MEMORANDUM

TO:	Chad Furl, Kristy Kollaus
FROM:	Christa Kunkel (BIO-WEST)
DATE:	**May 30, 2025**
SUBJECT:	EAHCP Critical Period Habitat Evaluations – Comal River System

COMAL RIVER SYSTEM: 70, 60, 50 cfs Habitat Evaluations

The 70 cfs Habitat Evaluation was completed on March 19th due to declining springflow conditions. Springflow continued to decrease and the 60 cfs Habitat Evaluation was completed as part of the Spring 2025 Comprehensive Biological Monitoring effort in April. Flows further declined beginning May 14th and the 50 cfs Habitat Evaluation was completed on May 21st. Rain events on May 26th and May 28th have since bumped the aquifer level and increased flows in the system. As of this memorandum, the total system discharge in the Comal Springs system is approximately 90 cfs (Figure 1).

Figure 1. Total Comal River discharge from March 1 to May 29, 2025 (USGS 08169000 Comal River at New Braunfels, Texas).

Seven-day trends in water temperature (°C) for multiple habitat evaluations in spring 2025 were assessed using temperature data loggers (HOBO Tidbit v2 Temp Loggers) at 13 permanent monitoring stations in the Comal Springs/River. Data for each monitoring station are based on all 10-minute measurements available for March 18-24 (~70 cfs), April 15-21 (~60 cfs), and May 18-24 (~50 cfs). Data from New Channel Upstream were omitted from analysis for April and May due to water temperatures closely aligning with air temperature trends during these timeframes, suggesting this logger was desiccated or in extremely shallow water. Similarly, data were also omitted from analysis for Blieders from May 22-24 and Booneville Far from May 20-24 when water temperatures began aligning with air temperature trends. For the two stations in the deepest portion of Landa Lake (upper and lower), trends were not assessed in May because water temperature logger data were last uploaded in April. Lastly, water temperature trends at Booneville Near and New Channel Downstream were not assessed in May due to desiccation (Booneville Near) and inaccessibility (New Channel Downstream). At all stations, data were compared to long-term water temperature data measured at 4-hour intervals for each month from 2000 – 2024 or to the greatest temporal extent available. For analysis, 7-day trends were compared with long-term data using boxplots to visualize differences in central tendency (i.e., median) and variation (e.g., interquartile range). Tables 1-3 summarize the descriptive statistics associated with each boxplot for each figure. Figures 2-4 present boxplots comparing recent 7-day trends with long-term data for the months of March, April, and May.

Overall, results suggest that between 60 to 70 cfs median water temperatures were generally stable and similar to long-term medians across all stations except Booneville Far. At 50 cfs, however, 7-day median water temperatures were greater than long-term medians across all stations that were downloaded, though the Old Channel remained below Fountain Darter larval (≥25°C) and egg (≥26°C) reproductive thresholds. Maximum water temperatures were elevated above these optimal temperature requirements, ranging from 26.8°C at Spring Run 1 to 33.99°C at Heidelberg. This was the only area in which maximum water temperatures approached the Fountain Darter mean critical thermal maximum of 34.8°C (Brandt et al. 1993).

Table 1. **Summary of boxplot descriptive statistics comparing recent 7-day (March 18-24) and long-term trends in water temperature (°C) at 13 monitoring stations in the Comal Springs/River for the month of March, 2025.**

Station	Period	Minimum	Lower Whisker	Lower Box	Median	Upper Box	Lower Whisker	Maximum	Interquartile Range
Blieders	7-day	16.32	16.32	18.73	20.56	21.36	24.70	24.70	2.63
Blieders	Long-term	16.19	18.62	21.39	22.36	23.24	25.98	26.99	1.85
Heidelberg	7-day	16.80	16.80	19.87	21.65	22.99	25.36	25.36	3.13
Heidelberg	Long-term	19.86	22.83	23.40	23.71	23.79	24.36	24.96	0.39
Booneville Near	7-day	23.79	23.79	23.81	23.83	23.83	23.86	23.91	0.02
Booneville Near	Long-term	22.88	23.42	23.52	23.57	23.64	23.81	24.21	0.12
Booneville Far	7-day	25.55	25.55	27.38	27.90	28.82	30.90	31.28	1.44
Booneville Far	Long-term	20.42	21.83	22.84	23.20	23.52	24.54	25.68	0.68
Landa Lake Upper	7-day	22.37	23.04	23.50	23.79	23.81	23.83	23.83	0.31
Landa Lake Upper	Long-term	20.13	23.04	23.52	23.75	23.85	24.28	24.38	0.33
Spring Run 1	7-day	22.85	22.85	23.18	23.33	23.47	23.57	23.57	0.29
Spring Run 1	Long-term	23.26	23.38	23.47	23.50	23.53	23.62	23.71	0.06
Spring Run 2	7-day	20.94	20.94	22.08	22.59	22.87	23.42	23.42	0.78
Spring Run 2	Long-term	18.31	22.98	23.31	23.44	23.52	23.84	23.94	0.22
Spring Run 3	7-day	23.30	23.33	23.47	23.52	23.57	23.71	24.27	0.10
Spring Run 3	Long-term	23.20	23.20	23.38	23.47	23.54	23.79	24.10	0.16
Landa Lake Lower	7-day	22.61	22.61	23.45	23.71	24.07	24.22	24.22	0.63
Landa Lake Lower	Long-term	22.63	23.61	23.76	23.85	23.86	24.00	25.23	0.10
Old Channel	7-day	20.72	20.72	22.15	22.82	24.10	25.77	25.77	1.94
Old Channel	Long-term	19.41	20.89	22.52	23.06	23.60	25.21	25.94	1.09
New Channel Upstream	7-day	23.79	23.79	25.99	26.76	27.58	28.94	28.94	1.59
New Channel Upstream	Long-term	20.93	22.00	23.06	23.35	23.77	24.81	25.45	0.71
New Channel Downstream	7-day	19.84	19.84	21.91	22.71	23.48	24.48	24.48	1.57
New Channel Downstream	Long-term	17.70	20.48	22.41	23.03	23.71	25.60	26.01	1.30
Other Place	7-day	19.18	19.18	21.40	22.37	23.23	24.63	24.63	1.84
Other Place	Long-term	19.25	20.75	22.44	23.04	23.58	25.23	25.53	1.14

Table 2. **Summary of boxplot descriptive statistics comparing recent 7-day (April 15-21) and long-term trends in water temperature (°C) at 13 monitoring stations in the Comal Springs/River for the month of April, 2025.**

Station	Period	Minimum	Lower Whisker	Lower Box	Median	Upper Box	Lower Whisker	Maximum	Interquartile Range
Blieders	7-day	22.51	22.51	23.45	24.15	24.65	26.01	26.01	1.21
Blieders	Long-term	17.06	19.60	22.26	23.28	24.07	26.76	27.74	1.81
Heidelberg	7-day	22.32	22.32	23.47	24.20	25.55	27.70	27.70	2.08
Heidelberg	Long-term	21.89	23.19	23.58	23.74	23.84	24.23	25.09	0.26
Booneville Near	7-day	23.76	23.81	23.81	23.81	23.83	23.86	23.86	0.02
Booneville Near	Long-term	22.88	23.34	23.52	23.57	23.64	23.81	24.38	0.12
Booneville Far	7-day	26.79	26.79	28.00	28.42	29.59	31.84	31.84	1.59
Booneville Far	Long-term	21.25	22.13	23.09	23.40	23.74	24.70	26.04	0.65
Landa Lake Upper	7-day	23.16	23.16	23.55	23.79	23.83	23.86	23.86	0.29
Landa Lake Upper	Long-term	19.79	23.20	23.59	23.75	23.86	24.13	24.13	0.26
Spring Run 1	7-day	20.65	23.33	23.52	23.59	23.67	23.71	23.71	0.14
Spring Run 1	Long-term	23.21	23.39	23.48	23.52	23.55	23.64	23.71	0.07
Spring Run 2	7-day	20.82	20.82	22.08	22.71	23.18	24.80	25.70	1.10
Spring Run 2	Long-term	19.13	23.02	23.33	23.44	23.55	23.88	23.96	0.22
Spring Run 3	7-day	21.75	21.94	22.90	23.42	23.55	24.51	25.65	0.65
Spring Run 3	Long-term	23.01	23.16	23.38	23.47	23.55	23.74	23.74	0.17
Landa Lake Lower	7-day	23.35	23.35	23.71	23.93	24.10	24.22	24.22	0.38
Landa Lake Lower	Long-term	22.63	23.58	23.79	23.86	23.93	24.14	24.82	0.14
Old Channel	7-day	22.15	22.15	23.06	23.62	24.53	26.40	26.40	1.47
Old Channel	Long-term	19.20	21.49	23.00	23.43	24.02	25.54	26.30	1.02
New Channel Upstream	7-day	-	-	-	-	-	-	-	-
New Channel Upstream	Long-term	20.91	22.18	23.27	23.54	24.00	25.09	25.96	0.73
New Channel Downstream	7-day	22.03	22.03	23.32	23.81	24.53	25.53	25.53	1.21
New Channel Downstream	Long-term	19.03	20.98	22.97	23.53	24.30	26.26	26.60	1.33
Other Place	7-day	21.99	21.99	23.35	23.91	24.41	25.67	25.67	1.06
Other Place	Long-term	18.25	21.15	22.92	23.45	24.10	25.87	27.36	1.18

Table 3. **Summary of boxplot descriptive statistics comparing recent 7-day (May 18-24) and long-term trends in water temperature (°C) at 13 monitoring stations in the Comal Springs/River for the month of May, 2025.**

Station	Period	Minimum	Lower Whisker	Lower Box	Median	Upper Box	Lower Whisker	Maximum	Interquartile Range
Blieders	7-day	25.84	25.84	27.85	28.49	29.27	30.34	30.34	1.42
Blieders	Long-term	18.60	21.62	23.75	24.46	25.17	27.29	29.77	1.42
Heidelberg	7-day	24.90	24.90	26.67	28.00	29.14	32.77	33.99	2.47
Heidelberg	Long-term	22.15	23.47	23.74	23.83	23.92	24.19	26.28	0.18
Booneville Near	7-day	-	-	-	-	-	-	-	-
Booneville Near	Long-term	23.28	23.31	23.52	23.55	23.67	23.88	24.17	0.15
Booneville Far	7-day	28.30	28.30	29.29	29.58	30.24	31.41	31.41	0.95
Booneville Far	Long-term	21.20	22.34	23.38	23.63	24.08	25.13	30.39	0.70
Landa Lake Upper	7-day	-	-	-	-	-	-	-	-
Landa Lake Upper	Long-term	20.20	23.31	23.64	23.76	23.86	24.18	24.22	0.22
Spring Run 1	7-day	21.08	23.40	24.22	24.45	24.77	25.60	26.82	0.56
Spring Run 1	Long-term	23.21	23.40	23.50	23.54	23.57	23.68	23.97	0.07
Spring Run 2	7-day	20.96	23.35	24.61	25.09	25.45	26.72	27.53	0.85
Spring Run 2	Long-term	19.65	23.02	23.38	23.45	23.62	23.98	24.17	0.24
Spring Run 3	7-day	21.56	23.09	24.59	24.97	25.60	26.97	26.97	1.01
Spring Run 3	Long-term	23.01	23.16	23.36	23.47	23.52	23.69	23.69	0.16
Landa Lake Lower	7-day	-	-	-	-	-	-	-	-
Landa Lake Lower	Long-term	23.18	23.57	23.79	23.86	23.93	24.15	24.63	0.15
Old Channel	7-day	22.94	22.94	24.03	24.56	25.80	28.02	28.02	1.77
Old Channel	Long-term	21.13	21.93	23.45	23.79	24.48	26.01	27.51	1.03
New Channel Upstream	7-day	-	-	-	-	-	-	-	-
New Channel Upstream	Long-term	21.60	22.49	23.50	23.71	24.19	25.22	26.79	0.69
New Channel Downstream	7-day	-	-	-	-	-	-	-	-
New Channel Downstream	Long-term	19.96	21.54	23.47	24.02	24.80	26.79	27.33	1.33
Other Place	7-day	24.27	24.27	25.38	26.16	26.87	28.02	28.02	1.49
Other Place	Long-term	19.71	21.84	23.47	23.91	24.57	26.20	27.14	1.10

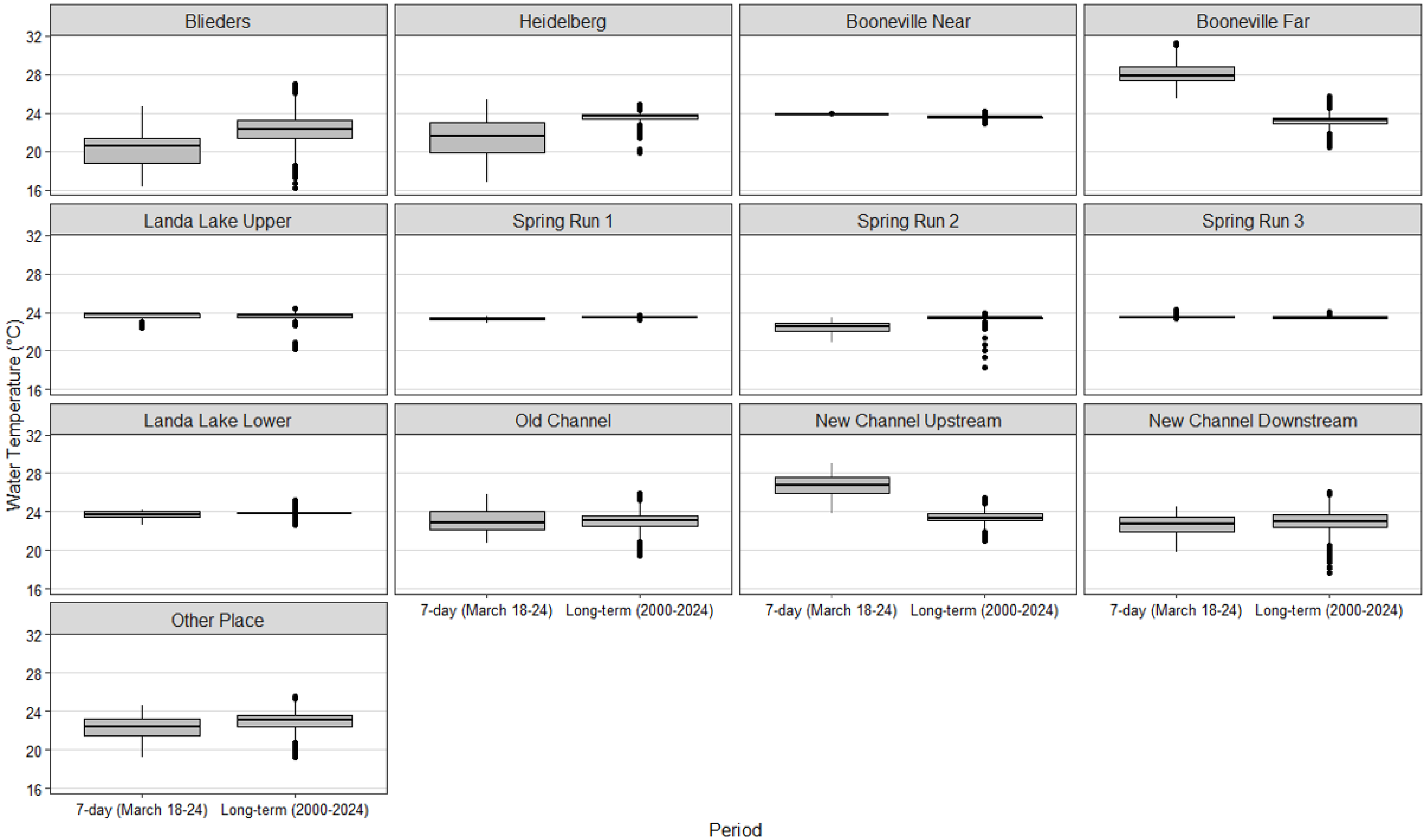

Figure 2. **Boxplots statistics comparing recent 7-day (March 18-24) and long-term (2000-2024) trends in water temperature (°C) at 13 monitoring stations in the Comal Springs/River for the month of March, 2025. The thick horizontal line in each box is the median and the upper/lower bounds of each box 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.**

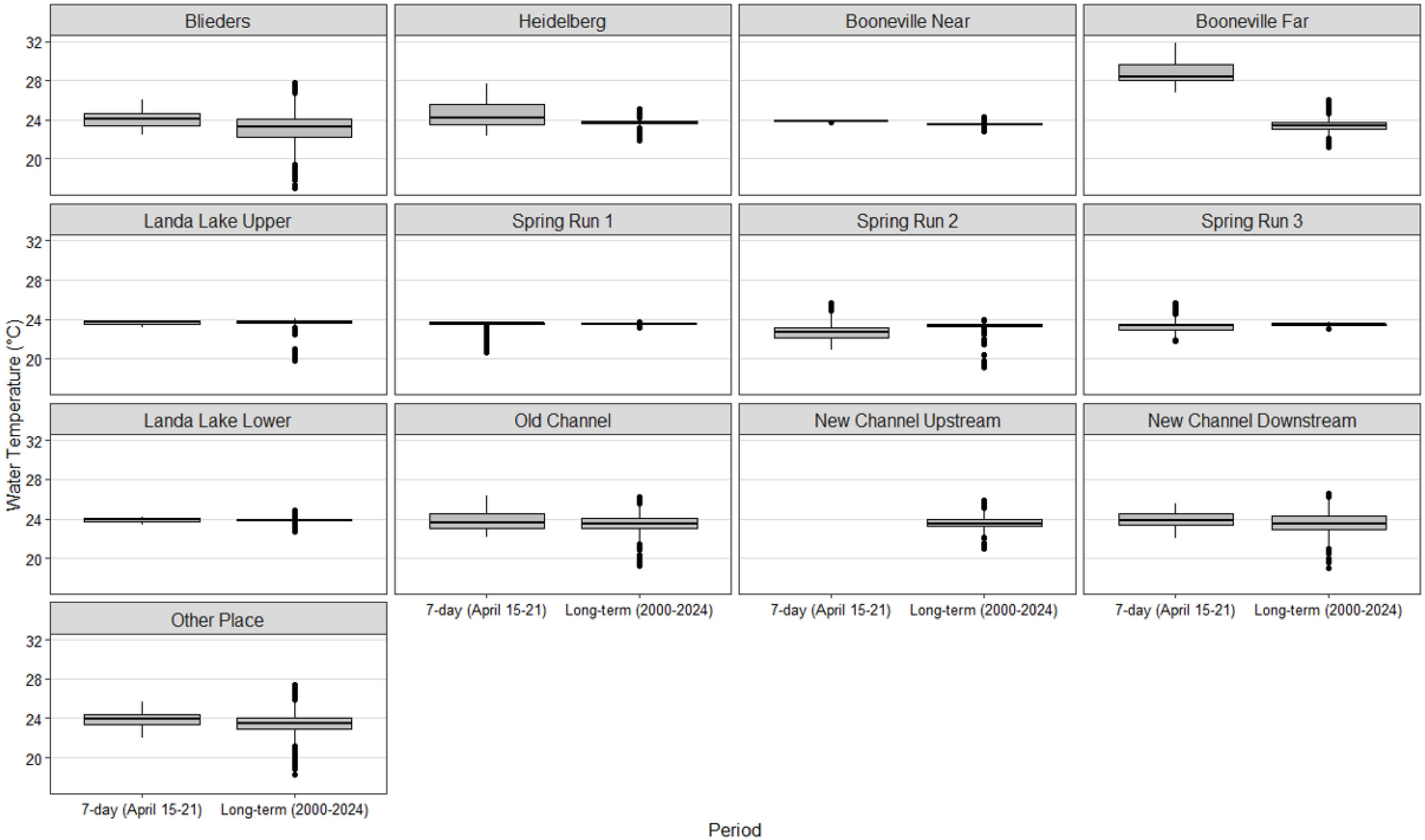

Figure 3. **Boxplots statistics comparing recent 7-day (April 15-21) and long-term (2000-2024) trends in water temperature (°C) at 13 monitoring stations in the Comal Springs/River for the month of April, 2025. The thick horizontal line in each box is the median and the upper/lower bounds of each box 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.**

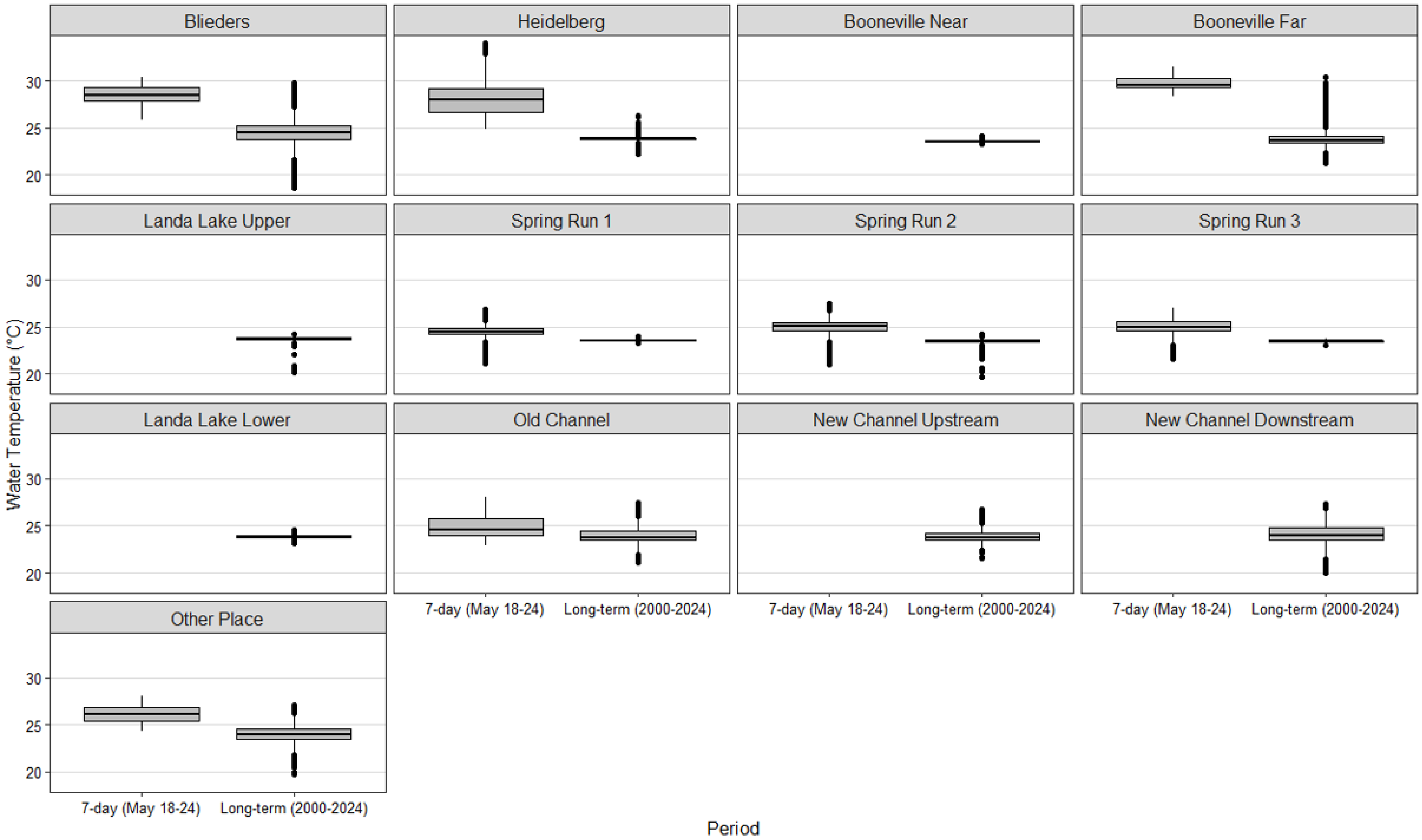

Figure 4. **Boxplots statistics comparing recent 7-day (May 18-24) and long-term (2000-2024) trends in water temperature (°C) at 13 monitoring stations in the Comal Springs/River for the month of May, 2025. The thick horizontal line in each box is the median and the upper/lower bounds of each box represents 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.**

As total system discharge declined from 70 to 60 cfs, wetted area at Upper Spring Run near the Heidelberg cabins decreased. At these flows, Fountain Darter habitat was limited to an algae/bryophyte mix and *Sagittaria*. However, by 50 cfs, *Sagittaria* was emergent through much of the study reach (Figure 5). *Chara* continued to expand under these low flow conditions, now representing a dominant taxon in this reach (Figure 6). Habitat also declined at Spring Island and the spring runs. Between 70 and 50 cfs, wetted area decreased along the fringes of Spring Island (Figure 7). Despite this decrease in wetted area, spring upwellings were still observed throughout Spring Island area at 50 cfs. Furthermore, Spring Island had the highest number of Comal Springs Riffle Beetles (68 adults) during the Spring Comprehensive Biomonitoring survey when total system discharge was approximately 60 cfs. In contrast, only two adult beetles were observed at Western Shoreline and no adult beetles were observed at Spring Run 3. More algae was observed in the Comal Springs Salamander sampling area and covered submerged aquatic vegetation around Spring Island. Although few salamanders were observed during the Spring Comprehensive Biomonitoring survey, they were still present at Spring Island, Spring Run 3, and Landa Lake near the Fountain Darter dive area. Salamander and beetle habitat were mostly dry at Spring Run 1 and greatly reduced at Spring Run 3, though Spring Run 3 was still flowing at 70 and 60 cfs. By 50 cfs, Spring Run 1 was completely dry and Spring Run 3 did not support visible surface flow.

Figure 5. Exposed river bed and emergent *Sagittaria* at Upper Spring Run (May 21st).

Figure 6. Dense stand of *Chara* expanding into a stand of *Sagittaria* at Upper Spring Run (May 21st).

Figure 7. Exposed dry bed on the far side of Spring Island (May 21st).

Landa Lake continued to maintain aquatic vegetation between 70-50 cfs. As expected, algal mats built up on the surface as flow decreased. More filamentous algae was observed during drop-netting activities at ~60 cfs; however, bryophytes were still present in discrete patches and intermixed with other taxa throughout the lake. By 50 cfs, the Landa Lake islands became exposed with surrounding vegetation (e.g., *Ludwigia* and *Sagittaria*) emergent. The Old Channel continued to operate as expected during these flow conditions and averaged ~37 cfs from March through May 22nd. Optimal Fountain Darter habitat was maintained as bryophytes and *Ludwigia* dominated the vegetation assemblage. In contrast, the New Channel exhibited noticeable declines in wetted area between 70 and 50 cfs. Around 70 cfs, much of the bank along river right was exposed and vegetation consisted only of *Cabomba* and *Hygrophila*. During drop-netting activities at ~60 cfs, increased filamentous algae was observed within the *Hygrophila*. Wetted area continued to decrease as flows approached 50 cfs with some patches of *Hygrophila* becoming emergent.

Although the system experienced habitat changes as flows declined, drop-netting during the Spring Comprehensive Biomonitoring survey in April demonstrated high Fountain Darter densities and typical spring recruitment. A total of 976 Fountain Darters were observed among the four study reaches ranging in size from 8 to 38 mm. Mean densities across all reaches were higher than in fall 2024 and similar to previous spring events. The highest densities occurred in bryophytes at Landa Lake and Old Channel, though densities were also high in *Ludwigia* and *Cabomba*. Dip-netting is an important criterion for Fountain Darter refugia salvage activities prescribed in the EAHCP. Section 6.4.3 (Comal Springs and River Ecosystem Adaptive Management Activities) in the EAHCP. Fountain Darter dip netting results from the April and May surveys are as follows:

April

Percent darter abundance – 78%

May

Percent darter abundance – 68%

In summary, total system discharge in the Comal System declined below 70 cfs on March 18th, below 60 cfs on April 15th, and approximated 50 cfs beginning May 14th. Water temperature conditions were generally stable throughout the system until 50 cfs when 7-day median temperatures were higher than previously observed system-wide, although data from Landa Lake were not examined. Despite these elevated springtime water temperatures in some areas, Fountain Darter recent recruits were observed during April drop-netting activities, and dip-netting in April and May indicated high overall presence. As flows declined, habitat conditions deteriorated in several locations. Reductions in wetted area were most exacerbated in upper spring areas and around Spring Island, and surface flow ceased in all spring runs by 50 cfs. This was the first time during the 24-year biomonitoring program that Spring Run 3 stopped flowing, leaving a majority of the spring run dry. Emergent vegetation and increased algae were observed throughout all reaches and were most noticeable at Upper Spring Run, around the Landa Lake Islands, and at Upper New Channel. In contrast, high quality Fountain Darter habitat still remains at Old Channel and through portions of Landa Lake. Figures 8-25 highlight the habitat conditions observed on March 19th (70 cfs) and May 21st (50 cfs) throughout the Comal System starting at the upper springs and moving downstream. It remains important to continue tracking the system-wide Fountain Darter and the surface-dwelling invertebrate's habitat conditions and species responses as these low discharge conditions persist into the summer.

Please reach out if you have any questions.

Thank you,

Christa

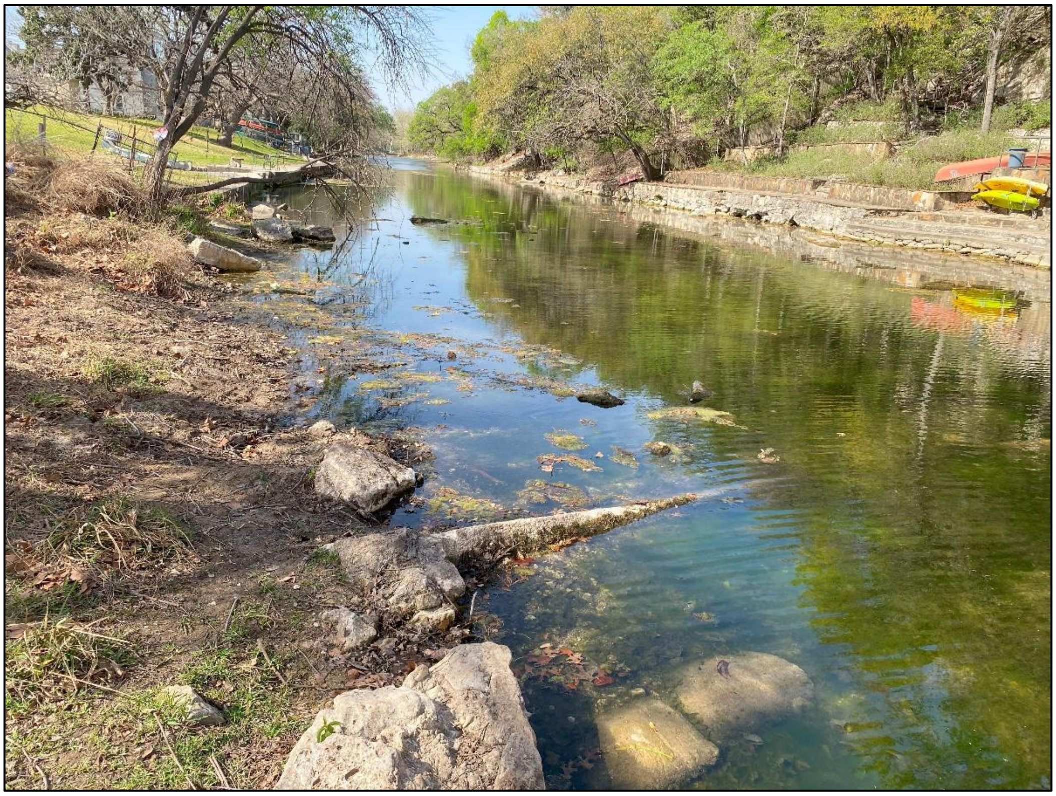

Figure 8. Upper Spring Run at 70 cfs (March 19th).

Figure 9. Exposed dry area and surface film in Upper Spring Run at 50 cfs (May 21st).

Figure 10. Spring Island looking upstream at 70 cfs (March 19th).

Figure 11. Spring Island looking upstream at 50 cfs (May 21st).

Figure 12. Spring Island looking downstream at 70 cfs (March 19th).

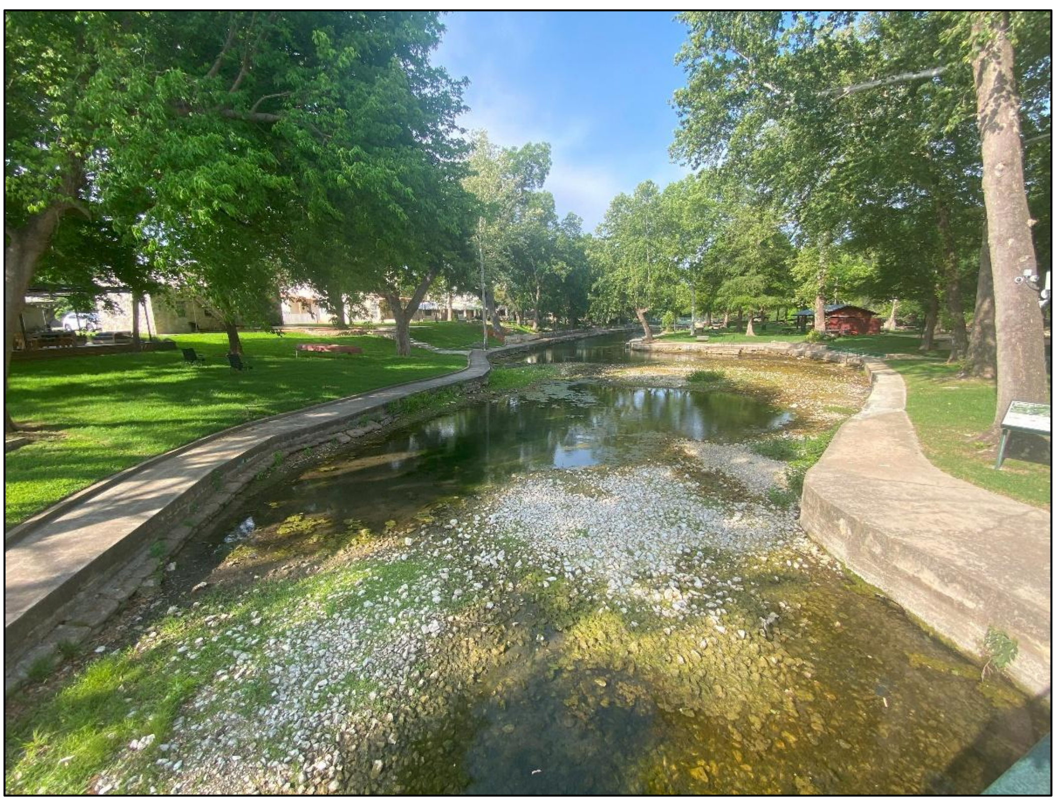

Figure 13. Spring Island looking downstream at 50 cfs (May 21st).

Figure 14. Landa Lake at 70 cfs (March 19th).

Figure 15. Emergent *Sagittaria* around the islands at Landa Lake at 50 cfs (May 21st).

Figure 16. Spring Run 1 at 70 cfs (March 19th).

Figure 17. Spring Run 1 completely dry at 50 cfs (May 21st).

Figure 18. Spring Run 3 looking upstream at 70 cfs (March 19th).

Figure 19. Spring Run 3 looking downstream at 50 cfs with some small puddles of water (May 21st).

Figure 20. Old Channel ERPA at 70 cfs (March 19th).

Figure 21. Old Channel ERPA at 50 cfs (May 21st).

Figure 22. Water flowing over the weir dam in the New Channel at 70 cfs (March 19th).

Figure 23. Weir dam holding water in the New Channel at 50 cfs. Water was still flowing through the culvert (May 21st).

Figure 24. Dewatered area at Upper New Channel at 70 cfs (March 19th).

Figure 25. Dewatered area at Upper New Channel at 50 cfs (May 21st).