Balcones Canyonlands Preserve
Karst Monitoring and Management
FY 2017 Annual Report



Cicurina travisae guarding its egg sac in Cotterell 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)

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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 2017 (FY17), 50 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	*Tartarocreagris texana*
Tooth Cave spider	*Tayshaneta myopica*[1]
Tooth Cave ground beetle	*Rhadine persephone*
Kretschmarr Cave mold beetle	*Texamaurops reddelli*
Bee Creek Cave harvestman	*Texella reddelli*
Bone Cave harvestman	*Texella reyesi*

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

[1] *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).

[2] *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 10/01/16- 9/30/17 (FY17). In FY17, 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 50 of the BCCP caves are "protected" in some way, with 12 "unprotected". The 50 "protected" BCCP caves are currently managed as follows: 22 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; eight 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 FY17, 11 endangered species karst features which were not listed on the BCCP permit are being protected on BCP lands (six features on TC BCP; five 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** *Tartarocreagris texana*	**Tooth Cave Spider** *Tayshaneta myopica*	**Tooth Cave Ground Beetle** *Rhadine persephone*	**Kretschmarr Cave Mold Beetle** *Texamaurops reddelli*	**Bee Creek Cave Harvestman** *Texella reddelli*	**Bone Cave Harvestman** *Texella reyesi*
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 Delete X 2017 (Ubick)	X 2017 (Ubick)

Cave Name	**Current Preserve Status**	**Karst Fauna Region**	**Tooth Cave Pseudoscorpion** *Tartarocreagris texana*	**Tooth Cave Spider** *Tayshaneta myopica*	**Tooth Cave Ground Beetle** *Rhadine persephone*	**Kretschmarr Cave Mold Beetle** *Texamaurops reddelli*	**Bee Creek Cave Harvestman** *Texella reddelli*	**Bone Cave Harvestman** *Texella reyesi*
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	X 2016 (Reddell)		
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			X 2017 (Ubick)
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** *Tartarocreagris texana*	**Tooth Cave Spider** *Tayshaneta myopica*	**Tooth Cave Ground Beetle** *Rhadine persephone*	**Kretschmarr Cave Mold Beetle** *Texamaurops reddelli*	**Bee Creek Cave Harvestman** *Texella reddelli*	**Bone Cave Harvestman** *Texella reyesi*
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 2009 (USFWS)	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; Reddell 2004,2005, 2010, 2016; HNTB 2005; USFWS 1994, 2009a, 2009b, 2009c; Ledford 2010, Ubick 2017.

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*, as also reported in USFWS 2009b.
X 2009 = USFWS - according to the 2009 5 year review on *Texella reyesi* the report lists *T. reyesi* as confirmed for Stovepipe Cave (USFWS 2009a); *Texella reddelli* 5-year review confirms *T. reddelli* for Stark's North Mine (USFWS 2009c); *Neoleptoneta myopica* 5-year review confirms this species for Stovepipe Cave (USFWS 2009b).
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)
X 2016 (Reddell) = confirmed by J. Reddell (pers. comm 2016)
Delete X 2017 (Ubick) = *T. reddelli* was accidentally listed as occurring in this cave, the species is actually *T reyesi* (personal communication Ubick 2017)
X 2017 (Ubick) = confirmed by D. Ubick (pers. comm 2017)

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 *Tartarocreagris texana*	Tooth Cave Spider *Tayshaneta myopica*	Tooth Cave Ground Beetle *Rhadine persephone*	Kretschmarr Cave Mold Beetle *Texamaurops reddelli*	Bee Creek Cave Harvestman *Texella reddelli*	Bone Cave Harvestman *Texella reyesi*
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
Little Black Hole	COA	Rollingwood					X 2009c	
Pond Party Pit	COA	Jollyville Plateau			X 2016			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: Reddell 2016; 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[1,2]

Key and footnotes follow table

Cave Name	*Aphrastochithonius N.S.*	*Caecidotea reddelli*	*Candona sp. nr. stagnalis*	*Cicurina bandida*[3]	*Cicurina travisae*[4]	*Cicurina sp.*[5]	*Eidmannella reclusa*	*Miktoniscus N.S.*	*Tayshaneta concinna*	*Tayshaneta devia*	*Rhadine austinica*	*Rhadine s. subterranea*	*Rhadine s. mitchelli*	*Speodesmus N.S.*	*Sphalloplana mohri*	*Tartarocreagris comanche*	*Tartarocreagris intermedia*	*Tartarocreagris N.S. 3*	*Texella spinoperca*	*Trichoniscinae 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						X								

Cave Name	*Aphrastochithonius N.S.*	*Caecidotea reddelli*	*Candona sp. nr. stagnalis*	*Cicurina bandida*[3]	*Cicurina travisae*[4]	*Cicurina sp.*[5]	*Eidmannella reclusa*	*Miktoniscus N.S.*	*Tayshaneta concinna*	*Tayshaneta devia*	*Rhadine austinica*	*Rhadine s. subterranea*	*Rhadine s. mitchelli*	*Speodesmus N.S.*	*Sphalloplana mohri*	*Tartarocreagris comanche*	*Tartarocreagris intermedia*	*Tartarocreagris N.S. 3*	*Texella spinoperca*	*Trichoniscinae 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							X								

Cave Name	*Aphrastochithonius N.S.*	*Caecidotea reddelli*	*Candona sp. nr. stagnalis*	*Cicurina bandida*[3]	*Cicurina travisae*[4]	*Cicurina sp.*[5]	*Eidmannella reclusa*	*Miktoniscus N.S.*	*Tayshaneta concinna*	*Tayshaneta devia*	*Rhadine austinica*	*Rhadine s. subterranea*	*Rhadine s. mitchelli*	*Speodesmus N.S.*	*Sphalloplana mohri*	*Tartarocreagris comanche*	*Tartarocreagris intermedia*	*Tartarocreagris N.S. 3*	*Texella spinoperca*	*Trichoniscinae 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	*Aphrastochithonius N.S.*	*Caecidotea reddelli*	*Candona sp. nr. stagnalis*	*Cicurina bandida*[3]	*Cicurina travisae*[4]	*Cicurina sp.*[5]	*Eidmannella reclusa*	*Miktoniscus N.S.*	*Tayshaneta concinna*	*Tayshaneta devia*	*Rhadine austinica*	*Rhadine s. subterranea*	*Rhadine s. mitchelli*	*Speodesmus N.S.*	*Sphalloplana mohri*	*Tartarocreagris comanche*	*Tartarocreagris intermedia*	*Tartarocreagris N.S. 3*	*Texella spinoperca*	*Trichoniscinae 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			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, Ledford et al. 2012, Hedin 2015, Reddell 2016.

Key and Footnotes

X = confirmed location based on collected specimen.

[1] *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).

[2] *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).

[3] 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).

[4] Occurrences of *Cicurina travisae* include localities formerly listed as *Cicurina reddelli* and *Cicurina wartoni*, which have been formally grouped together into the single species *C. travisae* (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[1,2]

Key and footnotes follow table

Cave Name	BCP Owner	*Aphrastochithonius N.S.*	*Caecidotea reddelli*	*Candona sp. nr. stagnalis*	*Cicurina bandida*[3]	*Cicurina travisae*[4]	*Cicurina sp.*[5]	*Eidmannella reclusa*	*Miktoniscus N.S.*	*Tayshaneta concinna*	*Tayshaneta devia*	*Rhadine austinica*	*Rhadine s. subterranea*	*Rhadine s. mitchelli*	*Speodesmus N.S.*	*Sphalloplana mohri*	*Tartarocreagris comanche*	*Tartarocreagris intermedia*	*Tartarocreagris N.S. 3*	*Texella spinoperca*	*Trichoniscinae 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							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, Reddell 2016.

Key and Footnotes

X = confirmed location based on collected specimen.

[1] *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).

[2] *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).

[3] 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).

[4] Occurrences of *Cicurina travisae* include localities formerly listed as *Cicurina reddelli* and *Cicurina wartoni*, which have been formally grouped together into the single species *C. travisae* (Hedin 2015).

[5] Localities of possible SOCs; 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 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. FY17 Ownership, protection, monitoring and access status of the 62 BCCP caves/karst features (35 caves with ES and 26 caves with SOC) [1, 2].

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 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 quarterly 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; periodic 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; periodic 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. Peter Sprouse (Zara Environmental) made active collections via modified bottle trap.	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 completed cave cricket exit counts in October 2015 and one cave faunal survey in February 2016 as part of an agreement to allow for on site construction of a berm to reduce flooding concerns.	none
Cave Y[1]	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; periodic RIFA control	none
Disbelievers Cave	ES	BCP/Private Section 10(a)		Protected by 10a permit, hired Plateau Land & Wildlife Management		none

Cave Name	ES or SOC	BCP or Private/ Current Owner	Gated/ Fenced	Protection Area Status /Adequate Preserve size	Species Monitoring Status	Public Access
District Park Cave	SOC	BCP/COA	Gated	Protected in parkland	COA quarterly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring; periodic RIFA control	1st room open, past 1st room protected by gate, access by permit*
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 possibly be negatively impacted by the newly constructed SH45.	COA quarterly surface monitoring; quarterly cave cricket exit counts; quarterly species monitoring; periodic 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 to be Fossil Cave	None
Fossil Garden Cave	ES	Private		Private - Unknown		none
Gallifer Cave	ES	BCP/TC	Gated and fenced	Protected on preserve	TC quarterly surface monitoring; bi-annual cave cricket exit counts; RIFA survey/control; bi-annual species monitoring	none
Get Down Cave	SOC	BCP/COA	Gated and fenced	Protected on preserve Managed by COA Watershed Protection Department (WPD). Inadequate setback from development.	No karst management in FY17. .	none
Goat Cave	SOC	BCP/COA	Fenced	Protected on preserve	COA monthly surface monitoring; annual species monitoring; periodic RIFA control	access by permit*
Hole-in-the-Road	ES	Private		Private –Unknown. (very close to a major roadway)		none
Ireland's Cave	SOC	BCP/ TC	Gated	Protected on preserve	TC quarterly 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
Jack's Joint	SOC	Private		Private - Unknown		none
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; periodic 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 quarterly surface monitoring; RIFA survey/control; annual species monitoring	none
Kretschmarr Double Pit	ES	BCP/TC	Fenced	Protected on preserve	TC quarterly 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 Creek 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 – COA WPD has negotiated a small setback from future development.		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 monthly surface monitoring bi-annual cave cricket exit counts; bi-annual species monitoring; periodic RIFA control	access by permit*
McDonald Cave	ES	BCP /TC	Fenced	Protected on preserve	TC quarterly surface monitoring; RIFA survey/control; annual species monitoring	None
McNeil Bat Cave	ES	Private		Private – Unknown (close proximity to high school)		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; periodic RIFA control	access by permit*
Moss Pit	SOC	Private		Private - Unknown		none
New Comanche Trail Cave	ES	BCP/TC	Fenced	Protected on preserve	TC quarterly 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 quarterly 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 WPD negotiated with Zara Environmental to excavate the entrance, add a cave gate, and placing a 300 ft buffer around the cave.	Zara Environmental species monitoring; Zara Environmental RIFA surveys/ control	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	COA WPD has 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 quarterly 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; COA periodic RIFA control.	none
Spanish Wells Cave	SOC	BCP/TC		Protected on preserve	TC quarterly surface monitoring; bi-annual cave cricket exit counts; RIFA survey/control; bi-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; periodic 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
Stark's North Mine[2]	ES	BCP/TC	Gated	Protected on preserve	TC quarterly surface monitoring; bi-annual cave cricket exit counts; RIFA survey/control; bi-annual species monitoring	none
Stovepipe Cave	ES	BCP/ COA	Fenced	Protected on preserve	COA quarterly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring periodic RIFA control	none
Talus Springs Cave[3]	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 quarterly surface monitoring; RIFA survey/control; annual species monitoring	none
Tooth Cave	ES	BCP/TC	Gated and Fenced	Protected on preserve	TC quarterly 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**

[1]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).
[2]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).
[3] 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 (PARD) 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 (2016). 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 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 1,096 person trips in FY17. 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 caves, BCP staff continues to meet with local educators (COA PARD, COA WPD Education, TCMA, and Barton Springs/ Edwards Aquifer Conservation District 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, to try to determine ways to mitigate this damage. To address the overuse issue, COA BCP staff is continuing to look for new caves and enhance existing 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.

Wildflower Cave is a relatively small non-BCCP cave on the Lady Bird Johnson Wildflower Center that received 2,459 visitors in FY17. Wildflower Cave has been used for education by COA Earth Camp since 1997 after it was restored by cleaning out trash fill. Wildflower Cave is unsuitable for many cave tours due to its currently limited extent and small size, but is heavily utilized in 5th grade Earth Camp cave education (see Cave Education Summary below).

Restoring Non-BCCP Caves for Education

By developing non-BCCP caves as a safe and accessible option for adequately trained and responsible groups for guided education/recreation tours, we can promote education while reducing BCCP cave impacts. Non-BCCP education caves should draw traffic away from BCCP caves and provide a greater range of experience. In FY17, considerable progress was made in developing non-BCCP caves for educational use:

During FY17, COA WPD staff continued to make significant progress excavating fill and trash from the following non-BCCP caves: Hideout and Wade Caves at Goat Cave karst preserve had work conducted by contractor Rich Zarria on behalf of COA BCP including sediment removal in the entrance sinkhole, installation of stacked rock steps and surface handrails to facilitate its use for public education. 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 endangered species caves: Millipede and Millipede Annex. In FY17, progress with restoration plans continued with revegetation work 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. Informal presentations on karst biology and geology were provided by Mark Sanders, Devin Grobert, and Jonny Scalise to the McNeil High School Green Club and AP Environmental Science classes as the students were introduced to the courtyard caves.

FY17 Cave Education Summary

COA Education Programs:

COA WPD conducts cave education through the following programs: Earth Camp and Earth School (fifth grade water quality programs), Watershed Detectives (middle school), Hydrofiles (high school), Clean Creek Camp (a summer parent/child water quality program), providing cave tours for Nature Nights at the Lady Bird Johnson Wildflower Center (all ages), and adult education such as the Grow Green Landscape Professionals Training and Groundwater to the Gulf: Summer Institute (professional development for teachers). 2016-2017 school year updates are detailed below:

Earth Camp is available to Title I (low socio-economic) schools in Austin Independent School District (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. During the 2016-2017 school year, Earth Camp guided 1,598 fifth-grade students into Wildflower Cave. An additional 4,803 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.

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. During the 2016-2017 school year, 510 middle school students were given educational caving tours (63 in Grassy Cove Cave, 218 in LaCrosse/Wildflower Cave, 114 in Lost Oasis Cave, and 115 in Whirlpool Cave). Additionally, 338 high school students were given educational caving tours (160 in Bowie Cave, 75 in Grassy Cove Cave, 77 in Lacrosse/Wildflower Cave, and 26 in Whirlpool Cave (Table 8).

In summer 2017, families and the general public were given opportunities to receive educational caving tours through **Clean Creek Camp** and a **Nature Nights** event at the Lady Bird Johnson Wildflower Center. 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. Clean Creek Camp brought 44 participants (29 children and 14 parents) into LaCrosse and Wildflower Cave (Table 8). On International Mud Day of 2017, the COA WPD and COA Wildland Conservation Division worked together to provide educational tours of LaCrosse Cave and Wildflower Cave to 268 participants (154 adults and 114 children) during the Lady Bird Johnson Wildflower Center's Nature Nights event on Water, Rocks, and Mud (Table 8).

Adult and Technical Education:

Grow Green Landscape Professional Training: The COA WPD's Grow Green Landscape Professional Training teaches professional landscapers about earth-wise landscaping and management practices from experts. In FY17, 18 Landscape Professionals toured LaCrosse Cave as part of this training (Table 8).

Groundwater to the Gulf Summer Institute: Groundwater to the Gulf is a 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 LaCrosse/Wildflower Caves 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 FY17, 56 teachers participated in the Institute (Table 8).

Table 8. Summary of school year 2016-2017 COA WPD education programs providing cave field trips and aquifer outreach.

Program	Grade	Adults reached	Students reached	Total reached
Earth Camp	5th	67	1,598	1,665
Earth School* (*presentation does not include cave immersion)	5th	160	4,803	4,963
Watershed Detectives	6th-8th	26	510	536
Hydrofiles	9th-12th	9	338	347
Clean Creek Camp	Adults and 4th-8th	15	29	44
Nature Nights	N/A	154	114	268
Grow Green Landscape Professional Training	N/A	18	0	18
Groundwater to the Gulf	Teachers	56	0	56
Total reached:		505	7,392	7,897

Restoration and renovation of education caves (including Bowie, Grassy Cove, LaCrosse, and Wildflower caves) has provided the opportunity to expand education programs while reducing impact on BCCP Caves. Of the 2,934 participants that COA WPD education programs took caving during 2016-2017 school year, 2,669 of the participants toured non-BCCP caves and only 265 of the participants toured BCCP caves (Table 9).

Table 9. Summary of school year 2016-2017 COA WPD education programs providing cave field trips into Non-BCCP Caves compared to BCCP Caves.

	Cave	# Adults reached	# Students reached	Total reached
Non-BCCP Caves	Bowie	1	160	2,669
	Grassy Cove	11	138	
	LaCrosse/ Wildflower	323	2,036	
BCCP Caves	Lost Oasis	1	114	265
	Whirlpool	9	141	

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 FY17, Whirlpool Cave was managed by Rich Zarria while Lost Oasis Cave was managed by Drew Thompson, 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 1,189 individuals accessing Whirlpool Cave and 232 individuals accessing Lost Oasis Cave.

FY17 Access Status

In FY17, access was granted to COA-owned BCCP Caves, TCMA-owned BCCP caves and other non-BCCP caves for educational/recreational/rescue training. The increased number of non-BCCP caves available has reduced traffic to BCCP caves. In FY17, 373 visitors were issued access permits by COA BCP staff to COA-owned BCCP caves including: Airmen's Cave (6), Goat Cave (329), Maple Run Cave (16), and Midnight Cave (22). 1,421 visitors were granted access to TCMA-owned BCCP caves including: Lost Oasis (232), and Whirlpool (1,189). 3,243 visitors were granted access to non-BCCP caves including: Avery Ranch Cave (96), Bowie Cave (161), Grassy Cove Cave (271), Hideout Cave (7), LaCrosse Cave (265), and Wildflower Cave (2443) (Table 10). 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.

Table 10. Summary of FY17 educational and recreational cave trips into Non-BCCP Caves compared to BCCP Caves.

Status	Cave	Visitors	Total Visitors

Non-BCCP Caves	Avery Ranch	96	3,243
	Bowie	161	
	Grassy Cove	271	
	Hideout	7	
	LaCrosse	265	
	Wildflower	2443	
BCCP Caves	Airmen's	6	1,794
	Goat	329	
	Lost Oasis	232	
	Maple Run	16	
	Midnight	22	
	Whirlpool	1189	
Non-BCCP and BCCP Caves Combined			5,032

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 United States were commonly filled by ranchers 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.

COA BCP continues to fund a team of cave specialists in FY17 to excavate caves of trash, ranch fill, and eroded sediment. Education cave development was funded by COA AWU's Wildland Conservation Division. The team consisted of a group of highly trained cave specialists, including Justin Shaw, Drew Thompson, Colin Strickland, and Fernando Hernandez.

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.

A multi-departmental/agency restoration effort was initiated in FY15 at this management unit, which now largely recharges most runoff generated on site, demonstrating the project's success. The final phase of the project to revegetate the disturbed areas around each cave was completed in FY16. The revegetation effort has helped stabilize soil and greatly improve habitat for cave crickets by dramatically increasing plant diversity and eventually increasing tree canopy cover. In FY17, COA WPD and BCP staff along with volunteers continue to monitor and maintain the recently planted vegetation to ensure success. COA BCP staff have initiated cave cricket exit counts at four of the restored features to get baseline data on cave cricket populations. This data will be used to measure if the habitat enhancement (increased plant diversity/ food source) has a positive impact on cave cricket numbers.

5.0 MANAGEMENT COORDINATION AND OVERSIGHT

COA and TC determined that there was a need to create a master database on BCP karst fauna 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 exit 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.

BCP staff completed a revision of the 2007 BCP Tier II-A Karst Species Land Management Plan in FY16. Revisions included updates on new karst invertebrate species localities and taxonomic changes, updates to threats of cave ecosystems to include climate change, tawny crazy ants and white nose syndrome, and revisions of karst management goals and conservation actions to reflect new USFWS Karst Preserve Design Recommendations (2012) and recent best practices improvements outlined in new USFWS Karst Preserve Management and Monitoring Recommendations (2014b). The BCCP Coordinating Committee approved the revision of this Land Management Plan in March 2016.

In FY16, 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 not been confirmed, to supplement BMPs created in FY15 focusing on construction activities within known TCA sites. 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. In FY17,these BMPs continue to be disseminated to appropriate TC/COA departments and other agencies.

In light of recent confirmed cases of tick-borne relapsing fever (TBRF) in FY17, COA BCP staff collaborated with Austin Public Health and researchers from Texas State University and the Baylor School of Medicine to get a better understanding of TBRF's prevalence in area caves, understand habitat preferences for its host (soft ticks) and try to determine threats posed to the public (especially in public access caves). TBRF is a bacteria closely related to Lyme disease and is transmitted to humans via infected soft ticks. COA BCP staff has assisted with collecting soft ticks from area caves with an emphasis on caves open to public access. If TBRF is confirmed from caves with public access, access will be closed until further notice. COA and TC BCP staff also participated in a Center for Disease Control and Prevention/Austin Public Health investigation to study the occupational risks of TBRF among workers with cave exposures.

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 *2016 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 at or 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).

FY17 TC/COA Collaborative Monitoring Projects

Since FY12, BCP staff have included monitoring for presence of tawny crazy ants (TCAs) at all visits to cave sites, using a TCA monitoring and collection protocol and reporting procedures created by TC and COA BCP staff and updated in FY15. 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 FY14, TC and COA also expanded monitoring of Weldon and No Rent Caves to document the arrival and impacts of another TCA population in the vicinity of these caves (EXHIBIT A).

In addition to monitoring for TCAs at caves, COA and TC BCP staff also 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; this grant was awarded in June 2015. Dr. LeBrun managed the project through 2017, with TC/COA staff providing in-kind contribution in the form of quarterly cave monitoring/cave cricket exit counts and design/implementation of a study to quantify TCA impacts in three BCCP caves (Weldon, No Rent, and Whirlpool). The study provided valuable insights into TCA use of cave environments, impacts to karst invertebrates, and feasibility of a host specific microsporidian pathogen (*Myrmecomorba nylanderiae*) for use as a tool for biological control. A final report of the study's findings was submitted in October 2017 (LeBrun et. al, 2017; APPENDIX R2 of BCCP FY17 Annual Report).

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 FY17 to gather baseline data

for the McNeil High School courtyard restoration project, which 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 continue to assist 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 FY17. 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.

City of Austin FY17 Biological Monitoring

During FY17, COA BCP staff conducted bi-annual monitoring on the following 15 pre-selected caves: Airman'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 2016/ Spring 2017 or Winter 2017/ Summer 2017. 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, Little Black Hole Cave, Rolling Rock Cave, and Slaughter Creek Cave (EXHIBIT A).

In FY17, COA BCP staff received confirmation from Dr. Marshal Hedin stating that the blind *Cicurina* collected from Hays Ranch Bat cave was confirmed as *Cicurina bandida*. COA BCP staff also received a correction from Dr. Darrell Ubick for the listed *Texella* found in Jest John Cave; Dr. Ubick confirmed that the species of *Texella* is *T. reyesi*, and not *T. reddelli*.

Also during FY17, 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 (EXHIBIT B). COA BCP staff also initiated bi-annual cave cricket exit counts at the newly restored caves located on the Blowing Sink tract (Sink in the Woods, Sinky Dinky, Winterwoods, and Wyoaka Caves) (EXHIBIT B). COA BCP staff also conducted one cave cricket exit count at Jest John Cave (EXHIBIT B).

Travis County FY17 Biological Monitoring

TC's BCP staff conducted bi-annual monitoring on the following ten pre-selected caves: Adobe Springs Cave, Amber Cave, Cold Cave, Gallifer Cave, Geode Cave (non-BCCP cave), No Rent Cave, Spanish Wells Cave, Stark's North Mine, Tooth Cave, and Weldon Cave. Faunal surveys in these ten caves, with permitted TC biologists, were conducted in Fall 2016/ Spring 2017 or Winter 2017/ Summer 2017 (EXHIBIT A). Annual faunal surveys were also conducted in six other TC-owned BCCP caves with federally listed species: Kretschmarr Cave, Kretschmarr Double Pit, McDonald Cave, 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 or SOC: Brew Pot Cave and Two Trunks Cave (EXHIBIT A).

In FY17, TC staff received a confirmation letter from Dr. Darrell Ubick of the California Academy of Sciences stating that a female *Texella* specimen collected from North Root Cave had been formally identified as a new locality for the endangered *Texella reyesi*. This specimen is deposited at the Texas Memorial Museum and cataloged as TMM #83728.

TC BCP staff conducted bi-annual cave cricket exit counts in FY17 at ten of the caves pre-selected for faunal surveys: Adobe Springs Cave, Amber Cave, Cold Cave, Gallifer Cave, Geode Cave, No Rent Cave, Spanish Wells Cave, Stark's North Mine, Tooth Cave, and Weldon Cave. Exit counts were conducted in Fall 2016/ Spring 2017 or Winter 2017/ Summer 2017 (EXHIBIT B).

RIFA surveys were performed in Fall 2016 and Spring 2017 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 three additional TC-owned BCCP caves (Ireland's Cave, Spanish Wells 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 2016, a total of 98 RIFA mounds were treated within these 80 m cave survey areas, with an additional 6 RIFA mounds treated in the vicinity of caves but outside of survey areas. In Spring of FY17, a total of 451 RIFA mounds were treated within these 80 m cave survey areas, with an additional 52 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 FY17 including Cactus Pit, Brew Pot Cave, Kretschmarr Sink, and karst features RI-1, LU-11 and LU-12.

Other Biological Monitoring Efforts

Zara Environmental conducted biological monitoring at Pennie's Cave in FY17 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 conducted two (Spring and Fall) RIFA treatments with boiling water in FY17. Zara also provided a written report of their work in FY17 (Zara Environmental 2017a; APPENDIX R4 of BCCP FY17 Annual Report).

Zara Environmental performed fieldwork for a TC professional services contract which focused on assessing and performing excavations on karst features at TC's Kotrla Unit to help identify karst invertebrate habitat on this BCP property. Zara provided a written report of their work, which includes 23 karst feature assessments and cave fauna observations/collections (Zara Environmental 2017b; APPENDIX R3 of BCCP FY16 Annual Report).

TC and COA BCP staff continue to assist James Reddell and the Texas Speleological Society (TSS) in surveying, excavating, and mapping the karst of the USFWS Balcones Canyonlands National Wildlife Refuge. Efforts expand the knowledge base of cave fauna in the karst fauna region shared by two BCCP caves: Jack's Joint and Armadillo Ranch Sink.

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.

No new hydrogeologic studies were initiated in FY17, but COA BCP staff continue to compile already collected data from Flint Ridge, Blowing Sink, Goat, Stark's North Mine, and Maple Run Caves to be included in future reports.

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 continue to evaluate the adequacy of protection for all 62 BCCP caves during FY18 by initiating hydrological studies, and prioritize efforts accordingly.

Future research needs for the BCP should include an effort to determine to species level currently unknown troglobites such as *Speodesmus* sp., *Eidmannella* sp., and Trichoniscidae found in BCP caves. A recent research need has also been identified by James Reddell concerning *Rhadine* beetles in the region,with the possibility that potentially two undescribed species could be found within BCP caves. Future research and funding may be needed to answer these research questions.

9.0 KARST MANAGEMENT ACTIVITIES

The BCP Karst Land Management Plan (2016) 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 FY17.

Table 11. FY17 BCCP Karst Feature Monitoring and Management Activities.
Adobe Springs Cave The Nature Conservancy 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. 2. TC performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave. 3. TC/COA conducted bi-annual cave faunal surveys (see EXHIBIT A). 4. TC conducted bi-annual cave cricket exit surveys. (See EXHIBIT B).
Airmen's Cave City of Austin 1. Conducted bi-annual cave faunal surveys (See EXHIBIT A). 2. Conducted bi-annual cave cricket exit counts. (SEE EXHIBIT B) 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. 4. Volunteers monitor the cave gate weekly, and in the past have helped COA staff make cave gate and sign repairs.
Amber Cave Travis County 1 .Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave. 2. Maintained fencing and signage to protect this area from unauthorized access and dumping. 3. Surveyed site for RIFA. Treated 13 mounds in Spring 2017. 4. Conducted bi-annual cave cricket exit surveys. (See EXHIBIT B).
Armadillo Ranch Sink Private
Arrow Cave City of Austin 1. Completed annual cave faunal survey (See EXHIBIT A). 2. Conducted quarterly site inspections. City staff continues to deal with ongoing dumping problems from the adjacent neighborhood. COA PARD Rangers continue to conduct occasional patrols at these problematic sites. 3. Inspected site for RIFA infestations. On all visits RIFA were observed within close proximity of the cave (but not inside the cave).
Bandit Cave Private
Beard Ranch Cave (Featherman's Cave) 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.

Table 11. FY17 BCCP Karst Feature Monitoring and Management Activities.
Bee Creek Cave Private
Blowing Sink Cave City of Austin 1. Inspected monthly and continued to operate security cameras. 2. Completed cave faunal survey (See EXHIBIT A). 3. COA staff removed invasive non-native vegetation from the preserve. 4. COA WPD staff successfully completed the restoration of five major karst features located on the tract. The work is 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; however, it is possible that some of the recently restored adjacent caves may lead to the water table.. 6. COA WPD completed a new perimeter fence for some of the most problematic sections of the property, greatly reducing trespass issues. 7. COA BCP staff continued to water recently planted vegetation around the restored caves with the goals of improving habitat for cave crickets and stabilizing the soil. 8. Bi-annual cave cricket exit counts were initiated by COA BCP in FY 17. 9. Treated site for RIFA with boiling water.
Broken Arrow Cave City of Austin 1. Inspected quarterly with no sign of human visitation or vandalism. 2. Completed bi-annual faunal surveys (See EXHIBIT A). 3. Completed bi-annual cave cricket exit counts. (See EXHIBIT B). 4. Treated site for RIFA with boiling water.
Buda Boulder Spring City of Austin 1. COA BCP staff visited the site twice and noted signs of recent transient camps activity near the spring. COA PARD Rangers were notified and now periodically patrol the site. 2. Peter Sprouse (Zara Environmental) attempted collections at the spring utilizing a modified bottle/ mop trap positioned at the head of the spring, and was successful at collecting a BCCP SOC (*Caecidotea reddelli*) on multiple occasions as well as other stygobitic crustaceans. Samples have been accessioned by James Reddell and sent to Randy Gibson for identification. Some *Caecidotea* specimens have also been delivered to Jerry Lewis for a molecular study.
Cave X Private 1. COA entered into a Private Landowner Agreement entitled "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. Regent's School staff conduct periodic surface inspections of the cave including gate and lock maintenance. 4. In an effort to get a better understanding of CO2 levels in Cave X and other area caves, COA BCP staff requested access to install air monitoring equipment but were declined the offer by the owner.
Cave Y City of Austin 1. Visited this cave 6 times and noticed no signs of vandalism to the gate. However, during a cave faunal survey, staff observed signs of excavation work inside the cave and responded by installing a cellular game camera. To date, no further excavation work has been detected. 2. Completed bi-annual cave faunal survey(See EXHIBIT A). 3. Completed bi-annual cave cricket exit counts. (See EXHIBIT B). 4. Surveyed site for RIFA; no mounds were discovered within the cave's treatment area.

Table 11. FY17 BCCP Karst Feature Monitoring and Management Activities.
Ceiling Slot Cave Private
Cold Cave 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).
Cotterell Cave City of Austin 1. Conducted quarterly site inspections. 2. RIFA surveys determined that the ants were located approximately 300 feet from the cave so no treatment was needed. 3. Conducted bi-annual cave faunal surveys (see EXHIBIT A). 4. Conducted bi-annual cave cricket exit surveys. (See EXHIBIT B).
Disbelievers Cave Private 10a Permit: PRT-808694
District Park Cave 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. COA BCP 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). 7. Surveyed site for RIFA; no mounds were discovered within the cave's treatment area.
Eluvial Cave Private 10a Permit: PRT-808694
Flint Ridge Cave City of Austin 1. Conducted six site visits and noted no signs of illegal trespass. 2. Conducted quarterly cave faunal surveys (See EXHIBIT A). 3. BCP staff and volunteers conducted quarterly cave cricket exit counts (See EXHIBIT B). 4. COA WPD continued monitoring the storm water catchment area of Flint Ridge cave. 5. COA BCP continued to work on a phase 2 hydrogeologic study that will delineate the subsurface catchment area to determine potential negative impacts from a newly proposed roadway. 6. Treated site for RIFA with boiling water.
Fossil Cave City of Austin 1. Inspected quarterly and found no new signs of vandalism 2. Inspected for RIFA infestations on all visits. RIFA were observed within close proximity of the "suspected" cave.

Table 11. FY17 BCCP Karst Feature Monitoring and Management Activities.
Fossil Garden Cave Private
Gallifer Cave Travis County 1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave. 2. Maintained fencing and signage to protect this area from unauthorized access and dumping. 3. Surveyed site for RIFA. Treated 7 mounds in Fall 2016 and 23 mounds in Spring 2017. 4. Conducted bi-annual cave faunal surveys (see EXHIBIT A). 5. Conducted bi-annual cave cricket exit surveys. (See EXHIBIT B).
Get Down Cave City of Austin 1. COA WPD assumed ownership of the Village of Western Oaks Karst Preserve. COA BCP staff are currently working with WPD staff on a Land Management Plan to address multiple issues such as karst monitoring and management of Get Down cave and public education. 2. BCP staff continued to work 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 in FY17. 3. COA BCP staff helped support neighbor Stephanie Simmons with her "Texas Most Wanted" campaign, whose goal is to promote native plants by offering free plants to the public and encouraging neighbors to remove invasive non-native species. It is hoped that this type of public education will indirectly improve habitat on the preserve.
Goat Cave City of Austin 1. Completed annual faunal survey (See EXHIBIT A). 2. With the help of volunteer stewards, conducted monthly site inspections, removed trash from preserve area and reported on anything out of the ordinary. 3. Allowed permitted access to this cave . 4. 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. 5. COA WPD staff purchased the adjacent 5.8 acre private preserve tract, which greatly enhances protection to two BCCP caves (Goat and Maple Run). 6. COA BCP, WPD, and PARD staff collaborated with the non-profit Save Barton Creek Association to enhance the preserve through grants. SBCA was awarded a grant that will replace the existing non-functional kiosk, add educational signs to Wade, Hideout, and Goat Cave, and install one additional bench. These efforts will greatly improve the educational experience at this site. 7. Treated site for RIFA with boiling water.
Hole-in-the-Road Cave Private
Ireland's Cave Travis County 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. 2. Fencing was completed in FY15 on the perimeter of the Ireland's Cave tract to protect the cave preserve from trespass. 3. Surveyed site for RIFA. Treated 88 mounds in Spring 2017. 4. TC conducted an annual cave faunal survey (see EXHIBIT A).
Jack's Joint Cave Private

Table 11. FY17 BCCP Karst Feature Monitoring and Management Activities.
Japygid Cave Private 10a Permit: PRT-808694
Jest John Cave City of Austin 1. Conducted 2 site visits found and no signs of vandalism or human visitation. 2. Inspected site for RIFA infestations, no RIFA were observed near the cave. 3. Conducted one cave cricket exist count. (See EXHIBIT B).
Jester Estates Cave City of Austin 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, since aside from minor brush dumping, no significant illegal activities were observed. 2. Treated site for RIFA with boiling water. 3. Conducted bi-annual cave faunal surveys (See EXHIBIT A). 4. Conducted bi-annual cave cricket exit counts. (SEE EXHIBIT B). 5. BCP staff removed non-native invasive vegetation.
Jollyville Plateau Cave Private 10a Permit: PRT-808694
Kretschmarr Cave Travis County 1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave. 2. Conducted a trash clean-up around the cave site and surrounding area. 3. Maintained fencing and signage to protect this area from unauthorized access and dumping. 4. Surveyed site bi-annually for RIFA. Treated 52 mounds in Fall 2016 and 127 mounds in Spring 2017. 5. Conducted annual cave faunal survey (see EXHIBIT A).
Kretschmarr Double Pit Travis County 1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave. 2. Maintained fencing and signage to protect this area from unauthorized access and dumping. 3. Surveyed site for RIFA. Treated 19 mounds in Spring 2017. 4. Conducted annual cave faunal survey (see EXHIBIT A).
Lamm Cave Section 7 Permit 2-15-93-F-075 (see USFWS files) 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. 2. The cave was gated and the preserve area was fenced following COA WPD and BCP staff recommendations and design. 3. No application of fertilizers, pesticides or herbicides will be allowed in the CEF area. 4. TC staff continue to periodically monitor the site to make certain that the gates and fences are secure. 5. Walmart has closed the store and are selling the property. COA and TC BCP staff will continue to monitor the site and attempt to contact the new owner regarding management and monitoring needs. 6.Concordia University is considering the possibility of taking over ownership of the preserve area for management and a possible outdoor classroom.

Table 11. FY17 BCCP Karst Feature Monitoring and Management Activities.
Little Bee Creek Cave City of Austin 1. Conducted two site visits. 2. Conducted bi-annual cave faunal survey (See EXHIBIT A). 3. Conducted bi-annual cave cricket exit counts. (See EXHIBIT B). 4. In an effort to enhance habitat, COA BCP staff excavated the cave extending the passage by roughly 10 feet. After excavation activities, staff improved habitat by bring in leaf litter, woody debris, and rocks. 5. COA BCP staff mapped the interior of the cave.
Lost Oasis Cave TCMA 1. Conducted five site visits. 2. COA WPD led four cave education trips into cave. 3. COA BCP staff treated the site for RIFA with boiling water.
Lost Gold Cave Private
Maple Run Cave City of Austin 1. Conducted bi-annual cave faunal survey (See EXHIBIT A). 2. Conducted bi-annual cave cricket exit counts. (See EXHIBIT B). 3. Staff conducted monthly site inspections and removed trash from preserve area. 4. Permitted access to this cave is allowed. 5. Treated site for RIFA with boiling water. 6. COA WPD staff purchased the adjacent 5.8 acre private preserve tract, which greatly enhances protection to two BCCP caves (Goat and Maple Run).
McDonald Cave Travis County 1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave. 2. Maintained fencing and signage to protect this area from unauthorized access and dumping. 3. Surveyed site bi-annually for RIFA. No RIFA mounds observed during surveys. 4. Conducted bi-annual cave faunal surveys (see EXHIBIT A).
McNeil Bat Cave Private
Midnight Cave City of Austin 1. Conducted quarterly site inspections; on multiple occasions vandals cut the chain to the gate. Staff installed a cellular game camera and made improvements to the gate and fence to better secure the site. 2. Conducted bi-annual cave faunal surveys. (See EXHIBIT A). 3. Conducted bi-annual cave cricket exit counts. (See EXHIBIT B). 4. Permitted access to this cave is allowed, though no access permits were granted this fiscal year. 5. Treated site for RIFA with boiling water.
M.W.A. Cave Private 10a Permit: PRT-808694
Moss Pit Cave Private

Table 11. FY17 BCCP Karst Feature Monitoring and Management Activities.
New Comanche Trail Cave Travis County 1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave. 2. Maintained fencing and signage to protect this area from unauthorized access and dumping. 3. Surveyed site for RIFA. Treated 23 mounds in Fall 2016 and 33 mounds in Spring 2017. 4. Conducted annual cave faunal survey (see EXHIBIT A).
No Rent Cave Private 1. TC gained permission from landowner to perform quarterly faunal surveys and cave cricket exit counts. 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/COA conducted quarterly cave faunal surveys (see EXHIBIT A). 5. TC/COA conducted quarterly cave cricket exit surveys. (See EXHIBIT B).
North Root Cave Travis County 1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave. 2. Maintained fencing and signage to protect this area from unauthorized access and dumping. 3. Surveyed site for RIFA. Treated 54 mounds in Spring 2017. 4. Conducted annual cave faunal survey (see EXHIBIT A).
Pennie's Cave Private 1 The entrance was re-excavated in 2012, providing access to the cave. 2.The cave entrance has been gated and fenced; boulders were also placed around the cave at the edge of a 300-ft buffer to better define the protected area. 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.
Pickle Pit Cave Private USFWS Section 7 Permit 2-15-93-F-075 1. A volunteer neighbor monitors the cave entrance/ gate monthly; no problems noted.
Pipeline Cave Private 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. 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.
Rolling Rock Cave City of Austin 1. Inspected quarterly and no sign of human visitation or vandalism was found. 2. Conducted one cave faunal survey. (See EXHIBIT A). 3. Treated site for RIFA with boiling water.
Root Cave Travis County 1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave. 2. Maintained fencing and signage to protect this area from unauthorized access and dumping. 3. Surveyed site for RIFA. Treated 54 mounds in Spring 2017. 4. Conducted annual cave faunal survey (see EXHIBIT A).

Table 11. FY17 BCCP Karst Feature Monitoring and Management Activities.
Slaughter Creek Cave City of Austin 1. Conducted quarterly site inspections,. 2. Conducted one cave faunal survey. (See EXHIBIT A) 3. COA BCP contracted with Zara Environmental for initial hydrological work in an effort to better determine if Texas Department of Transportation's proposed adjacent Mopac underpass project will negatively impact the cave.
Spanish Wells Cave Travis County 1. TC acquired Spanish Wells Cave and surrounding land that protects the cave cricket foraging area and surface/subsurface drainage basins in FY15. 2. Performed surface inspections with no signs of trespass or vandalism to the cave entrance or in the cave. 3. Surveyed site for RIFA. Treated 34 mounds in Spring 2017. 4. Conducted bi-annual cave faunal surveys (See EXHIBIT A). 5. Conducted summer cave cricket exit count. (See EXHIBIT B).
Spider Cave City of Austin 1. Conducted four site visits, and no sign of human access or vandalism was found. 2.Conducted bi-annual cave faunal surveys (See EXHIBIT A). 3. Conducted bi-annual cave cricket exit counts. (See EXHIBIT B). 4. Treated site for RIFA with boiling water.
Stark's North Mine Travis County 1. TC acquired this cave and 0.8 acres surrounding it in FY12. The area surrounding the cave is all previously developed. 2. Performed surface inspections and detected signs of vandalism to the cave entrance and inside the cave. 3. Surveyed site bi-annually for RIFA. No mounds found within 80 m of cave. 4. Conducted bi-annual cave faunal surveys (See EXHIBIT A). 5. Conducted bi-annual cave cricket exit counts (See EXHIBIT B). 6. Performed non-native plant removal projects on tract to increase native plant diversity.
Stovepipe Cave 1. Conducted 6 site inspections, and continued to remove new and old trash from the preserve. 2. Repaired perimeter fence. 3. Conducted bi-annual cave faunal surveys (See EXHIBIT A). 4. Conducted bi-annual cave cricket exit counts (See EXHIBIT B). 5. Surveyed site for RIFA; no mounds were discovered within the cave's treatment area.
Talus Spring Cave Private 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. 2. Performed surface inspections with no signs of vandalism to the cave entrance or in the cave. 3. Surveyed site bi-annually for RIFA. No mounds found within 80 m of cave. 4. Conducted annual cave faunal survey (see EXHIBIT A). 5. Performed a non-native plant removal project on tract to increase native plant diversity.
Tardus Hole Cave Travis County 1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave. 2. Maintained fencing and signage to protect this area from unauthorized access and dumping. 3. Surveyed site for RIFA. Treated 19 mounds in Spring 2017. 4. Conducted annual cave faunal survey (see EXHIBIT A).

Table 11. FY17 BCCP Karst Feature Monitoring and Management Activities.
Tooth Cave Travis County 1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave. 2. Maintained fencing and signage to protect this area from unauthorized access and dumping. 3. Surveyed site for RIFA. Treated 11 mounds in Fall 2016 and 77 mounds in Spring 2017. 4. Conducted bi-annual cave faunal surveys (see EXHIBIT A). 5. Conducted bi-annual cave cricket exit surveys. (See EXHIBIT B).
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 conducted quarterly cave cricket exit surveys. (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

FY17 City of Austin/Travis County Karst Faunal Surveys[1, 2]

			Endangered Species						Species of Concern												Other Significant Troglobites							
Cave	**Survey Date**	**Monitoring Agency**	***Rhadine persephone***	***Tartarocreagris texana***	***Tayshaneta myopica***	***Texamaurops reddelli***	***Texella reddelli***	***Texella reyesi***	***Caecidotea reddelli***	***Cicurina bandida***	***Cicurina travisae***	***Eidmannella reclusa***	***Rhadine austinica***	***Rhadine subterranea***	***Sphalloplana mohri***	***Tartarocreagris comanche***	***Tayshaneta concinna***	***Tayshaneta devia***	***Texella spinoperca***	***Cicurina buwata***	***Eidmannella* sp.**	***Speodesmus* sp.**	***Speodesmus bicornourus***	***Tartarocreagris infernalis***	***Tayshaneta* sp.**	***Texoreddellia texensis***	**Other notable species detected**
Adobe Springs Cave	11/29/2016	TC																										
Adobe Springs Cave	5/25/2017	TC																										
Airmen's Cave	1/17/2017	COA								6												8			2		*Perimyotis subflavus* (1)
Airmen's Cave	8/15/2017	COA								31											55		50					*Texella mulaiki* (2)
Arrow Cave	9/20/2017	COA								5												1						
Beard Ranch Cave	1/20/2017	COA						10			2										1							
Blowing Sink Cave	9/20/2017	COA								20			1									7					*Texoreddellia* sp. (1)
Brewpot Cave	11/1/2016	TC																										
Broken Arrow Cave	11/10/2016	COA							7					1						2		10					*Stygobromus russelli* (21)
Broken Arrow Cave	5/16/2017	COA	1						14				2	2						8		5					*Stygobromus russelli* (12)
Cave Y	1/17/2017	COA								3												9					*Perimyotis subflavus* (6) *Texella grubbsi* (6)
Cave Y	8/15/2017	COA								27												34				1	*Batrisodes* sp. (1) *Texella grubbsi* (18)
Cold Cave	2/8/2017	TC						8														47					*Cicurina sp.* (blind) (11) *Texoreddellia* sp. (1)
Cold Cave	8/23/2017	TC						5														9					*Batrisodes* sp. (11) *Cicurina sp.* (blind) (8)
Cortana Cave	1/26/2017	COA			43			9			6										17	3					Trichoniscidae (1)
Cortana Cave	9/8/2017	COA			55			17			13										30	5					
Cotterell Cave	1/20/2017	COA						23			70			7							1		23	3			*Anapistula* sp. (1) Trichoniscidae (1)
Cotterell Cave	8/11/2017	COA						14			108		5										15				*Tartarocreagris* sp. (4) Trichoniscidae (1)
District Park Cave	11/23/2016	COA								34												4					*Tartarocreagris* sp. (1) *Tayshaneta sandersi* (1) *Texella mulaiki* (1) Trichoniscidae (2)
District Park Cave	5/17/2017	COA								42												1					*Tartarocreagris* sp. (2) *Texella mulaiki* (1)
Flint Ridge Cave	11/28/2016	COA								10			1								8	58				2	*Perimyotis subflavus* (2) *Texella mulaiki* (3)
Flint Ridge Cave	1/24/2017	COA								10											7	46					

			Endangered Species						Species of Concern											Other Significant Troglobites							
Cave	**Survey Date**	**Monitoring Agency**	***Rhadine persephone***	***Tartarocreagris texana***	***Tayshaneta myopica***	***Texamaurops reddelli***	***Texella reddelli***	***Texella reyesi***	***Caecidotea reddelli***	***Cicurina bandida***	***Cicurina travisae***	***Eidmannella reclusa***	***Rhadine austinica***	***Rhadine subterranea***	***Sphalloplana mohri***	***Tartarocreagris comanche***	***Tayshaneta concinna***	***Tayshaneta devia***	***Texella spinoperca***	***Cicurina buwata***	***Eidmannella* sp.**	***Speodesmus* sp.**	***Speodesmus bicornourus***	***Tartarocreagris infernalis***	***Tayshaneta* sp.**	***Texoreddellia texensis***	**Other notable species detected**
Flint Ridge Cave	5/18/2017	COA								18											10	112					*Stygobromus* sp.(30) *Texella mulaiki* (2)
Flint Ridge Cave	8/18/2017	COA								34											1	129				1	*Myotis velifer* (1) *Stygobromus* sp.(64)
Gallifer Cave	2/15/2017	TC	19		23			46			35										2	22					*Perimyotis subflavus* (1) *Texoreddellia* sp. (6)
Gallifer Cave	8/17/2017	TC	8		50			89			87										6	12				1	*Batrisodes* sp. (5) *Perimyotis subflavus* (1)
Geode Cave	1/19/2017	TC	1		46			1			7	4										1					
Geode Cave	8/22/2017	TC			13			14			7	18										4					*Batrisodes* sp. (1)
Goat Cave	9/19/2017	COA								8												2					*Texella mulaiki* (3) Trichoniscidae (8)
Grassy Cove Cave	1/13/2017	COA																									*Stygobromus* sp.(2)
Ireland's Cave	2/9/2017	TC								5			7										2				
Jester Estates Cave	11/10/2016	COA		3	5		4															4					*Anapistula* sp. (2) Trichoniscidae (2)
Jester Estates Cave	5/16/2017	COA		7	5		15				14										24	2					*Anapistula* sp. (1)
Kretschmarr Cave	11/2/2016	TC									2			1							5		8				
Kretschmarr Double Pit	11/2/2016	TC									2											2					
Little Bee Creek Cave	11/23/2016	COA					6															3					
Little Bee Creek Cave	5/17/2017	COA					4			2												2					
Little Black Hole Cave	6/2/2017	COA					17															10					Argasidae (~100) Pseudoscorpionida (1)
Maple Run Cave	1/10/2017	COA								5																1	*Anapistula* sp. (4) Pseudoscorpionida (1) *Texella mulaiki* (2)
Maple Run Cave	8/17/2017	COA								12												1					*Texella mulaiki* (2)
McDonald Cave	8/16/2017	TC						12			41							5					47				*Texoreddellia* sp. (1)
Midnight Cave	1/10/2017	COA								35			4								19	12					*Batrisodes* sp. (19) *Stygobromus* sp.(4) *Texoreddellia* sp. (3) Trichoniscidae (21)
Midnight Cave	8/17/2017	COA								26			2								14						*Batrisodes* sp. (6)
Millipede Annex Cave	11/17/2016	COA						10												9	1	1					

			Endangered Species						Species of Concern										Other Significant Troglobites							
Cave	Survey Date	Monitoring Agency	*Rhadine persephone*	*Tartarocreagris texana*	*Tayshaneta myopica*	*Texamaurops reddelli*	*Texella reddelli*	*Texella reyesi*	*Caecidotea reddelli*	*Cicurina bandida*	*Cicurina travisae*	*Eidmannella reclusa*	*Rhadine austinica*	*Rhadine subterranea*	*Sphalloplana mohri*	*Tartarocreagris comanche*	*Tayshaneta concinna*	*Tayshaneta devia*	*Texella spinoperca*	*Cicurina buwata*	*Eidmannella* sp.	*Speodesmus* sp.	*Speodesmus bicornourus*	*Tartarocreagris infernalis*	*Tayshaneta* sp.	*Texoreddellia texensis*	Other notable species detected
Millipede Annex Cave	5/11/2017	TC/COA						11												7	4	2			1	2	*Anapistula* sp. (2) Trichoniscidae (1)
Millipede Cave	11/17/2016	COA						2												10	2	1			4		*Anapistula* sp. (1) *Tartarocreagris* sp. (1)
Millipede Cave	5/11/2017	TC/COA						2												6	3				4		*Anapistula* sp. (1) *Texoreddellia* sp. (1) Trichoniscidae (2)
New Comanche Trail Cave	8/22/2017	TC			6			5								2											*Cicurina sp.* (blind) (8)
No Rent Cave	11/16/2016	TC						2						1						22	2	3				1	*Batrisodes* sp. (1) *Texoreddellia* sp. (1)
No Rent Cave	1/31/2017	TC												1						29		4				1	*Texoreddellia* sp. (2)
No Rent Cave	5/17/2017	TC						3						5						28		6				1	*Batrisodes* sp. (1) *Texoreddellia* sp. (1)
No Rent Cave	8/2/2017	TC						4												11		3				2	*Anapistula* sp. (2) *Batrisodes* sp. (1)
North Root Cave	5/8/2017	TC																									
Pond Party Pit	1/20/2017	COA	4					7			2			1							5	4		4			Trichoniscidae (2)
Pond Party Pit	8/11/2017	COA						15			2										2	4					*Tartarocreagris* sp. (2)
Rolling Rock Cave	11/10/2016	COA																		1		2					*Batrisodes* sp. (1) *Rhadine* sp. (1)
Seibert Sink	1/10/2017	COA								2									1		1						
Seibert Sink	8/17/2017	COA								7									4			5					
Slaughter Creek Cave	9/20/2017	COA								5											3	45					*Batrisodes* sp. (3)
Spanish Wells Cave	2/6/2017	TC													60												*Stygobromus* sp.(~500)
Spanish Wells Cave	8/15/2017	TC													105												*Stygobromus* sp.(129)
Spider Cave	11/10/2016	COA	1				5				10										4		4				Pseudoscorpionida (1) Trichoniscidae (1)
Spider Cave	5/16/2017	COA	2				7				18										4		4				Pseudoscorpionida (2)
Stark's North Mine Cave	11/4/2016	TC																									*Perimyotis subflavus* (10)
Stark's North Mine Cave	5/25/2017	TC															1										
Stovepipe Cave	1/20/2017	COA	4			18		21			7	8										18					*Tartarocreagris attenuate* (3) Trichoniscidae (15)
Stovepipe Cave	8/11/2017	COA	1			10		14			15	11										5					*Tartarocreagris attenuata* (3) Trichoniscidae (39)

			Endangered Species						Species of Concern											Other Significant Troglobites							
Cave	**Survey Date**	**Monitoring Agency**	***Rhadine persephone***	***Tartarocreagris texana***	***Tayshaneta myopica***	***Texamaurops reddelli***	***Texella reddelli***	***Texella reyesi***	***Caecidotea reddelli***	***Cicurina bandida***	***Cicurina travisae***	***Eidmannella reclusa***	***Rhadine austinica***	***Rhadine subterranea***	***Sphalloplana mohri***	***Tartarocreagris comanche***	***Tayshaneta concinna***	***Tayshaneta devia***	***Texella spinoperca***	***Cicurina buwata***	***Eidmannella* sp.**	***Speodesmus* sp.**	***Speodesmus bicornourus***	***Tartarocreagris infernalis***	***Tayshaneta* sp.**	***Texoreddellia texensis***	**Other notable species detected**
Talus Springs Cave	8/22/2017	TC																									
Tardus Hole	11/1/2016	TC																									
Testudo Tube Cave	1/26/2017	TC/COA																		2		4				1	*Eurycea tonkawae* (12) *Sphalloplana* sp. (5) *Stygobromus* sp. (30) Trichoniscidae (1)
Testudo Tube Cave	9/7/2017	COA																		12	3	17					*Eurycea tonkawae* (28) *Sphalloplana* sp. (8) *Stygobromus* sp. (12) Trichoniscidae (1)
Tooth Cave	11/17/2016	TC	1		3	1		31			26	6											11				*Perimyotis subflavus* (1)
Tooth Cave	5/18/2017	TC	1		5	1		32			42	9											13			4	
Two Trunks Cave	1/19/2017	TC																									
Weldon Cave	11/16/2016	TC						6						16						3			3				
Weldon Cave	1/31/2017	TC						1						13						8							*Perimyotis subflavus* (1)
Weldon Cave	5/17/2017	TC						2						8						8			3				*Perimyotis subflavus* (1) Pseudoscorpionida (1)
Weldon Cave	8/2/2017	TC						1						9						8			1				*Perimyotis subflavus* (1)
Whirlpool Cave	11/15/2016	TC/COA								12			2														*Batrisodes* sp. (1) *Nylanderia fulva* (72)
Whirlpool Cave	1/24/2017	TC/COA								12			4									1					*Batrisodes* sp. (1) *Nylanderia fulva* (~1400) *Texella mulaiki* (1)
Whirlpool Cave	5/22/2017	TC/COA								7			6								2	4					*Nylanderia fulva* (~140)
Whirlpool Cave	7/31/2017	TC/COA								11			4									1					*Anapistula* sp. (1) *Batrisodes* sp. (1) *Nylanderia fulva* (~5100) Pseudoscorpionida (2) *Texella mulaiki* (1)

[1] All survey data and full species lists available by request through COA and TC.

[2] Surveyors in FY17 include Todd Bayless, Christina Campbell, Travis Clark, Devin Grobert, Christopher Franke, Paul Fushille, Fernando Hernandez, Linda Laack, Anthony Locatelli, Julie Murray, Mark Sanders, Jonny Scalise, Blake Sissel, Colin Strickland, and Drew Thompson.

EXHIBIT B:

CAVE CRICKET EXIT COUNT DATA REPORTS

FY17 COA/TC CAVE CRICKET EXIT COUNT DATA REPORTS

Surveyed Caves	Fall 2016 (November/ December)				Winter 2017 (January/February)				Spring 2017 (May/ June)				Summer 2017 (August/ September)			
	N:	J:	A:	TI:	N:	J:	A:	TI:	N:	J:	A:	TI:	N:	J:	A:	TI:
Adobe Springs Cave	0`	0	256	256					0	0	701	701				
Airman's Cave					171	29	6	206					19	6	3	28
Amber Cave	7	28	44	79					369	655	137	1161				
Broken Arrow Cave	317	206	319	842					997	1001	1103	3101				
Cave Y													297	173	412	882
Cold Cave					1083	512	4	1599					504	320	969	1793
Cortana Cave					45	42	90	177					59	60	298	417
Cotterell Cave					788	124	100	1012					1021	363	91	1475
District Park Cave	724	96	0	820					371	358	285	1014				
Flint Ridge Cave	10	0	0	10	172	47	8	227	174	70	74	318	13	49	259	321
Gallifer Cave					3	0	0	3					12	85	1958	2055
Geode Cave					0	0	0	0					52	530	664	1246
Jest John Cave													398	1454	97	1949
Jester Estates Cave	109	48	293	450					3427	421	131	3979				
Little Bee Creek Cave	7	0	0	7					0	1	66	67				
Maple Run Cave					807	194	22	1023								
Midnight Cave					2246	3703	760	6709					3589	2913	1625	8127
No Rent Cave	181	84	54	319	1158	1355	34	2547	475	541	1720	2736	241	208	693	1142
Pond Party Pit					75	58	44	177					96	47	1078	1221
Seibert Sink					75	220	177	472					173	72	67	312
Sinky Dinky													259	254	69	582
Spanish Wells Cave					328	298	6	632					195	193	254	642
Spider Cave	15	7	11	33					293	85	517	895				
Stark's North Mine	0	0	1	1					9	356	759	1124				

Surveyed Caves	Fall 2016 (November/December)				Winter 2017 (January/February)				Spring 2017 (May/ June)				Summer 2017 (August/ September)			
Stovepipe Cave					231	51	27	309					206	64	329	599
Testudo Tube					110	150	21	281					3	6	386	395
Tooth Cave	16	25	55	96					14	238	953	1205				
Weldon Cave	326	194	38	558	684	1289	71	2044	349	128	981	1458	503	90	190	783
Whirlpool Cave	5979	1367	190	7536	7682	3772	326	11780	7096	4052	386	11534	86	209	192	487
Winter Woods													93	148	78	319

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