# Balcones Canyonlands Preserve
# Karst Monitoring and Management
# FY 2020 Annual Report


New room discovered in Pipeline Cave, the Basement of the Alamo

**Travis County**
**Department of Transportation and Natural Resources**
**Natural Resources and Environmental Quality Division**
**and**
**City of Austin Balcones Canyonlands Preserve – Austin Water (AW)**

October 1, 2019 – September 30, 2020

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**TABLES:**

## 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 36 endangered species caves and 26 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 2020 (FY20), 50 of the 62 BCCP karst features have some form of formal protection on properties owned and managed by COA, TC, and BCCP partners, Texas Cave Management Association (TCMA), 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. s*tagnalis* |
| 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 10/01/19-9/30/20 (FY20). In FY20, 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).

Of the 62 BCCP permit caves, a total of 24 are still in the hands of private landowners and 38 are formally protected on the BCP. Of the 24 that are privately owned, three caves (Pennie's, Pipeline, and Cave X) have protection agreements that include development setbacks from the cave entrance, and two caves (Lost Oasis and Whirlpool Caves) are located on lands owned in part by Texas Cave Management Association (TCMA). Even though the latter of these have some protections in place (including faunal surveys, fire ant treatments, cave access accounting since 1996, and cave gates to regulate access) they do not have formal agreements with the BCP. However, COA BCP and TCMA are actively working on a cave management agreement. TC BCP also conducts species monitoring for the privately owned Cold Cave for the Preston Oaks HOA. This brings the total to 52 caves that are afforded some level of "protection" or monitoring, and nine (Armadillo Ranch Cave, Bandit Cave, Bee Creek Cave, Ceiling Slot, Fossil Garden Cave, Hole-In-The-Road Cave, Jacks Joint, McNeil Bat Cave and Moss Pit) that are still "unprotected" and it is unclear what management activities are conducted, if any at these nine caves. Lost Gold Cave has development setbacks but is considered unprotected since the owner has removed the buffer fencing, cleared vegetation in the surface catchment area, and installed infrastructure within the surface catchment area years ago with no resolution or mitigation as of yet. It should be noted that some of these "protected" caves only have protected entrances but are threatened by surrounding development or planned development. The 46 BCCP caves that are formally part of the BCP are currently managed as follows: 22 caves protected as part of the BCP on COA land (even though they are managed as such, 12 of these lack interdepartmental agreements to fully implement management practices of the Karst Land Management Plan); one cave protected on The Nature Conservancy (TNC) land; 15 caves protected as part of the BCP on TC land; eight caves protected as part of private Section 10(a) or Section 7 agreements with USFWS. Ownership and protection status of each of the 62 BCCP caves is detailed in Table 7.

The monitoring and management of BCCP permit caves entails faunal surveys annually for 15 caves, bi-annually for 25 caves; cricket exit counts are conducted at 26 caves, and red-imported fire ant treatments are performed at various times of the year for 33 caves. Of the permit caves, COA BCP conducts faunal surveys in 22 caves, cricket exit counts at 17 caves, and red imported fire ant treatments at 18 caves. TC BCP conducts faunal surveys in 17 caves, cricket exit counts at 11 caves, and red imported fire ant treatments at 14 caves. COA and TC BCP

collaborate for faunal surveys at Whirlpool Cave, and Zara Environmental is contracted to conduct bi-annual faunal surveys and red imported fire ant treatments at Pennie's Cave.

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 FY20, 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<br>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<br>X 2010 (Ledford) | P 1996<br>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<br>X 2005 | | |
| Jest John Cave | BCP Forest Ridge/COA | Jollyville Plateau | | | | | X 1996<br>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<br>X 2005 | | P 1996<br>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<br>X 2005 | | X 1996 | P 1996<br>X 2005 | | X 1996 |
| New Comanche Trail Cave | BCP Lake Travis/TC | Jollyville Plateau | | X 1996 | | | | X 1996 |
| No Rent Cave | BCP McNeil/TC | McNeil/Round Rock | | | | | | X 1996 |
| North Root Cave | BCP Jollyville/TC | Jollyville Plateau | | | X 1996 | | | X 2017 (Ubick) |
| Pickle Pit Cave | Private Section 7 | Jollyville Plateau | | | | | | X 2018 (USFWS) |
| 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 |

| 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* |
|---|---|---|---|---|---|---|---|---|
| Spider Cave | BCP Park West/COA | Jollyville Plateau | | | X 2004 (Reddell) | | X 2004 (Reddell) | |
| 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 Delete X 2018 (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 | BCP McNeil/TC | 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)
X 2018 (USFWS) = according to the 2018 5 year review on *Texella reyesi* the report list *T. reyesi* as confirmed for Pickle Pit Cave (USFWS 2018)
Delete X 2018 (USFWS) = according to the 2018 5 year review on *Tayshaneta myopica* the report list *T. devia* as confirmed for Stovepipe Cave (USFWS 2018)

**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. stygalis* | *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 of the caves listed in Table 7 as "protected" 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 the 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.

**Karst Preserve Management**

Karst preserves, even those pre-existing at the time containing permit caves, were not specified in the HCP/EIS. Karst preserves were directed to be created for the 62 listed karst features in the governing documents that generally include the water sources to the caves (surface and subsurface catchment areas) and other management areas.

Twelve of the 62 caves lie on City of Austin property that is managed by Austin Parks & Recreation Department (PARD). An interdepartmental management agreement between PARD and AW that specifies management in compliance with the BCCP permit and BCP land management plans is in progress. The dual management sites include Bull Creek District Park and Greenbelt, St. Edward's Park, Barrow Preserve, Commons Ford Park, Shoal Creek Greenbelt (Buda Boulder Spring); Barton Creek Wilderness Area and Greenbelt (Airmen's Cave and Cave Y), Mt. Bonnell, Blowing Sink Research Management Unit (now renamed William H. Russell Karst Preserve with Blowing Sink Cave), Stillhouse Hollow Nature Preserve (Cotterell Cave), Goat Cave Karst Nature Preserve (Goat Cave and Maple Run Cave); Dick Nichols District Park (District Park Cave); Circle C Ranch on Slaughter Creek (Midnight Cave, Arrow Cave, and Slaughter Creek Caves); and Hubert C. Schroeter Neighborhood Park (Fossil Cave). This agreement would allow AW BCP to conduct necessary restoration and cave management, to provide adequate protection for the sites, and eliminate toxic chemical application in sensitive water source areas.

**William H. Russell Karst Preserve**

While Blowing Sink Cave is the deepest cave on the BCCP permit, extending 240 feet to the water table, it has been obstructed since October 2013. The entire preserve contains surface and/or subsurface catchment area for Blowing Sink Cave. This preserve is currently managed by Austin Nature Preserves of Austin Parks and Recreation Department. There is no formal interdepartmental agreement yet that would allow dual management and restoration by AW BCP. In February 2020, a Tier III Management Plan was produced for the newly renamed William H. Russell Karst Preserve by AW BCP and Austin Nature Preserves Division of Austin Parks & Recreation Department. While the land management plan specifies the required management work, the interdepartmental agreement specifies which department is responsible for and empowered to accomplish the management tasks.

On March 21, 2019, Austin cave explorer William Russell passed away. William played a major role in discovery, mapping, and education of caves including many on the BCCP permit. On June 6, 2019, Austin City Council passed a resolution (Resolution No. 20190606-048) that renamed the Blowing Sink Research Management Area, where William discovered many

caves and played a major role in deeding the property to the City of Austin, as William H. Russell Karst Preserve. The resolution has additional directives including:

- "The City Manager is directed to coordinate Austin Water, the Parks and Recreation Department, and the Watershed Protection Department to collaboratively develop and establish a shared land management plan for the William H. Russell Karst Preserve with the goal of protecting water quality, increasing recharge, protecting sensitive and endangered species habitat, and continuing the legacy of Bill H. Russell's work on behalf of the City of Austin to further explore and document the City's karst resources with knowledgeable stakeholders in the community. The City Manager is directed to report back to Council on this land management plan by October 3, 2019."

- "The City Manager is directed to develop a report on existing cave and karst feature enhancement or restoration projects and programs that have been implemented or are in planning by Austin Water, the Parks and Recreation Department, and the Watershed Protection Department. The report should include potential opportunities for process improvements, regulatory considerations, additional water quality monitoring, guided public access, and best practices for engaging knowledgeable stakeholders in the community. The City Manager is directed to report back to Council on this report by January 2020."

- "The City Manager is directed to develop a memorandum of understanding among Austin Water, the Parks and Recreation Department, and the Watershed Protection Department to address cave restoration and water quality monitoring related to caves on City-owned land. The City Manager is directed to report back to Council on this memorandum of understanding by March 1, 2020."

In June 2020 a request was made to allow stormwater infiltration on a portion of the William H. Russell Preserve from an existing water-quality pond. An evaluation report was prepared (Appendix U9) that found the pond was a sinkhole and irrigation area was within the subsurface catchment Area for Blowing Sink Cave, consequently the request was denied.

**Village at Western Oaks Karst Preserve and Watershed Management Area**

The Village at Western Oaks Karst Preserve and Watershed Management Area (VWO Karst Preserve) contains the BCCP permit Get Down Cave and was acquired by the City of Austin in June 2016 under Watershed Protection Department management. An interdepartmental agreement in July 2018 delegated AW BCP with management of the karst preserve and

Watershed Protection responsibility for the water quality ponds and Millennium Cave, a non-permit education cave that underlies one pond.

The preserve has public trails maintained by the Village at Western Oaks Homeowners Association, including trash removal, pet waste bags, and trail maintenance. A formal agreement between VWOHOA and AW BCP will be sought in FY21, along with a Tier III management plan. AW BCP placed rule signs in FY19 at each entrance, specifying among other things that pesticide use is prohibited.

A Friends of the Preserve group was started by neighbor Stephanie Simmons, which participates in public education of preserve sensitivity through a Facebook page. The Friends educate neighbors on alternatives to pesticides, including the use of boiling water to suppress red imported fire ants, the benefits of increasing our tree canopy, and use of native plants, along with information on endangered songbirds and karst invertebrate ecosystems. They also notify and facilitate events, including neighborhood cave tours, Tree Folks planting, Native Plant Giveaways, Boy Scout projects, and others. In FY2020, Stephanie Simmons observed a contractor applying pesticides to weeds on the trail, which is prohibited, stopped the application, and reported the offense to AW BCP.

**Whirlpool Karst Preserve**

Whirlpool Cave is the third largest cave of the 62 permit caves and has historically been used in public education. In FY19, AW BCP proposed a formal management agreement with TCMA for Whirlpool, Lost Oasis, and Avery Ranch (non-BCCP permit education) caves. The agreement is expected to be ratified in FY21.

Whirlpool Cave is managed by Liz Herren on behalf of TCMA. Liz Herren, Justin Shaw, Rich Zarria and other members of TCMA discovered a new room south of the mapped cave extent which potentially has active drip formations that might be used in conducting future hydrogeological studies.

In February 2020, AW BCP acquired a 4.7-acre private lot that overlies the majority of Whirlpool Cave Once a formal agreement is ratified with TCMA and the preserve is expanded, Whirlpool Cave Preserve will be established as a BCP karst preserve (Figure 1). A Tier III management plan is expected to be created in FY21.

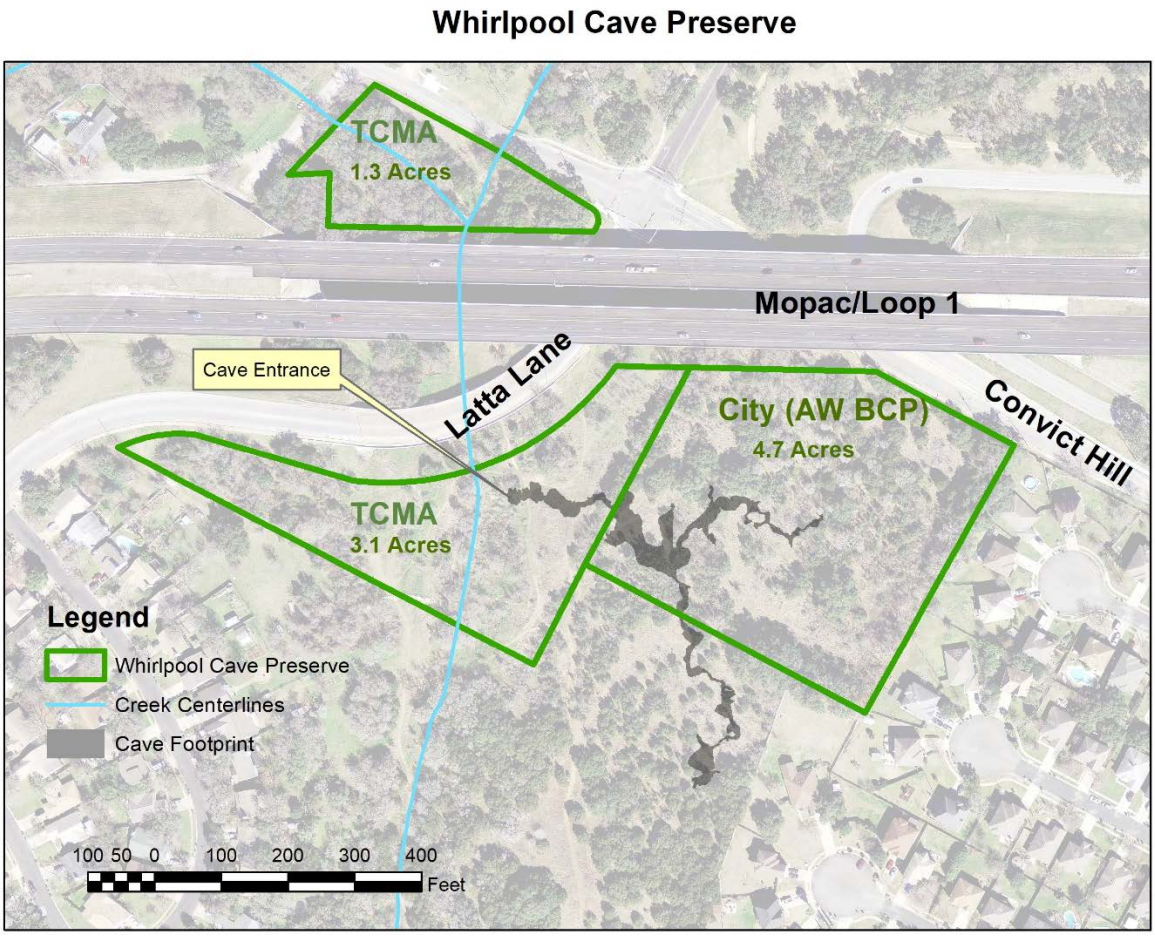


Figure 1. New lot acquired by AW BCP containing a large portion of Whirlpool Cave.

In FY20, AW BCP requested permission from TxDOT to install a cave mural on the Mopac underpass wall adjacent to Whirlpool Cave Preserve in collaboration with the Hill Country Conservancy (HCC), COA Public Works, and contract artist Barbara Attwell. HCC suggested the idea of a cave scene painting adjacent to the Violet Crown trail.

**Lost Oasis Karst Preserve**

Lost Oasis Cave Preserve is managed by Drew Thompson on behalf of TCMA and is adjacent to Tabor WQPL where Flint Ridge is located. A formal agreement for BCP management is being created with TCMA, although the cave is currently being managed per Tier II Karst Land Management Plan with regular fire ant treatments, annual faunal surveys, visitor traffic counts, etc. TCMA installed additional fencing around the preserve in FY2020.

**Four Points Private Karst Preserve**

On February 27, 2019 AW and TC BCP staff met with representatives of the Four Points Preserves that contain four (Disbelievers, Eluvial, Japygid, and MWA caves) of the 62 permit caves in a private karst preserve. BCP requested ownership and management responsibilities for the preserves. On September 13, 2019, representatives of the owner committed to transferring ownership after buildout of associated development and a certificate of occupancy is issued, which may take approximately 2 years. BCP has no data on what, if any, management has been occurring on this preserve or the status of the four permit caves, as this is reported directly to USFW.

**Table 7. FY20 Ownership, protection, monitoring and access status of the 62 BCCP caves/karst features (36 caves with ES and 25 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 Formal management agreement with PARD to ensure permit compliance is in progress | COA quarterly surface monitoring; 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; red-imported fire ant (RIFA) survey/ control | none |
| Armadillo Ranch Sink | SOC | Private | | Private - Unknown | | none |
| Arrow Cave | SOC | BCP/COA | Gated | Protected on parkland (There are nearby homes immediately south of the cave entrance). Formal management agreement with PARD to ensure permit compliance is in progress | 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 |

| Cave Name | ES or SOC | BCP or Private/ Current Owner | Gated/ Fenced | Protection Area Status /Adequate Preserve size | Species Monitoring Status | Public Access |
|---|---|---|---|---|---|---|
| Blowing Sink Cave | SOC | BCP/COA | Gated | Protected on preserve (200 acre preserve, but subsurface catchment extends more than a mile west). No formal agreement with PARD for dual management. Tier III plan is being developed. | COA monthly surface and annual species monitoring; bi-annual RIFA control | none |
| Broken Arrow Cave | ES | BCP/COA | Fenced | Protected on preserve | COA quarterly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring; bi-annual RIFA control | none |
| Buda Boulder Spring | SOC | BCP/COA | | Protected on parkland (close proximity to a hike and bike trail). Formal management agreement with PARD to ensure permit compliance is in progress | COA bi-annual surface monitoring; annual species monitoring. | none |
| Cave X | SOC | Private/COA Protection Agreement | Gated and fenced | Protected by landowner with 4.5 acre setback to protect cave entrance. Protected to some extent (not actively managed and the setback is inadequate). Owner recently rejected COA offer on Sept. 19, 2017 to assist in cave management and monitoring. | In the past, occasional species and surface monitoring by COA and SWCA. SWCA completed cave cricket exit counts in October 2015 and one partial cave faunal survey in February 2016 as part of an agreement to allow for on site construction of a berm to reduce flooding concerns. It is unknown if further biological monitoring has been performed | none |
| Cave Y[1] | SOC | BCP/COA | Gated | Protected on parkland. Lacks formal management agreement to ensure permit compliance<br><br>. | COA quarterly surface bi-annual species monitoring; bi-annual cave cricket exit counts; RIFA control as needed | none |

| Cave Name | ES or SOC | BCP or Private/ Current Owner | Gated/ Fenced | Protection Area Status /Adequate Preserve size | Species Monitoring Status | Public Access |
|---|---|---|---|---|---|---|
| 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 on parkland. (There are nearby homes immediately east of the cave entrance) Lacks formal management agreement to ensure permit compliance | COA quarterly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring; RIFA control as needed | none |
| Disbelievers Cave | ES | BCP/Private Section 10(a) | | Protected by 10a permit, hired Plateau Land & Wildlife Management | | none |
| District Park Cave | SOC | BCP/COA | Gated | Protected on parkland. Formal management agreement with PARD to ensure permit compliance is in progress | COA quarterly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring; RIFA control as needed | 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 (portions of the cave and its catchment area are overlain by the newly constructed SH45 SW). | COA quarterly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring; bi-annual RIFA control | none |
| Fossil Cave | ES | BCP/COA | Access protected by large rocks | Protected on parkland. All caves in park are filled in and require restoration. Formal management agreement with PARD to ensure permit compliance is in progress. | Exact location of cave is unknown. COA quarterly surface monitoring of Features suspected to be Fossil Cave | none |

| Cave Name | ES or SOC | BCP or Private/ Current Owner | Gated/ Fenced | Protection Area Status /Adequate Preserve size | Species Monitoring Status | Public Access |
|---|---|---|---|---|---|---|
| Fossil Garden Cave | ES | Private | | Private – Unknown | | none |
| Gallifer Cave | ES | BCP/TC | Gated and fenced | Protected on preserve | TC quarterly surface monitoring;<br>bi-annual cave cricket exit counts;<br>RIFA survey/control;<br>bi-annual species monitoring | none |
| Get Down Cave | SOC | BCP/COA | Gated and fenced | Protected on preserve | COA monthly surface monitoring;<br>bi-annual cave cricket exit counts;<br>bi-annual species monitoring;<br>bi-annual RIFA control | none |
| Goat Cave | SOC | BCP/COA | Fenced | Protected on parkland. Lacks formal management agreement to ensure permit compliance | COA monthly surface monitoring;<br>annual species monitoring;<br>RIFA control as needed | 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 and fenced | Protected on preserve | TC quarterly surface monitoring;<br>RIFA survey/control;<br>annual species monitoring | none |
| Jack's Joint | SOC | Private | | Private - Unknown | | none |
| Japygid Cave | ES | BCP/Private Section 10(a) | | Protected by 10a permit, managed by Plateau Land & Wildlife Management | | none |
| Jest John Cave | ES | BCP/COA | | Protected on preserve | COA cave cricket exit count;<br>bi-annual surface 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 |
|---|---|---|---|---|---|---|
| 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; bi-annual RIFA control | none |
| Jollyville Plateau Cave | ES | BCP/Private Section 10(a) | | Protected by 10a permit, managed by 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; bi-annual cave cricket exit counts; bi-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 on preserve | 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. In FY19, silt-laden runoff from a new water well and playscape structures were found built in the buffer by City inspectors, due to these violations a stop order is in place on the well installation, City staff are attempting to work with the landowner to remove the illegal improvements and restore the site. | | none |

| Cave Name | ES or SOC | BCP or Private/ Current Owner | Gated/ Fenced | Protection Area Status /Adequate Preserve size | Species Monitoring Status | Public Access |
|---|---|---|---|---|---|---|
| Lost Oasis Cave | SOC | Private/ TCMA | Gated and fenced | Protected by TCMA. Formal management agreement with AW BCP to ensure permit compliance is in progress | COA bi-annual cave cricket exit counts; bi-annual species monitoring; bi-annual RIFA control | controlled access**; |
| M.W.A. Cave | ES | BCP/Private Section 10(a) | | Protected by 10a permit, managed by Plateau Land & Wildlife Management | | |
| Maple Run Cave | SOC | BCP/COA | Gated | Protected on parkland. Lacks formal management agreement to ensure permit compliance | COA monthly surface monitoring bi-annual cave cricket exit counts; bi-annual species monitoring; RIFA control as needed | 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). Formal management agreement with PARD to ensure permit compliance is in progress | COA quarterly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring; RIFA control as needed | 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 cave cricket exit count; 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 |
|---|---|---|---|---|---|---|
| No Rent Cave | ES | BCP/TC | Gated | Protected on preserve | TC bi-annual surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring | none |
| North Root Cave | ES | BCP/TC | Fenced | Protected on preserve | TC quarterly surface monitoring; RIFA survey/control; annual species monitoring | none |
| 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. Management report attached in Appendix U7. | Zara Environmental species monitoring; Zara Environmental RIFA surveys/ control | none |
| Pickle Pit[4] | ES | BCP/Private Sec. 7 | Gated | Protected by Section 7 permit. | TC/COA occasional species monitoring; sporadic surface inspection concerned neighbor | none |
| Pipeline Cave | SOC | Private | Gated | Private – nearby petroleum pipeline exists. Lacks formal management agreement to ensure permit compliance. Permission granted for temporary access to allow for restoration, faunal surveys, and hydrogeological studies | COA quarterly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring; RIFA control as needed | none |
| Rolling Rock Cave | ES | BCP/COA | Fenced | Protected on preserve | COA quarterly surface and annual species monitoring; RIFA control as needed | none |

| Cave Name | ES or SOC | BCP or Private/ Current Owner | Gated/ Fenced | Protection Area Status /Adequate Preserve size | Species Monitoring Status | Public Access |
|---|---|---|---|---|---|---|
| Root Cave | ES | BCP/TC | Fenced | 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, and Mopac South excavation to cave level 500' east). Formal management agreement with PARD to ensure permit compliance is in progress | COA quarterly surface and annual species monitoring; RIFA control as needed. | none |
| Spanish Wells Cave | SOC | BCP/TC | Fenced | 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; bi-annual RIFA control | none |
| 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; RIFA control as needed | 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 |

| Cave Name | ES or SOC | BCP or Private/ Current Owner | Gated/ Fenced | Protection Area Status /Adequate Preserve size | Species Monitoring Status | Public Access |
|---|---|---|---|---|---|---|
| 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 | BCP/TC | Gated | Protected on preserve | TC quarterly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring | none |
| Whirlpool Cave | SOC | Private/ TCMA | Gated | Protected by TCMA. Formal management agreement with AW BCP to ensure permit compliance is in progress. AW BCP in process of acquiring private lot that overlies much of the cave | TCMA routine surface monitoring; COA/TC bi-annual 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.
[4] Pickle Pit was listed as a SOC cave in the 1996 BCCP Permit, but has since been determined to contain *Texella reyesi* (USFWS 2018).

* 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), the Balcones Canyonlands Preserve Program of Austin Water (BCP), 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 the Underground 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 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 721 person trips in FY20. 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 FY20, AW BCP worked on developing a formal written cave access policy that essentially describes the existing unwritten permit policy. The policy lists qualified guides for each cave, preserve site and delegated cave managers, and a new trip registration calendar. The policy is expected to be finalized in FY21 and requires acceptance by each preserve site manager.

Wildflower and LaCrosse caves are relatively small non-BCCP caves on the Lady Bird Johnson Wildflower Center that received 1,818 and 455 visitors respectively in FY20. 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 5$^{th}$ 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, education can be promoted while reducing BCCP cave impacts. Restoration of filled non-BCCP caves for educational purposes is expected to reduce traffic/impact to other publicly accessed BCCP listed caves; namely District Park, Goat, Lost Oasis, Maple Run, and Whirlpool Caves. Caves are a heritage for the

Austin area and provide resources for public education and opportunities to connect with local communities. Of the 3,490 participants of educational and recreational cave trips during FY2020, 2,555 of the participants toured non-BCCP caves and only 935 of the participants toured BCCP permit caves.

While fairly obvious once trash and ranch fill are removed, the cave ecosystem improves in education caves such as LaCrosse, Wade, and Wildflower caves are, it is still assumed that excessive traffic is detrimental to cave ecosystems until more detailed analysis is conducted and reported. Consequently, it is a goal to restore new education caves to both provide more resources for public cave education and to reduce traffic on federal permit caves. A compilation of historic traffic in both BCCP permit and education caves is shown below in Figures 2 & 3. In FY20, no significant progress was made in restoring new education caves or improving existing education caves. On February 22, 2020 the Annual Austin Cave Festival was held at the Lady Bird Johnson Wildflower Center.

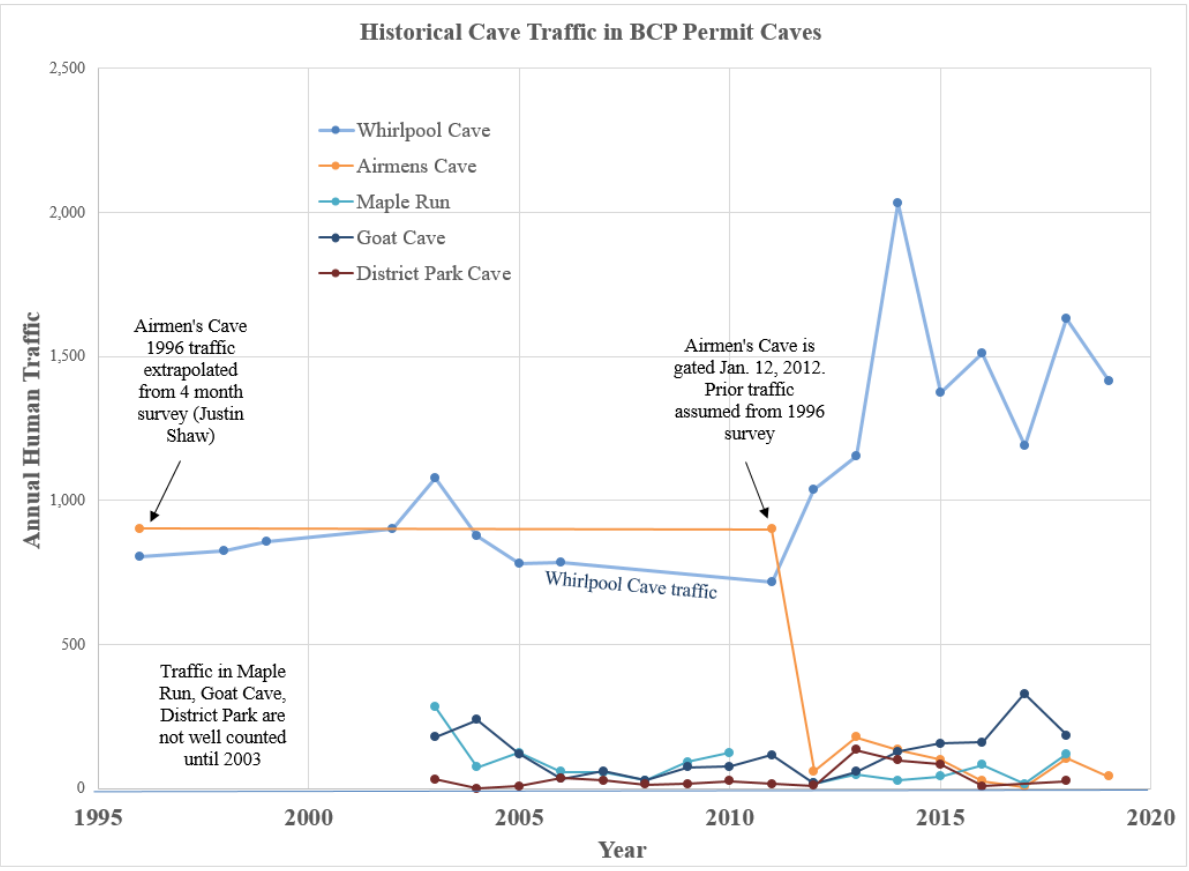


Figure 2. Historical traffic in BCP permit caves

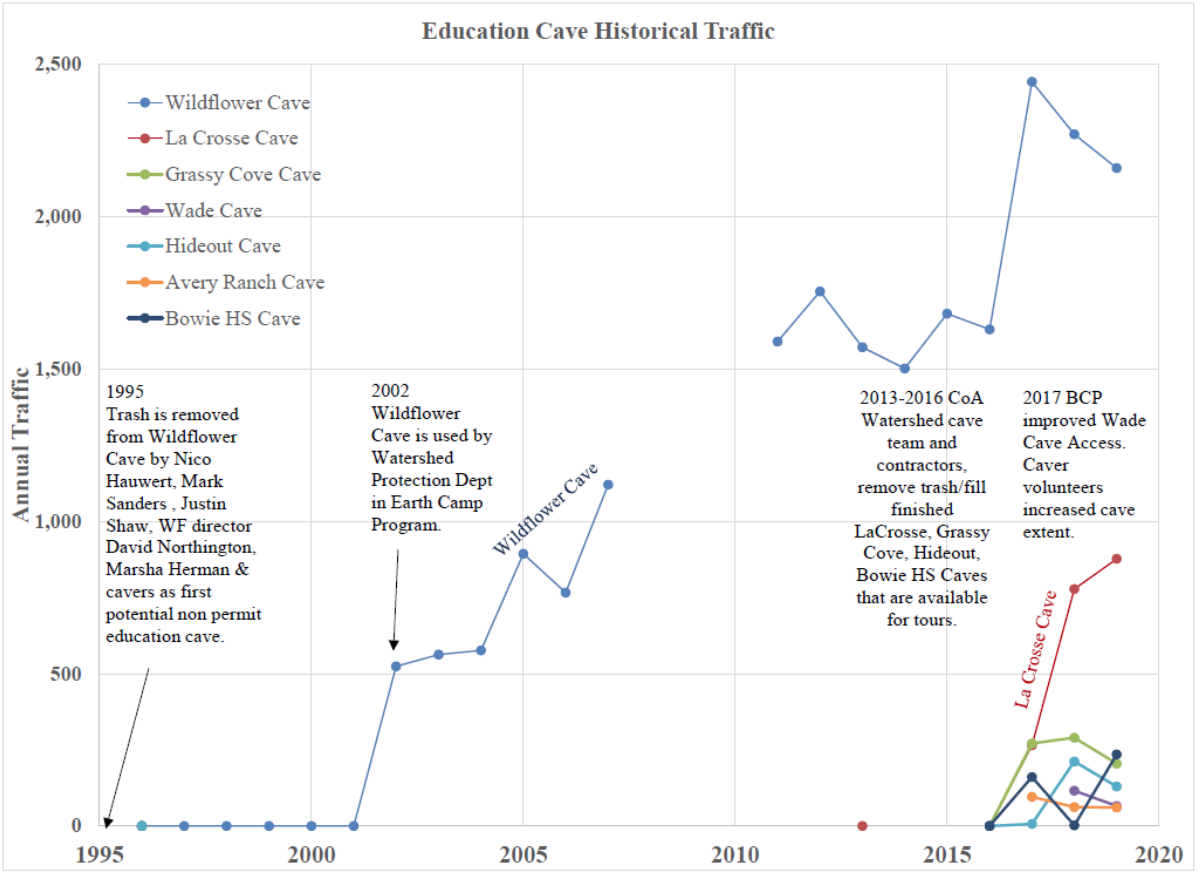


Figure 3. Historical traffic in education caves

## FY20 Cave Education Summary

**COA Watershed Protection Department (WPD) Education Programs:**
COA Watershed Protection Department conducts cave education through Earth Camp and Earth School (fifth grade water quality programs); Watershed Detectives (middle school); Hydrofiles (high school); American Public Gardens Education Community Symposium; and Austin Cave Festival. The 2019-2020 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 2019-2020 school year, Earth Camp guided 1,539 fifth-grade students into Wildflower Cave. An additional 2,356 fifth graders in AISD and Eanes ISD received Earth School, a hands-on classroom presentation using an Aquifer

Model (Table 8). The Lady Bird Johnson Wildflower Center is partnered with Earth Camp. More details on these programs can be found online at: www.austintexas.gov/EarthCamp and www.austintexas.gov/earthschool.

**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 2019-2020 school year, 206 middle school students were given educational caving tours (15 in Grassy Cove and 191 in Whirlpool Cave. Additionally, 30 high school students were given educational caving tours (15 in La Crosse Cave and 15 in Whirlpool Cave) (Table 8). More details on these programs can be found online at: www.austintexas.gov/watersheddetectives and www.austintexas.gov/hydrofiles.

**American Public Gardens Education Community Symposium:** Staff from the Ladybird Johnson Wildflower Center and WPD presented about how our organizations work together to connect people to nature through caving and provided an educational tour of La Crosse Cave for 10 participants. More details about this event can be found online at: www.publicgardens.org/professional-development/association-symposia/education2020-program.

**Austin Cave Festival:** Austin Cave Festival is a free, family event that features hands-on activities, including educational cave tours. Visitors have the opportunity to explore a cave, see how water makes its way to the aquifer and Barton Springs, and learn how to protect cave habitat and water resources. Austin Cave Festival is co-hosted by the Lady Bird Johnson Wildflower Center, the Barton Springs Edwards Aquifer Conservation District, the City of Austin (Austin Parks and Recreation Department, Austin Water Wildland Conservation Division, and WPD), Texas Speleological Association, and the caving community. In February 2020, staff from Austin Wildland Conservation Division, Barton Springs Edwards Aquifer Conservation District, and WPD worked together to take 356 participants caving at the Wildflower Center (221 in La Crosse Cave and 135 in Wildflower Cave. There were more than 2,000 participants at the Austin Cave Festival. Additional activities included exploring CaveSim (a realistic artificial cave) and the children's art cave, an educational tour of a sinkhole, virtual caving, and other hands-on activities related to cave education. More details about this event can be found online at: www.bseacd.org/education/austin-cave-festival/.

**Table 8. Summary of school year 2019-2020 COA WPD education programs providing cave field trips and aquifer outreach.**

| Program | Grade | Total reached |
|---|---|---|
| Earth Camp | 5th | 1,539 |
| Earth School* (*presentation does not include cave immersion) | 5th | 2,356* |
| Watershed Detectives | 6th-8th | 206 |
| Hydrofiles | 9th-12th | 30 |
| American Public Gardens Education Community Symposium | N/A | 10 |
| Austin Cave Festival | N/A | 356 |

**Austin Water Balcones Canyonlands Preserve Program**

Colin Strickland continues to produce short educational videos about karst invertebrates that are shared on the Wildlands Facebook page and used in cave training classes. They can be viewed on his YouTube channel:
Biosubterranea – https://www.youtube.com/channel/UCQFvoKJbPjTF1-HiTrSfugg

AW BCP conducted cave tours and other outreach to immerse the public into their cave heritage. Most focus is directed toward environmental/stewardship groups and East Austin community services such as Explore Austin.

- **Oct 29th, 2019:** Cave Guide Training, Grassy Cove Cave, LaCrosse Cave, and Wildflower Cave (14)
- **Nov 16th, 2019:** Volunteer Appreciation tour at Whirlpool Cave (14)
- **Nov 20th, 2019:** BCP cave tours of Grassy Cove Cave, LaCrosse Cave, and Wildflower Cave (8)
- **Jan 16th, 2020:** Barbara Attwell Corridor of Art - Meet the Artist/Meet the Biologist (~40)
- **Feb 1st, 2020:** Explore Austin, Grassy Cove Cave, LaCrosse Cave, and Wildflower Cave (12)
- **Feb 15th, 2020:** Explore Austin, Grassy Cove Cave, LaCrosse Cave, and Wildflower Cave (22)
- **Mar 11th, 2020:** Tom Devitt's UT biology class at Grassy Cove Cave (18)
- **Mar 21st, 2020:** Texas Most Wanted: Native Plant Giveaway & Native Plant Swap at Village at Western Oaks Karst Preserve (Self-guided surface tour)

**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

PARD rangers and AW BCP staff held an open house tour of Grassy Cove Cave in Circle C on Slaughter Creek Park on February 29, 2020 for 62 attendants.

**Travis County**

TC BCP staff, with the help of COA BCP, worked with Alan Fisher and TPWD to finalize a documentary detailing the introduction of tawny crazy ants (*Nylanderia fulva*) and their impacts to karst environments. This was broadcasted in late November of FY20.
It can be viewed here: https://www.youtube.com/watch?v=E1sN1xBKRB8

## FY20 Access Status

Because of the COVID 19 pandemic, subsequently many caves were closed after March 2020 for cave tours and fewer cave tours were offered. In FY20, 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 FY20, 187 visitors were issued access permits by COA BCP staff to COA-owned BCCP caves including: Airmen's Cave (31), District Park (39), Goat Cave (35), Maple Run Cave (66), and Midnight Cave (16). A total of 748 visitors were granted access to TCMA-owned BCCP caves including: Lost Oasis (27) and Whirlpool (721) caves. An additional 2,555 visitors toured non-BCCP caves with guides including: Avery Ranch Cave (52), Grassy Cove Cave (170), Hideout Cave (24), LaCrosse Cave (455), Wildflower Cave (1,818), and Wade Cave (36) (Table 9). Cave tours were supervised by trained staff from WPD, the Austin Nature and Science Center, COA PARD Rangers, BCP, and the UT Grotto. See Table 3 for access and gating status of all of the BCCP caves.

**Table 9. Summary of FY20 educational and recreational cave trips into Non-BCCP Caves compared to BCCP Caves.**

| Status | Cave | Visitors | Total Visitors |
|---|---|---|---|
| Non-BCCP Caves | Avery Ranch | 52 | 2,555 |
| | Bowie | 0 | |
| | Grassy Cove | 170 | |
| | Hideout | 24 | |
| | LaCrosse | 455 | |
| | Wildflower | 1818 | |
| | Wade | 36 | |
| BCCP Caves | Airmen's | 31 | 935 |
| | District Park | 39 | |
| | Goat | 35 | |
| | Lost Oasis | 27 | |
| | Maple Run | 66 | |
| | Midnight | 16 | |
| | Whirlpool | 721 | |
| Non-BCCP and BCCP Caves Combined | | | 3,490 |

## 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 modified and expanded 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. 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 the cave monitoring program is to provide a clearer understanding of the species distribution and health of karst ecosystems across the BCP.

In FY16, COA/TC BCP staff collaborated on creating guidelines to provide best management practices (BMPs) at construction sites where TCAs 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 FY20, these BMPs continue to be disseminated to appropriate TC/COA departments and other agencies.

In FY20, AW BCP contracted Zara Environmental LCC to continue air monitoring in Ireland's Cave, Grassy Cove, and Whirlpool Cave. This monitoring is intended to better understand factors influencing airflow and factors influencing concentrations of carbon dioxide gas, which is a potential hazard. The results of this monitoring are presented in Appendix U6. Additional monitoring will continue in FY21.

## 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 follow 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 seven (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. In FY2020 Colin Strickland produced a species trends report which examines the trends of ten species in 22 COA managed caves. The full report can be found in the appendices.

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 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).

**FY20 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) were confirmed to be infested by TCAs. COA and TC staff continued to conduct quarterly biological surveys at Whirlpool Cave from FY13 – FY17 to document TCA use of cave environments and assess impacts of this new invasive species on cave fauna (EXHIBIT A). Surveys at Whirlpool Cave were reduced to bi-annually in FY18. For FY 20 staff did not observe any TCA activity in Whirlpool cave. 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). Subsequently, the TCA population at these caves as disappeared for unknown reasons.

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 FY20 to gather baseline data for the McNeil High School courtyard restoration project, which commenced in FY15 (EXHIBIT A). Management activities such as vegetation planting and trash removal 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. In FY18, staff observed and collected an extremely rare arachnid, Order Schizomida from Millipede Cave for species identification. The specimen was determined to be *Stenochrus portoricensis*, believed to be native to the Yucatan Peninsula and has been discovered in greenhouses in Europe. It's likely that this species was inadvertently introduced via plants purchased at local nurseries by school staff. BCP staff will continue to monitor the species to see what impacts it may have on cave fauna.

TC and COA BCP staffs 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 FY20. 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 continue to collect from selected caves determined by James Reddell.

TC and COA BCP also assisted James Reddell with his project of updating the cave faunal lists and accurate locations of area caves for the Texas Speleological Society (TSS) database.

In FY18, TC and COA BCP staff assisted with a USFWS funded study to re-examine *Texella* species found in Travis and Williamson County. In FY20 Marshal Hedin and Shahan Derkarabetian produced a final report "Resolving the species status of *Texella reyesi* (Opiliones, Phalangodidae) using sequence capture of ultra-conserved elements". In the report they did not take formal taxonomic action, however, the report states that "Based on all data available, we hypothesize that the northern *T. reddelli* samples from the three caves that we sampled (from east Jollyville FKR) are members of *T. reyesi*", so if that's the case, then all of the *T. reddelli* caves north of the Colorado river would actually be *T. reyesi*. The report states that "We hypothesize that the Colorado River also acts as a species level barrier in *Texella*.
In regards to *T. reyesi*, the report found that there was a significant amount of genetic variation within the *T. reyesi* range, however, they hypothesize that these be considered the same species, "…while there is clear genetic and ecological differentiation within *T. reyesi*…the level of male genitalic divergence is limited…A conservative taxonomy would treat these as different populations within a single variable species…", so the *Texella* north of the Colorado River, Northern Travis and Williamson Counties are all hypothesized to be *T. reyesi*, therefore, no changes to the existing species determination.

In late FY18, TC BCP was approached by an individual interested in selling a property that contained a cave, which was known to BCP staff as Good Thunder Cave. The property is in close proximity to Lost Gold Cave, and in early FY19, TC and COA BCP collaborated to do a full investigation and evaluate its substitution potential for Lost Gold Cave on the BCCP permit. The analysis included a faunal survey (EXHIBIT A) including specimen collections for identification and cave mapping. The specimens were tuned over to James Reddell or sent to other experts for confirmations. TC and COA BCP are still awaiting most of these confirmations, but one notable specimen was identified as *Rhadine austinica*. In FY 20, the City of Austin made an offer to purchase the cave, however, the owner declined the offer.

**City of Austin FY20 Biological Monitoring**

During FY20, COA BCP staff conducted bi-annual monitoring on the following 16 pre-selected caves: Airman's Cave, Broken Arrow Cave, Cave Y, Cortana Cave (non-BCCP cave), Cotterell Cave, District Park Cave, Flint Ridge 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, Stovepipe Cave, and Testudo Tube (non-BCCP cave) (EXHIBIT A). In an effort to get a better handle on baseline data, in FY 18 COA BCP staff completed one year of quarterly faunal surveys at Get Down Cave, Lost Oasis Cave, and Pipeline Cave. Survey frequency for these caves has been reduced to bi-annual surveys. (EXHIBIT A).

Faunal surveys in these caves were conducted by permitted COA biologists in either Fall 2019/Spring 2020 or Winter 2020/Summer 2020. As part of a long-term site restoration project, COA BCP staff continued to conduct bi-annual surveys at Millipede and Millipede Annex Cave (EXHIBIT A). Annual faunal surveys were also conducted in Arrow Cave, Beard Ranch Cave, Black-cap cave, Blowing Sink, Goat Cave, Perry Park Cave, Rolling Rock Cave, Slaughter Creek Cave, , and Y2Kave. (EXHIBIT A).

In FY20, COA BCP staff, with the help of volunteers, conducted bi-annual cave cricket exit counts at the same 16 caves pre-selected for faunal surveys (EXHIBIT B). (EXHIBIT B). In FY 18 COA BCP staff completed one year of quarterly cave cricket exit counts at Get Down Cave, Lost Oasis Cave, and Pipeline Cave, and has now reduced survey efforts to bi-annual surveys (EXHIBIT B). COA BCP staff also conducted one cave cricket exit count at Black-cap cave, and Jest John Cave (EXHIBIT B).

**Travis County FY20 Biological Monitoring**

TC's BCP staff conducted bi-annual monitoring on the following nine pre-selected caves: Cold Cave, Gallifer Cave, Geode Cave (non-BCCP cave), Kretschmarr Cave, No Rent Cave, Spanish Wells Cave, Stark's North Mine, Tooth Cave, and Weldon Cave. Faunal surveys in these caves, with permitted TC biologists, were conducted in Fall 2019/Spring 2020 or Winter 2020/Summer 2020 (EXHIBIT A). Annual faunal surveys were also conducted in four other TC-owned BCCP caves with federally listed species: Kretschmarr Double Pit, McDonald Cave, New Comanche Trail Cave, and Tardus Hole (EXHIBIT A). TC staff also conducted annual faunal surveys at three additional BCCP listed caves: Adobe Springs Cave, Ireland's Cave, Root Cave, and Talus Springs Cave, and one additional TC-owned non-BCCP cave with listed ES or SOC: Two Trunks Cave (EXHIBIT A).

TC BCP staff conducted bi-annual cave cricket exit counts in FY20 at all of the caves pre-selected for faunal surveys: Cold Cave, Gallifer Cave, Geode Cave, Kretschmarr Cave, No Rent Cave, Spanish Wells Cave, Stark's North Mine, Tooth Cave, Weldon Cave. Adobe Springs Cave was an exception since it normally receives bi-annual cave cricket exit counts, but due to the COVID-19 pandemic, TC staff was only allowed access for the Spring count. Exit counts were conducted in Fall 2019/Spring 2020 or Winter 2020/Summer 2020 (EXHIBIT B).

RIFA surveys were performed in Fall 2019 and Spring 2020 on five of thirteen TC-owned BCCP caves with federally listed species. 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 2019, a total of 17 RIFA mounds were treated within these 80 m survey areas. In Spring of 2020, a total of 66 RIFA mounds were treated within these 80 m cave survey areas, with an additional 4 RIFA mounds treated in the vicinity of caves but outside of survey areas. An additional 34 RIFA mounds were surveyed at Tooth Cave (24 within 80 m of the cave entrance and 11 outside 80 m), but were unable to be treated due to COVID-19 restrictions. These restrictions also affect RIFA control at other caves that normally receive it. Survey results and treatments for individual caves are documented in Table 10.

In addition to managing the karst features required in the BCCP permit, TC voluntarily managed other karst features located on BCP land in FY20 including Cactus Pit, Brew Pot Cave, Kretschmarr Sink, and karst features RI-1, LU-11 and LU-12.

TC BCP staff is still monitoring caves found on the Kotrla Unit for troglobitic significance in hopes of finding suitable substitutes for Ceiling Slot and Moss Pit Caves. There are currently eight caves that have the potential to harbor significant trobolbitic diversity that are undergoing periodic monitoring.

It should be noted that the adjacent ranch (Flying K Ranch) to the Kotrla Unit is interested in selling more land to be incorporated into the BCP. In response to this, TC staff conducted a thorough investigation on 246 acres of uplands to locate potential karst features. This survey produced 80 locations of interest ranging from existing caves to depressions. Zara Environmental was then contracted to provide an initial investigation of 21 potential karst features. These 21 features were later reclassified to 18 since some exhibited connectivity after excavation. Fifteen of the features met USFWS evaluation criteria for having the potential to provide habitat for fedrally listed karst invertebrate species. Noteably, two caves were found to harbor blind *Cicurina*, which will be sent to Marshal Hedin in FY 21 for identification. One of these caves (FK-32) seems to be the best potential substitute for Moss Pit/Ceiling Slot that has been found in that area so far. Not only does it have blind *Cicurina*, it also containes other species such as *Cambala speobia*, Pseudoscorpindia, and roving beetles (which might be *Batrisodies* sp). All collections are waiting to be deposited with James Reddell.

## Other Biological Monitoring Efforts

Zara Environmental conducted biological monitoring at Pennie's Cave in FY20 as part of an adaptive cave management plan for a development project that began with the reopening of

the cave's entrance in 2012. Due to difficulty with securing a contract due to COVID 19, Zara Environmental scaled back monitoring efforts and conducted one Spring RIFA treatment with boiling water in FY20. Due to high $CO_2$ levels, in FY18 Zara installed a semi-permanent in-cave air ventilation system that greatly improved air quality, thus allowing for in-cave faunal monitoring, staff was also able to complete the interior cave mapping. A written report of their work in FY20 was also provided (Zara Environmental 2020a; Appendix U7 of BCCP FY20 Annual Report).

COA BCP staff continues to assist James Reddell and the Texas Speleological Survey (TSS) in surveying, excavating, and mapping the karst of the USFWS Balcones Canyonlands National Wildlife Refuge (BCNWR). One cave of interest that may be a suitable substitution for another BCP permit cave that has inadequate protections is Collaboration Cave. Mark Sanders and Colin Strickland initially visited the BCNWR in May 2018 to look at karst features that were recommended for investigation by James Reddell, the most promising of these were Unnamed Sinks 8 & 9. These two features are connected and 12 ft apart; they've now combined and renamed Collaboration Cave by Scott Rowin (BCNWR biologist), due to the collaborative efforts made between the BCNWR, James Reddell, and COA BCP. Collaboration Cave was initially a 25.5 ft deep shaft plugged with rocks and soil. After 14 days of excavation (ten in FY18 and four in FY19), the shaft is approximately 35 ft deep and there is about 40 ft of horizontal passage with a small stream flowing through it. The stream is inhabited by stygobitic isopods *Caecidotea* sp. and amphipods *Stygobromus* sp. Colin Strickland produced a video of this cave stream and its inhabitants which can be viewed here: https://www.youtube.com/watch?v=XbFbXYWo16c. Excavation activities will continue both upstream and downstream until all promising leads have been exhausted. At which point, the cave will be mapped, and thorough faunal surveys will be conducted. These efforts continue to expand the knowledge of cave fauna in the karst fauna region shared by two BCCP caves: Jack's Joint and Armadillo Ranch Sink. Once the map and faunal surveys are completed, COA BCP staff will provide a written report of their efforts.

In FY20 COA BCP started a new project of delineating *Cicurina* species in the Austin area. DNA is analyzed by Bold Systems (https://www.boldsystems.org). Initially *Cicurina* were collected from BCP caves where the species was already confirmed to make sure the species determinations match what we believe is in each cave. In FY21 we will start collecting in sites where the species is not known. We are interested in determining the boundary between *C. buwata* and *C. travisae* in North Austin. In South Austin and Hays County we are interested in determining how far South *C. bandida* extends and what other species are found on the COA Water Quality Protection Lands (WQPL). Depending on how successful this project is we are planning to expand DNA analysis to other species. We are particularly interested in species

where we are unable to find a taxonomist who can make species level determinations. Stygobitic isopods and amphipods are good candidates. Also, *Speodemus*, since there are likely cryptic species that DNA analysis will reveal. There are also likely multiple species of undescribed trichoniscids in Central Texas caves, and though DNA analysis will not properly describe them, it can give us an idea of the diversity present, and maybe encourage a taxonomist to take on the project.

COA BCP has also been collaborating with Texas State University, Baylor School of Medicine, and the Centers for Disease Control (CDC) on a study to further understand and document the recent increased occurrence of Tick-borne Relapsing Fever (TBRF) in Central Texas. TBRF is a bacterial infection that can cause recurring bouts of fever, headache, muscle and joint aches, and nausea. *Borrelia* bacteria that cause TBRF are transmitted to humans through the bite of infected soft ticks of the genus *Ornithodoros*. All recently confirmed cases of TBRF in the Austin area have been attributed to *Borrelia turicatae*, and the ticks have all been confirmed as *Ornithodoros turicata*. Soft ticks (Family: Argasidae) differ from the more familiar hard ticks (Family: Ixodidae) in two main ways. They have a short feeding duration, usually less than half an hour, and they do not search for hosts in grass or brush but instead reside in animal burrows (CDC TBRF, 2015).

COA BCP has started monitoring soft tick populations to get a better understand the level of risk that may be associated with caves accessed by the public (Figure 4). Priority has been given to the education caves due to the large number of children visiting them, followed by caves in the Barton Creek Greenbelt that are well known hangouts for hikers that are seeking relief from the Texas heat.

Pit fall traps using dry ice were deployed in 20 caves in the Austin area to survey soft tick populations. Specimens were collected alive and stored in ventilated plastic vials for transport to Texas State University's Professor Dr. Ivan Castro and his students Rosa Ramirez, Matt Milholland, and Michaela Bowlsby. Some ticks were then sent to Job Lopez at Baylor College of Medicine for *Borrelia* identification and further TBRF research, while Michaela took some to research effective chemical deterrents. The information gathered is being shared with Jeff Taylor of the Epidemiology and Disease Surveillance Unit of the Austin Public Health Department, and the CDC.

Large numbers of ticks where only found in Bullet and Live Oak Caves, and warning signs have been placed at their entrances to help minimize the public's exposure to TBRF. It is unclear what causes some caves to have such high numbers. It is likely due to the presence of favorable cave environments (soft, dry soil that is easy to burrow in) and ample access for

specific host species such as mice, racoons, and rock squirrels. Reddell (1988) noted that relapsing fever is typically associated with dry, shelter-like cave entrances with specific mammals such as goats and that infections of a cave by *O. turicata* with *Borrelia turicatae* could possibly by cyclic. Some birds and mammals, particularly predators, are associated with reductions in ticks, either by reducing/intimidating host species such as rodents or by directly preying on ticks (Hofmeester et al., 2017; Ostfeld et al., 2018). COA BCP will continue to monitor education and public access caves, such as Airman's and Bullet Caves. The detection of a single tick does not make a cave high risk for relapsing fever; however, cave guides should be informed about the risk of TBRF should later symptoms arise. There is concern that fear-driven over reaction to TBRF could lead to impairment or destruction of cave ecosystems, as was historically the case in earlier planned bat extermination efforts as a result of irrational fear of rabies. Furthermore, the soft ticks must be infected with *Borrelia turicatae* in order to transmit TBRF.

Due to the pandemic, only LaCrosse, Wildflower, and Grassy Cove were surveyed in FY2020. As it is likely cave tours will resume in late 2021, surveys will be conducted at education caves with favorable soft tick habitat before tours resume. In FY20, caves where people have contracted TBRF and are identified as a high risk for TBRF include Live Oak Cave in Village at Western Oaks Karst Preserve; Airmen's Cave, Spider Wire Cave, and Bullet Caves along Barton Creek greenbelt; and Little Black Hole.

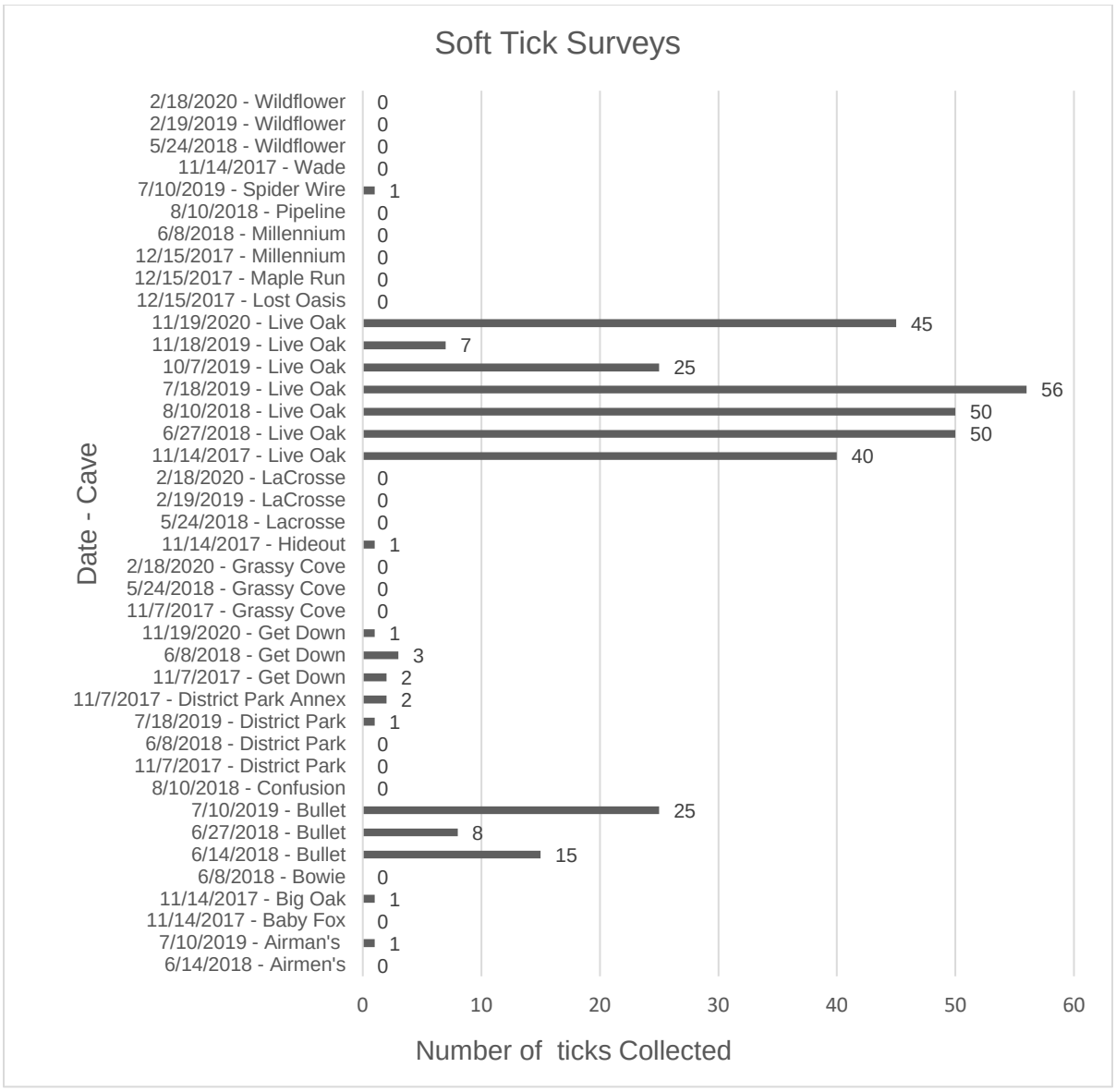


Figure 4. Results for City of Austin BCP soft tick surveys

## 7.0 HYDROGEOLOGIC STUDIES & CAVE RESTORATION

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.

Cave restoration is an extremely slow and labor-intensive part of cave preserve management that is a necessary prerequisite for conducting hydrogeological studies, vital for re-establishing necessary nutrient input and habitat for cave ecosystems. Historical land use practices over karst areas across the Austin area involved plugging caves and sinkholes to keep water at the surface for livestock ponds, mills, and access to shallow sources. Open caves also created hazards for people and livestock, and filling caves with trash seemed like a practical solution to ranchers, particularly given that, prior to local dye tracing studies, many scientists erroneously believed groundwater flowed slowly through tiny pores and that ground water was completely filtered before reaching the water table. Many caves were also covered by urbanization and many local caves that could have been preserved were filled in under the assumption that this measure protected the underlying aquifer from contamination. Efforts to remove trash and fill from caves is slow and regulated to a small group of cave-trained women and men. Once trash and fill are removed from a cave, utilization of the cave by cave-adapted organisms follow, including cave crickets, bats, and other mammals that bring nutrients from the surface. A large number of the 62 federal permit caves required excavation of fill or trash, and some such as in the case of Pipeline Cave below, still require it. An article on cave restoration by AW BCP was published in the Wildflower Center magazine in November 2019 (Hauwert and Sanders 2019). In addition to restoring cave habitat, cave restoration can also serve to restore recharge and reduce flooding where the cave catchment area is large, improve water-quality in caves filled with trash, and provide educational resources necessary to allow the public to make connections with natural ecosystems. To support cave restoration efforts, AW BCP produced a Guidelines for Cave Restoration in February 2020. In November 2018, AW BCP released version 3 of Austin Cave Activity Hazards and Safety Report that describes unique cave hazards, protocols for addressing them, and relevant safety regulations.

In addition to the large challenges of widespread historical cave filling, the highly specialized skill and dedicated physical effort required to restore them, and limited resources available for cave restoration, in January 2018, while attempting to unplug BCCP permit Blowing Sink Cave, it was observed that regulation of cave restoration was unclear. In order to clarify the regulatory status of cave restoration and provide distinction of cave restoration from other development activities that could harm caves, Austin Water, Watershed Protection Department, Parks and Recreation Department, and the Development Services Department finalized an MOA which took effect on April 1, 2020 that clarifies that cave restoration using hand-held tools is not a development activity requiring a permit. However, for cave restoration, the use of backhoes and similar heavy machinery, laying of impervious cover and even cave

gating requires prior discussion with WPD staff. The Texas Commission on Environmental Quality Edwards Rules similarly requires approval prior to the use of heavy machinery for cave restoration.

Monitoring of Flint Ridge Cave continued in FY20, including flow monitoring of three drainages entering the sinkhole, monitoring of Headquarters Flat Sinkhole which serves as a comparison sinkhole, drip monitoring inside Flint Ridge Cave, and water-quality sampling of drips following storm events. A data-logging Hydrolab sonde has been continually recording water quality metrics every hour since July 31st, 2019. It measures water temperature, specific conductivity, pH, and dissolved oxygen, and turbidity. In May 2019 State Highway 45 SW began operation as a toll road over the cave and subsurface catchment area.

With the tremendous support of Parkside Village South owner Whitestone Reit, along with the nearby Alamo Drafthouse, COA BCP and Zara Environmental LLC was able to make a major breakthrough in Pipeline Cave, a BCCP permit cave, in FY20. The Austin Mobility Corridor project of City of Austin Public Works funded Zara Environmental to work with AW BCP in a hydrogeological study of federal permit caves along Slaughter Lane. The hydrogeological study report delineating the surface and subsurface catchment areas for BCCP permit caves south of Slaughter Lane west of Mopac South is being completed in FY21. Melissa Beatty of Whitestone Reit generously provided BCP staff permission to access, manage and monitor this cave as well as the adjacent Confusion Cave (non-BCCP cave). From 1966, when cave explorers first reported Pipeline Cave until 2019, Pipeline Cave had a length of 30 feet and depth of 15 feet with an estimated volume of 1,000 $feet^3$ (Elliott 1997). Pipeline Cave was historically used in Circle C/Covert Ranch as a trash dump site (Ira Yates 2020 personal communication), as was BCCP permit Midnight Cave, and Wildflower Cave. Midnight Cave was restored from 1993-1999 in a huge trash removal project overseen by Mark Sanders then of Austin Parks and Recreation Department. On August 10 and August 17, 2018, Mark Sanders, Drew Thompson, and Colin Strickland of AW BCP removed trash from Pipeline Cave, primarily for dating the fill (Figure 5). On February 12, 2019, AW BCP staff removed sixteen 42-gallon trash bags or roughly 90 $feet^3$ of trash (Figure 6). Faunal surveys began August 21, 2018.

Figure 5. Trash pile in entrance room of Pipeline Cave August 10, 2018, photo by Colin Strickland

Figure 6. Drew Thompson with a portion of trash removed from Pipeline Cave on 2/12/19, photo by Colin Strickland

In November 2019 Drew Thomson and Colin Strickland of AW BCP, AW BCP contractor Dylan Beeler, Bill Larsen and Lucas Pustka of Zara Environmental LLC excavated a 30-feet long mud and trash-filled crawl passage in the lower level C where air blew strongly and raccoon prints indicated access to a deeper open passage. The 30-feet long crawl passage led into one of the largest cave rooms in Travis County. Now referred to as "the Basement of the Alamo", it is approximately 80 ft long by 40 ft wide with ceiling heights of up to 14ft tall Figures 7 & 8). The calculated volume of Pipeline Cave in FY2020 is now 20,000 $ft^3$, or 20 times its pre-BCP management 2018 volume. The new room contained bat guano and indications it historically housed a bat colony prior to the cave's use as a trash dump.

Figure 7. Colin Strickland in the Basement of the Alamo, photo by Drew Thompson

Figure 8. Colin Strickland in the Basement of the Alamo, photo by Drew Thompson

The cave was surveyed by Aubri Jenson, Colin Strickland and Drew Thompson. Colin Strickland then sketched and drafted a detailed map of the cave which can be found in the appendices. Staff aided by contractor Zara Environmental continued the hydrogeological study for Pipeline Cave which also includes other features found on that property as well as the adjacent Circle C Metro Park. Two drip gauges were installed under drips in Pipeline Cave.

As part of the hydrogeological study, other nearby features were evaluated. Confusion Cave was evaluated until a low crawling room 10 feet by 10 feet by 2 feet tall was found. With no obvious way forward, efforts were turned to the nearby feature known as Big Woof Sink located on adjacent City of Austin parkland. Initially a large sink approximately 30 feet in diameter by 4 feet deep with discarded fencing and multiple blowing apertures, restoration focused on removing ranch fill in FY20. Big Woof Cave was gated by Charlie Savvas and restoration work continues.

In FY19 restoration work was done by Charley Savvas and 4Caves on Another Cave which is near BCCP permit Slaughter Creek Cave. After a climb down there is a large room with multiple leads. It was discovered that there is historic graffiti carved into a flowstone formation with initials and dates of 1885 and 1887 (Figure 9). No restoration work was done in FY20, since a bobcat was observed inhabiting the cave. Restoration work will likely continue in FY21.

Figure 9. 1885 carved into flowstone in Another Cave, photo by Colin Strickland

Additional cave restoration was conducted in the Jollyville Plateau of North Austin in a project funded in part through TxDOT mitigation funds. This work is reported separately in Appendices.

## 8.0 RECOMMENDATIONS

COA and TC should continue 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. Staff will also continue to search for possible substitutions for some of the caves which are not adequately

protected. Additionally, COA and TC will continue to evaluate the adequacy of protection for all 62 BCCP caves by continuing hydrological studies initiated in FY2019 and prioritize efforts accordingly. Karst preserves will be established to preserve the surface and subsurface catchment areas, cave cricket foraging areas, and other guidelines for preserves outlined by USFWS (2012).

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 10 below includes a summary of monitoring and management activities for these features completed in FY20.

| **Table 10**. FY20 BCCP Karst Feature Monitoring and Management Activities. |
|---|
| Adobe Springs Cave<br>The Nature Conservancy<br>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.<br>2. TC performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave.<br>3. TC conducted annual cave faunal survey due to lack of access from COVID-19 in Spring (see EXHIBIT A).<br>4. TC conducted annual cave cricket exit surveys due ot lack of access from COVID-10 in Spring. (See EXHIBIT B). |
| Airmen's Cave<br>City of Austin<br>1. Conducted bi-annual cave faunal surveys (See EXHIBIT A).<br>2. Conducted bi-annual cave cricket exit counts. (SEE EXHIBIT B)<br>3. COA installed a cave gate within 18 feet of the entrance of the cave in January 2012. 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.<br>4. Conducted quarterly site inspections and continued to operate security camera. |
| Amber Cave<br>Travis County<br>1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave.<br>2. Maintained fencing and signage to protect this area from unauthorized access and dumping.<br>3. Surveyed site for RIFA. Treated 4 mounds in Fall 2019 and 11 mounds in Spring 2020. |

| **Table 10**. FY20 BCCP Karst Feature Monitoring and Management Activities. |
|---|
| Armadillo Ranch Sink<br>Private |
| Arrow Cave<br>City of Austin<br>1. Completed annual cave faunal survey (See EXHIBIT A).<br>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.<br>3. Zara Environmental installed and monitored dye trace packets as part of the area hydrological study.<br>4. Contractors also opened up nearby features (most notably St Edwards Sinks) in conjunction with the hydrological study. |
| Bandit Cave<br>Private |
| Beard Ranch Cave (Featherman's Cave)<br>City of Austin<br>1. Completed annual cave faunal survey (See EXHIBIT A).<br>2. Conducted quarterly site inspections.<br>3. No RIFA were found. A healthy population of native fire ants was found in close proximity to the cave. |
| Bee Creek Cave<br>Private |
| Blowing Sink Cave<br>City of Austin<br>1. Inspected monthly and continued to operate security cameras.<br>2. Completed annual cave faunal survey (See EXHIBIT A).<br>3. The lower passageways have been inaccessible since the October 2013 flood; however, it is possible that some of the recently restored adjacent caves may lead to the water table. With the recent installation of the shaft allowing direct entry into the main passage of the cave, future excavation work will be feasible, thus allowing rock and silt to be removed which will open up the lower passageways of the cave.<br>4. An interdepartmental agreement between PARD and AW BCP is being sought to establish formal BCCP karst preserve management.<br>5. COA BCP appreciates permission from PARD Natural Resources Division Austin Nature Preserves to access the site. |
| Broken Arrow Cave<br>City of Austin<br>1. Inspected quarterly with no sign of human visitation or vandalism.<br>2. Completed bi-annual faunal surveys (See EXHIBIT A).<br>3. Completed bi-annual cave cricket exit counts. (See EXHIBIT B).<br>4. Treated site for RIFA with boiling water. |
| Buda Boulder Spring<br>City of Austin<br>1. COA BCP staff conducted quarterly site visits and noted signs of recent transient camps near the spring. COA PARD Rangers were notified and now periodically patrol the site.<br>2. An interdepartmental agreement between PARD and AW BCP is being sought to establish formal BCCP karst |

| **Table 10**. FY20 BCCP Karst Feature Monitoring and Management Activities. |
|---|
| preserve management. |
| Cave X<br>Private<br>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.<br>2. Cave entrance is gated and also has a fence for added protection.<br>3. Regent's School staff conduct periodic surface inspections of the cave including gate and lock maintenance.<br>4. In an effort to get a better understanding of CO2 levels in Cave X and assist in managing/monitoring, COA BCP staff requested access to install air monitoring equipment but were declined the offer by the owner in September 2017. |
| Cave Y<br>City of Austin<br>1. Conducted quarterly site inspections.<br>2. Completed bi-annual cave faunal survey(See EXHIBIT A).<br>3. Completed bi-annual cave cricket exit counts. (See EXHIBIT B).<br>4. Surveyed site for RIFA; no mounds were discovered within the cave's treatment area. |
| Ceiling Slot Cave<br>Private |
| Cold Cave<br>1. TC is negotiating with the landowners concerning the possibility of purchase, conservation easement, or a management agreement for this 8 acre tract.<br>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.<br>3. TC performed surface inspections with no signs of vandalism to the cave entrance or in the cave, but the cave gate still in need of repair<br>4. TC conducted bi-annual cave faunal surveys (see EXHIBIT A).<br>5. TC conducted bi-annual cave cricket exit surveys. (See EXHIBIT B). |
| Cotterell Cave<br>City of Austin<br>1. Conducted quarterly site inspections, staff temporarily installed a game camera to monitor wildlife exiting the cave, however the camera was stolen, staff installed a new camera more securely and was able to get one month of data.<br>2. RIFA surveys determined that the ants were located approximately 300 feet from the cave so no treatment was needed.<br>3. Conducted bi-annual cave faunal surveys (see EXHIBIT A).<br>4. Conducted bi-annual cave cricket exit surveys. (See EXHIBIT B). |
| Disbelievers Cave<br>Private 10a Permit: PRT-808694 |

| **Table 10**. FY20 BCCP Karst Feature Monitoring and Management Activities. |
|---|
| District Park Cave<br>City of Austin<br>1. BCP staff conducted bi-annual cave faunal surveys (See EXHIBIT A).<br>2. BCP staff and volunteers conducted bi-annual cave cricket exit counts (See EXHIBIT B).<br>3. Conducted site surveys quarterly, other than trash at the entrance no new major problems noted.<br>4. Permitted access to this cave was allowed.<br>5. BCP staff removed trash from the un-gated portion of the cave.<br>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).<br>7. Surveyed site for RIFA; no mounds were discovered within the cave's treatment area.<br>8. An interdepartmental agreement between PARD and AW BCP is being sought to establish formal BCCP karst preserve management. |
| Eluvial Cave<br>Private 10a Permit: PRT-808694 |
| Flint Ridge Cave<br>City of Austin<br>1. Conducted monthly site visits and and continued to operate security cameras.<br>2. Conducted bi-annual cave faunal surveys (See EXHIBIT A).<br>3. BCP staff and volunteers conducted bi-annual cave cricket exit counts (See EXHIBIT B).<br>4. Continuous monitoring of drips was conducted in various rooms.<br>5. New flow meters and autosamplers were installed at the entrance sink.<br>6. Four autosamplers were installed inside Flint Ridge Cave.<br>7. COA BCP drafted a hydrogeologic study report that will delineate the subsurface catchment areas of water sources. This is expected to be released in FY20.<br>8. BCP staff continuously monitor temperature, pH, dissolved oxygen, salinity, and turbidity with a mini-sonde hydrolab.<br>9. Construction of SH45SW was completetd and sections of this highway are over portions of the cave and its surface/subsurface catchment areas. |
| Fossil Cave<br>City of Austin<br>1. Inspected quarterly and found no new signs of vandalism<br>2. Inspected for RIFA infestations on all visits. RIFA were observed within close proximity of the "suspected" cave.<br>3. While there are about 10 filled caves located in Schroeter Park, and it is unclear which might be Fossil Cave, once an interdepartmental Agreement with PARD is completed that would allow AW BCP to restore Fossil Cave and establish a formal karst preserve with protective measures within a city park. |
| Fossil Garden Cave<br>Private<br>1. Apple Inc started construction of their new campus in November 2019, the new campus is located immediately adjacent to Fossil Garden Cave. |

| **Table 10**. FY20 BCCP Karst Feature Monitoring and Management Activities. |
|---|
| Gallifer Cave<br>Travis County<br>1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave.<br>2. Maintained fencing and signage to protect this area from unauthorized access and dumping.<br>3. Conducted bi-annual cave faunal surveys (see EXHIBIT A).<br>4. Conducted bi-annual cave cricket exit surveys. (See EXHIBIT B). |
| Get Down Cave<br>City of Austin<br>1. In July of FY18, COA BCP and WPD signed an Interdepartmental Agreement which allows COA BCP to manage the karst preserve and Get Down Cave according to the Tier II karst management plan and allows WPD to manage the water quality ponds and underlying Millennium Cave, which they use in their aquifer education.<br>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 FY20.<br>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.<br>4. BCP staff conducted bi-annual cave faunal surveys (See EXHIBIT A).<br>5. BCP staff conducted bi-annual cave cricket exit counts (See EXHIBIT B).<br>6. Conducted quarterly site visits and continued to operate security cameras.<br>8. Removed non-native invasive plants.<br>9. BCP staff continued to collect soft ticks from Live Oak Cave and to collaborate with Texas State and Baylor researchers whom are trying to determine more information about tick borne relapsing fever (TBRF). |
| Goat Cave<br>City of Austin<br>1. Completed annual faunal survey (See EXHIBIT A).<br>2. Conducted quarterly site surveys, staff noticed and repaired vandalized gate, and also noticed possible new graffiti inside the cave.<br>3. Allowed permitted access to this cave.<br>4. An interdepartmental agreement between PARD and AW BCP is being sought to establish formal BCCP karst preserve management. |
| Hole-in-the-Road Cave<br>Private |
| Ireland's Cave<br>Travis County<br>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.<br>2. Fencing was completed in FY15 on the perimeter of the Ireland's Cave tract to protect the cave preserve from trespass.<br>3. TC conducted an annual cave faunal survey (see EXHIBIT A).<br>4. TC and COA contracted with Zara Environmental to continuously monitor air quality in Irelands Cave. Ireland's Cave is known to have elevated levels of $CO_2$, and this study will provide vital information to staff on cave safety. |
| Jack's Joint Cave<br>Private |

| **Table 10**. FY20 BCCP Karst Feature Monitoring and Management Activities. |
|---|
| Japygid Cave<br>Private 10a Permit: PRT-808694 |
| Jest John Cave<br>City of Austin<br>1. Conducted 2 site visits found and no signs of vandalism or human visitation.<br>2. Inspected site for RIFA infestations, no RIFA were observed near the cave.<br>3. Conducted one cave cricket exist count. (See EXHIBIT B). |
| Jester Estates Cave<br>City of Austin<br>1. BCP staff conducted 8 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.<br>2. BCP staff met with neighbors in regard to wildfire concerns, staff plan to conduct fuel mitigation treatment in January.<br>3. Conducted bi-annual cave faunal surveys (See EXHIBIT A).<br>4. Conducted bi-annual cave cricket exit counts. (SEE EXHIBIT B).<br>5. BCP staff removed non-native invasive vegetation. |
| Jollyville Plateau Cave<br>Private 10a Permit: PRT-808694 |
| Kretschmarr Cave<br>Travis County<br>1. Performed surface inspections with no signs of vandalism to the cave entrance or in the cave.<br>2. Maintained fencing and signage to protect this area from unauthorized access and dumping.<br>3. Part of the 105 m setback sustained impacts in FY19 from adjacent development in the form of tree clearing. Reparations have been collected and a restoration project is planned for FY21.<br>4. Surveyed site for RIFA. Treated 7 mounds in Fall 2019 and 42 mounds in Spring 2020.<br>5. TC conducted bi-annual cave faunal surveys (see EXHIBIT A).<br>6. TC conducted bi-annual cave cricket exit surveys (See EXHIBIT B). |
| Kretschmarr Double Pit<br>Travis County<br>1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave.<br>2. Maintained fencing and signage to protect this area from unauthorized access and dumping.<br>3. Surveyed site for RIFA. Treated 3 mounds in Fall 2019 and 10 mounds in Spring 2020.<br>4. Conducted annual cave faunal survey (see EXHIBIT A). |

| **Table 10**. FY20 BCCP Karst Feature Monitoring and Management Activities. |
|---|
| Lamm Cave<br>Section 7 Permit 2-15-93-F-075<br>(see USFWS files)<br>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.<br>2. The cave was gated, and the preserve area was fenced following COA WPD and BCP staff recommendations and design.<br>3. No application of fertilizers, pesticides or herbicides will be allowed in the CEF area.<br>4. TC staff continue to periodically monitor the site to make certain that the gates and fences are secure.<br>5. Walmart has closed the store and sold 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. |
| Little Bee Creek Cave<br>City of Austin<br>1. Conducted quarterly site visits.<br>2. Conducted bi-annual cave faunal survey (See EXHIBIT A).<br>3. Conducted bi-annual cave cricket exit counts. (See EXHIBIT B). |
| Lost Oasis Cave<br>TCMA<br>1. Conducted five site visits.<br>2. COA WPD led one cave education trip.<br>3. COA AW led one cave education trip.<br>4. COA BCP staff treated the site for RIFA with boiling water.<br>5. Conducted bi-annual cave faunal survey (See EXHIBIT A).<br>6. Conducted bi-annual cave cricket exit counts. (See EXHIBIT B).<br>7. Removed non-native invasive plants.<br>8. New fencing was installed by TCMA<br>9. A draft agreement for formal co-management with TCMA was prepared in August and expected approved in FY21 |
| Lost Gold Cave<br>Private<br>1. The owner of the lot removed the fence for the buffer lot, cleared vegetation within the surface catchment up to the entrance of Lost Gold Cave, placed mulch and a playscape in the preserve buffer lot. |
| Maple Run Cave<br>City of Austin<br>1. Conducted bi-annual cave faunal survey (See EXHIBIT A).<br>2. Conducted bi-annual cave cricket exit counts. (See EXHIBIT B).<br>3. COA BCP staff conducted monthly site inspections and removed trash from preserve area.<br>4. Permitted access to this cave is allowed.<br>5. An interdepartmental agreement between PARD and AW BCP is being sought to establish formal BCCP karst preserve management. |
| McDonald Cave<br>Travis County<br>1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave.<br>2. Maintained fencing and signage to protect this area from unauthorized access and dumping.<br>3. Conducted annual cave faunal surveys (see EXHIBIT A). |

| **Table 10**. FY20 BCCP Karst Feature Monitoring and Management Activities. |
|---|
| McNeil Bat Cave<br>Private |
| Midnight Cave<br>City of Austin<br>1. Conducted quarterly site inspections; on multiple occasions in the past vandals cut the chain to the gate. Staff continue to monitor a cellular game camera and continue to make improvements to the gate and fence to better secure the site.<br>2. Conducted bi-annual cave faunal surveys. (See EXHIBIT A).<br>3. Conducted bi-annual cave cricket exit counts. (See EXHIBIT B).<br>4. Permitted access to this cave is allowed, though no access permits were granted this fiscal year.<br>5. Zara Environmental installed and monitored dye trace packets as part of the area hydrological study.<br>6. An interdepartmental agreement between PARD and AW BCP is being sought to establish formal BCCP karst preserve management.<br>7. On August 18, 2020 staff observed a large number of dead cave crickets in zone 2 (pit). BCP staff were unable to determine the cause of mortality, however, BCP staff are working with Austin Parks and Recreation staff to ensure that the existing IPM plan which restricts the use of pesticides within the cave cricket foraging area is enforced. |
| M.W.A. Cave<br>Private 10a Permit: PRT-808694 |
| Moss Pit Cave<br>Private |
| New Comanche Trail Cave<br>Travis County<br>1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave.<br>2. Maintained fencing and signage to protect this area from unauthorized access and dumping.<br>3. TC conducted annual cave faunal survey (see EXHIBIT A).<br>4. TC conducted annual cave cricket exit survey. (See EXHIBIT B). |
| No Rent Cave<br>Travis County<br>1. TC acquired No Rent Cave and surrounding land that protects a portion of the cave cricket foraging area and surface/subsurface drainage basins in FY19.<br>2. Zara Environmental installed an elevated cave gate in FY19.<br>3. TC performed surface inspections with no current signs of vandalism to the cave entrance or in the cave.<br>4. TC conducted bi-annual cave faunal surveys (see EXHIBIT A).<br>5. TC conducted bi-annual cave cricket exit surveys. (See EXHIBIT B). |
| North Root Cave<br>Travis County<br>1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave.<br>2. Maintained fencing and signage to protect this area from unauthorized access and dumping.<br>3. Annual cave faunal survey was not conducted due to snake issue. |
| Pennie's Cave<br>Private |

| **Table 10**. FY20 BCCP Karst Feature Monitoring and Management Activities. |
|---|
| 1 The entrance was re-excavated in 2012, providing access to the cave.<br>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.<br>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.<br>4. Zara Environmental provided an annual report to the BCP on all monitoring and management activities. |
| Pickle Pit Cave<br>Private USFWS Section 7 Permit 2-15-93-F-075<br>1. A volunteer neighbor occasionally monitors the cave entrance/ gate monthly; no problems noted. |
| Pipeline Cave<br>Private<br>1. A 2004 agreement between COA and Stratus set aside an approximately 8 acre 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.<br>2. Developer installed cave gate (including a gate on the nearby "Confusion Cave."<br>3. In August 2018, COA BCP staff met with the property manager and obtained provisional access to begin monitoring and management of Pipeline and the adjacent Confusion Cave according to the Tier II karst land management plan.<br>4. Conducted bi-annual cave faunal surveys. (See EXHIBIT A).<br>5. Conducted bi-annual cave cricket exit counts. (See EXHIBIT B).<br>6. COA BCP provided a monitoring and management report to the property manager.<br>7. Staff has removed trash fill from the cave on multiple occasions, which is initially dated to late 1950's and early 1960's.<br>8. COA and Zara Environmental are continuing to conduct a hydrological study which includes several other nearby caves.<br>9. A new heavily decorated section of the cave was discovered as well as several new nearby karst features (most notably Big Woof Cave) have been evaluated in coordination with the hydrological study.<br>10. BCP staff mapped the cave including the newly discovered portion of the cave. |
| Rolling Rock Cave<br>City of Austin<br>1. Inspected quarterly and no sign of human visitation or vandalism was found.<br>2. Conducted one cave faunal survey. (See EXHIBIT A). |
| Root Cave<br>Travis County<br>1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave.<br>2. Maintained fencing and signage to protect this area from unauthorized access and dumping.<br>3. Conducted annual cave faunal survey (see EXHIBIT A). |
| Slaughter Creek Cave<br>City of Austin<br>1. Conducted quarterly site inspections.<br>2. Conducted one cave faunal survey. (See EXHIBIT A)<br>3. Zara Environmental installed and monitored dye trace packets as part of the area hydrological study.<br>4. An interdepartmental agreement between PARD and AW BCP is being sought to establish formal BCCP karst preserve management. |
| Spanish Wells Cave<br>Travis County |

| **Table 10**. FY20 BCCP Karst Feature Monitoring and Management Activities. |
|---|
| 1. TC acquired Spanish Wells Cave and surrounding land that protects the cave cricket foraging area and surface/subsurface drainage basins in FY15.<br>2. Performed surface inspections with no signs of trespass or vandalism to the cave entrance or in the cave.<br>3. Conducted bi-annual cave faunal surveys (See EXHIBIT A).<br>4. Conducted bi-annual cave cricket exit count. (See EXHIBIT B). |
| <u>Spider Cave</u><br>City of Austin<br>1. Conducted four site visits, and no sign of human access or vandalism was found.<br>2.Conducted bi-annual cave faunal surveys (See EXHIBIT A).<br>3. Conducted bi-annual cave cricket exit counts. (See EXHIBIT B).<br>4. Treated site for RIFA with boiling water.<br>5. As part of the new adjacent highway expansion work, TXDOT has provided funds for hydrological studies, which includes excavation of features adjacent to spider cave, the ultimate goal of finding active drips which would allow for dye trace studies that would accurately determine the subsurface drainage basin. |
| <u>Stark's North Mine</u><br>Travis County<br>1. TC acquired this cave and 0.8 acres surrounding it in FY12. The area surrounding the cave is all previously developed.<br>2. TC acquired a conservation easement on the adjacent 0.38 acres which contains much of the cave cricket foraging area.<br>3. Performed surface inspections and detected signs of vandalism to the cave entrance and inside the cave. Cave gate was subsequently repaired by Zara Environmental.<br>4. Surveyed site bi-annually for RIFA. No mounds found within 80 m of cave.<br>5. Conducted bi-annual cave faunal surveys (See EXHIBIT A).<br>6. Conducted bi-annual cave cricket exit counts (See EXHIBIT B).<br>7. Performed non-native plant removal projects on tract to increase native plant diversity. |
| <u>Stovepipe Cave</u><br>1. Conducted 6 site inspections and continued to remove new and old trash from the preserve.<br>2. Repaired perimeter fence.<br>3. Conducted bi-annual cave faunal surveys (See EXHIBIT A).<br>4. Conducted bi-annual cave cricket exit counts (See EXHIBIT B).<br>5. Surveyed site for RIFA; no mounds were discovered within the cave's treatment area.<br>6. Continued karst assessment of site in FY20.<br>7. As part of the new adjacent highway expansion work, TXDOT has provided funds for hydrological studies, which includes excavation of features adjacent to stovepipe cave, the ultimate goal of finding active drips which would allow for dye trace studies that would accurately determine the subsurface drainage basin.<br>8. A drip gauge was installed in the cave. |
| <u>Talus Spring Cave</u><br>Private<br>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 homeowner's association donate the land to TC.<br>2. Performed surface inspections with no signs of vandalism to the cave entrance or in the cave.<br>3. Conducted annual cave faunal survey (see EXHIBIT A).<br>4. Performed a non-native plant removal project on tract to increase native plant diversity. |
| <u>Tardus Hole Cave</u><br>Travis County |

| **Table 10**. FY20 BCCP Karst Feature Monitoring and Management Activities. |
|---|
| 1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave.<br>2. Maintained fencing and signage to protect this area from unauthorized access and dumping.<br>3. Surveyed site for RIFA. Treated 3 mounds in Fall 2019 and 10 mounds in Spring 2020.<br>4. Conducted annual cave faunal survey (see EXHIBIT A). |
| <u>Tooth Cave</u><br>Travis County<br>1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave. However, a homeless camp was found onsite in the Fall of 2108 and was removed.<br>2. Maintained fencing and signage to protect this area from unauthorized access and dumping.<br>3. Zara Environmental replaced old cave gate with a newer elevated gate in FY18.<br>4. Surveyed site for RIFA. A total of 23 were found within the 80 m buffer and 11 outside of it in Spring 2020. COVID-19 restricted the treatment of these mounds.<br>5. Conducted bi-annual cave faunal surveys (see EXHIBIT A).<br>6. Conducted bi-annual cave cricket exit surveys. (See EXHIBIT B). |
| <u>Weldon Cave</u><br>Travis County<br>1. TC acquired Weldon Cave and surrounding land that protects a portion of the cave cricket foraging area and surface/subsurface drainage basins in FY19.<br>2. Zara Environmental install a cave gate in FY19.<br>3. TC performed surface inspections with no current signs of vandalism to the cave entrance or in the cave.<br>4. TC conducted bi-annual cave faunal surveys (see EXHIBIT A).<br>5. TC conducted bi-annual cave cricket exit surveys. (See EXHIBIT B). |
| <u>Whirlpool Cave</u><br>TCMA<br>1. A draft agreement for formal co-management with TCMA was prepared in August and expected approved in FY21<br>2. TC/COA conducted bi-annual cave faunal surveys (see EXHIBIT A).<br>3. TC/COA conducted bi-annual cave cricket exit surveys. (See EXHIBIT B).<br>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.<br>5. Continuous monitoring of $CO_2$, humidity, and airflow is being conducted in the East caverns passage by Zara Environmental on behalf of COA BCP. |

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# EXHIBIT A:

# KARST FAUNAL SURVEY REPORTS

# FY20 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 | 11/21/2019 | TC | | | | | | | | | | | | | | | | | | | | | | | | | |
| Adobe Springs Cave | No survey due to COVID-19 | TC | | | | | | | | | | | | | | | | | | | | | | | | | |
| Airmen's Cave | 1/15/2020 | COA | | | | | | | | 9 | | | | | | | | | 4 | | 65 | | 4 | | | | *Cambala speobia* (11)<br>*Tartarocreagris intermedia* (2)<br>*Texella mulaiki* (1) |
| Airmen's Cave | 8/15/2020 | COA | | | | | | | | 43 | | | | | | | | | | | 62 | | 14 | | | | *Cambala speobia* (9)<br>Pseudoscorpionida (13)<br>*Texella mulaiki* (1) |
| Beard Ranch Cave | 1/17/2020 | COA | | | | | | 5 | | | 1 | | | | | | | | | | | | | | | | *Cambala speobia* (1) |
| Black-cap Cave | 8/7/2020 | COA | | | 1 | | | 4 | | | | | | | | | | | | | 2 | 1 | | | | | *Cambala speobia* (3) |
| Blowing Sink Cave | 9/13/2020 | COA | | | | | | | | 11 | | | 1 | | | | | | | | | 3 | | | | | *Batrisodes* sp. (2)<br>*Texella mulaiki* (1) |
| Broken Arrow Cave | 11/19/2019 | COA | | | | | | | 15 | | | | | | | | | | | 8 | | 4 | | | | | *Cambala speobia* (41) |
| Broken Arrow Cave | 5/15/2020 | COA | 1 | | | | | | 39 | | | | | | | | | | | 4 | | 12 | | | | | *Batrisodes* sp. (1)<br>*Cambala speobia* (64) |
| Cave Y | 1/15/2020 | COA | | | | | | | | 5 | | | | | | | | | | | | | 1 | | | | *Batrisodes* sp. (1)<br>*Cambala speobia* (1)<br>*Perimyotis subflavus* (30)<br>*Texella grubbsi* (4) |
| Cave Y | 8/18/2020 | COA | | | | | | | | 16 | | | 1 | | | | | | | | | | 5 | | | | *Cambala speobia* (7)<br>*Texella grubbsi* (7)<br>*Texoreddellia* sp. (1) |
| Cold Cave | 2/17/2020 | TC | | | | | | 1 | | | | | | | | | | | | 34 | | 12 | | | | | *Cambala speobia* (5) |
| Cold Cave | 8/24/2020 | TC | | | | | | 1 | | | | | | | | | | | | 8 | | 2 | | | | | *Batrisodes* sp. (3)<br>*Cambala speobia* (168) |
| Cortana Cave | 1/23/2020 | COA | | | 35 | | | 5 | | | 5 | 25 | | | | | | | | | | | | | | | *Cambala speobia* (2) |
| Cortana Cave | 8/10/2020 | COA | | | 22 | | | 13 | | | 6 | 32 | | | | | | | | | | 7 | | | | | *Cambala speobia* (4) |
| Cotterell Cave | 1/10/2020 | COA | 1 | | | | | 24 | | | 104 | | | 3 | | | | | | | | | 44 | 2 | | | *Cambala speobia* (6) |
| Cotterell Cave | 8/13/2020 | COA | | | | | | 16 | | | 63 | | | | | | | | | | | | 43 | 5 | | | *Cambala speobia* (14) |
| District Park Cave | 11/22/2019 | COA | | | | | | | | 17 | | | | | | | | | | | | | | | | | *Cambala speobia* (40) |
| District Park Cave | 1/16/2020 | COA | | | | | | | | 22 | | | 1 | | | | | | | | | 2 | | | | | *Cambala speobia* (34)<br>*Tartarocreagris* sp. (1)<br>*Tayshaneta sandersi* (1) |
| District Park Cave | 5/27/2019 | COA | | | | | | | | 27 | | | | | | | | | | | 1 | | | | | | *Cambala speobia* (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*** | ***Eidmanella reclusa*** | ***Rhadine austinica*** | ***Rhadine subterranea*** | ***Rhadine* sp.** | ***Tartarocreagris comanche*** | ***Tayshaneta concinna*** | ***Tayshaneta devia*** | ***Texella spinoperca*** | ***Cicurina buwata*** | ***Eidmanella* sp.** | ***Speodesmus* sp.** | ***Speodesmus bicornourus*** | ***Tartarocreagris infernalis*** | ***Tayshaneta* sp.** | ***Texoreddellia texensis*** | **Other notable species detected** |
| Flint Ridge Cave | 11/21/2019 | COA | | | | | | | | 20 | | | 22 | | | | | | | | | 8 | 28 | | | | | *Cambala speobia* (2)<br>*Perimyotis subflavus* (1)<br>*Stygobromus russelli* (2)<br>*Texella mulaiki* (1)<br>*Texoreddellia* sp. (1) |
| Flint Ridge Cave | 1/16/2020 | COA | | | | | | | | 28 | | | | | | | | | | | | 1 | 42 | | | | | *Cambala speobia* (3)<br>*Perimyotis subflavus* (7)<br>*Texoreddellia* sp. (1) |
| Flint Ridge Cave | 5/11/2020 | COA | | | | | | | | 24 | | | | | | | | | | | | 4 | 13 | | | | 1 | *Cambala speobia* (1) |
| Gallifer Cave | 1/28/2020 | TC | | | 89 | | | 50 | | | 169 | | | | | | | | | | | | 2 | | | | | *Batrisodes* sp. (1)<br>*Cambala speobia* (22) |
| Gallifer Cave | 8/18/2020 | TC | | | 63 | | | 26 | | | 129 | | | | | | | | | | | | 2 | | | | | *Cambala speobia* (78)<br>*Tartarocreagris* sp. (1)<br>*Texoreddellia* sp. (2) |
| Geode Cave | 2/7/2020 | TC | | | 62 | | | | | | 1 | 5 | | | | | | | | | | | | | | | | *Batrisodes* sp. (1) |
| Geode Cave | 8/11/2020 | TC | | | 38 | | | 3 | | | 2 | 15 | | | | | | | | | | | | | | | | *Texoreddellia* sp. (1) |
| Get Down Cave | 11/22/2019 | COA | | | | | | | | 37 | | | | | | | | | | | | | 3 | | | | | *Cambala speobia* (4)<br>*Perimyotis subflavus* (3)<br>*Tayshaneta sandersi* (4)<br>*Texella mulaiki* (1) |
| Get Down Cave | 5/27/2020 | COA | | | | | | | | 20 | | | | | | | | | | | | | 5 | | | | | *Cambala speobia* (2)<br>Pseudoscorpionida (1)<br>*Tayshaneta sandersi* (7)<br>*Texella mulaiki* (1) |
| Goat Cave | 9/18/2020 | COA | | | | | | | | 3 | | | | | | | | | | | | | 1 | | | 2 | | *Cambala speobia* (3)<br>*Texella mulaiki* (2)<br>Trichonisicidae (2) |
| Ireland's Cave | 2/26/2020 | TC | | | | | | | | 17 | | | | | | | | | | | | | | 2 | | | | *Batrisodes* sp. (1)<br>*Eidmanella pallida* (1) |
| Jester Estates Cave | 11/19/2019 | COA | | | 2 | | 25 | | | | 2 | | | | | | | | | | | | 1 | | | | | *Cambala speobia* (11) |
| Jester Estates Cave | 5/19/20120 | COA | | 4 | 8 | | 44 | | | | 6 | | | | | | | | | | | | 7 | | | | | Trichonisicidae (6) |
| Kretschmarr Cave | 11/20/2019 | TC | | | | | | | | | 4 | | | | | | | | | | | | 1 | | | | | *Cambala speobia* (4) |
| Kretschmarr Cave | 6/16/2020 | TC | | | | | | | | | 17 | | | | | | | | | | | 57 | | 3 | | | | *Cambala speobia* (16)<br>Pseudoscorpionida (1) |
| Kretschmarr Double Pit | 11/20/2019 | TC | | | | | | | | | 4 | | | | | | | | | | | | 1 | | | | | *Cambala speobia* (4)<br>*Texella grubbsi* (1) |
| Little Bee Creek Cave | 11/25/2019 | COA | | | | | 12 | | | | | | | | | | | | | | | | | | | | | *Cambala speobia* (16)<br>Pseudoscorpionida (1) |
| Little Bee Creek Cave | 5/28/2020 | COA | | | | | | | | | | | | | | | | | | | | | | | | | | *Cambala speobia* (10)<br>*Tartarocreagris* sp. (2) |
| Lost Oasis Cave | 11/21/2019 | COA | | | | | | | | 23 | | | | | | | | | | | | | 5 | | | | | *Cambala speobia* (35)<br>*Tartarocreagris* sp. (3)<br>*Texella mulaiki* (3) |
| Lost Oasis Cave | 5/30/2020 | COA | | | | | | | | 26 | | | | | | | | | | | | | | | | | | *Cambala speobia* (76)<br>*Texoreddellia* sp. (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** |
| Maple Run Cave | 1/27/2020 | COA | | | | | | | | 5 | | | | | | | | | | | | 2 | | | | 1 | *Texella mulaiki* (2) |
| Maple Run Cave | 8/26/2020 | COA | | | | | | | | 6 | | | | | | | | | | | | 4 | | | | | *Cambala speobia* (2)<br>Pseudoscorpionida (1)<br>*Texella mulaiki* (3) |
| McDonald Cave | 8/13/2020 | TC | | | | | | 2 | | | 75 | | | | | | | 1 | | | | | 14 | | | | *Cambala speobia* (20)<br>*Eidmannella restrata* (13)<br>*Texoreddellia* sp. (4) |
| Midnight Cave | 1/16/2020 | COA | | | | | | | | 16 | | | | | | | | | | | | 18 | | | | | *Batrisodes* sp. (2)<br>*Cambala speobia* (90)<br>*Eidmanella pallida* (45)<br>*Texoreddellia* sp. (12)<br>Trichoniscidae (65) |
| Midnight Cave | 8/18/2020 | COA | | | | | | | | 12 | | | 1 | | | | | | | | 10 | 2 | | | | | *Batrisodes* sp. (1)<br>*Cambala speobia* (11)<br>Trichoniscidae (6) |
| Millipede Annex Cave | 12/5/2019 | COA | | | | | | 6 | | | | | | | | | | | | 5 | | | | | 9 | | Trichoniscidae (2) |
| Millipede Annex Cave | 5/21/2020 | COA | | | 8 | | | 8 | | | | | | | | | | | | 6 | | | | | | | *Cambala speobia* (4)<br>*Texoreddellia* sp. (1)<br>Trichoniscidae (1) |
| Millipede Cave | 12/5/2019 | COA | | | | | | 1 | | | | | | | | | | | | 9 | | | | | 2 | | *Stenochrus portoricensis* (2)<br>Trichoniscidae (2) |
| Millipede Cave | 5/21/2020 | COA | | | | | | 2 | | | | | | | | | | | | 16 | | | | | | | *Cambala speobia* (1)<br>*Stenochrus portoricensis* (9)<br>*Tartarocreagris domina* (1)<br>Trichoniscidae (3) |
| New Comanche Trail Cave | 8/11/2020 | TC | | | | | | 5 | | | 10 | | | | | | | | | | | | | | | | *Cambala speobia* (1)<br>*Texoreddellia* sp. (3) |
| No Rent Cave | 2/25/2020 | TC | | | | | | 4 | | | | | | | | | | | | 40 | 4 | 3 | | | | | *Cambala speobia* (32)<br>*Perimyotis subflavus* (3)<br>*Texoreddellia* sp. (1) |
| No Rent Cave | 8/19/2020 | TC | | | | | | 3 | | | | | | | | | | | | 35 | 5 | | | | | | *Cambala speobia* (40) |
| Perry Park Cave | 8/18/2020 | COA | | | | | | | | | | | | | | | | | | | 1 | | | | | | *Cambala speobia* (123)<br>*Ciciurina* sp. (1)<br>*Tartarocreagris* sp. (1) |
| Pipeline Cave | 11/25/2019 | COA | | | | | | | | 29 | | | | | | | | | | | 1 | 30 | | | | | *Batrisodes* sp. (2)<br>*Cambala speobia* (1)<br>*Texella mulaiki* (12)<br>*Texoreddellia* sp. (3) |
| Pipeline Cave | 5/12/2020 | COA | | | | | | | | 15 | | | | | | | | | | | | 14 | | | 1 | | *Texella mulaiki* (4)<br>*Texoreddellia* sp. (4) |
| Pond Party Pit | 1/17/2020 | COA | 2 | | | | | 9 | | | | | | | | | | | | | 3 | 18 | | 11 | | | *Cambala speobia* (7)<br>Trichoniscidae (2) |
| Pond Party Pit | 8/21/2020 | COA | | | | | | 6 | | | | | | | | | | | | | 2 | | | 4 | | | *Cambala speobia* (23)<br>Trichoniscidae (3) |
| Rolling Rock Cave | 11/19/2019 | COA | | | | | | | | | | | | | | | | | | 2 | | | | | | | *Cambala speobia* (4)<br>Trichoniscidae (4) |
| Root Cave | 2/18/2020 | TC | | | | | | | | | 8 | | | | | | | | | | | 1 | | | | | *Cambala speobia* (13) |
| Seibert Sink | 1/15/2020 | COA | | | | | | | | 1 | | | | | | | 1 | | | | | | | | | | *Texella spinoperca* (4) |
| Seibert Sink | 8/26/2020 | COA | | | | | | | | 11 | | | | | | | 4 | | 5 | | 1 | 4 | | | | | Trichoniscidae (3) |

| | | | 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** |
| Slaughter Creek Cave | 9/17/2020 | COA | | | | | | | | 15 | | | | | | | | | | | 3 | 21 | | | | | *Cambala speobia* (4)<br>*Batrisodes* sp. (1) |
| Spanish Wells Cave | 2/17/2020 | TC | | | | | | | | | | | | | | | | | | | | | | | | | *Sphalloplana mohri* (40)<br>*Stygobromus russelli* (150) |
| Spanish Wells Cave | 8/17/2020 | TC | | | | | | | | | | | | | | | | | | | 7 | | | | | | *Sphalloplana mohri* (4)<br>*Stygobromus russelli* (5) |
| Spider Cave | 11/19/2019 | COA | 1 | | | 1 | | | | | 13 | | | | | | | | | | 2 | | 4 | | | | *Cambala speobia* (4)<br>Pseudoscorpionida (1) |
| Spider Cave | 5/13/2020 | COA | | | | | 4 | | | | 17 | | | | | | | | | | 1 | | 6 | | | | *Cambala speobia* (4)<br>Pseudoscorpionida (1) |
| Stark's North Mine Cave | 11/9/2019 | TC | | | | | | | | | | | | | | | | | | | | | | | | | *Perimyotis subflavus* (9) |
| Stark's North Mine Cave | 6/3/2019 | TC | | | | | | | | | | | | | | | 4 | | | | | | | | | | |
| Stovepipe Cave | 1/17/2020 | COA | 2 | | | 6 | | 34 | | | 6 | | | | | | | | | | | 2 | 79 | | | | *Cambala speobia* (83)<br>*Tartarocreagris attenuata* (1)<br>Trichoniscidae (6) |
| Stovepipe Cave | 8/13/2020 | COA | 3 | | | 2 | | 32 | | | 5 | 3 | | | | | | | | | | 22 | | | | | *Cambala speobia* (89)<br>*Tartarocreagris attenuate* (3)<br>Trichoniscidae (11) |
| Talus Springs Cave | 8/12/2020 | TC | | | | | | | | | | | | | | | | | | | 1 | | | | | | *Texoreddellia* sp. (2) |
| Tardus Hole | 11/20/2019 | TC | | | | | | | | | | | | | | | | | | | | | | | | | |
| Testudo Tube Cave | 1/23/2020 | COA | | | | | | | | | | | | | 8 | | | | | 39 | | 5 | | | | | *Batrisodes* sp. (2)<br>*Cambala speobia* (148)<br>*Eurycea tonkawae* (17)<br>*Stygobromus* sp. (25)<br>Trichoniscidae (3) |
| Testudo Tube Cave | 8/5/2020 | COA | | | | | | | | | | | | 1 | 16 | | | | | 9 | 11 | 8 | | | | | *Batrisodes* sp. (1)<br>*Eurycea tonkawae* (17)<br>*Stygobromus russelli* (16) |
| Tooth Cave | 11/19/2019 | TC | | 4 | 6 | 1 | | 42 | | | 81 | 3 | | | | | | | | | | | 8 | | | | *Cambala speobia* (42)<br>*Perimyotis subflavus* (3)<br>*Texoreddellia* sp. (1)<br>Trichoniscidae (1) |
| Tooth Cave | 6/3/2020 | TC | | | 2 | | | 33 | | | 37 | 1 | | | | | | | | | | | 7 | | | | *Batrisodes* sp. (1)<br>*Cambala speobia* (15)<br>*Texoreddellia* sp. (5) |
| Two Trunks Cave | 2/18/2020 | TC | | | | | | | | | 3 | | | | | | | | | | 2 | | | | | | *Cambala speobia* (2) |
| Weldon Cave | 2/25/2020 | TC | | | | | | 1 | | | | | | 1 | | | | | | 2 | | | | | | | *Cambala speobia* (7)<br>*Perimyotis subflavus* (3) |
| Weldon Cave | 8/19/2020 | TC | | | | | | | | | | | | 1 | | | | | | 11 | 1 | | 1 | | | | *Cambala speobia* (11)<br>*Perimyotis subflavus* (3) |
| Whirlpool Cave | 1/27/2020 | TC/COA | | | | | | | | 4 | | | | | | | | | | | 1 | | | | | | *Batrisodes* sp. (1) |
| Whirlpool Cave | 8/19/2020 | TC/COA | | | | | | | | 23 | | | 2 | | | | | | | | | | | | | | *Batrisodes* sp. (1)<br>Pseudoscorpionida (1)<br>*Tayshaneta sandersi* (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** |
| Y2Cave | 3/4/2020 | COA | | | | | | | | 1 | | | | | | | | | | | | | | | | | *Cambala speobia* (15)<br>Pseudoscorpionida (2) |

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

[2] Surveyors in FY20 include: Samuel Berg, Cristina Campbell, Travis Clark, Paul Fushille, Devin Grobert, Darrell Hutchinson, David Morgan, Julie Murray, Mark Sanders, Nancy Sandoval, Johnny Scalise, Blake Sissel, Colin Strickland, and Drew Thompson

# EXHIBIT B:

# CAVE CRICKET EXIT COUNT DATA REPORTS

# FY20 COA/TC CAVE CRICKET EXIT COUNT DATA REPORTS

| Surveyed Caves | Fall 2019 (November/ December) | | | | Winter 2020 (January/February) | | | | Spring 2020 (May/ June) | | | | Summer 2020 (August/ September) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N: | J: | A: | TI: | N: | J: | A: | TI: | N: | J: | A: | TI: | N: | J: | A: | TI: |
| Adobe Springs Cave | 0 | 4 | 39 | 43 | | | | | NA | NA | NA | NA | | | | |
| Airman's Cave | | | | | 23 | 2 | 0 | 25 | | | | | 304 | 123 | 64 | 491 |
| Black-cap Cave | | | | | | | | | | | | | 7 | 7 | 265 | 279 |
| Broken Arrow Cave | 62 | 68 | 78 | 208 | | | | | 143 | 88 | 356 | 587 | | | | |
| Cave Y | | | | | 24 | 54 | 123 | 201 | | | | | 199 | 169 | 110 | 478 |
| Cold Cave | | | | | 1290 | 916 | 21 | 2227 | | | | | 1638 | 822 | 2040 | 4500 |
| Cortana Cave | | | | | 5 | 15 | 20 | 40 | | | | | 25 | 26 | 360 | 411 |
| Cotterell Cave | | | | | 592 | 274 | 107 | 973 | | | | | 1821 | 395 | 242 | 2458 |
| District Park Cave | 92 | 109 | 203 | 404 | | | | | 176 | 443 | 154 | 773 | | | | |
| Flint Ridge Cave | 15 | 0 | 0 | 15 | | | | | 20 | 57 | 296 | 373 | | | | |
| Gallifer Cave | | | | | 13 | 0 | 0 | 13 | | | | | 14 | 23 | 335 | 372 |
| Get Down Cave | NA | NA | NA | NA | | | | | 283 | 124 | 207 | 614 | | | | |
| Geode Cave | | | | | 0 | 1 | 0 | 1 | | | | | 74 | 104 | 34 | 212 |
| Jest John Cave | | | | | | | | | | | | | 209 | 225 | 72 | 506 |
| Jester Estates Cave | 231 | 286 | 490 | 1007 | | | | | 1584 | 169 | 63 | 1816 | | | | |
| Kretschmarr Cave | 42 | 15 | 50 | 107 | | | | | 35 | 298 | 429 | 762 | | | | |
| Little Bee Creek Cave | 2 | 1 | 1 | 4 | | | | | 0 | 0 | 45 | 45 | | | | |
| Lost Oasis Cave | NA | NA | NA | NA | | | | | 347 | 122 | 133 | 602 | | | | |
| Maple Run Cave | | | | | 295 | 146 | 61 | 502 | | | | | 84 | 17 | 22 | 123 |
| Midnight Cave | | | | | 3304 | 2778 | 1151 | 7233 | | | | | 1452 | 1446 | 3831 | 6729 |
| New Comanche Trail Cave | | | | | | | | | | | | | 19 | 1052 | 473 | 1544 |
| No Rent Cave | | | | | 101 | 121 | 0 | 222 | | | | | 62 | 51 | 8 | 121 |
| Pipeline Cave | 238 | 142 | 101 | 481 | | | | | 274 | 204 | 359 | 837 | | | | |
| Pond Party Pit | | | | | 4 | 8 | 6 | 18 | | | | | 100 | 73 | 274 | 447 |
| Seibert Sink | | | | | 87 | 63 | 37 | 187 | | | | | 364 | 160 | 140 | 664 |

| Surveyed Caves | Fall 2019 (November/December) | | | | Winter 2020 (January/February) | | | | Spring 2020 (May/ June) | | | | Summer 2020 (August/ September) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Spanish Wells Cave** | | | | | 30 | 23 | 0 | 53 | | | | | 921 | 1295 | 604 | 1991 |
| **Spider Cave** | 17 | 46 | 64 | 127 | | | | | 53 | 28 | 56 | 137 | | | | |
| **Stark's North Mine** | 1 | 1 | 3 | 5 | | | | | 1 | 27 | 209 | 233 | | | | |
| **Stovepipe Cave** | | | | | 112 | 51 | 37 | 200 | | | | | 114 | 25 | 137 | 276 |
| **Testudo Tube** | | | | | 104 | 239 | 104 | 447 | | | | | 10 | 25 | 557 | 592 |
| **Tooth Cave** | 8 | 3 | 6 | 17 | | | | | 88 | 209 | 116 | 413 | | | | |
| **Weldon Cave** | | | | | 317 | 194 | 0 | 511 | | | | | 654 | 30 | 152 | 837 |
| **Whirlpool Cave** | | | | | NA | NA | NA | NA | | | | | 1452 | 559 | 1407 | 3418 |

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