

**Balcones Canyonlands Preserve  
Karst Monitoring and Management  
FY 2015 Annual Report**



Cave scorpion (*Pseudouroctonus reddelli*) eating a *Cicurina bandida*  
in Slaughter Creek Cave, Travis County.  
Photo by Mark Sanders

**Travis County  
Department of Transportation and Natural Resources  
Natural Resources and Environmental Quality Division  
and  
City of Austin BCP – Austin Water Utility (AWU)**



October 1, 2014 – September 30, 2015

<b>TABLE OF CONTENTS</b>	<b>PAGE</b>
1.0 REGIONAL PERMIT .....	1
2.0 CAVE MANAGEMENT SUMMARY .....	3
3.0 OWNERSHIP AND PROTECTION STATUS.....	14
4.0 ACCESS STATUS AND KARST EDUCATION/RESTORATION.....	22
5.0 MANAGEMENT COORDINATION .....	30
6.0 BIOLOGICAL MONITORING .....	31
7.0 HYDROGEOLOGIC STUDIES .....	36
8.0 RECOMMENDATIONS.....	39
9.0 KARST MANAGEMENT ACTIVITIES .....	40
10.0 LITERATURE CITED .....	49
 <b>TABLES:</b>	
TABLE 1: Federally Listed Karst Species Covered by the BCCP .....	1
TABLE 2: Karst Species of Concern Covered by the BCCP .....	2
TABLE 3: Endangered Karst Invertebrate Locations in BCCP Caves.....	4
TABLE 4: Non-BCCP listed Caves/Karst Features with Listed Invertebrates Protected on BCP.....	7
TABLE 5: Karst Invertebrate SOC within BCCP Caves, Travis County, Texas .....	8
TABLE 6: Non-BCCP Caves/Karst Features with Karst SOC Protected on BCP.....	13
TABLE 7: FY15 Ownership, Protection, Monitoring and Access Status of the 62 BCCP Karst Features.....	15
TABLE 8: Summary of FY15 City of Austin Watershed Protection Department Education Programs.....	25
TABLE 9: Tracer Injection Sites along Highway 45 SW ROW near Flint Ridge Cave..	36
TABLE 10: Results of Runoff Quality Entering Flint Ridge Sinkhole 2008-2015.....	39
TABLE 11: FY15 BCCP Karst Feature Monitoring and Management Activities.....	40

**FIGURES:**

FIGURE 1: Phase 1 Preliminary Interpretation Results of Surface Tracing to Flint  
Ridge Cave.....37

**EXHIBIT A:** KARST FAUNAL SURVEY REPORTS:.....53  
TRAVIS COUNTY (30 REPORTS)  
CITY OF AUSTIN (50 REPORTS)  
TRAVIS COUNTY/CITY OF AUSTIN (10 REPORTS)

**EXHIBIT B:** CAVE CRICKET EXIT COUNT DATA REPORTS:.....58  
TRAVIS COUNTY (23 REPORTS)  
CITY OF AUSTIN (35 REPORTS)

## 1.0 REGIONAL PERMIT

There are six species of endangered karst invertebrates (ES; Table 1) and 25 karst species of concern (SOC; Table 2) covered by the Balcones Canyonlands Conservation Plan (BCCP), a regional 10(a)1(B) permit issued by the U.S. Fish and Wildlife Service (USFWS) to the City of Austin (COA) and Travis County (TC) in May 1996 (USFWS 1996a). If these 25 species of concern become listed as endangered in the future, no additional mitigation will be necessary to protect them, provided that all karst protection requirements, outlined in the BCCP, are fully implemented.

The Regional Permit requires protection of 35 endangered species caves and 27 additional caves that support SOC, for a total of 62 karst features (60 caves, one mine and one karst spring). Several of these karst features occur in clusters, identified in the Regional Permit's associated Habitat Conservation Plan/Environmental Impact Statement (HCP/EIS) as the Four Points, McNeil, and Northwood cave clusters (USFWS 1996b). As of Fiscal Year 2015 (FY15), 48 of the 62 BCCP karst features have some form of formal protection on properties owned and managed by COA, TC, and BCCP partners, as well as private mitigation lands.

**Table 1. Federally Listed Karst Species Covered by the BCCP**

*Footnotes follow table*

Common Name	Scientific Name
Tooth Cave pseudoscorpion	<i>Tartarocreagris texana</i>
Tooth Cave spider	<i>Tayshaneta myopica</i> <sup>1</sup>
Tooth Cave ground beetle	<i>Rhadine persephone</i>
Kretschmarr Cave mold beetle	<i>Texamaurops reddelli</i>
Bee Creek Cave harvestman	<i>Texella reddelli</i>
Bone Cave harvestman	<i>Texella reyesi</i>

<sup>1</sup> *Tayshaneta myopica* is listed in the regional permit as *Neoleptoneta myopica*, but a 2012 study revised the genus *Neoleptoneta*, thus identifying this species in the genus *Tayshaneta* (Campbell et al. 2012).

**Table 2. Karst Species of Concern Covered by the BCCP**

Footnotes follow table

Common Name	Scientific Name
Flatworm	<i>Sphalloplana mohri</i>
Ostracod	<i>Candona</i> sp. nr. <i>stagnalis</i>
Isopod	<i>Caecidotea reddelli</i>
Isopod	<i>Trichoniscinae</i> N. S.
Isopod	<i>Miktoniscus</i> N. S.
Spider	<i>Cicurina bandida</i>
Spider	<i>Cicurina cueva</i>
Spider	<i>Cicurina ellioti</i>
Spider	<i>Cicurina reddelli</i>
Spider	<i>Cicurina reyesi</i>
Spider	<i>Cicurina travisae</i>
Spider	<i>Cicurina wartoni</i>
Spider	<i>Tayshaneta concinna</i> <sup>1</sup>
Spider	<i>Tayshaneta devia</i> <sup>1</sup>
Spider	<i>Eidmannella reclusa</i>
Pseudoscorpion	<i>Aphrastochthonius</i> N. S.
Pseudoscorpion	<i>Tartarocreagris comanche</i> <sup>2</sup>
Pseudoscorpion	<i>Tartarocreagris reddelli</i>
Pseudoscorpion	<i>Tartarocreagris intermedia</i>
Pseudoscorpion	<i>Tartarocreagris</i> N. S. 3
Harvestman	<i>Texella spinoperca</i>
Millipede	<i>Speodesmus</i> N. S
Ground Beetle	<i>Rhadine s. subterranea</i>
Ground Beetle	<i>Rhadine s. mitchelli</i>
Ground Beetle	<i>Rhadine austinica</i>

<sup>1</sup> *Tayshaneta concinna* and *Tayshaneta devia* are listed in the regional permit with the genus *Neoleptoneta*, but a 2012 study revised the genus *Neoleptoneta*, thus identifying these species in the genus *Tayshaneta* (Campbell et al. 2012).

<sup>2</sup> *Tartarocreagris comanche* is improperly listed in the regional permit as the New Comanche Trail Cave harvestman.

## **2.0 CAVE MANAGEMENT SUMMARY**

This annual report covers the fiscal year 10/01/14- 9/30/15 (FY15). In FY15, the BCCP partners continued efforts to determine and track the 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 (see Tables 3 and 5 for species localities).

A total of 48 of the BCCP caves are “protected” in some way, with 14 “unprotected”. The 48 “protected” BCCP caves are currently managed as follows: 21 caves protected as part of the BCP on COA land; one cave protected on The Nature Conservancy (TNC) land; 13 caves protected as part of the BCP on TC land; two caves protected on Texas Cave Management Association (TCMA) land; seven caves protected as part of private Section 10(a) or Section 7 agreements with USFWS; and four caves that have protection agreements that include development setbacks from the cave entrance. Some of these “protected” caves only have protected entrances, but are threatened by surrounding development or planned development. Ownership and protection status of each of the 62 BCCP caves is detailed in Table 7 below.

In addition to protecting and monitoring caves covered by the BCCP permit, COA and TC also provide protection for other karst features found on the BCP containing ES and SOC (Tables 4 and 6). Some of these additional karst features are incorporated into TC and COA’s shared biological monitoring program, as described in Section 6.0. As of FY15, 13 endangered species karst features which were not listed on the BCCP permit are being protected on BCP lands (six features on TC BCP; seven features on COA BCP; Table 4). Additionally, 11 SOC karst features not listed on the Permit are also being protected on BCP lands (six features on TC BCP; five features on COA BCP; Table 6).

To assist with analyzing the adequacy of the current preserve design for each karst feature, including the amount of surface and subsurface habitat needed to support these ecosystems, the COA and TC have been working together to maintain a comprehensive database for the 62 features and other features identified within the BCP since the regional permit was issued in 1996. The database also incorporates monitoring data and management issues for each karst feature. The karst database is discussed in more detail in Section 5.0.

**Table 3. Endangered Karst Invertebrate Locations within BCCP caves of Travis County, Texas.**

This table, originally in the BCCP 1996 documents, has been revised to show new species location information. *Key and footnotes follow table.*

Cave Name	Current Preserve Status	Karst Fauna Region	Tooth Cave Pseudoscorpion <i>Tartarocreagris texana</i>	Tooth Cave Spider <i>Tayshaneta myopica</i>	Tooth Cave Ground Beetle <i>Rhadine persephone</i>	Kretschmarr Cave Mold Beetle <i>Texamaurops reddelli</i>	Bee Creek Cave Harvestman <i>Texella reddelli</i>	Bone Cave Harvestman <i>Texella reyesi</i>
Amber Cave	BCP Jollyville/TC	Jollyville Plateau	X 1996		X 2010 (Reddell)	X 1996		
Bandit Cave	Private	Rollingwood					P 1996 X 2009	
Beard Ranch Cave	BCP Ivanhoe/COA	Jollyville Plateau						X 1996
Bee Creek Cave	Private	Rollingwood					X 1996	
Broken Arrow Cave	BCP Lime Creek Preserve/COA	Cedar Park			X 1996			
Cold Cave	Private	McNeil/Round Rock						X 1996
Cotterell Cave	BCP Spicewood Springs Park/COA	Central Austin						X 1996
Disbelievers Cave	BCP Private 10(a)	Jollyville			X 1996			
Eluvial Cave	BCP Private 10(a)	Jollyville						X 1996
Fossil Cave	BCP Schroeter Park/COA	McNeil/Round Rock						X 1996
Fossil Garden Cave	Private	McNeil/Round Rock						X 1996
Gallifer Cave	BCP Jollyville/TC	Jollyville Plateau		P 1996 X 2010 (Ledford)	P 1996 X 2005	X 2009 (Chandler)		X 1996
Hole-in-the-Road Cave	Private	McNeil/Round Rock						X 1996
Japygid Cave	BCP Private 10(a)	Jollyville			X 1996	P 1996 X 2005		
Jest John Cave	BCP Forest Ridge/COA	Jollyville Plateau					X 1996	

Cave Name	Current Preserve Status	Karst Fauna Region	Tooth Cave Pseudoscorpion <i>Tartarocreagris texana</i>	Tooth Cave Spider <i>Tayshaneta myopica</i>	Tooth Cave Ground Beetle <i>Rhadine persephone</i>	Kretschmarr Cave Mold Beetle <i>Texamaurops reddelli</i>	Bee Creek Cave Harvestman <i>Texella reddelli</i>	Bone Cave Harvestman <i>Texella reyesi</i>
Jester Estates Cave	BCP Forest Ridge/COA	Jollyville Plateau	X 2008 (Cokendolpher)	X 2010 (Ledford)			X 1996	
Jollyville Plateau Cave	BCP Private 10(a)	Jollyville			X 1996			X 1996
Kretschmarr Cave	BCP Jollyville/TC	Jollyville Plateau			X 1996	X 1996		
Kretschmarr Double Pit	BCP Jollyville/TC	Jollyville Plateau	P 1996 X 2005		P 1996 X 2005		P 1996	
Lamm Cave	Private Section 7	Jollyville Plateau			X 1996			
Little Bee Creek Cave	BCP Ullrich WTP/COA	Rollingwood					X 1996	
McDonald Cave	BCP Jollyville/TC	Jollyville Plateau						X 1996
McNeil Bat Cave	Private	McNeil/Round Rock		X 2010 (Ledford)				X 1996
M.W.A. Cave	BCP Private 10(a)	Jollyville	P 1996 X 2005		X 1996	P 1996 X 2005		X 1996
New Comanche Trail Cave	BCP Lake Travis/TC	Jollyville Plateau		X 1996				X 1996
No Rent Cave	Private	McNeil/Round Rock						X 1996
North Root Cave	BCP Jollyville/TC	Jollyville Plateau			X 1996			
Rolling Rock Cave	BCP Lime Creek Preserve/ COA,Sec.10(a)	Cedar Park			X 1996			
Root Cave	BCP Jollyville/TC	Jollyville Plateau		X 2010 (Ledford)	X 1996			X 1996
Spider Cave	BCP Park West/COA	Jollyville Plateau			X 2004 (Reddell)		X 2004 (Reddell)	

Cave Name	Current Preserve Status	Karst Fauna Region	Tooth Cave Pseudoscorpion <i>Tartarocreagris texana</i>	Tooth Cave Spider <i>Tayshaneta myopica</i>	Tooth Cave Ground Beetle <i>Rhadine persephone</i>	Kretschmarr Cave Mold Beetle <i>Texamaurops reddelli</i>	Bee Creek Cave Harvestman <i>Texella reddelli</i>	Bone Cave Harvestman <i>Texella reyesi</i>
Stark's North Mine Cave	BCP Stark's/TC	Not within a KFR					X 2009 (USFWS)	
Stovepipe Cave	BCP Canyon Creek/ COA	Jollyville Plateau			X 1996	X 1996		P 1996 X 2009 (USFWS)
Tardus Hole	BCP Jollyville/TC	Jollyville Plateau			X 1996	X 2009 (Chandler)		
Tooth Cave	BCP Jollyville/TC	Jollyville Plateau	X 1996	X 1996	X 1996	X 1996		X 1996
Weldon Cave	Private	McNeil/Round Rock						X 1996

Sources: BCCP Permit 1996, Elliott 1992, USFWS 1994, Reddell 2004 and 2005, HNTB 2005, USFWS 2009a, 2009b, Ledford 2010

Key and Footnotes

X 1996 = confirmed occurrence based on collected specimen, the designation in the 1996 BCCP permit

P 1996 = probable occurrence based on observation but not confirmed with collected specimen, the designation in 1996 BCCP permit

X 2004 (Reddell) = confirmed by J. Reddell (pers. comm 2004)

X 2005 = was listed as confirmed in the HNTB summary of James Reddell's data, 2005 report for USFWS

X 2008 = Cokendolpher (pers. comm 2008) confirmed that Jester Estates Cave is a new site for *Tartarocreagris texana*

X 2009 = USFWS - according to the 2009 5 year review on *Texella reyesi* the report lists *T. reyesi* as confirmed for Stovepipe Cave; *Texella reddelli* 5-year review confirms *T. reddelli* for Stark's North Mine (USFWS 2009c).

X 2009 (Chandler) = confirmed by D. Chandler, as reported in USFWS 5-year review (2009b).

X 2010 (Ledford) = confirmed by J. Ledford (pers. comm 2010)

X 2010 (Reddell) = confirmed by J. Reddell (pers. comm 2010)

**Table 4. Non-BCCP listed Caves/Karst Features with Listed Invertebrates Protected on BCP**

Key follows table

Cave Name	Current Preserve Status	Karst Fauna Region	Tooth Cave Pseudoscorpion <i>Tartarocreagris texana</i>	Tooth Cave Spider <i>Tayshaneta myopica</i>	Tooth Cave Ground Beetle <i>Rhadine persephone</i>	Kretschmarr Cave Mold Beetle <i>Texamaurops reddelli</i>	Bee Creek Cave Harvestman <i>Texella reddelli</i>	Bone Cave Harvestman <i>Texella reyesi</i>
Cortana Cave	COA	Jollyville Plateau		X 2010				X 2008
Down Dip Sink	COA	Jollyville Plateau			X 2007a			
Garden Hoe Cave	COA	Jollyville Plateau			X 2007b			
Geode Cave	TC	Jollyville Plateau		X 2008	X 2008			X 2008
LU-11	TC	Jollyville Plateau		X 2008				
LU-12	TC	Jollyville Plateau						X 2008
IV-3	COA	Jollyville Plateau						X 2010
Little Black Hole	COA	Rollingwood					X 2009c	
Merkin Hole	COA	Jollyville Plateau					X 2010	
Pond Party Pit	COA	Jollyville Plateau						X 2010
RI-1	TC	Jollyville Plateau					X 2010	
Tight Pit Cave	TC	Jollyville Plateau		X 2010				
Two Trunks Cave	TC	Jollyville Plateau			X 2008 (USFWS)			

**Sources:** USFWS 2008, 2009c; Zara Environmental 2007a, 2007b, 2008, and 2010.

**Key:** X = confirmed occurrence based on collected specimen.

**Table 5. Karst Invertebrate SOC within BCCP Caves, Travis County, Texas<sup>1,2</sup>**

Key and footnotes follow table

Cave Name	<i>Aphrastochitonius</i> N.S.	<i>Caecidotea reddelli</i>	<i>Candona</i> sp. nr. <i>stagnalis</i>	<i>Cicurina bandida</i> <sup>3</sup>	<i>Cicurina travisae</i> <sup>4</sup>	<i>Cicurina</i> sp. <sup>5</sup>	<i>Eidmannella reclusa</i>	<i>Miktoniscus</i> N.S.	<i>Tayshaneta concinna</i>	<i>Tayshaneta devia</i>	<i>Rhadine austinica</i>	<i>Rhadine s. subterranea</i>	<i>Rhadine s. mitchelli</i>	<i>Speodesmus</i> N.S.	<i>Sphalloplana mohri</i>	<i>Tartarocreagris comanche</i>	<i>Tartarocreagris intermedia</i>	<i>Tartarocreagris</i> N.S. 3	<i>Texella spiniperca</i>	<i>Trichoniscinae</i> N.S.
Adobe Springs Cave																				
Airmen's Cave				X						X							X		X	
Amber Cave					X								X							
Armadillo Ranch Sink		X																		
Arrow Cave				X						X										
Bandit Cave				X						X										X
Beard Ranch Cave					X															
Bee Creek Cave				X						X										
Blowing Sink Cave				X						X										
Broken Arrow Cave																				
Buda Boulder Spring		X																		
Cave X		X	X	X				X		X				X						
Cave Y				X						X										
Ceiling Slot Cave						X														
Cold Cave						X														

Cave Name	<i>Aphrastochthonius</i> N.S.	<i>Caecidotea reddelli</i>	<i>Candona</i> sp. nr. <i>stagnalis</i>	<i>Cicurina bandida</i> <sup>3</sup>	<i>Cicurina travisae</i> <sup>4</sup>	<i>Cicurina</i> sp. <sup>5</sup>	<i>Eidmannella reclusa</i>	<i>Miltoniscus</i> N.S.	<i>Tayshaneta concinna</i>	<i>Tayshaneta devia</i>	<i>Rhadine austinica</i>	<i>Rhadine s. subterranea</i>	<i>Rhadine s. mitchelli</i>	<i>Speodesmus</i> N.S.	<i>Sphalloplana mohri</i>	<i>Tartarocreagris comanche</i>	<i>Tartarocreagris intermedia</i>	<i>Tartarocreagris</i> N.S. 3	<i>Texella spiniperca</i>	<i>Trichoniscinae</i> N.S.
Cotterell Cave					X							X								
Disbelievers Cave						X														
District Park Cave				X							X									
Eluvial Cave																				
Flint Ridge Cave				X							X									
Fossil Cave												X								
Fossil Garden Cave						X						X								
Gallifer Cave					X															
Get Down Cave				X							X									
Goat Cave				X										X						
Hole-in-the-Road Cave						X														
Ireland's Cave				X							X									
Jack's Joint		X				X														
Japygid Cave																				
Jest John Cave					X															
Jester Estates Cave					X															

Cave Name	<i>Aphrastochthonius</i> N.S.	<i>Caecidotea reddelli</i>	<i>Candona</i> sp. nr. <i>stagnalis</i>	<i>Cicurina bandida</i> <sup>3</sup>	<i>Cicurina travisae</i> <sup>4</sup>	<i>Cicurina</i> sp. <sup>5</sup>	<i>Eidmannella reclusa</i>	<i>Miltoniscus</i> N.S.	<i>Tayshaneta concinna</i>	<i>Tayshaneta devia</i>	<i>Rhadine austinica</i>	<i>Rhadine s. subterranea</i>	<i>Rhadine s. mitchelli</i>	<i>Speodesmus</i> N.S.	<i>Sphalloplana mohri</i>	<i>Tartarocreagris comanche</i>	<i>Tartarocreagris intermedia</i>	<i>Tartarocreagris</i> N.S. 3	<i>Texella spiniperca</i>	<i>Trichoniscinae</i> N.S.
Jollyville Plateau Cave																				
Kretschmarr Cave					X								X							
Kretschmarr Double Pit					X															
Lamm Cave																				
Little Bee Creek Cave				X							X									
Lost Gold Cave				X					X		X									
Lost Oasis Cave				X							X									
M.W.A. Cave																		X		
Maple Run Cave				X							X									
McDonald Cave					X					X										
McNeil Bat Cave												X								
Midnight Cave				X							X									
Moss Pit																				
New Comanche Trail Cave						X	X										X			
No Rent Cave												X								
North Root Cave					X															

Cave Name	<i>Aphrastochthonius</i> N.S.	<i>Caecidotea reddelli</i>	<i>Candona</i> sp. nr. <i>stagnalis</i>	<i>Cicurina bandida</i> <sup>3</sup>	<i>Cicurina travisae</i> <sup>4</sup>	<i>Cicurina</i> sp. <sup>5</sup>	<i>Eidmannella reclusa</i>	<i>Miltoniscus</i> N.S.	<i>Tayshaneta concinna</i>	<i>Tayshaneta devia</i>	<i>Rhadine austinica</i>	<i>Rhadine s. subterranea</i>	<i>Rhadine s. mitchelli</i>	<i>Speodesmus</i> N.S.	<i>Sphalloplana mohri</i>	<i>Tartarocreagris comanche</i>	<i>Tartarocreagris intermedia</i>	<i>Tartarocreagris</i> N.S. 3	<i>Texella spiniperca</i>	<i>Trichoniscinae</i> N.S.
Pennie's Cave											X			X						
Pickle Pit					X															
Pipeline Cave														X						
Rolling Rock Cave						X								X						
Root Cave					X															
Slaughter Creek Cave				X																
Spanish Wells Cave		X													X					
Spider Cave					X		X													
Stark's North Mine									X											
Stovepipe Cave	X				X		X													
Talus Springs Cave																				
Tardus Hole																				
Tooth Cave					X		X						X							
Weldon Cave	X											X								
Whirlpool Cave				X						X										

Sources: Elliot 1997, Paquin and Hedin 2005, Paquin et al. 2008, TMM 2007, Zara Environmental 2008, 2010, Hedin 2015.

Key and Footnotes

X = confirmed location based on collected specimen.

<sup>1</sup> *Cicurina ellioti* listed as an SOC in the regional permit is not included in this table because this species has now been synonymized with *Cicurina buwata*, a non-SOC (Cokendolpher 2004).

<sup>2</sup> *Tartarocreagris reddelli* listed as a SOC in the regional permit is not included in this table because this species has now been synonymized with *Tartarocreagris infernalis*, a non-SOC (Muchmore 2001).

<sup>3</sup> Occurrences of *Cicurina bandida* include localities formerly listed as *Cicurina cueva* and *Cicurina reyesi*, which have been formally grouped together into the single species *C. bandida* (Paquin et al. 2008).

<sup>4</sup> Occurrences of *Cicurina trivisae* include localities formerly listed as *Cicurina reddelli* and *Cicurina wartoni*, which have been formally grouped together into the single species *C. trivisae* (Hedin 2015).

Localities of possible SOCs; blind *Cicurina* specimens not yet confirmed to species level.

**Table 6. Non-BCCP Caves/Karst Features with Karst SOC Protected on BCP<sup>1,2</sup>**

Key and footnotes follow table

Cave Name	BCP Owner	<i>Aphrastochitonius</i> N.S.	<i>Caecidotea reddelli</i>	<i>Candona</i> sp. nr. <i>stagnalis</i>	<i>Cicurina bandida</i> <sup>3</sup>	<i>Cicurina trivisae</i> <sup>4</sup>	<i>Cicurina</i> sp. <sup>5</sup>	<i>Eidmannella reclusa</i>	<i>Miltoniscus</i> N.S.	<i>Neoleptoneta concinna</i>	<i>Neoleptoneta devia</i>	<i>Rhadine austinica</i>	<i>Rhadine s. subterranea</i>	<i>Rhadine s. mitchelli</i>	<i>Speodesmus</i> N.S.	<i>Sphalloplana mohri</i>	<i>Tartarocreagris comanche</i>	<i>Tartarocreagris intermedia</i>	<i>Tartarocreagris</i> N.S. 3	<i>Texella spiniperca</i>	<i>Trichoniscinae</i> N.S.
Brewpot Cave	TC									X											
Cortana Cave	COA						X														
Down Dip Cave	COA						X														
Geode Cave	TC					X		X													
IV-3	COA					X															
LU-29	TC						X														
Pond Party Pit	COA						X														
RI-1	TC						X														
RI-3	TC						X														
Siebert Sink	COA				X					X											X
Two Trunks Cave	TC					X															

**Sources:** Bayless pers. comm 2013, Paquin and Hedin 2005, Sanders pers. comm 2013, TMM 2007, Zara Environmental 2008, 2010, Hedin 2015.

Key and Footnotes

X = confirmed location based on collected specimen.

<sup>1</sup> *Cicurina ellioti* listed as an SOC in the regional permit is not included in this table because this species has now been synonymized with *Cicurina buwata*, a non-SOC (Cokendolpher 2004).

<sup>2</sup> *Tartarocreagris reddelli* listed as a SOC in the regional permit is not included in this table because this species has now been synonymized with *Tartarocreagris infernalis*, a non-SOC (Muchmore 2001).

<sup>3</sup> Occurrences of *Cicurina bandida* include localities formerly listed as *Cicurina cueva* and *Cicurina reyesi*, which have been formally grouped together into the single species *C. bandida* (Paquin et al. 2008).

<sup>4</sup> Occurrences of *Cicurina trivisae* include localities formerly listed as *Cicurina reddelli* and *Cicurina wartoni*, which have been formally grouped together into the single species *C. trivisae* (Hedin 2015).

<sup>5</sup> Localities of possible SOC; blind *Cicurina* specimens not yet confirmed to species level.

### 3.0 OWNERSHIP AND PROTECTION STATUS

Many karst features listed in the BCCP permit have adequate protection, based on the criteria outlined in USFWS's *Karst Preserve Design Recommendations* (USFWS 2012). However, some caves listed in Table 3 as "protected" under individual USFWS Section 10(a) or Section 7 permits may not be adequately protected as defined in USFWS (2012). Efforts are being made by the BCCP Permit Holders to contact owners of privately owned caves to assess their protection efforts and to assist them with protection where possible.

Though not specifically required in the BCCP permit, the updated USFWS karst preserve design recommendations direct that the protected area surrounding the cave should be at least 16–40 ha (40-99 acres) in size to capture the majority of plant and animal community elements needed to support the karst ecosystem, as well as protect the cave footprint and surface/subsurface drainage basins of the cave (USFWS 2014a). Some caves within the BCP meet or exceed these recommendations, while others do not due to conditions that existed before the Permit was issued, such as pre-existing development in the form of subdivisions, roads, power lines, petroleum lines, and sewer lines that preclude complete protection of the recommended preserve areas. BCCP Permit Holders will continue to do what is reasonable to protect these features from pre-existing development and continue efforts to acquire and protect the karst features listed in the BCCP permit.

Per BCCP Permit Conditions S2 and T2, if new karst features "are discovered with a significant diversity of troglobitic fauna, those karst features may be submitted to the Service for consideration for exchange with karst features identified for protection by the BCCP" (USFWS 1996a). In order to allow the Permit holders to implement these Permit conditions, COA and TC created a Cave Substitution Policy in FY15 that provides a process that allows caves listed in the BCCP permit to be substituted with other suitable caves in a manner that is transparent, science based, and consistent with the vision and intent established for BCCP. This policy includes a definition of "significant diversity of troglobitic fauna" as it applies to eligibility of a cave for substitution, and determines parameters that quantify preservation of environmental integrity for BCCP-listed caves and candidate substitution caves as it applies to management of caves. These defined criteria will be used in determining both the need to substitute a feature listed on the Permit as well as whether the substitution cave will adequately replace the previously identified BCCP cave or caves. The BCCP Cave Substitution Policy was adopted by the BCCP Coordinating Committee in August 2015.

**Table 7. FY15 Ownership, protection, monitoring and access status of the 62 BCCP caves/karst features (35 caves with ES and 26 caves with SOC) <sup>1,2</sup>.**

Cave Name	ES or SOC	BCP or Private/ Current Owner	Gated/ Fenced	Protection Area Status /Adequate Preserve size	Species Monitoring Status	Public Access
Adobe Springs Cave	SOC	BCP/TNC		Protected on preserve	TC bi-annual surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring	none
Airmen's Cave	SOC	BCP/COA	Gated	Protected on parkland	COA twice weekly surface monitoring (volunteers check on gate); bi-annual cave cricket exit counts; bi-annual species monitoring	Access by permit
Amber Cave	ES	BCP/TC	Gated and fenced	Protected on preserve (very close to road and sewer line)	TC bi-annual surface monitoring; bi-annual cave cricket exit counts; red-imported fire ant (RIFA) survey/control; bi-annual species monitoring	none
Armadillo Ranch Sink	SOC	Private		Private - Unknown		none
Arrow Cave	SOC	BCP/COA	Gated	Protected in parkland (There are nearby homes immediately south of the cave entrance)	COA quarterly surface monitoring; annual species monitoring	none
Bandit Cave	ES	Private	Gated	Protected by private ecologically concerned landowner		none
Beard Ranch Cave	ES	BCP/COA		Protected on preserve	COA quarterly surface monitoring; annual faunal survey	none
Bee Creek Cave	ES	Private		Private- Unknown		none
Blowing Sink Cave	SOC	BCP/COA	Gated	Protected on preserve	COA semi-monthly surface and annual species monitoring; RIFA control	none

Cave Name	ES or SOC	BCP or Private/ Current Owner	Gated/ Fenced	Protection Area Status /Adequate Preserve size	Species Monitoring Status	Public Access
Broken Arrow Cave	ES	BCP/COA	Fenced	Protected on preserve	COA quarterly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring; RIFA control	none
Buda Boulder Spring	SOC	BCP/COA		Protected in parkland (close proximity to a hike and bike trail)	COA bi-annual surface monitoring; annual species monitoring	none
Cave X	SOC	Private/COA Protection Agreement	Gated and fenced	Protected by landowner with 4.5 acre setback to protect cave footprint. Protected to some extent (not actively managed and the setback is inadequate).	Occasional species and surface monitoring by COA and SWCA. SWCA will complete cave cricket exit counts in October 2015 as part of an agreement to allow for on site construction of a berm to reduce flooding concerns.	none
Cave Y <sup>1</sup>	SOC	BCP/COA	Gated	Protected in parkland	COA quarterly surface bi-annual species monitoring; bi-annual cave cricket exit counts; periodic RIFA control	none
Ceiling Slot Cave	SOC	Private		Private - Unknown		none
Cold Cave	ES	Private	Gated	Private - Unknown	TC bi-annual surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring	none
Cotterell Cave	ES	BCP/COA	Gated and fenced	Protected in parkland. (There are nearby homes immediately east of the cave entrance)	COA quarterly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring; RIFA control	none
Disbelievers Cave	ES	BCP/Private Section 10(a)		Protected by 10a permit, hired Plateau Land & Wildlife Management		none
District Park Cave	SOC	BCP/COA	Gated	Protected in parkland	COA quarterly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring; RIFA control	1 <sup>st</sup> room open, past 1 <sup>st</sup> room protected by gate, access by permit*

Cave Name	ES or SOC	BCP or Private/ Current Owner	Gated/ Fenced	Protection Area Status /Adequate Preserve size	Species Monitoring Status	Public Access
Eluvial Cave	ES	BCP/Private Section 10(a)		Protected by 10a permit, hired Plateau Land & Wildlife Management		none
Flint Ridge Cave	SOC	BCP/COA	Gated	Protected on Water Quality Protection Land (drainage basin will be negatively impacted by the construction of a proposed highway, if constructed.)	COA quarterly surface monitoring; quarterly cave cricket exit counts; quarterly species monitoring; RIFA control	none
Fossil Cave	ES	BCP/COA	Access protected by large rocks	Protected in parkland	Exact location of cave is unknown. COA quarterly surface monitoring of feature suspected as Fossil Cave	None
Fossil Garden Cave	ES	Private		Private - Unknown	Occasional COA and TC species monitoring	none
Gallifer Cave	ES	BCP/TC	Gated and fenced	Protected on preserve	TC bi-annual surface monitoring; bi-annual cave cricket exit counts; RIFA survey/control; bi-annual species monitoring	none
Get Down Cave	SOC	Private/COA Protection Agreement	Gated and fenced	Protected with Protection Agreement - Inadequate setback from development.		none
Goat Cave	SOC	BCP/COA	Fenced	Protected on preserve	COA weekly surface monitoring (volunteers check on gate); annual species monitoring; RIFA control	access by permit*
Hole-in-the-Road	ES	Private		Private –Unknown. (very close to a major roadway)	Occasional COA species monitoring	none
Ireland's Cave	SOC	BCP/ TC	Gated	Protected on preserve	TC bi-annual surface monitoring; RIFA survey/control; annual species monitoring	none
Jack's Joint	SOC	Private		Private - Unknown		none

Cave Name	ES or SOC	BCP or Private/ Current Owner	Gated/ Fenced	Protection Area Status /Adequate Preserve size	Species Monitoring Status	Public Access
Japygid Cave	ES	BCP/Private Section 10(a)		Protected by 10a permit, hired Plateau Land & Wildlife Management		none
Jest John Cave	ES	BCP/COA		Protected on preserve	COA cave cricket exit count; bi-annual surface monitoring	none
Jester Estates Cave	ES	BCP/COA	Gated and fenced	Protected on preserve ( 3.2 acre preserve surrounded by homes).	COA monthly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring; RIFA control	none
Jollyville Plateau Cave	ES	BCP/Private Section 10(a)		Protected by 10a permit, hired Plateau Land & Wildlife Management		none
Kretschmarr Cave	ES	BCP/TC	Gated and fenced	Protected on preserve. Close to roadway and in power line ROW.	TC bi-annual surface monitoring; RIFA survey/control; annual species monitoring	none
Kretschmarr Double Pit	ES	BCP/TC	Fenced	Protected on preserve	TC bi-annual surface monitoring; RIFA survey/control; annual species monitoring	none
Lamm Cave	ES	BCP/Private Section 7	Gated and fenced	COA negotiated setback (approximately 150')	Occasional surface and species monitoring by COA and TC	none
Little Bee Cr. Cave	ES	BCP/COA	Gated	Protected by COA AWU Dept.	COA quarterly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring	none
Lost Gold Cave	SOC	Private	Gated	Private –		none
Lost Oasis Cave	SOC	Private/ TCMA	Gated and fenced	Protected by TCMA	Sporadic species and surface monitoring by TCMA	controlled access**

Cave Name	ES or SOC	BCP or Private/ Current Owner	Gated/ Fenced	Protection Area Status /Adequate Preserve size	Species Monitoring Status	Public Access
M.W.A. Cave	ES	BCP/Private Section 10(a)		Protected by 10a permit, hired Plateau Land & Wildlife Management		
Maple Run Cave	SOC	BCP/COA	Gated	Protected on preserve	COA weekly surface monitoring (volunteers check on gate); bi-annual cave cricket exit counts; bi-annual species monitoring; RIFA control	access by permit*
McDonald Cave	ES	BCP Jollyville/TC	Fenced	Protected on preserve	TC bi-annual surface monitoring; bi-annual cave cricket exit counts; RIFA survey/control; bi-annual species monitoring	None
McNeil Bat Cave	ES	Private		Private – Unknown (close proximity to high school)	Occasional COA and TC species monitoring	none
Midnight Cave	SOC	BCP/COA	Fenced	Protected on parkland (close proximity to soccer fields)	COA quarterly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring; RIFA control	access by permit*
Moss Pit	SOC	Private		Private - Unknown		none
New Comanche Trail Cave	ES	BCP/TC	Fenced	Protected on preserve	TC bi-annual surface monitoring; RIFA survey/control; Annual species monitoring	none
No Rent Cave	ES	Private		Private - Unknown	TC/COA quarterly surface monitoring; quarterly cave cricket exit counts; quarterly species monitoring	none
North Root Cave	ES	BCP/TC		Protected on preserve	TC bi-annual surface monitoring; RIFA survey/control; annual species monitoring	none

Cave Name	ES or SOC	BCP or Private/ Current Owner	Gated/ Fenced	Protection Area Status /Adequate Preserve size	Species Monitoring Status	Public Access
Pennie's Cave	SOC	Private		Landowner had filled entrance. COA Watershed Protection Department (WPD) negotiated with Zara Environmental to excavate the entrance and add a cave gate, as well as adding a 300 ft buffer around the cave.	Zara Environmental species monitoring	none
Pickle Pit	SOC	BCP/Private Sec. 7	Gated	Protected by Section 7 permit.	TC/COA occasional species monitoring Monthly surface inspections by concerned neighbor	none
Pipeline Cave	SOC	Private	Gated	WPD have negotiated a small setback from future platted development.		none
Rolling Rock Cave	ES	BCP/COA	Fenced	Protected on preserve	COA quarterly surface and annual species monitoring; periodic RIFA control	none
Root Cave	ES	BCP/TC		Protected on preserve	TC bi-annual surface monitoring; RIFA survey/control; annual species monitoring	none
Slaughter Creek Cave	SOC	BCP/COA	Gated	Protected on parkland (Nearby homes are immediately south of cave entrance)	COA quarterly surface and annual species monitoring; RIFA control	none
Spanish Wells Cave	SOC	BCP/TC		Protected on preserve	TC bi-annual surface monitoring; RIFA survey/control; annual species monitoring	none
Spider Cave	ES	BCP/COA	Fenced	Protected on preserve	COA quarterly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring; RIFA control	none
Stark's North Mine <sup>2</sup>	ES	BCP/TC	Gated	Protected on preserve	TC bi-annual surface monitoring; bi-annual cave cricket exit counts; RIFA survey/control; bi-annual species monitoring	none

Cave Name	ES or SOC	BCP or Private/ Current Owner	Gated/ Fenced	Protection Area Status /Adequate Preserve size	Species Monitoring Status	Public Access
Stovepipe Cave	ES	BCP/ COA	Fenced	Protected on preserve	COA quarterly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring	none
Talus Springs Cave <sup>3</sup>	N/A	BCP/Private Section 10(a)	Gated	Protected by Homeowners Association and TC, only has 50' setback from houses and is probably affected by uphill development.	TC bi-annual surface monitoring; RIFA survey/control; annual species monitoring	none
Tardus Hole	ES	BCP/TC	Fenced	Protected on preserve	TC bi-annual surface monitoring; RIFA survey/control; annual species monitoring	none
Tooth Cave	ES	BCP/TC	Gated and Fenced	Protected on preserve	TC bi-annual surface monitoring; bi-annual cave cricket exit counts; RIFA survey/control; bi-annual species monitoring	none
Weldon Cave	ES	Private		Private - Unknown	TC/COA quarterly surface monitoring; quarterly cave cricket exit counts; quarterly species monitoring	None
Whirlpool Cave	SOC	Private/ TCMA	Gated	Protected by TCMA	TCMA routine surface monitoring; COA/TC quarterly species monitoring and cave cricket exit counts to assess tawny crazy ant impacts	controlled access**

<sup>1</sup>Cave Y was considered an ES cave (*Texella reddelli*) in the 1996 BCCP Permit, but has since been determined not to contain *Texella reddelli* (Reddell 2004).

<sup>2</sup>Stark's North Mine was listed as a SOC cave in the 1996 BCCP Permit, but has since been determined to contain *Texella reddelli* (USFWS 2009c).

<sup>3</sup>Talus Springs Cave has never been known to contain ES or SOC. This cave was placed on the BCCP permit because it contained the amphipod *Stygobromus birfurcatus*, originally considered as a SOC candidate; however, *S. birfurcatus* was not included in the Permit's final list of 25 SOC karst species to be protected.

\* Access by Permit - Permit may be issued by COA – Austin Water Utility or Austin Parks and Recreation Department (PARC) staff.

\*\* Controlled Access - Private cave owners control the access.

#### **4.0 ACCESS STATUS AND KARST EDUCATION/RESTORATION ACTIVITIES**

Public education on caves and cave ecosystems is recognized as vital for karst species preservation in the BCP Karst Land Management Plan (2007). Currently, most opportunities for children to enter caves and learn about cave ecosystems is through programs provided by COA Watershed Protection Department (WPD) and Austin Nature and Science Center (ANSC) summer camps. Adult wild cave tours in the Austin area are not widely available, although many tours are conducted through TCMA and University of Texas Grotto. Overall there is more demand for cave education than can be met with existing programs.

One factor limiting cave education is a deficit of caves suitable for cave immersion, particularly considering the high demand and its effectiveness as both a teaching tool and management practice to support stewardship for cave ecosystems. Cave education/recreation primarily occurs in 10% of the BCCP permit caves, which have been used for this purpose prior to the 1996 permit. Whirlpool Cave (owned and managed by TCMA) has the highest traffic of all the BCCP caves, totaling 1,373 person trips in FY15. Although studies on human impacts to cave ecosystems are limited, it is assumed that high human traffic in a cave will negatively impact the cave fauna.

In response to the potential negative impacts to BCCP permit caves, BCP staff continues to meet with local educators (COA PARD, WPD Education, TCMA, and BS/EACD staff) to review existing cave access/ public education issues. The primary focus of these meetings is to review existing policy to see if current access policy is having a detrimental impact to BCCP caves, and if so, try to determine ways to mitigate this damage. To address the overuse issue, COA WPD staff are currently looking for new caves that could be used in lieu of BCCP caves. Also, TCMA has initiated a policy of charging for access, which may reduce total access numbers to Whirlpool Cave.

After Whirlpool Cave, the next most heavily used cave is Wildflower Cave, a relatively small non-BCCP cave on the Lady Bird Johnson Wildflower Center that received 1,682 visitors in FY15. Wildflower Cave has been used for education by COA Earth Camp since 1997 after it was restored by cleaning out trash fill on December 4, 1993, March 6, 1994, and April 22, 1995. Wildflower Cave is unsuitable for many cave tours due to its currently limited extent and small size, but is heavily utilized in 5<sup>th</sup> grade Earth Camp cave education (see Cave Education Summary below).

### **Restoring Non-BCCP Caves for Education**

By developing non-BCCP caves to be safe and accessible for adequately trained and responsible groups to be used for guided education/recreation tours, we can promote education while reducing BCCP cave impacts. Non-BCCP education caves should draw traffic from BCCP caves and provide a greater range of experience. In FY15, considerable progress was made in developing non-BCCP caves to use for education:

During FY15, significant progress was made excavating fill and trash from the following non-BCCP caves: LaCrosse Cave at the Wildflower Center, Hideout and Wade Caves at Goat Cave karst preserve, Grassy Cove Cave in the COA Slaughter Creek greenbelt, and Bowie High School Cave beneath the science wing of Bowie High School. All five of these caves are currently gated, as Hideout and Grassy Cove Caves were gated in FY15 and Wade and LaCrosse Caves were gated in FY14. Additional modifications for safe access are scheduled for early FY16. These restoration efforts were largely funded by a COA Capital Improvement project specifically to facilitate COA WPD cave education programs. The excavation work was primarily conducted by a cave team of COA WPD staff, coordinated by Nico Hauwert. Cave gates were installed by contractors Charlie Savas and Jim Kennedy, and steps in LaCrosse Cave were constructed by contractor Rich Zarria with the help of COA WPD. The introduction of new non-BCCP caves such as these for education is expected to reduce traffic in approximately 10% of the 62 BCCP caves, particularly Whirlpool, Maple Run, Goat, and District Park Caves.

McNeil High School is located within the BCCP permit's McNeil cave cluster and its courtyard contains two caves, Millipede and Millipede Annex, with endangered species. In FY15, progress with restoration plans continued (revegetation and fire ant treatment of the courtyard) to enhance the underlying cave ecosystem. McNeil HS science teacher Tina Vick initiated the project with assistance from Mark Sanders of COA BCP, Jean Krejca of Zara Environmental, Cyndee Watson of USFWS, and landscape architect, Vivian Loftin of the COA WPD cave team. Twice annual cave faunal surveys were conducted by Mark Sanders and Todd Bayless (TC BCP), and twice annual cave cricket exit counts were conducted by Tina Vick and her students. In November 2014 and April 2015, presentations on karst biology and geology were provided by Todd Bayless and Mark Sanders to the McNeil High School Green club and AP Environmental Science classes as the students were introduced to the courtyard caves. In April and May 2015, students also assisted BCP staff by participating in cave cleanups of Millipede Annex Cave, where large quantities of trash were removed, improving cave invertebrate habitat. The trash was carefully inspected to make certain that no karst invertebrates were accidentally removed from the cave.

## **FY15 Cave Education Summary**

### **COA Youth Education Programs:**

COA WPD conducts cave education through Earth Camp and Earth School (fifth grade water quality programs), Clean Creek Camp (a summer parent/child water quality program), Watershed Detectives (middle school), Hydrofiles (high school), and adult education such as Groundwater to the Gulf: Summer Institute (professional development for teachers). FY15 updates are detailed below:

**Earth Camp** is available to Title I (low socio-economic) schools in AISD. Students spend one school day at camp immersed in Wildflower Cave looking for clues that water travels through the cave into the Edwards Aquifer, which includes the discovery of cave biota. Students also investigate a sinkhole and flow through karstic rock, as well as visiting Barton Springs and the Splash! Exhibit to learn of the connection of the recharge zone to the discharge area. In FY15, Earth Camp guided 1,682 students into Wildflower Cave. An additional 5,583 fifth-graders in AISD, Eanes ISD and Del Valle ISD received Earth School, a hands-on classroom presentation using an Aquifer Model (Table 8). The Lady Bird Johnson Wildflower Center is partnered with Earth Camp. More details on these programs can be found online at: [www.austintexas.gov/EarthCamp](http://www.austintexas.gov/EarthCamp) and [www.austintexas.gov/department/earth-school](http://www.austintexas.gov/department/earth-school).

In summer 2015, **Family Clean Creek Camp** brought 30 children and parents into Whirlpool Cave (Table 8). Clean Creek Camp is a partnership between COA WPD and Keep Austin Beautiful. Activities focus on watersheds, the Edwards Aquifer and citizen actions that improve water quality. Clean Creek Camp is offered in summer to parents and their children ages 9-14. ([www.austintexas.gov/department/clean-creek-camp](http://www.austintexas.gov/department/clean-creek-camp))

**Watershed Detectives** and **Hydrofiles** reach middle and high school classes with hands-on inquiry based investigations of Austin's water resources. Local field studies involve monitoring local creeks and caving into the Edwards Aquifer. Students learn about hydrogeology and cave biology through "Austin Underground" videos and cave tours led by COA WPD staff. In FY15, 44 middle school students were guided through Lost Oasis Cave and 128 middle school students and approximately 115 high school students were guided through Whirlpool Cave (Table 8). ([www.austintexas.gov/department/watershed-detectives](http://www.austintexas.gov/department/watershed-detectives) and [www.austintexas.gov/department/hydrofiles](http://www.austintexas.gov/department/hydrofiles))

**Adult and Technical Education:**

**Groundwater to the Gulf- Summer Institute:** Groundwater to the Gulf is collaboration among over a dozen local agencies to offer a three-day, field trip-based institute for Central Texas teachers that emphasizes techniques for teaching water-based curricula to students. COA WPD educators take teachers inside Wildflower Cave and give presentations at a sinkhole at the Lady Bird Johnson Wildflower Center and Barton Springs so teachers have the background knowledge to teach about the Edwards Aquifer in their classrooms. In FY15, 34 teachers participated in the Institute (Table 8; [www.keeptaustinbeautiful.org/GroundwatertoGulf](http://www.keeptaustinbeautiful.org/GroundwatertoGulf))

**Table 8. Summary of FY15 COA WPD education programs providing cave field trips and aquifer outreach.**

Program	Grade	Number reached
Earth Camp	5 <sup>th</sup>	1684
Earth School	5 <sup>th</sup>	5,583 (presentation does not include cave immersion)
Watershed Detectives	6 <sup>th</sup> -8 <sup>th</sup>	226
Hydrofiles	9 <sup>th</sup> -12 <sup>th</sup>	115
Clean Creek Camp	Adults and 4 <sup>th</sup> -8 <sup>th</sup>	30
Groundwater to the Gulf	teachers	34
<b>Total reached:</b>		7,672

**Annual BCCP Infrastructure Workshop**

COA , LCRA, and TC staff organized the annual BCCP Infrastructure workshop on October 30, 2014. This workshop is primarily intended to help project managers and field supervisors involved in infrastructure projects avoid impacts to the BCP. COA WPD and AWU staff along with staff from Zara Environmental presented on the challenges of permitting and constructing a water line in front of McNeil High School over endangered species habitat. TC and COA BCP staff provided a field trip to Kretschmarr Cave and presented on karst environments, biology, and impacts to karst ecosystems.

**Austin Parks and Recreation**

The Splash Exhibit in Zilker Park includes a simulated cave and indoor displays, movies, and activities regarding the Edwards Aquifer.

<http://www.austintexas.gov/department/austin-nature-science-center>)

### **Texas Cave Management Association Cave Education**

In FY15, Whirlpool Cave was managed by Matt Turner while Lost Oasis Cave was managed by Chris Vreeland, both volunteers for TCMA. Whirlpool Cave supports the BCP as the most suitable cave currently available for lengthy recreation/education trips.

Access numbers continued to be high this year to both TCMA owned caves, with 1,373 individuals accessing Whirlpool Cave and a total of 213 individuals accessing Lost Oasis Cave.

### **FY15 Access Status**

In FY15, 384 visitors were issued access permits by COA BCP staff to COA BCCP caves for educational/recreational/rescue training including: Airmen's cave (100), District Park Cave (84), Goat Cave (155), Maple Run Cave (41), and Midnight Cave (4). With the exception of Airmen's Cave, cave tours were supervised by trained staff from the Austin Nature and Science Center, COA PARD Rangers, and the UT Grotto. See Table 3 for access and gating status of all of the BCCP caves. This total includes the numbers listed above issued to COA PARD for education activities.

### **BCCP Cave Preserve Restoration**

During the last 200 years, considerable sediment disturbance has occurred over a relatively short period of time, attributed to the introduction of livestock and ranching practices, removal of juniper/oak woodlands, intentional obscuring of caves to reduce trespassing and increase the marketability for development, and urbanization. Caves across the US were commonly filled by ranches to eliminate livestock hazards and dispose of trash. While most BCCP caves were opened by volunteer cave explorers, there have been few funded efforts in Travis County for the purposes of restoring filled caves. Major cleanup projects such as the six year (1994-1999) removal of trash from Midnight Cave, although sponsored by COA staff, were only achieved through the use of volunteers. Even recognizing filled-in caves has been a challenge for geologists conducting site assessments and the subject of numerous field trips. Without recognition and necessary excavation, few of the BCCP caves would likely be preserved today.

Beginning in FY13, COA WPD continued to fund a team of cave specialists to excavate caves of trash, ranch fill, and eroded sediment. Education cave development was funded by COA WPD Education and Water Resource Evaluation divisions. The team consisted of a group of highly trained cave specialists, including Heather Tucek, Justin Shaw, landscape

architect Vivian Loftin, Don Broussard, Guin McDaid, David Comer, Yaz Avila, Drew Thompson, Lee Jay Graves Jeff Nichols, and Fernando Hernandez. In FY15, the team primarily worked restoring five project caves (Brownlee, Sinky Dinky, Winter Woods, Wyoka, and Sink-in-the-Woods/Williams Well) on Blowing Sink Research Management Unit. Restoration efforts for these caves are described below.

### **Blowing Sink Research Management Unit restoration**

The Blowing Sink Research Management Unit contains Blowing Sink Cave, one of the longest and deepest of the BCCP caves as well as five other sinkholes/caves that recharge rainwater runoff. Historical ranching practices and lack of proper maintenance led to impairment of the sinkholes, causing them to plug with sediment.

Through multi-departmental/agency effort this site now largely recharges most runoff generated on site. The COA WPD cave team excavated dirt and washed-in soil from Winter Woods, Wyoaka, Brownlee, Sink in the Woods, and Sinky Dinky Caves so that each accepts recharge and does not pond except when their capacity is exceeded during unusually high flooding events. COA WPD Field Operations crews filled in the east road and placed berms using soil excavated from the sinkholes. This road restoration largely stopped the east road from diverting runoff away from natural sinkhole destinations. LCRA staff assisted in the project by removing all remaining excavated soil piles, and helped fill Sink in the Woods with cave rock excavated from surrounding caves. By the end of September 2015, the surface sinkholes restoration was completed, except for long term revegetation and canopy regeneration.



Sinky Dinky Cave November, 2013



Sinky Dinky Cave Restored August 10, 2015



Winter Woods Cave collapsing after flood on January 1, 2013. Top of wooden structure was originally near flush with ground.



Winter Woods Cave restored on August 10, 2015



Brownlee Cave plugged on January 1, 2013



Brownlee Cave restored in October 2014

## **5.0 MANAGEMENT COORDINATION AND OVERSIGHT**

COA and TC determined that there was a need to create a master database on BCP karst faunal monitoring and management with the ability to analyze these data to determine current status and compliance with the regional permit, as well as determine future needs of the listed species. In 2009, Rob Clayton (COA WPD) developed the Karst Database that houses all

faunal survey data from BCCP caves and provides much of the information needed for these karst analyses. This database is now available for use by BCP partners to enter survey data, and all available data have been entered to date. Though the intent is for this database to be a “shared” information source for all the BCP partners, there are still confidentiality challenges on how to establish this protocol. This database will focus on permit compliance, species status, and contribution to recovery.

Based on recommendations made in Dr. Butch Weckerly’s analyses of karst survey efforts on the BCP (Weckerly 2010), COA and TC have determined a need to modify and expand the BCP’s cave monitoring program. In FY11, COA and TC identified 25 caves within Travis County managed through BCP partners that provide a more evenly distributed dataset across cave clusters and karst fauna regions (KFRs); this dataset includes both BCCP caves and other ES/SOC caves on the BCP. This new monitoring plan commenced in FY11, and the number and frequency of karst faunal surveys and cave cricket counts are now synchronized among managing partners to better accommodate comparisons and determine species trends. The goal of these changes to the cave monitoring program is to provide a clearer understanding of the species distribution and health of karst ecosystems across the BCP.

In FY15, COA/TC BCP staff collaborated on creating guidelines to provide best management practices (BMPs) at construction sites where tawny crazy ants (TCAs; *Nylanderia fulva*) have been confirmed. TCAs are a newly discovered non-native ant species which could potentially adversely affect forest and karst ecosystems on the BCP. Implementation of these BMPs will be critical to minimizing the potential of introducing new populations of this destructive species to other parts of Austin and elsewhere. These BMPs were completed in FY15, and since have been disseminated to appropriate TC/COA departments and other agencies.

COA and TC BCP staff also continued to facilitate and monitor protection efforts within karst zones and near karst features for LCRA’s T-160 power line upgrade. In FY15, staff oversaw both implementation of mitigation measures at impacted sites and LCRA’s post-construction restoration efforts.

## **6.0 BIOLOGICAL MONITORING**

Caves containing endangered and rare karst invertebrates on BCP properties are monitored to determine long term trends in populations of cave organisms and overall cave conditions. All

COA and TC-owned BCP caves with endangered species are surveyed annually. In addition, TC and COA incorporated the newly expanded monitoring plan in FY11, which includes the 25 Travis County caves selected to represent an evenly distributed dataset across cave clusters and KFRs. Caves included in this monitoring plan are surveyed bi-annually, occurring in Spring (May) and Fall (November) or Summer (August) and Winter (mid-January-mid February). Biomonitoring of the caves follow methodology and techniques supported by USFWS to provide results that can be compared between caves throughout the region for better study and analysis (USFWS 2014a).

Beyond USFWS recommendations, survey methodology also follows guidelines described in the *2007 Balcones Canyonlands Preserve Land Management Plan: Tier II-A Chapter IX Karst Species Management*. The protocol for research and monitoring cave fauna involves the use of one to four (depending on size of cave and logistics) predesignated, permanent survey zones per cave in which all living organisms encountered are identified and enumerated. Survey zones are either transects approximately 5 meters in length that span the width of the cave, or distinct units of the cave such as a small room or an easily discernible section, so that the size and location of the survey area remains constant during the course of the study for trend comparison. For each survey zone, start and end time and the presence of trash or new vandalism are recorded. Relative humidity, temperature, nutrient input, dampness condition, and the presence of red-imported fire ants (RIFA; *Solenopsis invicta*) and TCAs are also recorded both outside the cave and at each transect or zone. All data collected during cave surveys are entered into the BCP Karst Database.

Any unknown invertebrates observed during faunal surveys are collected and identified by a karst invertebrate specialist. In caves containing endangered species, collecting only occurs with a special collecting permit obtained by USFWS. All collected specimens are deposited within the Texas Memorial Museum or other reputable facility (USFWS 2014a). The date of deposition and collection number is also recorded (USFWS 2014a).

Land managers also monitor the entrances of caves containing endangered species at least once a year for anything that might harm the rare invertebrates including presence of toxic substances, unauthorized access by recreational cavers, and surface disturbances which might have erosive potential or cause changes in surface drainage patterns.

The overall health of caves is also monitored by performing semi-annual cave cricket exit counts. Cave cricket exit counts are done as crickets emerge from caves during good weather nights (i.e. not raining, warm etc.). The duration of the counts is timed for two hours starting just after sunset, to maintain consistency with all surveys done between managing partners. Current weather conditions, surface temperature, and relative humidity are documented for

each survey. Crickets emerging are placed in one of three age classes: nymph (up to 5 mm), sub-adult/juvenile (5-12mm) and adult (>12mm). Number of individuals exiting the cave is counted in ten-minute intervals. Time of first cave cricket exit and any other vertebrates exiting the cave are also recorded. An evaluation of TC/COA's cave cricket exit count survey protocol determined that this methodology meets criteria necessary to assess cave cricket abundance at caves as well as estimate changes over time in the number of cave crickets that emerge from cave entrances, both of which are necessary for determining the state of cave ecosystems and evaluating the effectiveness of the BCP's karst management goals (Weckerly 2012).

### **FY15 TC/COA Collaborative Monitoring Projects**

In FY15, TC and COA BCP staff updated a monitoring and collection protocol and reporting procedures for the tawny crazy ants. Since FY12, BCP staff have included monitoring for presence of TCAs at all visits to cave sites. In FY13, at least two BCCP caves (Whirlpool Cave and No Rent Cave) have been confirmed to be infested by TCAs. COA and TC staff have continued to conduct quarterly biological surveys at Whirlpool Cave since FY13 to document TCA use of cave environments and assess impacts of this new invasive species on cave fauna (EXHIBIT A). In FY15, TC and COA also continued expanded monitoring of Weldon and No Rent Caves to document the arrival and impacts of another TCA population in the vicinity of these caves. In addition, COA and TC BCP staff collaborated with local TCA specialist Ed LeBrun of UT's Brackenridge Field Lab on a USFWS Traditional Section 6 grant proposal to study impacts to karst invertebrate assemblages and design control methods for use within sensitive karst environments, which was awarded in June 2015. Dr. LeBrun will be managing the project for the next two years, with TC/COA staff providing in-kind contribution in the form of quarterly cave monitoring and design/implementation of a study to quantify TCA impacts in three BCCP caves.

TC and COA BCP staff began conducting bi-annual cave faunal surveys of Millipede Cave and Millipede Annex Cave in FY13 and continued surveys for FY15 to gather baseline data for the McNeil High School courtyard restoration project, which also commenced in FY15 (EXHIBIT A). Cave cricket exit counts and management activities such as vegetation planting and RIFA control were coordinated with McNeil High School staff and students to improve surface conditions of these two non-BCCP ES caves, with the intent of improving nutrient input and benefiting cave crickets and cave fauna.

TC and COA BCP staff assisted with James Reddell's efforts to refine species distribution and range of *Rhadine* beetles of central Texas, by incorporating extensive collecting of *Rhadine* species from known and unknown localities during cave faunal surveys in FY15. For this study, morphological as well as molecular work of collected species will be

employed to achieve this goal. To date, TC and COA BCP staff have successfully collected from multiple caves in Hays, Travis, and Williamson County.

Also in FY15, COA and TC staff compiled and formatted BCP cave survey data at the request of USFWS to be used in a USGS Endangered Karst Invertebrate Detectability Study. This study's objective is to improve USFWS presence/absence criteria for karst features in central Texas.

### **City of Austin FY15 Biological Monitoring**

During FY15, COA BCP staff conducted bi-annual monitoring on the following 15 pre-selected caves: Airmen's Cave, Broken Arrow Cave, Cave Y, Cortana Cave (non-BCCP cave), Cotterell Cave, District Park Cave, Jester Estates Cave, Little Bee Creek Cave, Maple Run Cave, Midnight Cave, Pond Party Pit (non-BCCP cave), Seibert Sink (non-BCCP cave), Spider Cave, and Stovepipe Cave, and Testudo Tube (non-BCCP cave) (EXHIBIT A). Faunal surveys in these caves were conducted by permitted COA biologists in either Fall 2014/ Spring 2015 or Winter 2015/ Summer 2015. In addition, COA BCP staff conducted quarterly surveys at Flint Ridge Cave (EXHIBIT A). Annual faunal surveys were also conducted in Arrow Cave, Beard Ranch Cave, Blowing Sink, Goat Cave, Rolling Rock Cave, and Slaughter Creek Cave COA staff also conducted annual faunal surveys in five non-BCCP caves: Barker Ranch Cave # 1, County Line Bat Cave, Five-Star Cactus Cave, Hoskins Hole, and Sky Ranch Cave, and conducted bi-annual surveys in two non-BCCP caves: Hays Ranch Bat Cave, and Tabor Crevice (EXHIBIT A).

In FY15, COA BCP staff with the help of volunteers conducted bi-annual cave cricket exit counts (quarterly at Flint Ridge Cave) at the same 15 caves pre-selected for faunal surveys, including Testudo Tube (EXHIBIT B). COA BCP staff also conducted one cave cricket exit count at Jest John Cave. (EXHIBIT B).

### **Travis County FY15 Biological Monitoring**

TC's BCP staff conducted bi-annual monitoring on the following nine pre-selected caves: Adobe Springs Cave, Amber Cave, Cold Cave, Gallifer Cave, Geode Cave (non-BCCP cave), McDonald Cave, Stark's North Mine, Tooth Cave, and Weldon Cave. Faunal surveys in these nine caves, with permitted TC biologists, were conducted in Fall 2014/ Spring 2015 or Winter 2015/ Summer 2015 (EXHIBIT A). Annual faunal surveys were also conducted in five other TC-owned BCCP caves with federally listed species: Kretschmarr Cave, Kretschmarr Double Pit, New Comanche Trail Cave, North Root Cave, and Tardus Hole (EXHIBIT A). TC staff also conducted annual faunal surveys at two additional BCCP listed

caves: Ireland's Cave and Talus Spring Cave, and two additional TC-owned non-BCCP caves with listed ES: Two Trunks Cave and Tight Pit Cave (EXHIBIT A).

In FY15, TC conducted bi-annual cave cricket exit counts at eight of the caves pre-selected for faunal surveys: Adobe Springs Cave, Amber Cave, Cold Cave, Gallifer Cave, Geode Cave, Stark's North Mine, Tooth Cave, and Weldon Cave. Exit counts were conducted in Fall 2014/ Spring 2015 or Winter 2015/ Summer 2015 (EXHIBIT B). TC BCP staff also conducted one cave cricket exit count at Whirlpool Cave, and quarterly cave cricket exit counts at No Rent Cave. (EXHIBIT B).

RIFA surveys were performed in Fall 2014 and Spring 2015 on all eleven TC-owned BCCP caves with federally listed species, as well as one other TC-owned cave with ES (Geode Cave). RIFA surveys were also conducted at two additional TC-owned BCCP caves (Ireland's Cave and Talus Spring Cave). RIFA mounds were surveyed within an 80 m radius around cave entrances, and all active mounds found during surveys were treated with boiling water as recommended by USFWS (2014b). In Fall of 2014, a total of 234 RIFA mounds were treated within these 80 m cave survey areas, with an additional 24 RIFA mounds treated in the vicinity of caves but outside of survey areas. In Spring of FY15, a total of 258 RIFA mounds were treated within these 80 m cave survey areas, with an additional 21 RIFA mounds treated in the vicinity of caves but outside of survey areas. Survey results and treatments for individual caves are documented in Table 7.

In addition to managing the karst features required in the BCCP permit, TC voluntarily managed other karst features located on BCP land in FY15, including Cactus Pit, Brew Pot Cave, Kretschmarr Sink, Kretschmarr Salamander Cave and karst features RI-1, LU-11 and LU-12.

### **Other Biological Monitoring Efforts**

Zara Environmental conducted biological monitoring at Pennie's Cave in FY15 as part of an adaptive cave management plan for a development project that began with the reopening of the cave's entrance in 2012. Zara Environmental performed two karst faunal surveys and conducted two (Spring and Fall) RIFA treatments with boiling water in FY15. Zara also drafted a cave map and provided a written report of their work in FY15 (Zara Environmental 2015; APPENDIX P22).

## 7.0 HYDROGEOLOGIC STUDIES

The understanding and protection of water sources to caves is vital for preserving cave life that relies on it. Water sources include surface catchment areas that direct runoff to the cave entrance and subsurface catchment areas where overlying water infiltration from either rainfall or runoff supports cave drips. Surface catchment area delineation generally involves examination of a combination of field GPS delineation of catchment divides and drainages as well as surface topographic contour coverages. Subsurface catchment studies may involve direct tracing, water-quality characterization, drip rate monitoring, geological mapping, cave survey mapping, and cave radio surveying. In FY15, BCP research permits were provided to Brian Cowan and other staff from Zara Environmental, Nico Hauwert and members of the COA WPD cave team, and Roger Glick and hydrology staff of COA WPD.

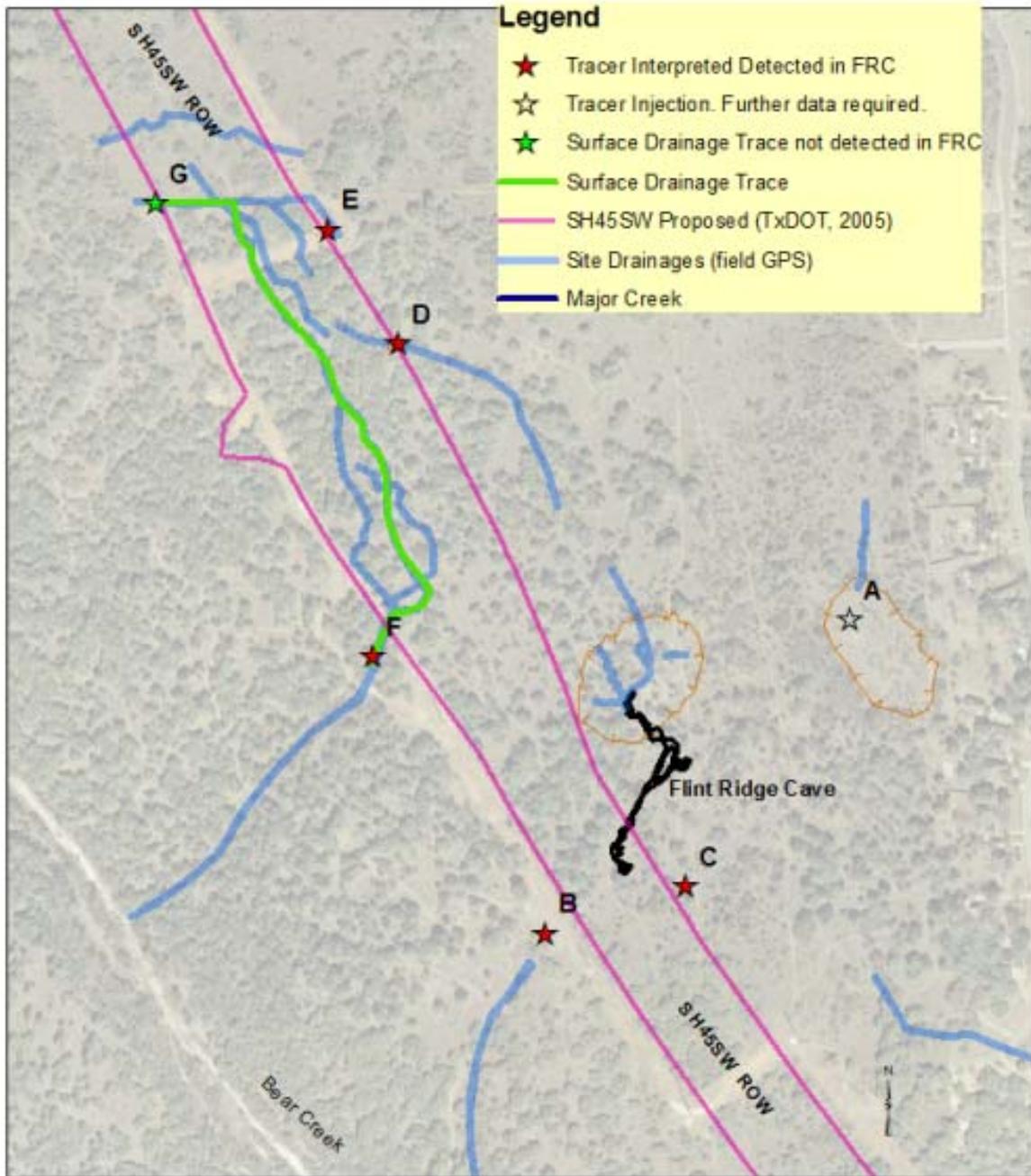
### Flint Ridge Cave

The right-of-way (ROW) for proposed State Highway 45 SW overlays portions of Flint Ridge Cave. In order to best protect the cave, Dr. Nico Hauwert and Dr. Roger Glick of COA WPD continued a hydrogeological study of Flint Ridge Cave in FY15. A quality assurance plan for the tracing and sampling was completed and authorization from the Barton Springs/Edwards Aquifer Conservation District was granted for groundwater tracing. Dr. Hauwert and COA WPD cave team staff conducted the tracing and subsurface monitoring. On November 4 and November 22, 2014, organic and chemical tracers were injected on the surface and into one monitoring well and flushed using natural runoff and supplemented with well water for sites B, C, and E (Figure 1; Table 9).

**Table 9. Tracer Injection Sites along Highway 45 SW ROW near Flint Ridge Cave**

Phase	Feature	Name	Tracer	Mass (kg)	(lb)	Injection Date/time	Results	comments
	A	Quadborder	KBr	12	26	11/22/2014 22:00	Unclear. 0.04 mg/l rise in Br at Culvert Crawl Upper Pool, 2 mg/l increase in K at Flint Ridge Fault Dome and 7 mg/l rise in K at Mudnight Drips	K and Br peaks not corresponding in magnitude
	B	TAB11 Funnel	Ammonium Carbonate	4	9	11/4/2014 23:30	Possible hit in Breakdown Pool, Culvert Crawl Lower Pool, Cheese & Chocolate Pool, and Fault Dome Drip	
	C	Soil Pipe	Tinopal	1	3	11/5/2014 0:00	Detected in Flint Ridge Balcony Room, possible hit Sparkles Infeeder of Tabor Crevice	
	D	FR North Trib	Fe	0.50	1	11/22/2014 21:00	Detected in Culvert Crawl Lower and Upper Pool, and Cheese and Chocolate pool	10-0.5 Liter bottles 10,000mg/l
	F	MW	DY96	7	4	11/5/2014 0:30	Detected at Flint Ridge entrance gate and Balcony Room after 11/24/14	
	F	Honeycomb Drainage	LiCl	6	13	11/22/2014 14:00	increase in LiCl 3 to 0.5 ug/l in Flint Ridge Breakdown Room Pool and Fault Dome Drip; Possibly Culvert Crawl and Drip Pit	LiCl elevated through 6/11/15
	G	North Tabor Valley	Pyranine	1	2	11/22/2014 20:30	no tracer recovered underground as of 12/9/2014	

Figure 1. Phase 1 Preliminary Interpretation Results of Surface Tracing to Flint Ridge Cave



Prepared by Nico Hauwert, PhD, PG #5171, Modified June 22 2015. Phase 1 tracers injected Nov. 2014.



Watershed Protection cave team member Drew Thompson injects a LiCl tracer at site F and pyranine dye at site G on November 22, 2014.

One surface flow tracing from site G utilized pyranine tracer to visually observed runoff pathways. The tracer revealed that some natural surface runoff flowpaths have been diverted by temporary access roads and could divert natural surface runoff sources away from the cave entrance. The preliminary results from Phase I traces suggest that infiltration from both the east and west sides of proposed SH45SW ROW and within a half mile of Flint Ridge Cave contributes to its cave drips. Proposed Phase II traces includes verification and additional traces to delineate the surface and subsurface catchment boundaries and is anticipated to occur in early FY16 with a suitable rain event. Both surface and subsurface water quality and discharge monitoring assist in establishing existing conditions and determining potential water sources. The Phase 1 results interpretation is shown on Table 9 above.

Roger Glick of COA WPD and his staff of hydrologists have been monitoring runoff quality entering Flint Ridge Sinkhole through three drainages (FR1, FR2, and FR3) since 2008. The results from 2008 through 2015 are shown below (Table 10).

**Table 10. Results of runoff quality entering Flint Ridge Sinkhole 2008-2015.**

	FR1				FR2				FR3			
	Count	Mean	Max	Min	Count	Mean	Max	Min	Count	Mean	Max	Min
TSS (mg/L)	20	81.5	200.7	11.8	31	89.6	494.0	4.1	27	96.3	402.0	12.0
VSS (mg/L)		15.3	34.8	4.9		18.6	86.0	2.5		15.8	86.0	3.4
TN (mg/L)		1.76	2.87	1.10		1.87	3.91	0.86		1.62	3.66	0.78
NO <sub>3</sub> +NO <sub>2</sub> (mg/L)		0.406	1.310	0.033		0.377	1.300	0.010		0.33	1.77	0.03
TKN (mg/L)		1.38	2.02	0.95		1.54	3.19	0.76		1.29	2.23	0.72
NH <sub>3</sub> (mg/L)		0.025	0.055	0.004		0.036	0.212	0.003		0.036	0.083	0.004
TP (mg/L)		0.142	0.250	0.078		0.139	0.401	0.010		0.124	0.347	0.010
DP (mg/L)		0.025	0.079	0.001		0.030	0.135	0.001		0.016	0.090	0.001
COD (mg/L)		58.5	73.8	12.0		75.6	251.4	38.0		58.8	114.6	37.0
TOC (mg/L)		13.81	19.50	9.50		18.33	31.00	11.74		14.43	19.90	2.11
Pb (µg/L)		2.91	7.22	0.50		2.75	13.90	0.20		2.64	18.90	0.40
Zn (µg/L)		12.6	21.5	7.3		13.2	135.0	3.6		17.6	39.0	6.9
Cu (µg/L)		3.23	5.34	1.00		2.82	8.64	0.75		3.03	10.45	0.35
Cd (µg/L)		0.493	1.000	0.012		0.539	2.590	0.043		0.465	1.000	0.019

The City of Austin also funded a USGS Survey gauging station that was installed on Bear Creek at the Spillar Ranch low water crossing. In addition, Dr. Glick maintains a gauging station on Bear Creek below FM 1626. The two gauging stations will help monitor the recharge occurring within the channel of Bear Creek.

### **District Park Cave**

As part of an ongoing hydrological study, WPD staff continued to monitor temperature and drip rates in the Aquifer room and Aggie level Room in FY15.

## **8.0 RECOMMENDATIONS**

COA and TC should continue to attempt to contact the owners of each privately-owned BCCP cave in order to assess current faunal assemblages and negotiate protection of these caves. The precise location of some of these privately owned caves is currently unknown; therefore, COA and TC should attempt to locate these caves in order to make a meaningful assessment. Additionally, COA and TC will also continue to evaluate the adequacy of protection for all 62 BCCP caves during FY16, and prioritize efforts accordingly.

Future research needs for the BCP should include an effort to determine to species level for currently unknown troglobites such as *Speodesmus* sp., *Eidmannella* sp., and Trichoniscidae found in BCP caves.

## 9.0 KARST MANAGEMENT ACTIVITIES

The BCP Karst Land Management Plan (2007) outlines planned activities concerning the 62 BCCP karst features. Table 11 below includes a summary of monitoring and management activities for these features completed in FY15.

Table 11. FY15 BCCP Karst Feature Monitoring and Management Activities.
<p><u>Adobe Springs Cave</u> The Nature Conservancy</p> <ol style="list-style-type: none"> <li>1. TC was granted continued permission from TNC to perform bi-annual faunal surveys and cave cricket exit counts for the expanded BCP Cave Monitoring program.</li> <li>2. TC performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave.</li> <li>3. TC/COA conducted bi-annual cave faunal surveys (see EXHIBIT A).</li> <li>4. TC conducted bi-annual cave cricket exit surveys. (See EXHIBIT B).</li> </ol>
<p><u>Airmen's Cave</u> City of Austin</p> <ol style="list-style-type: none"> <li>1. Conducted bi-annual cave faunal surveys (See EXHIBIT A).</li> <li>2. Conducted bi-annual cave cricket exit counts. (SEE EXHIBIT B)</li> <li>3. COA installed a cave gate within 18 feet of the entrance of the cave. The cave gate not only protects the cave from ongoing vandalism, but also serves to protect the public from future accidents involving un-trained access. Access is still allowed via permit and the COA and volunteers host an "open house day" once a month allowing the public access to the cave.</li> <li>4. Volunteers monitor the cave gate twice weekly, and have helped COA staff make cave gate and sign repairs. Volunteers installed trail markers inside the cave, this will dramatically reduce impacts by eliminating traffic in sensitive areas of the cave.</li> </ol>
<p><u>Amber Cave</u> Travis County</p> <ol style="list-style-type: none"> <li>1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave.</li> <li>2. Maintained fencing and signage to protect this area from unauthorized access and dumping.</li> <li>3. Surveyed site bi-annually for RIFA. Treated 57 mounds in Fall 2014 and 16 mounds in Spring 2015.</li> <li>4. Conducted bi-annual cave faunal surveys (see EXHIBIT A).</li> <li>5. Conducted bi-annual cave cricket exit surveys. (See EXHIBIT B).</li> </ol>
<p><u>Armadillo Ranch Sink</u> Private</p>
<p><u>Arrow Cave</u> City of Austin</p> <ol style="list-style-type: none"> <li>1. Completed annual cave faunal survey (See EXHIBIT A).</li> <li>2. Conducted quarterly site inspections. City staff continues to deal with ongoing dumping problems from the adjacent neighborhood. COA PARD Rangers continue to conduct periodic patrols at these problematic sites.</li> <li>3. Inspected site for RIFA infestations. On all visits RIFA were observed within close proximity of the cave (but not inside the cave).</li> </ol>
<p><u>Bandit Cave</u> Private</p>

**Table 11. FY15 BCCP Karst Feature Monitoring and Management Activities.**

<p><u>Beard Ranch Cave (Featherman’s Cave)</u>  City of Austin  1. Completed annual cave faunal survey (See EXHIBIT A).  2. Conducted quarterly site inspections.  3. No RIFA were found. A healthy population of native fire ants was found in close proximity to the cave.</p>
<p><u>Bee Creek Cave</u>  Private</p>
<p><u>Blowing Sink Cave</u>  City of Austin  1. Inspected monthly, continued to operate security cameras, repaired perimeter fence, added “no trespass” signs, and met with COA PARD Rangers and WPD staff in an effort to increase on site patrols.  2. Treated site for RIFA with boiling water.  3. Completed cave faunal survey (See EXHIBIT A).  4. COA staff removed invasive non-native vegetation from the preserve.  4. WPD staff continued efforts to stabilize and secure five major karst features located on the tract. The work is nearly complete, and considered a major success by allowing clean recharge into the aquifer and reducing negative impacts to Blowing Sink Cave.  5. The lower passageways are currently inaccessible.  6. AFD staff conducted rescue training in one of the restored karst features (Sinky Dinky Cave).</p>
<p><u>Broken Arrow Cave</u>  City of Austin  1. Inspected quarterly with no sign of human visitation or vandalism.  2. Treated site for RIFA with boiling water.  3. Completed bi-annual faunal surveys (See EXHIBIT A).  4. Completed bi-annual cave cricket exit counts. (See EXHIBIT B).</p>
<p><u>Buda Boulder Spring</u>  City of Austin  1. Visited the site twice and noted no new negative impacts to the spring.  2. Searched for aquatic invertebrates in the spring, no SOC were observed.</p>
<p><u>Cave X</u>  Private  1. COA entered into a Private Landowner Agreement “Cave X, Management and Monitoring Plan, Covenants and Restrictions”, with the property owners (Regent’s School) in Oct. 1999. The agreement sets aside a 4.5 acre area to protect the cave footprint. USFWS was involved in the discussions on protection.  2. Cave entrance is gated and also has a fence for added protection.  3. Regents staff conduct periodic surface inspections of the cave including gate and lock maintenance.  4. COA WPD negotiated with the property owner to increase biological monitoring (bi-annual cave faunal and cave cricket exit count surveys) and management of the cave as part of an agreement for a variance for on-site construction of a berm to reduce the area currently listed as within the 100 year flood plain. Regents hired SWCA to do the above mentioned work, and they performed bi-monthly cave cricket exit counts in FY14; faunal surveys were not conducted due to high CO2 levels (SWCA 2014). COA WPD and BCP staff are continuing to try to work with the applicant to fulfil their agreement (ongoing).</p>
<p><u>Cave Y</u>  City of Austin  1. Visited this cave 6 times and noticed no signs of vandalism to the cave or cave gate.  2. Completed bi-annual cave faunal survey(See EXHIBIT A).  3. Completed bi-annual cave cricket exit counts. (See EXHIBIT B).</p>

**Table 11. FY15 BCCP Karst Feature Monitoring and Management Activities.**

<p><u>Ceiling Slot Cave</u> Private</p>
<p><u>Cold Cave</u> 1. TC is negotiating with the landowners concerning the possibility of purchase, conservation easement, or a management agreement for this 8 acre tract. 2. TC gained continued permission from landowner to perform bi-annual faunal surveys and cave cricket exit counts for the expanded BCP Cave Monitoring program. 3. TC performed surface inspections with no signs of vandalism to the cave entrance or in the cave. 4. TC conducted bi-annual cave faunal surveys (see EXHIBIT A). 5. TC conducted bi-annual cave cricket exit surveys. (See EXHIBIT B).</p>
<p><u>Cotterell Cave</u> City of Austin 1. Conducted quarterly site inspections. 2. RIFA were treated once with boiling water; most of the ants were located at the parking lot, approximately 300 feet from the cave. 3. Conducted bi-annual cave faunal surveys (see EXHIBIT A). 4. Conducted bi-annual cave cricket exit surveys. (See EXHIBIT B).</p>
<p><u>Disbelievers Cave</u> Private 10a Permit: PRT-808694</p>
<p><u>District Park Cave</u> City of Austin 1. BCP staff conducted bi-annual cave faunal surveys (See EXHIBIT A). 2. BCP staff and volunteers conducted bi-annual cave cricket exit counts (See EXHIBIT B). 3. Conducted site surveys quarterly, other than trash at the entrance no new major problems noted. 4. Permitted access to this cave was allowed. 5. BCP staff removed trash from the un-gated portion of the cave. 6. Treated site for RIFA with boiling water. 7. COA WPD Hydrogeologist continued to work on a hydrological study to determine the sub-surface drainage and to see if the adjacent developed area of the park could negatively impact the cave (ongoing). 8. Cave was negatively impacted by recent floods; BCP staff responded by removing a large amount of rock and sediment to allow for access to the cave.</p>
<p><u>Eluvial Cave</u> Private 10a Permit: PRT-808694</p>
<p><u>Flint Ridge Cave</u> City of Austin 1. Conducted six site visits and noted no signs of illegal trespass. 2. Treated site for RIFA with boiling water; staff treated numerous active mounds due to favorable habitat (open and disturbed). 3. Conducted quarterly cave faunal surveys (See EXHIBIT A). 4. BCP staff and volunteers conducted quarterly cave cricket exit counts (See EXHIBIT B). 5. COA WPD continued monitoring the storm water catchment area of Flint Ridge cave. 6. COA WPD and BCP staff reviewed TXDOT proposal to build SH45 that is proposed to be built over the surface catchment area as well as the cave footprint. 7. COA WPD initiated a new phase 2 hydrogeologic study that will delineate the subsurface catchment area to determine potential negative impacts from a newly proposed roadway.</p>

**Table 11. FY15 BCCP Karst Feature Monitoring and Management Activities.**

<p><u>Fossil Cave</u> City of Austin</p> <ol style="list-style-type: none"> <li>1. Inspected quarterly and found no new signs of vandalism</li> <li>2. Inspected for RIFA infestations on all visits. RIFA were observed within close proximity of the “suspected” cave</li> </ol>
<p><u>Fossil Garden Cave</u> Private</p>
<p><u>Gallifer Cave</u> Travis County</p> <ol style="list-style-type: none"> <li>1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave.</li> <li>2. Maintained fencing and signage to protect this area from unauthorized access and dumping.</li> <li>3. Surveyed site for RIFA. Treated 51 mounds in Spring 2015.</li> <li>4. Conducted bi-annual cave faunal surveys (see EXHIBIT A).</li> <li>5. Conducted bi-annual cave cricket exit surveys. (See EXHIBIT B).</li> </ol>
<p><u>Get Down Cave</u> TCMA</p> <ol style="list-style-type: none"> <li>1. COA WPD is currently in negotiations with the neighborhood association to take over ownership and management of this cave and property (includes several other significant karst features).</li> <li>2. BCP staff worked with neighbors regarding ways to limit negative impacts to cave crickets while treating for RIFA on adjacent private property. The protocol was posted on their web site.</li> </ol>
<p><u>Goat Cave</u> City of Austin</p> <ol style="list-style-type: none"> <li>1. Completed annual faunal survey (See EXHIBIT A).</li> <li>2. Treated RIFA annually with boiling water.</li> <li>3. With the help of volunteer stewards, conducted twice monthly site inspections, removed trash from preserve area and reported on anything out of the ordinary.</li> <li>4. Allowed permitted access to this cave .</li> <li>5. Continued to periodically repair the perimeter fence cuts and tagged signs by vandals, many of these incidents were reported by our volunteer land steward and in some cases the volunteer made the needed repairs.</li> <li>6. COA WPD staff initiated efforts to purchase the adjacent private preserve, which would greatly enhance protection to 2 BCCP caves.</li> <li>7. COA BCP, WPD, and PARD staff collaborated with the non-profit SBCA to enhance the preserve through grants; the main objective is to replace the existing kiosk which is no longer functional.</li> </ol>
<p><u>Hole-in-the-Road Cave</u> Private</p>
<p><u>Ireland’s Cave</u> Travis County</p> <ol style="list-style-type: none"> <li>1. TC acquired the 4.8 acre tract containing the cave from Muirfield Homeowner Association and began full management of the cave and surrounding property in FY12.</li> <li>2. Fencing was completed on the perimeter of the Ireland’s Cave tract to protect the cave preserve from trespass.</li> <li>3. Surveyed site for RIFA. Treated 52 mounds in Fall 2014.</li> <li>4. TC conducted an annual cave faunal survey (see EXHIBIT A).</li> </ol>
<p><u>Jack’s Joint Cave</u> Private</p>

**Table 11. FY15 BCCP Karst Feature Monitoring and Management Activities.**

<p><u>Japygid Cave</u> Private 10a Permit: PRT-808694</p>
<p><u>Jest John Cave</u> City of Austin</p> <ol style="list-style-type: none"><li>1. Conducted 2 site visits found and no signs of vandalism or human visitation.</li><li>2. Inspected site for RIFA infestations, no RIFA were observed near the cave.</li><li>3. Conducted one cave cricket exist count. (See EXHIBIT B).</li></ol>
<p><u>Jester Estates Cave</u> City of Austin</p> <ol style="list-style-type: none"><li>1. BCP staff conducted 6 site visits looking for signs of illegally discharged pools, dumped brush and trash from neighbors. It appears that past educational efforts have paid off, no illegal activities were observed.</li><li>2. Treated site twice for RIFA with boiling water.</li><li>3. Conducted bi-annual cave faunal surveys (See EXHIBIT A).</li><li>4. Conducted bi-annual cave cricket exit counts. (SEE EXHIBIT B).</li><li>5. BCP staff removed non-native invasive vegetation.</li></ol>
<p><u>Jollyville Plateau Cave</u> Private 10a Permit: PRT-808694</p>
<p><u>Kretschmarr Cave</u> Travis County</p> <ol style="list-style-type: none"><li>1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave.</li><li>2. Conducted a trash clean-up around the cave site and surrounding area.</li><li>3. Maintained fencing and signage to protect this area from unauthorized access and dumping.</li><li>4. Surveyed site bi-annually for RIFA. Treated 47 mounds in Fall 2014 and 109 mounds in Spring 2015.</li><li>5. Conducted annual cave faunal survey (see EXHIBIT A).</li></ol>
<p><u>Kretschmarr Double Pit</u> Travis County</p> <ol style="list-style-type: none"><li>1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave.</li><li>2. Maintained fencing and signage to protect this area from unauthorized access and dumping.</li><li>3. Surveyed site bi-annually for RIFA. Treated 17 mounds in Fall 2014 and 12 mounds in Spring 2015.</li><li>4. Conducted annual cave faunal survey (see EXHIBIT A).</li></ol>
<p><u>Lamm Cave</u> Section 7 Permit 2-15-93-F-075 (see USFWS files)</p> <ol style="list-style-type: none"><li>1. The City of Austin negotiated protective measures for this cave including a Land Management Plan for this cave. The cave has a setback size of approximately 4.13 acres. The radius of the setback varies from a minimum of 123 feet south of the cave to a maximum of 340 feet north of the cave.</li><li>2. The cave was gated and the preserve area was fenced following COA WPD and BCP staff recommendations and design.</li><li>3. No application of fertilizers, pesticides or herbicides will be allowed in the CEF area.</li><li>4. TC staff continue to periodically monitor the site to make certain that the gates and fences are secure.</li></ol>
<p><u>Little Bee Creek Cave</u> City of Austin</p> <ol style="list-style-type: none"><li>1. Conducted two site visits.</li><li>2. Conducted bi-annual cave faunal survey (See EXHIBIT A).</li><li>3. Conducted bi-annual cave cricket exit counts. (See EXHIBIT B).</li></ol>

**Table 11. FY15 BCCP Karst Feature Monitoring and Management Activities.**

<p><u>Lost Oasis Cave</u> TCMA</p>
<p><u>Lost Gold Cave</u> Private</p>
<p><u>Maple Run Cave</u> City of Austin</p> <ol style="list-style-type: none"> <li>1. Conducted bi-annual cave faunal survey (See EXHIBIT A).</li> <li>2. Conducted bi-annual cave cricket exit counts. (See EXHIBIT B).</li> <li>3. With the help of volunteer stewards: conducted weekly site inspections, removed trash from preserve area and reported on anything out of the ordinary.</li> <li>4. Permitted access to this cave is allowed.</li> <li>5. Treated site for RIFA with boiling water.</li> </ol>
<p><u>McDonald Cave</u> Travis County</p> <ol style="list-style-type: none"> <li>1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave.</li> <li>2. Maintained fencing and signage to protect this area from unauthorized access and dumping.</li> <li>3. Surveyed site bi-annually for RIFA.</li> <li>4. Conducted bi-annual cave faunal surveys (see EXHIBIT A).</li> <li>5. Conducted bi-annual cave cricket exit surveys. (See EXHIBIT B).</li> </ol>
<p><u>McNeil Bat Cave</u> Private</p>
<p><u>Midnight Cave</u> City of Austin</p> <ol style="list-style-type: none"> <li>1. Conducted quarterly site inspections</li> <li>2. Conducted bi-annual cave faunal surveys. (See EXHIBIT A).</li> <li>3. Treated site for RIFA with boiling water and trained COA PARD staff on RIFA treatment methods.</li> <li>4. Conducted bi-annual cave cricket exit counts. (See EXHIBIT B).</li> <li>5. Permitted access to this cave is allowed, though no access permits were granted this fiscal year.</li> </ol>
<p><u>M.W.A. Cave</u> Private 10a Permit: PRT-808694</p>
<p><u>Moss Pit Cave</u> Private</p>
<p><u>New Comanche Trail Cave</u> Travis County</p> <ol style="list-style-type: none"> <li>1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave.</li> <li>2. Maintained fencing and signage to protect this area from unauthorized access and dumping.</li> <li>3. Surveyed site for RIFA. Treated 23 mounds in Fall 2014.</li> <li>4. Conducted annual cave faunal survey (see EXHIBIT A).</li> </ol>
<p><u>No Rent Cave</u> Private</p> <ol style="list-style-type: none"> <li>1. TC gained permission from landowner to perform quarterly faunal surveys and cave cricket exit counts.</li> <li>2. TC performed surface inspections with no current signs of vandalism to the cave entrance or in the cave.</li> <li>3. TC/COA continued increased monitoring efforts and incorporated new methods to document the arrival and impacts of a nearby TCA population.</li> <li>4. TC/COA conducted quarterly cave faunal surveys (see EXHIBIT A).</li> <li>5. TC/COA conducted quarterly cave cricket exit surveys. (See EXHIBIT B).</li> </ol>

**Table 11. FY15 BCCP Karst Feature Monitoring and Management Activities.**

<p><u>North Root Cave</u> Travis County</p> <ol style="list-style-type: none"><li>1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave.</li><li>2. Maintained fencing and signage to protect this area from unauthorized access and dumping.</li><li>3. Surveyed site for RIFA. Treated 60 mounds in Spring 2015.</li><li>4. Conducted annual cave faunal survey (see EXHIBIT A).</li></ol>
<p><u>Pennie's Cave</u> Private</p> <ol style="list-style-type: none"><li>1 The entrance was re-excavated in 2012, providing access to the cave.</li><li>2.The cave entrance has been gated and boulders placed around the cave at the edge of a 300-ft buffer to better define the protected area.</li><li>3. Zara Environmental has secured a one year contract to conduct quarterly cave faunal surveys, map the interior of the cave and treat the site for RIFA. Although only a one year contract, it is hoped that the owner will extend the contract for multiple years.</li></ol>
<p><u>Pickle Pit Cave</u> Section 7 Permit 2-15-93-F-075</p> <ol style="list-style-type: none"><li>1. Staff from Loomis, USFWS, and COA BCP and COA WPD staff met on site and conducted one cave faunal survey (collected blind <i>Cicurina</i> to help with future species identification. (See EXHIBIT A).</li><li>2. USFWS contracted with Marshal Hedin to verify the validity of the species <i>Cicurina wartoni</i>, which has been petitioned to be listed. Hedin's work determined that the species does not warrant listing due to the fact that <i>C. wartoni</i> is not a distinct species.</li><li>3. A volunteer neighbor monitors the cave entrance/ gate monthly.</li></ol>
<p><u>Pipeline Cave</u> Private</p> <ol style="list-style-type: none"><li>1. A 2004 agreement between COA and Stratus set aside a fenced buffer around Pipeline cave that varies from 100 feet to the east and up to 300 feet west of the cave and an additional setback of 300 feet to the north and west; 150 ft to east and south for the adjacent feature known as Confusion Sink.</li><li>2. Developer installed cave gate (including a gate on the nearby "confusion cave", silt fences were in place but no permanent fences delineating the preserve area was in place. COA BCP staff reported findings to WPD staff.</li></ol>
<p><u>Rolling Rock Cave</u> City of Austin</p> <ol style="list-style-type: none"><li>1. Inspected quarterly and no sign of human visitation or vandalism was found.</li><li>2. Conducted one cave faunal survey. (See EXHIBIT A).</li></ol>
<p><u>Root Cave</u> Travis County</p> <ol style="list-style-type: none"><li>1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave.</li><li>2. Maintained fencing and signage to protect this area from unauthorized access and dumping.</li><li>3. Surveyed site for RIFA. Treated 60 mounds in Spring 2015.</li><li>4. Conducted annual cave faunal survey (see EXHIBIT A).</li></ol>
<p><u>Slaughter Creek Cave</u> City of Austin</p> <ol style="list-style-type: none"><li>1. Conducted quarterly site inspections, observed signs of attempted vandalism (digging tools, fire, and trash), and met on site with COA PARD Rangers in an effort to increase onsite patrols..</li><li>2. Conducted one cave faunal survey. (See EXHIBIT A)</li></ol>

**Table 11. FY15 BCCP Karst Feature Monitoring and Management Activities.**

<p><u>Spanish Wells Cave</u> Travis County</p> <ol style="list-style-type: none"><li>1. TC acquired Spanish Wells Cave and surrounding land that protects the cave cricket foraging area and surface/subsurface drainage basins in FY15.</li><li>2. Performed surface inspections with no signs of trespass or vandalism to the cave entrance or in the cave.</li></ol>
<p><u>Spider Cave</u> City of Austin</p> <ol style="list-style-type: none"><li>1. Conducted four site visits, and no sign of human access or vandalism was found.</li><li>2. Conducted bi-annual cave faunal surveys (See EXHIBIT A).</li><li>3. Conducted bi-annual cave cricket exit counts. (See EXHIBIT B).</li><li>4. Treated site for RIFA with boiling water.</li></ol>
<p><u>Stark's North Mine</u> Travis County</p> <ol style="list-style-type: none"><li>1. TC acquired this cave and 0.8 acres surrounding it in FY12. The area surrounding the cave is all previously developed.</li><li>2. Performed surface inspections and detected signs of vandalism to the cave entrance and inside the cave.</li><li>3. Surveyed site bi-annually for RIFA. No mounds found within 80 m of cave.</li><li>4. Conducted bi-annual cave faunal surveys (See EXHIBIT A).</li><li>5. Conducted bi-annual cave cricket exit counts (See EXHIBIT B).</li><li>6. Documented complete flooding of cave during Memorial day flood event.</li></ol>
<p><u>Stovepipe Cave</u></p> <ol style="list-style-type: none"><li>1. Conducted 6 site inspections, and continued to remove old trash from the preserve.</li><li>2. Repaired perimeter fence.</li><li>3. Conducted bi-annual cave faunal surveys (See EXHIBIT A).</li><li>4. Conducted bi-annual cave cricket exit counts (See EXHIBIT B).</li></ol>
<p><u>Talus Spring Cave</u> Private</p> <ol style="list-style-type: none"><li>1. The USFWS 10a permit PRT 815447 mitigation requirement intended this cave to go to TC, however, the cave is located on private land just outside of the mitigation area. TC has continued requesting that the homeowners association donate the land to TC; coordinated management with them.</li><li>2. Performed surface inspections with no signs of vandalism to the cave entrance or in the cave.</li><li>3. Surveyed site bi-annually for RIFA. No mounds found within 80 m of cave.</li><li>4. Conducted annual cave faunal survey (see EXHIBIT A).</li></ol>
<p><u>Tardus Hole Cave</u> Travis County</p> <ol style="list-style-type: none"><li>1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave.</li><li>2. Maintained fencing and signage to protect this area from unauthorized access and dumping.</li><li>3. Surveyed site bi-annually for RIFA. Treated 13 mounds in Fall 2014 and 10 mounds in Spring 2015.</li><li>4. Conducted annual cave faunal survey (see EXHIBIT A).</li></ol>
<p><u>Tooth Cave</u> Travis County</p> <ol style="list-style-type: none"><li>1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave.</li><li>2. Maintained fencing and signage to protect this area from unauthorized access and dumping.</li><li>3. Conducted a trash clean-up around the cave site and surrounding area.</li><li>4. Surveyed site bi-annually for RIFA. Treated 38 mounds in Fall 2014 and 21 mounds in Spring 2015.</li><li>5. Conducted bi-annual cave faunal surveys (see EXHIBIT A).</li><li>6. Conducted bi-annual cave cricket exit surveys. (See EXHIBIT B).</li></ol>

**Table 11. FY15 BCCP Karst Feature Monitoring and Management Activities.**

Weldon Cave

Private

1. TC gained continued permission from landowner to perform bi-annual faunal surveys and cave cricket exit counts for the expanded BCP Cave Monitoring program.
2. TC performed surface inspections with no current signs of vandalism to the cave entrance or in the cave.
3. TC/COA continued increased monitoring efforts and incorporated new methods to document the arrival and impacts of a nearby TCA population.
4. TC conducted quarterly cave faunal surveys (see EXHIBIT A).
5. TC conducted quarterly cave cricket exit surveys. (See EXHIBIT B).

Whirlpool Cave

TCMA

1. TC/COA continued increased monitoring efforts and incorporated new methods to document the arrival and impacts of a nearby TCA population.
2. TC/COA conducted quarterly cave faunal surveys (see EXHIBIT A).
3. TC/COA initiated quarterly cave cricket exit surveys in late FY15. (See EXHIBIT B).
4. TCMA continued to allow permitted access to the cave; however, in an effort to limit access and to raise funds for cave management, they are now charging a fee for access.

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**EXHIBIT A:**  
**KARST FAUNAL SURVEY REPORTS**

FY15 City of Austin/Travis County Karst Faunal Surveys<sup>1,2</sup>

Cave	Survey Date	Monitoring Agency	Endangered Species							Species of Concern							Other Significant Troglabites							Other notable species detected				
			<i>Rhadine persephone</i>	<i>Tartarocreagris texana</i>	<i>Teysshaneta myopica</i>	<i>Texanurorops reddelli</i>	<i>Texella reddelli</i>	<i>Texella reyesi</i>	<i>Caecidotea reddelli</i>	<i>Cicurina bandida</i>	<i>Cicurina travisae</i>	<i>Eidmannella reclusa</i>	<i>Rhadine ausitnica</i>	<i>Rhadine subterranea</i>	<i>Sphalloplana mohri</i>	<i>Tartarocreagris comanche</i>	<i>Tartarocreagris intermediella</i>	<i>Teysshaneta concinna</i>	<i>Teysshaneta devia</i>	<i>Texella spinopereca</i>	<i>Eidmannella rostrata</i>	<i>Eidmannella sp.</i>	<i>Speodesmus bicornourus</i>		<i>Speodesmus sp.</i>	<i>Tartarocreagris infernalis</i>	<i>Texoreddella texensis</i>	
Adobe Springs Cave	11/25/2014	TC																									Trichoniscidae (1)	
Adobe Springs Cave	5/27/2015	TC																										
Airman's Cave	1/8/2015	COA							42												37		1					
Airman's Cave	8/11/2015	COA							27							1					45		4					
Amber Cave	12/3/2014	TC								2													21					
Amber Cave	5/26/2015	TC	1			1				2													6					<i>Batrisesodes sp.</i> (1)
Arrow Cave	9/25/2015	COA							15												1		1					<i>Texella mulaiki</i> (1)
Barker Ranch Cave 1	11/17/2014	COA							15						2								19					<i>Myotis velifer</i> (1) <i>Tartarocreagris sp.</i> (1)
Beard Ranch Cave	1/21/2015	COA						4			1										1							
Blowing Sink Cave	9/25/2015	COA							2						1							4		2		3		<i>Batrisesodes sp.</i> (1)
Broken Arrow Cave	11/26/2014	COA							12														1					<i>Cicurina buwata</i> (1)
Broken Arrow Cave	5/29/2015	COA	1						1														7					<i>Batrisesodes sp.</i> (1) Trichoniscidae (1)
Cave Y	1/8/2015	COA								4											2	29						<i>Tartarocreagris sp.</i> (2) <i>Texella grubbsi</i> (10)
Cave Y	8/11/2015	COA								11													69		2			<i>Batrisesodes sp.</i> (1) <i>Texella grubbsi</i> (29)
Cold Cave	2/4/2015	TC						4															26					<i>Batrisesodes sp.</i> (1) <i>Cicurina sp.</i> (blind) (3)
Cold Cave	8/24/2015	TC						5															15		2			<i>Batrisesodes sp.</i> (18) <i>Cicurina sp.</i> (blind) (3) <i>Tartarocreagris sp.</i> (1) Trichoniscidae (13)
Cortana Cave	1/29/2015	COA			47			1			3										1		1					
Cortana Cave	8/27/2015	COA			43			10			3										6		6					
Cotterell Cave	1/21/2015	COA						24			66											35		5				
Cotterell Cave	8/3/2015	COA						65			79						1				2	58		2				
County Line Bat Cave	2/23/2015	COA								11													36					<i>Myotis velifer</i> (1) <i>Perimyotis subflavus</i> (12) <i>Texella mulaiki</i> (1)
District Park Cave	11/12/2014	COA								21						4							2					



Cave	Survey Date	Monitoring Agency	Endangered Species						Species of Concern										Other Significant Troglobites					Other notable species detected	
			<i>Rhadine persephone</i>	<i>Tartarocreagrís texana</i>	<i>Tayshaneta myopica</i>	<i>Texananarops reddelli</i>	<i>Texella reddelli</i>	<i>Texella reyesi</i>	<i>Caecidotea reddelli</i>	<i>Cicurina bandida</i>	<i>Cicurina travisae</i>	<i>Eidmannella reclusa</i>	<i>Rhadine austinica</i>	<i>Rhadine subterranea</i>	<i>Sphalloptana mohri</i>	<i>Tartarocreagrís comanche</i>	<i>Tartarocreagrís intermedia</i>	<i>Tayshaneta concinna</i>	<i>Tayshaneta devia</i>	<i>Texella spiniperca</i>	<i>Eidmannella rostrata</i>	<i>Eidmannella</i> sp.	<i>Speodesmus bicornatus</i>		<i>Speodesmus</i> sp.
Maple Run Cave	8/6/2015	COA						6																	<i>Anapistula</i> sp. (4) <i>Texella mulaiki</i> (9)
McDonald Cave	1/27/2015	TC					7		11								22		10		16			1	
McDonald Cave	8/18/2015	TC					16		53								4		8		56				
Midnight Cave	1/12/2015	COA						42			1									32					<i>Batrísodes</i> sp. (1) <i>Stygobromus russelli</i> (2)
Midnight Cave	8/6/2015	COA						47			1											1		1	<i>Batrísodes</i> sp. (3)
Millipede Annex Cave	11/18/2014	TC/COA					17															1			<i>Cicurina buwata</i> (1) <i>Tayshaneta</i> sp. (3)
Millipede Annex Cave	4/22/2015	TC/COA					17															1			<i>Cicurina buwata</i> (10) <i>Tartarocreagrís</i> sp. (3) <i>Tayshaneta</i> sp. (10)
Millipede Cave	11/18/2014	TC/COA					1													1		1			<i>Cicurina buwata</i> (6) <i>Tayshaneta</i> sp. (3)
Millipede Cave	4/22/2015	TC/COA																		1				1	<i>Cicurina buwata</i> (6) <i>Tayshaneta</i> sp. (2)
New Comanche Trail Cave	9/2/2015	TC			2		4				1											5			<i>Cicurina</i> sp. (blind) (1)
No Rent Cave	11/20/2014	TC/COA					1													10					<i>Batrísodes</i> sp. (20) <i>Cicurina buwata</i> (11) <i>Nylandería fulva</i> (~1450)
No Rent Cave	2/12/2015	TC/COA					1															3			<i>Batrísodes</i> sp. (2) <i>Cicurina buwata</i> (22) <i>Nylandería fulva</i> (~400)
No Rent Cave	5/20/2015	TC										4								11		8		2	<i>Cicurina buwata</i> (32)
North Root Cave	6/13/2015	TC							1																
Pond Party Pit	1/21/2015	COA					7			1										7		29	5		<i>Rhadine</i> sp. (1) Trichoniscidae (2)
Pond Party Pit	8/3/2015	COA					20			1										6		16	8		<i>Rhadine</i> sp. (3) Trichoniscidae (6)
Rolling Rock Cave	11/26/2014	COA																							<i>Cicurina buwata</i> (1) <i>Perimyotis subflavus</i> (8)
Root Cave	2/4/2015	TC																				1			
Seibert Sink	1/13/2015	COA															6			8		4			
Seibert Sink	8/12/2015	COA							3								1					14			
Sky Ranch Cave	3/10/2015	COA							6											3					<i>Batrísodes</i> sp. (1) <i>Texella</i> sp. (2)
Slaughter Creek Cave	9/25/2015	COA							15													66		2	<i>Batrísodes</i> sp. (2) <i>Texella mulaiki</i> (2)
Spider Cave	11/26/2014	COA					4			26										6	2				

Cave	Survey Date	Monitoring Agency	Endangered Species						Species of Concern										Other Significant Troglobites					Other notable species detected		
			<i>Rhadine persephone</i>	<i>Tartarocreagris texana</i>	<i>Tayshaneta myopica</i>	<i>Texanurorops reddelli</i>	<i>Texella reddelli</i>	<i>Texella reyesi</i>	<i>Caecidotea reddelli</i>	<i>Cicurina bandida</i>	<i>Cicurina trivisae</i>	<i>Eidmannella rectusa</i>	<i>Rhadine austinica</i>	<i>Rhadine subterranea</i>	<i>Sphallopilana mohri</i>	<i>Tartarocreagris comanche</i>	<i>Tartarocreagris intermediata</i>	<i>Tayshaneta concinna</i>	<i>Tayshaneta devia</i>	<i>Texella spinoperea</i>	<i>Eidmannella rostrata</i>	<i>Eidmannella sp.</i>	<i>Speodesmus bicornourus</i>		<i>Speodesmus sp.</i>	<i>Tartarocreagris infernalis</i>
Spider Cave	5/29/2015	COA	1				2			17											3		1			
Stark's North Mine Cave	11/14/2014	TC														11										<i>Perimyotis subflavus</i> (16) <i>Tartarocreagris sp.</i> (12)
Stovepipe Cave	1/21/2015	COA	6			5		24		11											1		77			<i>Tartarocreagris attenuata</i> (1) Trichoniscidae (5)
Stovepipe Cave	8/3/2015	COA	3		2	5		40		11											4		22			Trichoniscidae (4)
Tabor Crevice	11/17/2014	COA								2											7		4			
Tabor Crevice	2/23/15	COA								6											2		6			<i>Perimyotis subflavus</i> (1) <i>Rhadine sp.</i> (3) <i>Texella mulaiki</i> (1)
Talus Spring Cave	9/2/2015	TC																					1			
Tardus Hole	11/19/2014	TC																								
Testudo Tube Cave	1/29/2015	COA								3											11		30			<i>Cicurina buwata</i> (18) <i>Eurycea sp.</i> (22) <i>Stygobromus russelli</i> (100) Trichoniscidae (16)
Testudo Tube Cave	8/10/2015	COA																					13			<i>Cicurina buwata</i> (26) <i>Eurycea sp.</i> (25) <i>Stygobromus russelli</i> (40) Trichoniscidae (4)
Tight Pit Cave	2/4/2015	TC																								
Tooth Cave	11/6/2014	TC	1		3			25		25	2												11		2	<i>Perimyotis subflavus</i> (4)
Tooth Cave	5/13/2015	TC	10		3			29		25	3												8		6	
Two Trunks Cave	2/4/2015	TC																								<i>Perimyotis subflavus</i> (1)
Weldon Cave	11/20/2014	TC						1															2			<i>Batrisodes sp.</i> (1) <i>Cicurina buwata</i> (1) <i>Perimyotis subflavus</i> (2) Trichoniscidae (1)
Weldon Cave	2/12/2015	TC						1															4			<i>Cicurina buwata</i> (3) <i>Perimyotis subflavus</i> (2)
Weldon Cave	5/20/2015	TC																					3			<i>Cicurina buwata</i> (2)
Weldon Cave	8/11/2015	TC																			2	6				<i>Cicurina buwata</i> (6)
Whirlpool Cave	11/12/2014	TC/COA								3													61			<i>Batrisodes sp.</i> (1) <i>Nylanderia fulva</i> (52)
Whirlpool Cave	1/26/2015	TC/COA								2													49	1		<i>Batrisodes sp.</i> (1) <i>Nylanderia fulva</i> (~600) <i>Tayshaneta sandersi</i> (2)
Whirlpool Cave	6/1/2015	TC/COA								1													22			<i>Batrisodes sp.</i> (1) <i>Nylanderia fulva</i> (8)
Whirlpool Cave	8/25/2015	TC/COA								1													5	1		

<sup>1</sup> All survey data and full species lists available by request through COA and TC.

<sup>2</sup> Surveyors in FY15 include Todd Bayless, Christina Campbell, Travis Clark, Erin Cord, Renee Fields, Devin Grobert, Paul Fushille, Ben Hutchins, Linda Laack, Mark Sanders, Jonny Scalise, and William Simper.

**EXHIBIT B:**  
**CAVE CRICKET EXIT COUNT DATA REPORTS**

## FY 15 COA/TC CAVE CRICKET EXIT COUNT DATA REPORTS

Surveyed Caves	Fall 2014 (November/December)				Winter 2015 (January/February)				Spring 2015 (May)				Summer 2015 (August/ September)			
	N:	J:	A:	TI:	N:	J:	A:	TI:	N:	J:	A:	TI:	N:	J:	A:	TI:
Adobe Springs Cave	9	17	87	113					4	76	520	600				
Airmen's Cave					678	54	10	742					36	24	7	67
Amber Cave	99	43	26	168					40	144	561	745				
Broken Arrow Cave	263	133	606	1002					143	159	369	671				
Cave Y					148	53	11	212					346	713	72	1131
Cold Cave					1584	282	3	1869					331	225	422	978
Cortana Cave					50	26	33	109					91	6	10	107
Cotterell Cave					344	80	24	448					453	90	13	556
District Park Cave	696	154	20	870					320	397	389	1106				
Flint Ridge Cave	519	363	650	1532	140	102	50	292	165	56	13	234	138	106	118	362
Gallifer Cave					60	57	5	122					15	9	175	199
Geode Cave					59	69	9	137					4	17	204	225
Jest John Cave													120	422	344	886
Jester Estates Cave	232	45	3	280					704	89	69	862				
Little Bee Creek Cave	0	0	0	0					0	0	5	5				
Maple Run Cave					2821	1690	604	5115					346	65	18	429
Midnight Cave					2456	364	99	2919					2879	1753	883	5515
No Rent Cave	449	626	1111	2186	413	532	20	965	740	358	599	1697	352	266	358	976
Pond Party Pit					259	341	47	647					44	26	160	230
Seibert Sink					161	137	26	324					131	25	43	199
Spider Cave	50	32	74	156					43	26	63	132				
Stark's North Mine	4	0	1	5					0	14	8	22				
Stovepipe Cave					214	82	16	312					105	27	65	197

Surveyed Caves	Fall 2014 (November/December)				Winter 2015 (January/February)				Spring 2015 (May)				Summer 2015 (August/ September)			
<b>Testudo Tube</b>					349	394	90	833					14	34	243	291
<b>Tooth Cave</b>	27	57	35	119					31	63	75	171				
<b>Weldon Cave</b>	899	1268	2722	4939	596	1040	131	1767	213	120	1023	1356	118	37	172	327
<b>Whirlpool Cave</b>													80	44	65	189

N= nymphs; J= juveniles; A= adults; TI= total individuals.