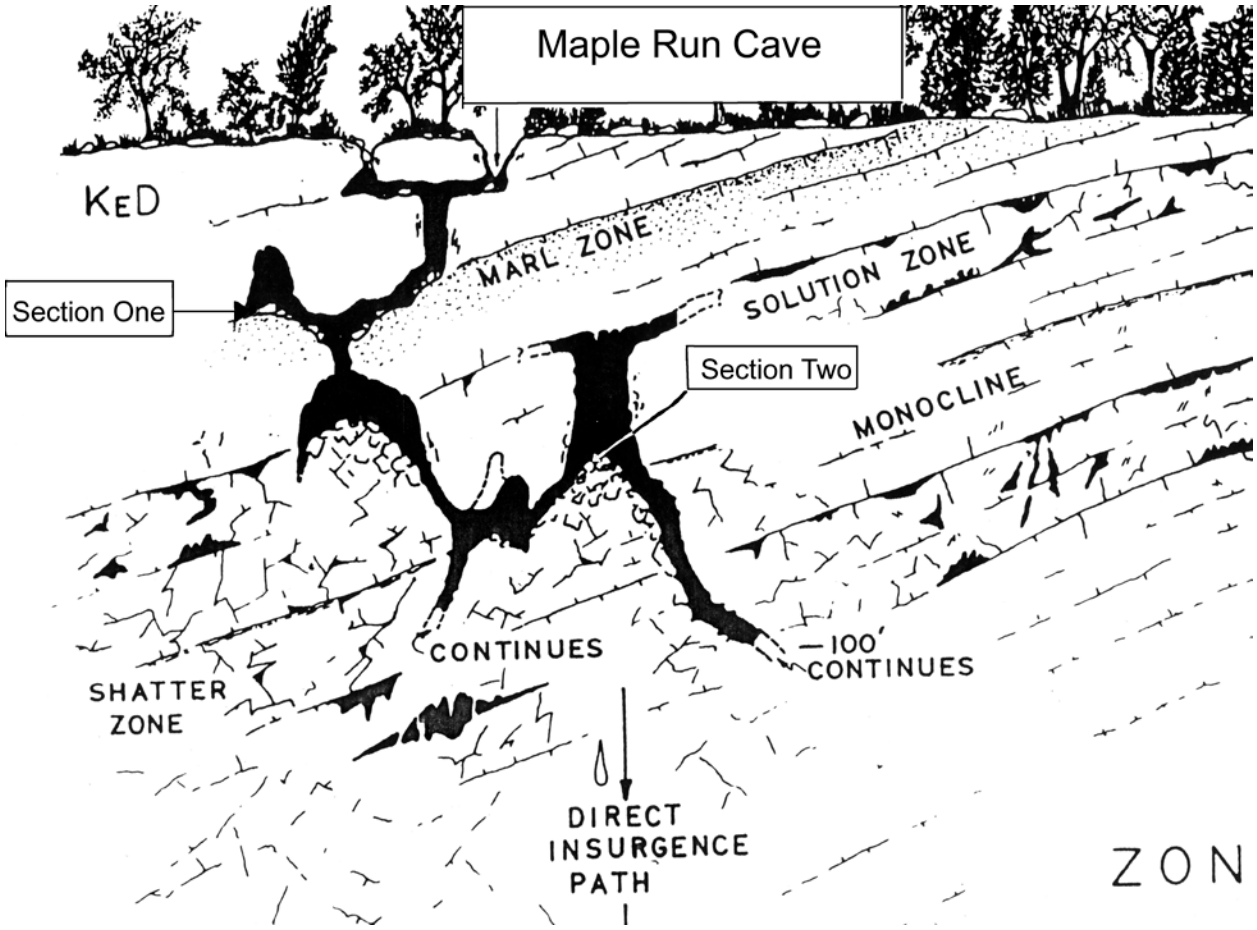
Deepest Point 43ft, 13m



ENTRANCE SECTION

Entrance Drop 19ft. 5.8m




Maple Run Cave
KED
MARL ZONE
SOLUTION ZONE
Section One
Section Two
MONOCLINE
CONTINUES
100'
CONTINUES
SHATTER
ZONE
DIRECT
INSURGENCE
PATH
ZON

Attachment B:

Texas Cave Management Association (TCMA)
December 2001

WHIRLPOOL CAVE

Whirlpool Cave is utilized primarily for educational/recreational activity by the City of Austin Nature Center and other outdoors and nature related organizations. Other uses include safety and fire rescue training, science monitoring for the TCMA and BCP and caver training by local Texas cave grottos. The cave is typically visited at least once a week during the late spring and through summer by one or more organizations. In the fall new cavers receive training and experience in Whirlpool. Groups using the cave stay to the well-worn path and seldom if ever stray from the established route. Visits may take as little as 45 minutes or last for many hours, depending on the educational needs, age and background of the group touring the cave. Whirlpool received 889 registered visitors in 2001.

A biological survey was performed on December 22, 2001 by Bill Russell and Julie Jenkins both of the TCMA. This survey was designed to assess the cave biology in the least favorable environment possible, providing an indication of the effects of winter airflow and wetness, both of which in the past have decreased the apparent number of cave adapted animals.

There had been an extensive wet event period prior to the rain event of November 16, 2001 that produced rains in the vicinity of Whirlpool Cave of about 12 inches in one afternoon with extensive flooding. Preceding the date of the survey the ground had been saturated for considerable periods and recharge through the surface was probably the maximum that could be expected for any extended period. This was reflected in the cave, as drips had formed on every projection of the ceiling and water oozed from every crack. Large areas of the ceiling were covered with a film of liquid water and considerable pools had formed in the lower passages leading to the Travis County room. The substrate, normally powdery and crumbly, was damp and spongy, with numerous drip holes. The amount of pooled water in the cave had increased since the proceeding week, likely indicating the arrival of the water from the major flood of November 16. The cave was as wet as it has been since the construction of the cave gate prevented the direct flooding of the cave in the early 90's. Before that time both the areas sampled in the current survey were flooded to the ceiling about twice a year. The increased wetness is not just an increase in the relative humidity, but a large increase in the amount of liquid water in the cave, changing the characteristics of the floor material.

In addition to this wetness there had been stronger than usual airflow through the cave, powered by the changes in outside air pressure during the numerous storms. This airflow is normally **out** of the cave through the day and **into** the cave at night. During airflows into the cave, the cold outside air is warmed by the walls of the cave, reducing the relative humidity and enabling the airflow to evaporate water from the cave. This evaporation and contact with the cool outside air has lowered the temperature of the floor and walls. The wetness, combined with the lowered nighttime humidity and the cool temperature tend to keep the cave adapted animals immobilized, and we expected to observe relatively low numbers of cave adapted animals.

The results of the survey were somewhat as expected. Relatively few animals were observed. Especially noticeable was the lack of Rhadine beetles, only one was observed on the trip and none were seen in the "survey areas". Our working hypothesis is that cave animals retreat into cracks and protected areas during adverse times. This is supported by the large variations in numbers of caves adapted animals seen in many caves on closely spaced trips. During especially dry conditions, which is much more typical of our area of Central Texas, animals can be found hidden beneath rocks where moisture is trapped. However, the undersides of rocks were carefully examined and no cave adapted animals were found. This is understandable, as a small rock would offer little protection to excessive wetness, so most of the refuges used to avoid cold and wet are likely small holes and cracks in the walls of the cave. The faster animals such as crickets and beetles would be able to reach these refuges while the slower moving millipedes would be less likely to encounter a favorable habitat. The observable spider population was also greatly depressed; likely due both to retreat into refuges and the likelihood that they would not weave a web in wet conditions where they would be unlikely to catch anything. It is our intent to re-survey the cave using the same areas as soon as conditions in the cave improve.

For the long-term we plan to re-establish the survey areas to new locations. Our current thinking is that one area will be entirely off the trail in a low area before the Travis County room, and the other survey area will be a part of the Travis County room. These will be marked with permanent markers for greater consistency. For the first few survey's both the new areas and the old will be surveyed. The principal problem with the old survey areas is that the area just below the entrance is affected by outside conditions and both areas are on the main route used by visitors. The new survey areas will have one traveled area, and one area well off the main route.

LOST OASIS CAVE

Lost Oasis Cave has received little to no interest from recreational groups or other organizations. The cave is mostly comprised of one room about 35 x 40 feet. The current gated entrance is particularly difficult to access in part because, the gate is quite heavy and difficult to open and the entrance crawl must be made sliding on one's back through a very low 6 foot long bedding plane squeeze. This cave has been gated for almost a decade. Except for an annual check of the lock and/or to change the combination to the perimeter fence, this site is left completely undisturbed by humans.

Plans for the future, based on BCP guidelines will include biological monitoring to assess the current cave biology. Based on early reports from the TSS files, "this cave, being shallow but damp, contains a rich biota. Two species of cave-adapted millipedes were observed, as well as a species of blind Rhadine beetle, and several types of spiders. Much organic matter enters the cave from a now-filled entrance along the east wall of the room."

As this cave is now completely cutoff from any energy input from the entrance due to the gate and the complete lack of activity from the surface, it will make an interesting study when we examine the current biology and attempt to assess where the energy input to the cave originates.

GET DOWN CAVE

Get Down Cave, visited by TCMA in December 2001, contains a flourishing colony of cave adapted animals, including two species of concern, species considered threatened, but which have not been officially listed as endangered species. These species were designated species of concern, because, like the officially endangered species, their entire range was likely to be covered by urban development. One of the species of concern is a ground beetle, the *Rhadine austinica.* This species is most common in Faunal Area B, in an area floored with a fine soft powder. The other species of concern is *Speodesmus sp.*, as yet an undescribed millipede of the genius *Speodesmus,* which is noticeably shorter than the more widespread *S. bicornours*. The new species is found throughout the cave, with relatively large numbers in Faunal Area C.

Many of these animals live a considerable distance from the entrance, and most of their food appears to originate from the surface area above the cave, rather than through the cave entrance. The extended profile showing the actual passage length, also clearly indicates the difficulty of nutrients from the entrance area ever reaching the areas of the cave distant from the entrance. In long caves the energy input through the entrance is relatively less

important, as most of the energy reaching the interior of the cave percolates down from the surface.

Most caves that contain species of concern and endangered species are quite small, reflecting the fact that most caves are small. The regulatory concern about the condition of the entrance area is derived from populations in these small caves, where the entire cave is biologically part of the entrance area. In Get Down Cave the condition of the cave is dependent on the condition of the surface above the entire cave.

In the last year there has been a considerable increase in raccoon droppings. Large accumulations are present as far back into the cave as the end of Faunal Area B, with smaller piles found throughout the cave. This increase in fecal material is likely due to increased construction and the resulting surface habitat destruction, which forces raccoon from surrounding areas into the preserve.

To maintain the population of cave adapted species there is an optimum level of energy input into the cave. A small increase of energy input will increase the population, but a larger energy input will disrupt the ecology and be harmful to the species of concern. James Reddell reports that Electromag Cave in Williamson County has been heavily contaminated with raccoon droppings to the detriment of the endangered species. To prevent a similar disruption of the ecology in Get Down Cave it is recommended that the raccoon access hole into Get Down Cave be blocked until the present accumulation of droppings has stabilized. For the future the TCMA will work with USFWS to quantify the optimum level of droppings. From causal observations of many caves this appears to be about 10cm per 50 square meters, or about one pile every 100 feet for the average central Texas cave. Larger accumulations only attract the entrance fauna back into the cave, driving the cave-adapted species back into the smaller voids.

The distribution of cave adapted species in Get Down Cave indicates that most of the organic material that provides food for the species of concern does not enter the cave through the entrance. Until recently raccoons did not have access to the lower portion of the cave and their introduction does not appear to have benefited the cave adapted animals. The cave animals are concentrated in areas of favorable substrate or moisture and it is difficult to envision a mechanism that would transmit organic material through the cave prior to the introduction of raccoons. The animals appear to depend on material seeping down from the surface.

FLINTRIDGE CAVE

TCMA has undertaken a drip monitoring project in order to quantify the time it took rainfall to reach the cave's wetter passages. After a somewhat serious drought year in 2000 we noticed that the drip activity was great enough to be measurable. We set up monitoring

sites beneath several very active ceiling formations. A late summer rain after so long a dry spell apparently created a large flush of water into the cave destroying our monitoring formations and our project. It will resume in 2002.

The COA flagged the drainage area of the cave and TCMA flagged the footprint of the cave on the surface for further discussions with TxDot. TCMA is working with the highway dept. to move the highway alignment out of the cave drainage. So far with little success. We hope to involve the BS/EACD as they now have a new general manager and they also have specific legal duties and by law must be involved with the SH45 alignment issues. In late fall the cave received huge amounts of good quality floodwater.

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