



MEMORANDUM

TO: Chad Furl, Kristy Kollaus
 FROM: Ed Oborny (BIO-WEST)
 DATE: **September 1, 2023**
 SUBJECT: EA HCP Critical Period Habitat Evaluations – Comal System

Habitat Evaluations (100 to 80 cfs, 70 cfs, 60 cfs)

COMAL SYSTEM:

The Spring 2023 Comprehensive Biological Monitoring effort for the Comal System was completed in May 2023. That monitoring event doubled for the 150 cfs full Critical Period monitoring trip since total system discharge during that routine monitoring ranged from approximately 130 cfs to 150 cfs. Mid-May rains and resulting recharge increased total system daily discharge to over 200 cfs briefly towards the end of May. However, subsequent hot and dry conditions has led to total system discharge steadily declining this summer. The under 100 cfs full Critical Period monitoring event was triggered in mid-July which incorporated the 100 to 80 cfs habitat evaluation. Subsequently, the 70 cfs habitat evaluation was conducted on August 10th and the 60 cfs habitat evaluation was conducted on August 21st. All activities associated with Comal Critical Period Biological Monitoring < 100 cfs event have been completed as shown below:

- Aquatic vegetation mapping of the four (Upper Spring Run, Landa Lake, Old Channel, and upper New Channel) study reaches.
- Comal Salamander surveys (Spring Run 1, Spring Run 3, and Spring Island).
- Comal Springs discharge measurements
- Landa Lake Flow partitioning measurements
- Thermister downloads and zebra mussel lure assessment.
- Fixed-station photography.
- Fountain Darter presence/absence and timed dip netting.
- Fountain Darter drop netting in the four study reaches.
- Fountain Darter visual surveys in Landa Lake.
- Comal Springs Riffle Beetle cotton lure sampling (Spring Run 3, Western Shoreline, and Spring Island).
- Suite I and II water quality sampling
- Fish Community sampling via SCUBA and seine.

Additionally, all continued activities associated with Critical Period biological monitoring (**Task 2**) and low-flow monitoring (**Task 3**) have been completed through August. This memorandum highlights habitat conditions this summer in the Comal system. Figure 1 shows the total system discharge at the USGS Comal gage over the past 30 days. As of September 1st, J-17 aquifer conditions are reported as 628.5 (see image to right).

Area Index	Today	Yesterday	Ten Day
Bexar (J-17)	628.5	628.8	628.7
Uvalde (J-27)	841.2	841.2	841.2
Comal Springs	68	69	67
San Marcos	69	69	68

Provisional Daily water readings as of 9:00 AM
 Last Updated on September 1 2023

Comal Rv at New Braunfels, TX - 08169000

August 2, 2023 - September 1, 2023

Discharge, cubic feet per second

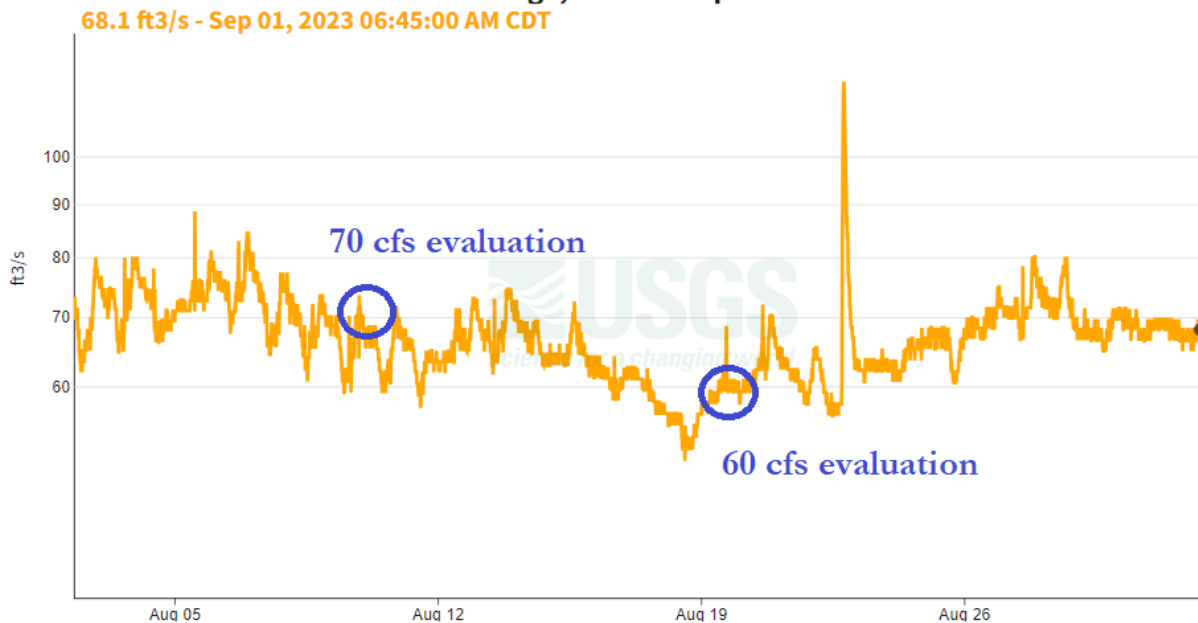


Figure 1: Total system discharge over the past 30 days at USGS gage on the Comal River.

Key ecological information regarding study reaches and full-system sampling are included herein relative to the July Critical Period and low-flow monitoring for comparison. Water temperature is a key component system-wide as it supports spring-related aquatic assemblages. Recent one-month trends in water temperature (°C) for August Critical Periods were assessed using temperature data loggers (HOBO Tidbit v2 Temp Loggers) at 11 permanent monitoring stations in the Comal Springs/River. Data for each monitoring station are based on 10-minute intervals and dates for recent trends extended from the last day that each data logger was downloaded to the first of the month. One-month trends were examined from 8/1 – 8/30 (n = 30 days) for all stations except Blieders Creek (8/15-8/30; n = 16 days). At all stations, data were compared to long-term water temperature data measured at 4-hour intervals in August from 2001 – 2022 or to the greatest temporal extent available. For analysis, one-month trends were compared to long-term data using boxplots to visualize differences in central tendency (i.e., median) and variation (e.g., interquartile range). Results are provided in Table 1 and graphically depicted in Figure 2. Overall, it is evident that lower than average discharge coupled with summer time conditions this August created elevated water temperatures in Blieders Creek and Heidelberg in the Upper Spring Run and at locations further downstream from the spring flow orifices (Figure 2).

Table 1. Summary of boxplot descriptive statistics comparing recent one-month and long-term trends in water temperature (°C) at 11 monitoring stations in the Comal Springs/River for the month of August.

Station	Period	Lower Whisker	Lower Box	Median	Upper Box	Upper Whisker	Interquartile Range
Blieders	1-month	27.46	29.07	29.59	30.14	31.05	1.08
Blieders	Long-term	22.86	25.74	26.98	28.35	31.69	2.60
Heidelberg	1-month	23.83	25.99	27.51	28.52	30.65	2.53
Heidelberg	Long-term	23.43	23.81	23.91	24.07	24.46	0.26
Booneville Near	1-month	23.83	23.86	23.88	23.93	24.03	0.07
Booneville Near	Long-term	23.28	23.52	23.63	23.69	23.94	0.17
Booneville Far	1-month	23.26	23.86	24.10	25.16	27.09	1.31
Booneville Far	Long-term	22.71	23.76	24.01	24.53	25.67	0.77
Spring Run 1	1-month	24.05	24.20	24.36	24.46	24.85	0.27
Spring Run 1	Long-term	23.42	23.57	23.67	23.74	23.99	0.17
Spring Run 2	1-month	23.62	24.00	24.12	24.27	24.65	0.27
Spring Run 2	Long-term	23.37	23.52	23.55	23.62	23.76	0.10
Spring Run 3	1-month	23.47	23.53	23.59	23.67	23.86	0.14
Spring Run 3	Long-term	23.43	23.48	23.50	23.52	23.57	0.04
Old Channel	1-month	23.40	24.22	24.94	26.30	27.95	2.09
Old Channel	Long-term	22.97	23.98	24.36	25.16	26.89	1.18
New Channel Upstream	1-month	23.74	24.77	25.72	26.89	29.89	2.12
New Channel Upstream	Long-term	22.99	23.81	24.15	24.85	26.40	1.04
New Channel Downstream	1-month	23.62	25.07	25.96	26.89	27.63	1.83
New Channel Downstream	Long-term	22.99	24.29	24.92	25.75	27.92	1.46
The Other Place	1-month	24.41	26.09	26.84	27.38	28.59	1.30
The Other Place	Long-term	23.03	24.46	25.10	25.79	27.47	1.33

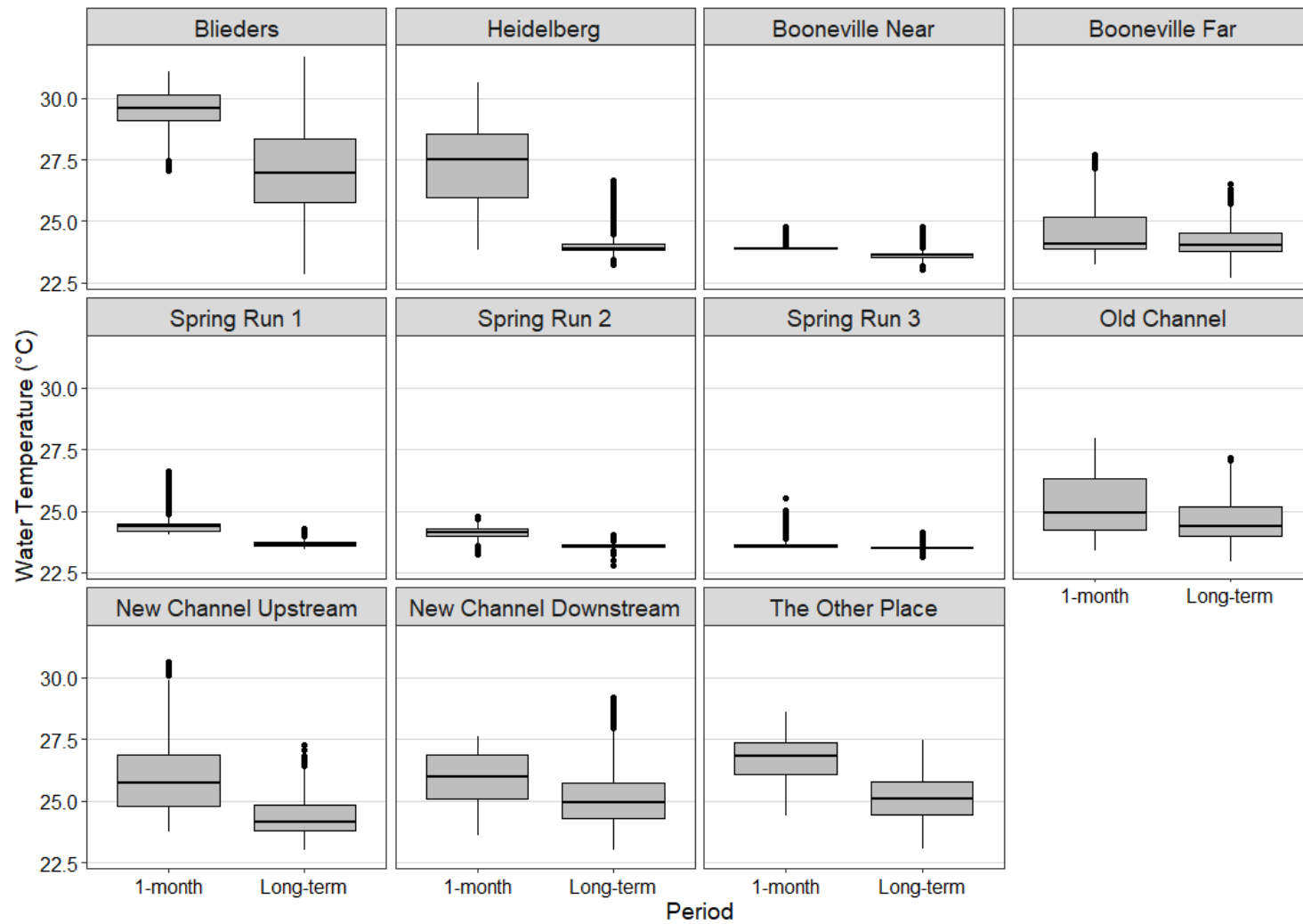


Figure 2. Boxplots comparing recent one-month and long-term water temperature trends at 11 monitoring stations from Blieders to The Other Place for the month of August. The thick horizontal line in each box is the median and the upper/lower bounds of each box represents the interquartile range. Whiskers represent minimum/maximum values up to 1.5 times the interquartile range, and outliers beyond this are designated with solid black circles.

From Spring through August 2023, the five Comal Study reaches have varied in response to aquatic vegetation coverage. The Upper Spring Run reach lost all bryophytes, but retained most *Sagittaria* and saw some increases in *Cabomba*. The Landa Lake reach exhibited a slight decline overall while the Old Channel increased in native aquatic vegetation and is the only reach at the conclusion of August that is still supporting bryophytes. The New Channel reaches experienced large declines in vegetation coverage with approximately a 90% reduction in *Cabomba*. The substrate in the new channel is highly disturbed with considerable turbidity during high recreation periods. At present, the aquatic vegetation conditions in the New Channel are worse than noted throughout the Summer of 2014. This submerged aquatic vegetation coupled with water temperature typically drives Fountain Darter habitat conditions. In the latest Fountain Darter dip net, random 50-site sampling conducted on August 30th, the presence/absence results were:

Upper Spring Run	0%
Old Channel	100%
Landa Lake	60%
New Channel	20%

Although recording 0% in the presence / absence abbreviated sampling, Fountain Darters were recorded in the Upper Spring Run reach during the July Critical Period drop netting and observed during the August 21st habitat evaluation in this reach. Landa Lake continues to support quality Fountain Darter habitat in areas, but the majority of bryophytes are gone and *Ludwigia* had started going emergent in the Three Islands area when flows were < 70 cfs. The Old Channel ERPA continues to maintain excellent Fountain Darter habitat from Landa Lake through the Old Channel LTBG reach. The New Channel reaches are showing considerable impact to Fountain Darter habitat, but darters are still occupying these areas.

Aquatic vegetation and Fountain Darter dip netting are key monitoring components as they comprise the equation / criteria for Fountain Darter refugia salvage activities described in Section 6.4.3 (**Comal Springs and River Ecosystem Adaptive Management Activities**) in the EAHCP. Those trigger conditions for the Fountain Darter in the Comal system are as follows:

- *Less than 50 percent mean aquatic vegetation (Landa Lake and Old Channel) AND less than 20 percent darter presence system-wide,*
OR
- *Less than 25 percent mean aquatic vegetation (Landa Lake and Old Channel) AND less than 30 percent darter presence system-wide.*

The results of the July and August calculations are presented below.

JULY

Approximate* percentage aquatic vegetation of mean - 95%
Percent darter abundance - 76%

AUGUST

Approximate* percentage aquatic vegetation of mean - 90%
Percent darter abundance - 66%

*Please note that the vegetation coverages used for the calculations below are draft at this time because we have not had time to polish them up for maps yet.

It is evident that both indicators have declined over the past month, but continue to be considerably above the EAHCP refugia criteria.

Comal Spring riffle beetle and Comal Springs salamander habitat throughout each species range has been reduced as water levels declined over the course of the summer. This is most exasperated in the upper reaches springs, Spring Runs 1 and 2, but also quite notable in Spring Run 3, the Western Shoreline, and around Spring Island. As of August 9th, there were abundant numbers of Comal Springs riffle beetles being supported in the system. After a 2-week recovery period, Comal Springs riffle beetle limited, low-flow sampling has been resumed. The entire Comal Springs salamander survey areas for Spring Run 1 and the spring runs on Spring Island have been dry for the entirety of August, thus no salamanders have been recorded in these areas. Comal Springs salamander sampling is occurring weekly with individuals being recorded each week in Spring Run 3 and the eastern outfall of Spring Island where wetted area permits surface area sampling. It will be imperative to track both water temperature increases and wetted area reductions in the Comal System as this drought continues into the fall.

The following pictorial habitat evaluation over the course of the late summer highlights the current Covered species habitat conditions throughout the Comal System starting at the upper springs / Blieders Creek confluence and working downstream.



Figure 3: Blieders Creek looking downstream on July 25, 2023 (~85 cfs - left), August 10 (~70 cfs - center) and August 21 (~60 cfs – right). During each event there was no visible flow with abundant green algae, emergent *Sagittaria* and floating mats of dead vegetation.



Figure 4: Upper Spring Run reach Fountain Darter habitat on July 25, 2023 (Left ~85 cfs). Inactive Greenthroat Darter with flared gills in Upper Spring Run reach observed on the substrate on August 9, 2023 (Right ~70 cfs).



Figure 5: Spring Island Eastern Outfall Covered Species Habitat on July 25, 2023 (~85 cfs – upper left), August 10 (~70 cfs – upper right) and August 21 (~60 cfs – bottom center). During each event there was exposed substrate, but active springs and bryophytes are still present in wetted areas.



Figure 6: Landa Lake deeper section condition (left) and Fountain Darter in visual transect survey (right) on July 25, 2023 (~85 cfs).

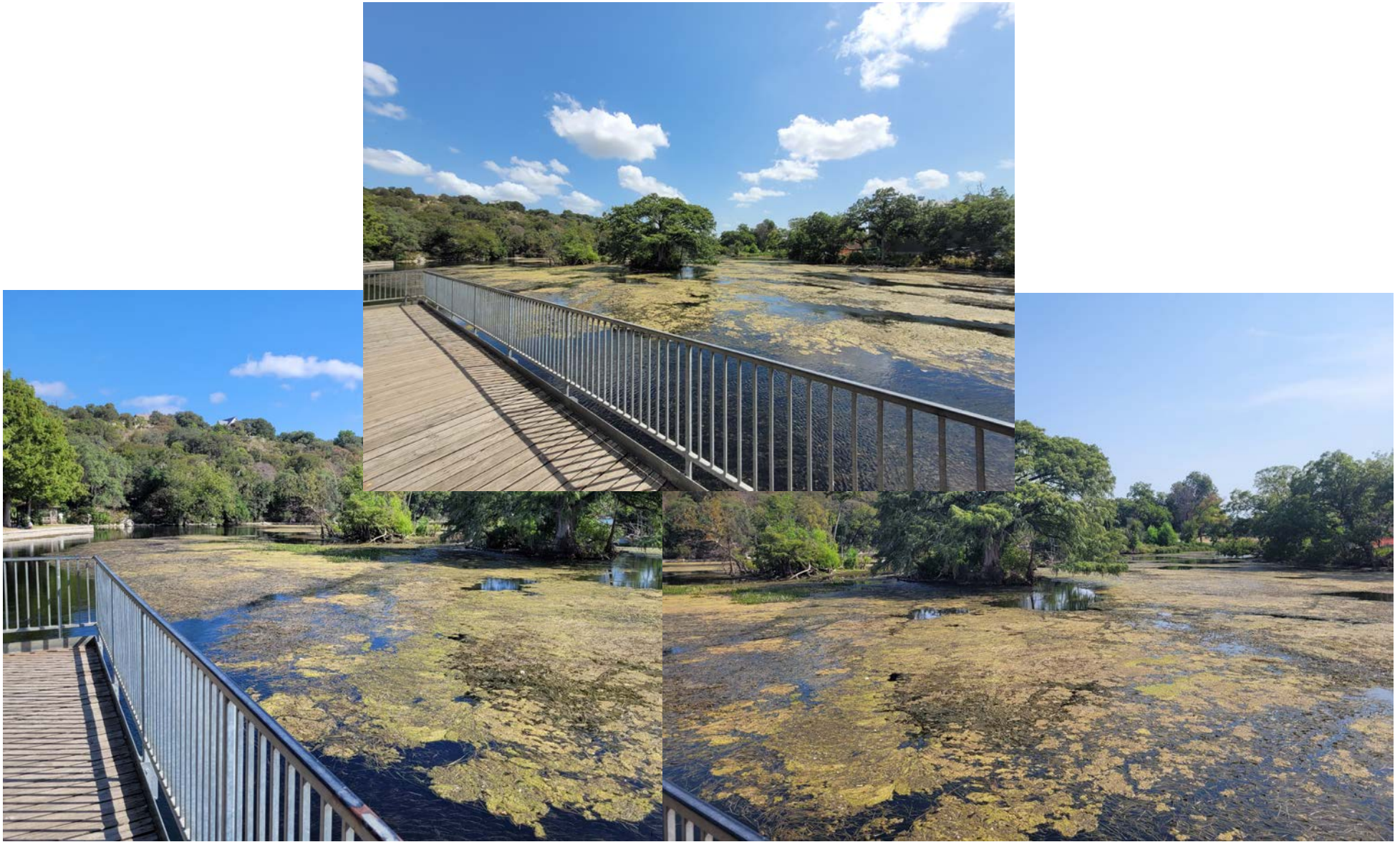


Figure 7: Landa Lake Floating Vegetation Mats looking upstream from Fishing Pier on July 25, 2023 (~85 cfs – upper center), August 10 (~70 cfs – lower left) and August 21 (~60 cfs – lower right). Areas of *Ludwigia* located between the three islands started to go emergent at around 70 cfs.



Figure 8: Spring Run 1 looking downstream from headwaters on July 25, 2023 (~85 cfs). Spring Run 1 headwaters remained dry throughout August.



Figure 9: Spring Run 2 kiddie pool looking downstream from bridge on July 25, 2023 (~85 cfs - left), August 10 (~70 cfs - center) and August 21 (~60 cfs – right).



Figure 10: Spring Run 3 looking downstream from headwaters on July 25, 2023 (~85 cfs - left), August 10 (~70 cfs - center) and August 21 (~60 cfs – right).



Figure 11: Casey Williams mapping submerged aquatic vegetation at the confluence of Spring Run 3 and Landa Lake on August 21 (~60 cfs).



Figure 12: Old Channel ERPA looking upstream from Golf Course Bridge on July 25, 2023 (~85 cfs – upper left), August 10 (~70 cfs – lower left) and August 21 (~60 cfs – right). Fountain Darter habitat including water temperature remains in excellent condition throughout the ERPA.



Figure 13: New Channel Park Office Weir on July 25, 2023 (~85 cfs – left [flow over weir], August 10 (~70 cfs – center [trickle of water flowing over weir] and August 21 (~60 cfs – right [no water flowing over weir – only seepage through dam]).



Figure 14: New Channel river left bank with no irrigation on July 25, 2023 (~85 cfs - left); New Channel looking downstream toward Park Office Weir on August 21 (~60 cfs – right).



Figure 15: New Channel and Old Channel confluence downstream on July 25, 2023 (~85 cfs).

In summary, total system discharge in the Comal System in 2023 declined below those levels observed in 2014. As witnessed in 2014, should this downward trend continue, these lower discharges will create worsening surface habitat conditions each week for the Comal Springs invertebrates. The positive news is that Comal invertebrates are persisting in areas with wetted surface habitat at this time and the system continues to support quality Fountain Darter habitat in Landa Lake and throughout the Old Channel ERPA. The slight rains and subsequent bump in the Aquifer levels in late August was also very welcome. This has caused overall total system discharge to increase slightly this past week. It remains to be seen if the fringes of the system (Blieders Creek, Upper Spring Run and New Channel) are approaching a tipping point or will continue to hold fast. As such, it is vital to keep tracking the surface-dwelling invertebrates should surface habitat continue to decline at Comal Springs. It is also important to continue monitoring the temporal component of these low flow conditions on submerged aquatic vegetation and Fountain Darter habitat. With no significant rainfall over the next two weeks, a second full Critical Period monitoring event (< 50 cfs) may be triggered in September. However, with a few rains, it is likely the next full monitoring event will be conducted in conjunction with the Fall Routine sampling later in October. Meanwhile, all Task 2 and Task 3 low-flow sampling components that are actively triggered at this time will be continued throughout September.

As always, if you have any questions, please don't hesitate to reach out.

Ed