Cave Drip Monitoring
Under the Tabor Water Quality Management Area
FY 2018 Report



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For the City of Austin - Austin Water Utility - Wildland Conservation Division

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Cover Photo: Within the Jupiter Chamber of Tabor Crevice Cave there are numerous tubular stalactites, commonly called soda straws. This one shows fine calcite crystal growths feathering into the water droplet. This is likely the result of a slow drip rate into a cave atmosphere with slightly elevated Co2 levels.



A water droplet about to drip off of the stalactite that is the Drip Pit station.

Introduction

This report is an update to the status of ongoing cave drip monitoring activities under the Tabor Water Quality Management Area. It also includes a written summary of my observations following Hurricane Harvey.

In all we attempted automated drip measurements at 11 sites in three caves under the Tabor WQPL Tract. Our efforts produced 203,345 new drip rate measurements. Overall we had good success during the past year, however the harsh cave environment continues to present challenges to our equipment.

Two deployments saw our first year using the newly released Onset HOBO USB Micro Station Data Logger H21-USB. Our trial run indicates these are more waterproof than their predecessor, as two of these units survived inside Flint Ridge cave throughout the Hurricane Harvey recharge event. Had the old model micro stations still been in place I would have expected them to be swamped.

The Onset HOBO Pendant Event Data Logger UA-003-64 continues to be reliable in terms of waterproof and durability, though limited in memory capacity.

Moving Forward, since we've had good results with the new Onset HOBO USB Micro Station Data Logger H21-USB, we will be changing the dataloggers at the three sites where the memory capacity of the Onset HOBO Pendant Event Data Logger UA-003-64 could be insufficient. This would be Balcony Room Drip, Cheese and Chocolate Drip, and Drip above Dunvegan Pool.



Cave Specialist Peter "Dash" Gott moving through Breakdown Room Crawl

Balcony Room Drips

34,710 drip rate measurements
Good data collected 10/1/2017 through 9/2/2017 and 9/16/2017 through 9/27/2018

From 9/2/2017 to 9/16/2017 we suffered a data gap due to data logger failure/memory full.

Station is currently deployed and operational. The current configuration is an isco 674 tipper connected to an Onset HOBO Pendant Event Data Logger UA-003-64.



Balcony Joint

35,025 drip rate measurements
Good data collected all year.

Station is currently deployed and operational. The current configuration is a RainWise tipper connected to an Onset HOBO Pendant Event Data Logger UA-003-64



Cave Specialist Dylan Beeler cleaning the drip collection tarp at Balcony Joint.

Fondue Drip

16,962 drip rate measurements
Good data collected 10/1//2017 through 04/24/2018. A brief snapshots of good data was collected 7/14/18 through 7/20/18.

Datalogger failures appeared to be due to corrosion on the circuit board.

Station is currently deployed and operational. The current configuration is a RainWise tipper connected to an Onset HOBO Pendant Event Data Logger UA-003-64



Cave Specialist Justin Shaw downloading data at Fondue Drip.

Cheese and Chocolate Drip

8,744 drip rate measurements
Good data collected 10/1/2017 through 01/09/2018 and 03/29/2018 through 04/24/2018

From 01/09/2018 to 03/29/2018 we suffered a data gap due to data logger failure/memory full.

From 4/24/2018 onward we suffered a data gap due to tipper failure.

Station is currently offline. Station was configured as an isco 674 tipper connected to an Onset HOBO Pendant Event Data Logger UA-003-64

A new tipper and datalogger will soon be installed. Station will be redeployed as a RainWise Tipper connected to a Onset HOBO USB Micro Station Data Logger H21-USB



Cave Specialist Kevin Walsh inspecting Cheese and Chocolate Drip.

Fault Dome

36,184 drip rate measurements
Good data collected all year.

This marked the first year of using the recently released Onset HOBO USB Micro Station Data Logger H21-USB. First installed on 9/16/2017, this unit survived in the cave through the Hurricane Harvey recharge event, an encouraging demonstration of durability.

Station is currently deployed and operational. The current configuration is an Onset RG3 tipper connected to an Onset HOBO USB Micro Station Data Logger H21-USB

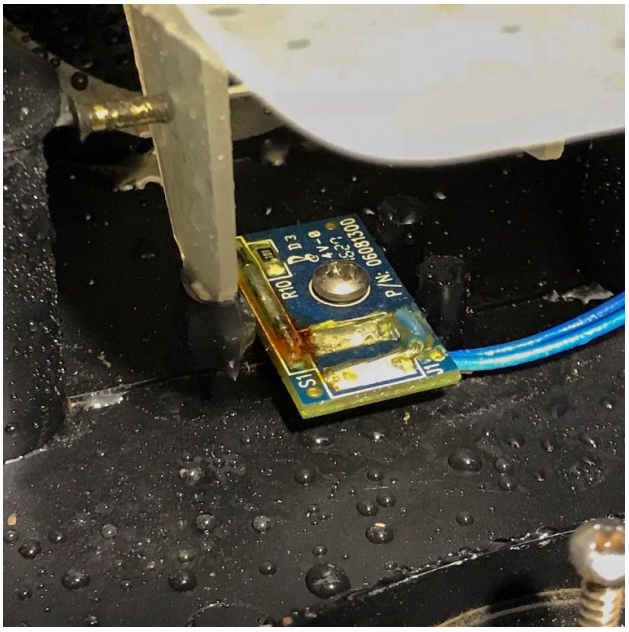


Drip Pit

15,259 drip rate measurements
Good data collected 4/25/2018 through 9/30/2018

This station continues to be the most difficult station to maintain. We deployed a new data logger on 9/16/2017 and it stopped recording tips just over a day later. Troubleshooting revealed an obviously “fried” circuit board on the tipper gauge. The datalogger itself survived in the cave through the Hurricane Harvey recharge event, an encouraging demonstration of durability. On 4/24/2018 we installed new Rain Wise tipper and new pulse adapter.

Currently deployed and operational. Current configuration is a Rain Wise tipper connected to an Onset HOBO USB Micro Station Data Logger H21-USB



The “fried” circuit board from inside the tipper gauge at Drip Pit.



Cave Specialist Kevin Walsh inspects the Drip Pit station

Zeus' Finger

2,721 drip rate measurements
Good data collected 4/27/2018 to 5/11/2018

Datalogger failure was due to an undetermined cause. All stations in Tabor Crevice Cave are connected to the same datalogger, as such the following also applies to Jupiter Drips and Sparkles Infeeder.

Tabor Crevice Cave has become significantly more difficult to access since the construction of HW-45-SW has begun. This problem can be overcome by accessing the Tabor WQMA from the Bliss Spiller gate. Access includes a rough hike without a trail.

Accessing the cave was further complicated because the cave had become home to an aggressive porcupine, which prevented entry on first encounter. This problem could be overcome by visiting the cave at night when porcupine leaves the cave to forage. During our last visit it appeared porcupine is no longer using the cave. We observed newly deposited silt remained undisturbed through the section of cave previously identified as the porcupine bedding area. The procupine latrine had no recent scat.

Unfortunately these access complication resulted in fewer monitoring trips, and as such a datlogger failure was not discovered for 7 months.

Station is currently deployed and operational. The current configuration is a Rain Wise tipper connected to an Onset HOBO USB Micro Station Data Logger H21-USB (all stations in Tabor Crevice are sharing the same datalogger)



Zeus’ Finger station.

Jupiter Drips

2,715 drip rate measurements
Good data collected 4/27/2018 to 5/11/2018

All the stations in Tabor Crevice Cave are connected to the same datalogger, as such the above details for Zeus' Finger also apply to Jupiter Drips.

Station is currently deployed and operational. The current configuration is a Rain Wise tipper connected to an Onset HOBO USB Micro Station Data Logger H21-USB (all stations in Tabor Crevice are sharing the same datalogger)



Sparkles Infeeder

1,349 drip rate measurements
Good data collected 4/27/2018 to 5/11/2018

All the stations in Tabor Crevice Cave are connected to the same datalogger, as such the above details for Zeus' Finger also apply to Sparkles Infeeder.

(There was a significant event recorded just before the beginning of FY2018 which is detailed here despite not being included in the above statistics for the number of measurements recorded during FY2018.) This site is normally observed dry, however clues indicate it responds to rain events and it had occasionally been seen flowing immediately following a rain event. Automated drip rate measurements began at this station in May of 2017 and recorded zero tips until the Hurricane Harvey recharge event moved through the cave. The drip began flowing on 8/28/2017 at 17:30 and by 8/30/2017 at 15:45 over 241 liters of water had flowed through the tipper. Unfortunately, at this point the Onset HOBO Pendant Event Data Logger UA-003-64 failed due to memory full. This station has since been wired into the Onset HOBO USB Micro Station Data Logger H21-USB which is shared by all stations in Tabor Crevice Cave.

Station is currently deployed and operational. The current configuration is a Rain Wise tipper connected to an Onset HOBO USB Micro Station Data Logger H21-USB (all stations in Tabor Crevice are sharing the same datalogger)



Extra care is taken when servicing Sparkles Infeeder, as it feeds an area of cave pearls.



The area just below Sparkles Infeeder is characterized by numerous microtravertine pools filled with cave pearls. This area of Cave Pearls is the only occurrence of Cave Pearls in Travis County that I know of. This area is almost always dry, however the presence of this rare speleothem in pristine condition within it's given context was a good clue that the Sparkles Infeeder would be an actively dripping formation area following rain events.



Close up of dry cave pearls in microtravertine.

Drip Above Dunvegan Pool

14,640 drip rate measurements
Good data collected 4/10/2018 through 9/9/2018

(There was a significant event recorded just before the beginning of FY2018 which is detailed here despite not being included in the above statistics for the number of measurements recorded during FY2018.) This site is normally observed dry, however clues indicate it responds to rain events and it had occasionally been seen flowing immediately following a rain event. Automated drip rate measurements began at this station in May of 2017 and recorded zero tips until the Hurricane Harvey recharge event moved through the cave. The drip began flowing on 8/26/2017 at 08:30 and by 21:45 nearly 289 liters of water had flowed through the tipper. Unfortunately, at this point the Onset HOBO Pendant Event Data Logger UA-003-64 failed due to memory full.

A rain event on 9/9/2018 also generated a single pulse that overwhelmed the Onset HOBO Pendant Event Data Logger UA-003-64, therefore we upgraded to an Onset HOBO USB Micro Station Data Logger H21-USB.

Station is currently deployed and operational. The current configuration is a RainWise tipper connected to an Onset HOBO USB Micro Station Data Logger H21-USB



Dunvegan Drip

35,036 drip rate measurements
Good data collected all year.

Station is currently deployed and operational. The current configuration is an Onset RG3 tipper connected to an Onset HOBO Pendant Event Data Logger UA-003-64





Cave Specialist Dylan Beeler inside the main chamber of Dunvegan Dungeon.

Hurricane Harvey (appendix A)

While this event occurred outside of FY2018, it was near to the end of FY2017 and as such my written account was not prepared in time for that years annual reporting. It has therefore been included here.

August of 2017 closed out with much of Texas being saturated by Hurricane Harvey. While the Austin area was spared the brunt of the storm, NOAA reports a rainfall event total of 9.49 inches at a weather station .55 miles from the entrance to Flint Ridge Cave. (Tanglewood Forest 2.2 SW, TX-TV-229, 30.155918 -97.868332; Source: https://www.nhc.noaa.gov/data/tcr/supplemental/harvey_rain.xlsx)

An interesting observation to emerge from a review of the automated drip data, is that Balcony Joint did not respond to Hurricane Harvey. Historically this station shows a response to rain events of 3 inches or more.

The first trip into the cave following Hurricane Harvey was on September 16, 2017 and consisted of Cave Specialist Kevin Walsh and myself.

Counting since this ongoing monitoring bagin as part of the recent hydrogeo study in 2014, this trip was my 119th work trip into Flint Ridge Cave; so I am very familiar with the cave and have seen it after many rain events, some even larger than Harvey. Combining the sheer quantity of experience in this cave with a photographic memory and I'm capable of making a thorough assessment of any changes to the cave. This was Walsh's 7th work trip into the cave, so he too was somewhat familiar with the cave.

The entrance of the cave had further destabilized, however this is regularly seen after large rain events as the entrance of Flint Ridge Cave currently consists of a route dug through anthropogenic fill material. Consensus between myself and 4 other cave specialist is that the entrance remains safe and stable for now, however eventually further excavation / restoration will be necessary.



Cave Specialist Dylan Beeler inspects an area of anthropogenic fill, just inside the entrance to Flint Ridge Cave. Bedrock is visible above and behind him, as well as connected to the gate; all other material in the picture is fill.

As we made our way through the cave nothing was unexpected or out of the ordinary until we reached Culvert Crawl Upper Pool. This is an important study site and as such quite familiar.

Culvert Crawl Upper Pool has a bedrock floor strewn with looses limestone and chert cobbles and there is a gravel bar of the same material which separates Culvert Crawl Upper Pool from Culvert Crawl (the passage). Stabilizing the gravel bar, and composing much of the exposed east wall is a dark red clay. Everything is rock, water, or dark red clay.

Past the Culvert Crawl Upper Pool is the namesake passage; Culvert Crawl; which at first is a cave stream about two feet wide and two to four inches deep. It has always been bare exposed bedrock. During the course of the recent hydrogeo study it has been standard practice that if rocks or gravel wash into this area we have been removing them so to maintain unhindered flow of the water. Beyond this the passage makes a zig-zag and then the cave stream is characterized as being 4 to 9 inches wide and 4 to 6 inches deep, with both walls tapered creating a V shaped chanel. This channel has also been maintained as bare bedrock throughout the Hydrogeo Study, again so that the water can flow unhindered.

Culvert Crawl Lower Pool is the same channel of culvert crawl, being impounded behind a mass of rocks and red clay. This is where the autosampler drew from during the recent hydrogo study. It too has been maintained as bare bedrock throughout the study.

On September 16, 2017 I was proceeding first and upon entering the water of Culvert Crawl Upper Pool the water turned a milky white color as I disturbed an unusual sediment, which was instantly notably different from all previous trips. Having noticed this I carefully positioned myself onto the gravel bar so I could observe the Culvert Crawl before disturbing it. In Culvert Crawl the bedrock floor was covered in a thin layer of white fine silt-like material. When I disturbed the water it would billow a plume through the water that spread very rapidly. This was obviously different than the red clay or any previously observed material in the water.

Before I even had a chance to say something, Walsh commented to me that the sediment seemed new and different to him. Whatever this sediment material is, I had never previously observed it in Culvert Crawl, and neither had Walsh. This sediment material was observed just up to the zig-zag.

We returned on October 5, which is when I was able to photograph the material. By this time the material had made its way well beyond the zig-zag. On each subsequent trip it continues to move downstream. As of 7/18/2018 the sediment had reached Culver Crawl Lower Pool.

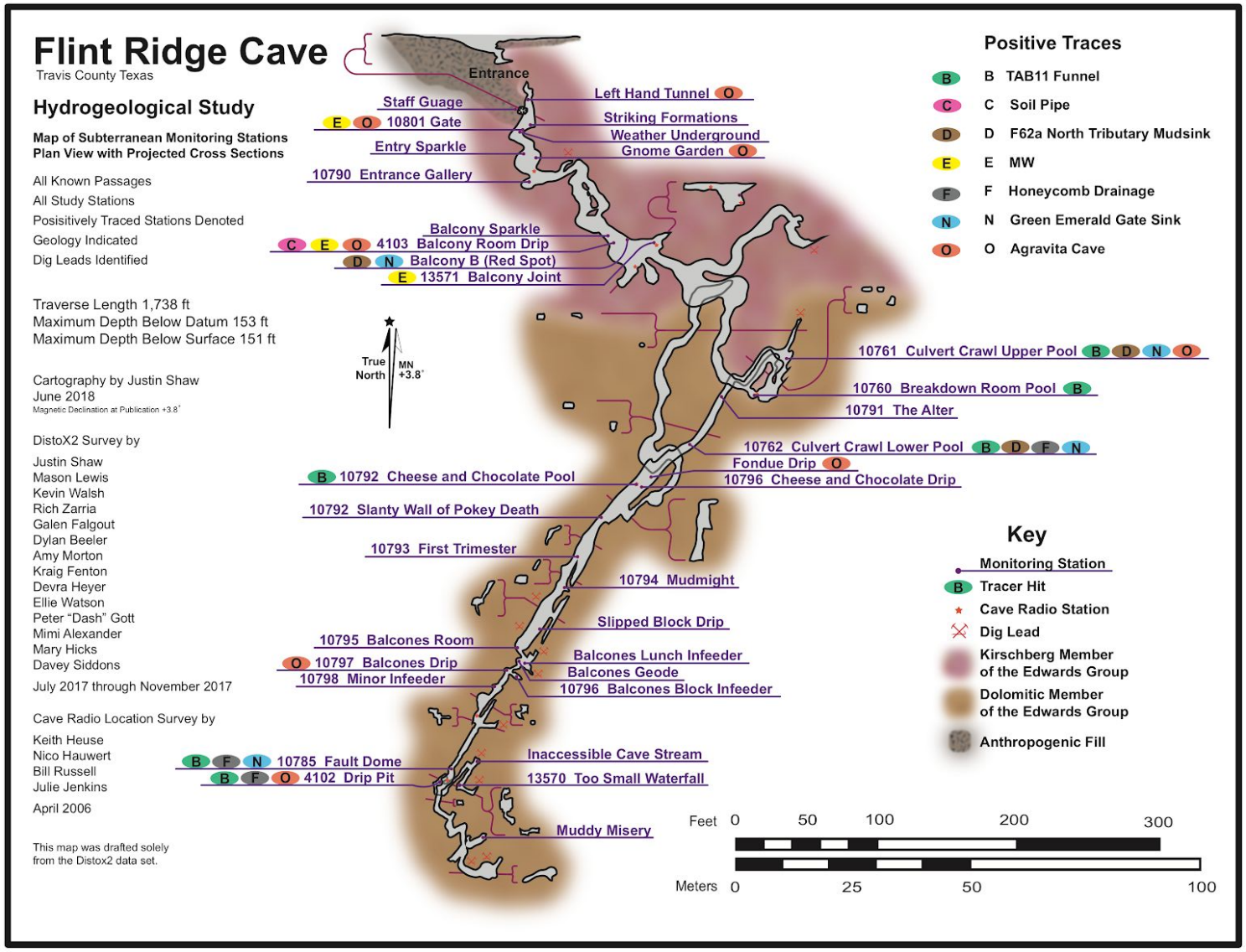
The water of Culvert Crawl Upper Pool, Culvert Crawl Passage, and Culvert Crawl Lower Pool are all prime habitat for a healthy population of Stygobromus russelli. On all trips so far I am still observing what appear to me to be normal numbers of this species. While I don’t do any formal form of biological inventory or survey, I am always observing to see if I notice a marked decline, increase, or absence of this or any other of the cave species I regularly observe.

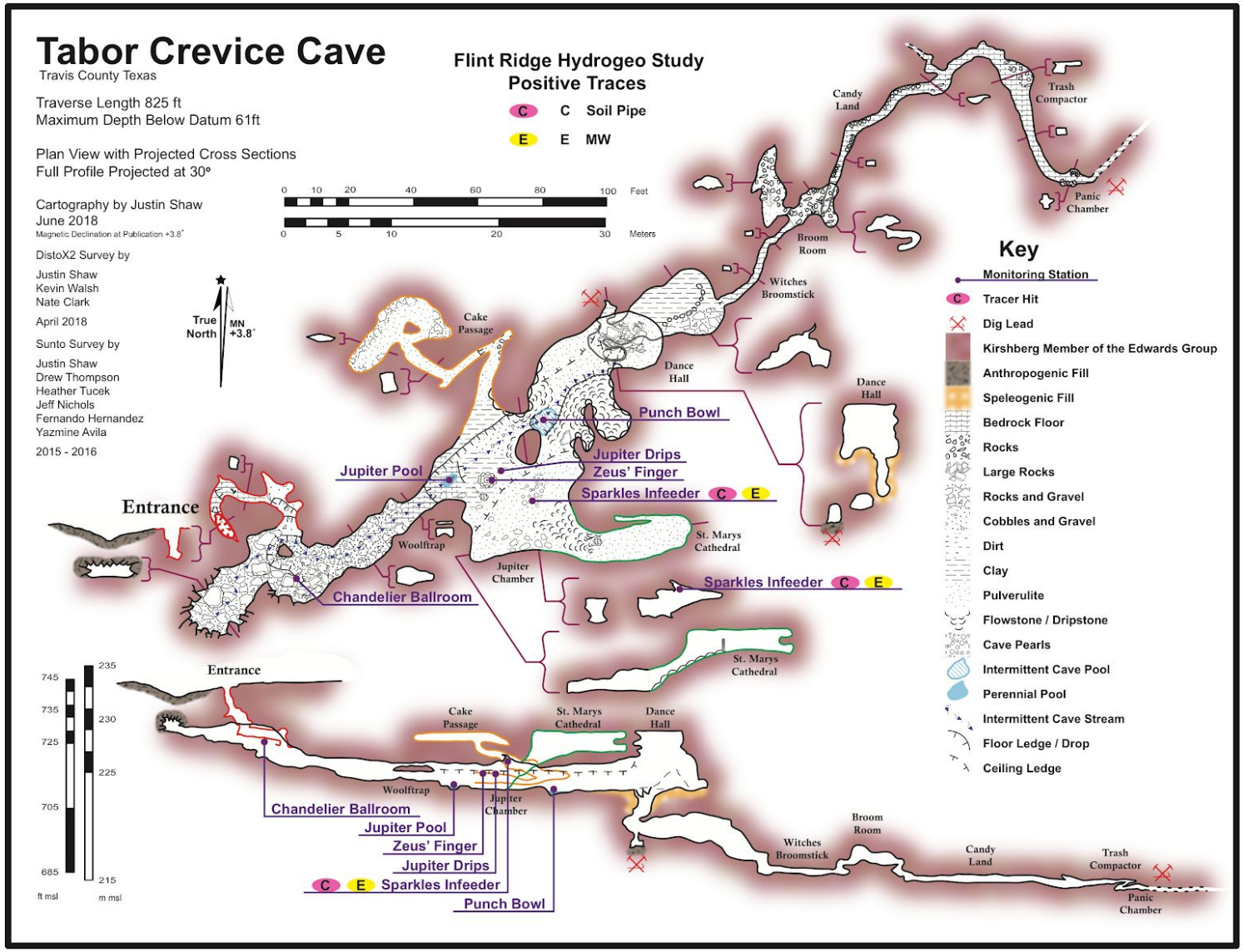


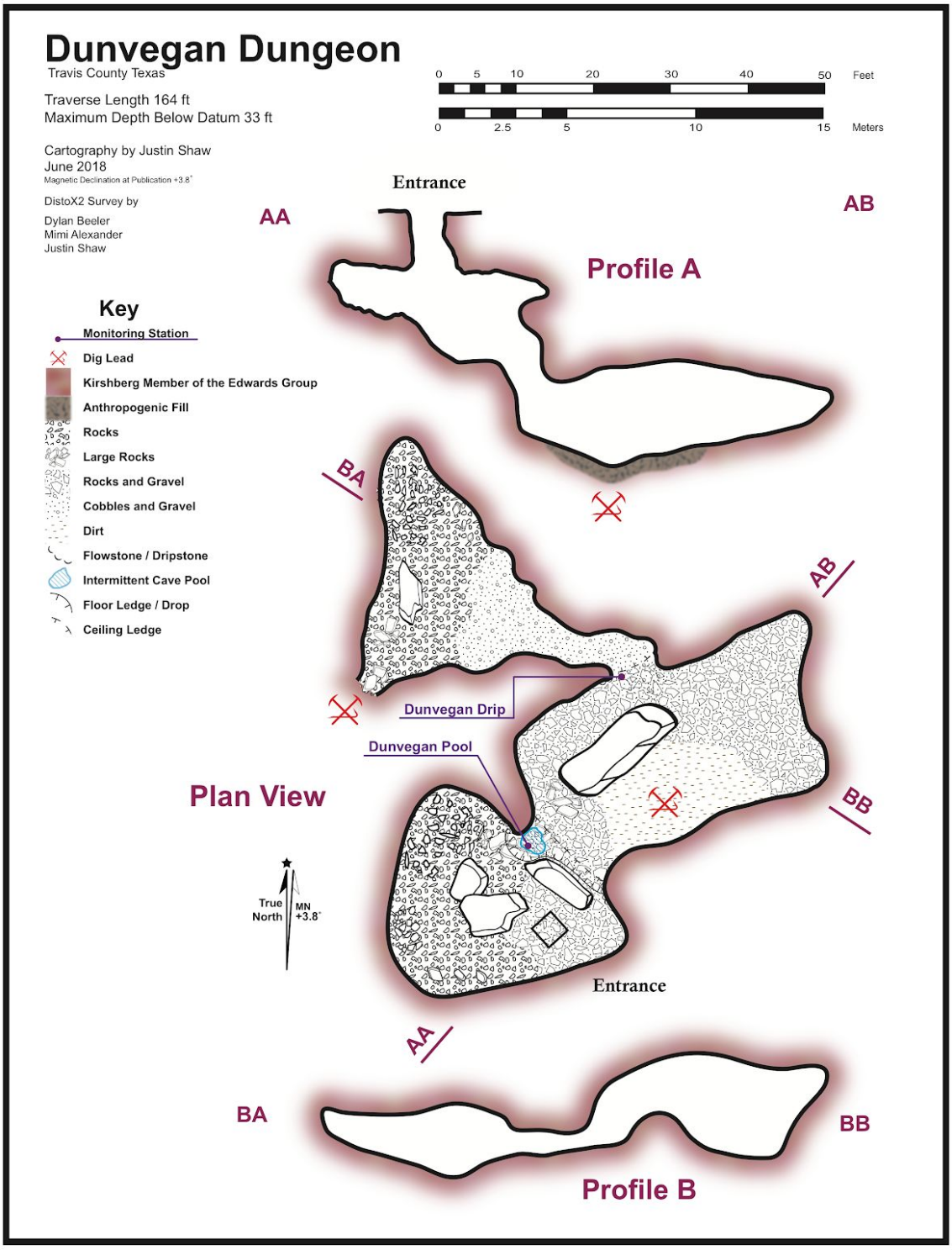
10/5/2017 Culvert Crawl with an unidentified sediment deposit. The sediment is made visibly evident in this picture by the circles seen where cave drips hit the water and create a wave which displaces the sediment revealing a small circular area of bare bedrock floor. Prior to Hurricane Harvey this section of passage floor was exposed bedrock only. Hydrogeologist Nico Hauwert is seen in the background on the gravel bar that separates Culvert Crawl Upper Pool from Culvert Crawl Passage.



Section of Culvert Crawl just beyond where the passage zig-zags. Here you can easily see the sediment deposited in the bottom of the V shaped channel. Prior to Hurricane Harvey this V shaped channel was exposed bedrock only.


Flint Ridge Cave
Travis County Texas
Hydrogeological Study
Map of Subterranean Monitoring Stations
Plan View with Projected Cross Sections
All Known Passages
All Study Stations
Posisitively Traced Stations Denoted
Geology Indicated
Dig Leads Identified
Traverse Length 1,738 ft
Maximum Depth Below Datum 153 ft
Maximum Depth Below Surface 151 ft
Cartography by Justin Shaw
June 2018
Magnetic Declination at Publication +3.8°
DistoX2 Survey by
Justin Shaw
Mason Lewis
Kevin Walsh
Rich Zarria
Galen Falgout
Dylan Beeler
Amy Morton
Kraig Fenton
Devra Heyer
Ellie Watson
Peter "Dash" Gott
Mimi Alexander
Mary Hicks
Davey Siddons
July 2017 through November 2017
Cave Radio Location Survey by
Keith Heuse
Nico Hauwert
Bill Russell
Julie Jenkins
April 2006
This map was drafted solely from the Distox2 data set.
Entrance
Staff Guage
E O 10801 Gate
Entry Sparkle
10790 Entrance Gallery
Left Hand Tunnel O
Striking Formations
Weather Underground
Gnome Garden O
Balcony Sparkle
C E O 4103 Balcony Room Drip
D N Balcony B (Red Spot)
E 13571 Balcony Joint
True North
MN +3.8°
10761 Culvert Crawl Upper Pool B D N O
10760 Breakdown Room Pool B
10791 The Alter
10762 Culvert Crawl Lower Pool B D F N
Fondue Drip O
B 10792 Cheese and Chocolate Pool
10796 Cheese and Chocolate Drip
10792 Slanty Wall of Pokey Death
10793 First Trimester
10794 Mudmight
Slipped Block Drip
10795 Balcones Room
O 10797 Balcones Drip
10798 Minor Infeeder
Balcones Lunch Infeeder
Balcones Geode
10796 Balcones Block Infeeder
B F N 10785 Fault Dome
B F O 4102 Drip Pit
Inaccessible Cave Stream
13570 Too Small Waterfall
Muddy Misery
Positive Traces
B B TAB11 Funnel
C C Soil Pipe
D D F62a North Tributary Mudsink
E E MW
F F Honeycomb Drainage
N N Green Emerald Gate Sink
O O Agravita Cave
Key
Monitoring Station
B Tracer Hit
Cave Radio Station
Dig Lead
Kirschberg Member of the Edwards Group
Dolomitic Member of the Edwards Group
Anthropogenic Fill
Feet 0 50 100 200 300
Meters 0 25 50 100


Tabor Crevice Cave
Travis County Texas
Traverse Length 825 ft
Maximum Depth Below Datum 61ft
Plan View with Projected Cross Sections
Full Profile Projected at 30°
Cartography by Justin Shaw
June 2018
Magnetic Declination at Publication +3.8°
DistoX2 Survey by
Justin Shaw
Kevin Walsh
Nate Clark
April 2018
Sunto Survey by
Justin Shaw
Drew Thompson
Heather Tucek
Jeff Nichols
Fernando Hernandez
Yazmine Avila
2015 - 2016
Flint Ridge Hydrogeo Study
Positive Traces
C C Soil Pipe
E E MW
0 10 20 40 60 80 100 Feet
0 5 10 20 30 Meters
True North MN +3.8°
Key
Monitoring Station
Tracer Hit
Dig Lead
Kirshberg Member of the Edwards Group
Anthropogenic Fill
Speleogenic Fill
Bedrock Floor
Rocks
Large Rocks
Rocks and Gravel
Cobbles and Gravel
Dirt
Clay
Pulverulite
Flowstone / Dripstone
Cave Pearls
Intermittent Cave Pool
Perennial Pool
Intermittent Cave Stream
Floor Ledge / Drop
Ceiling Ledge
Entrance
Cake Passage
Dance Hall
Punch Bowl
Jupiter Drips
Zeus' Finger
Jupiter Pool
Sparkles Infeeder C E
Woolftrap
Jupiter Chamber
St. Marys Cathedral
Chandelier Ballroom
Witches Broomstick
Broom Room
Candy Land
Trash Compactor
Panic Chamber
745
735
725
705
685
ft msl
235
230
225
215
m msl


Dunvegan Dungeon
Travis County Texas
Traverse Length 164 ft
Maximum Depth Below Datum 33 ft
Cartography by Justin Shaw
June 2018
Magnetic Declination at Publication +3.8°
DistoX2 Survey by
Dylan Beeler
Mimi Alexander
Justin Shaw
0 5 10 20 30 40 50 Feet
0 2.5 5 10 15 Meters
Key
Monitoring Station
Dig Lead
Kirshberg Member of the Edwards Group
Anthropogenic Fill
Rocks
Large Rocks
Rocks and Gravel
Cobbles and Gravel
Dirt
Flowstone / Dripstone
Intermittent Cave Pool
Floor Ledge / Drop
Ceiling Ledge
Entrance
AA
AB
Profile A
BA
AB
Dunvegan Drip
Dunvegan Pool
Plan View
BB
True North
MN +3.8°
Entrance
AA
BA
BB
Profile B