MEMORANDUM

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FROM:	Christa Kunkel (BIO-WEST)
DATE:	**March 24, 2026**
SUBJECT:	EAHCP Low Flow Evaluation – Comal River System

COMAL RIVER SYSTEM: Critical Period and Species-specific Sampling Events

This memorandum highlights the habitat and biotic conditions observed in the Comal River system during Critical Period and Species-specific sampling events from January – March 2026. Activities that have been completed as part of this evaluation include:

- Aquatic vegetation mapping of the four study reaches (Upper Spring Run, Landa Lake, Old Channel, and New Channel)*
- Fountain darter presence/absence and timed dip netting
- Fountain darter drop netting
- Comal Springs salamander surveys (Spring Run 1, Spring Run 3, and Spring Island)
- Comal Springs riffle beetle cotton lure sampling
- Comal Springs discharge measurements
- Thermistor downloads
- Suite I and II water quality sampling
- Fixed-Station Photography

A Full System Critical Period sampling event was initiated in January as the monthly median discharge was 71.3 cubic feet per second (cfs) (Figure 1). In February, monthly median discharge was similar at 72.2 cfs. Flows declined in March and were approximately 60 cfs at the conclusion of winter sampling on March 6th. As of this memorandum (March 24th), total system discharge in the Comal Springs/River System is approximately 62 cfs.

*Aquatic vegetation coverages described herein are tentative at this time and subject to change. Post-processing (e.g., QA/QC) of aquatic vegetation shapefiles is ongoing and final results will be presented in the 2026 biological monitoring report.

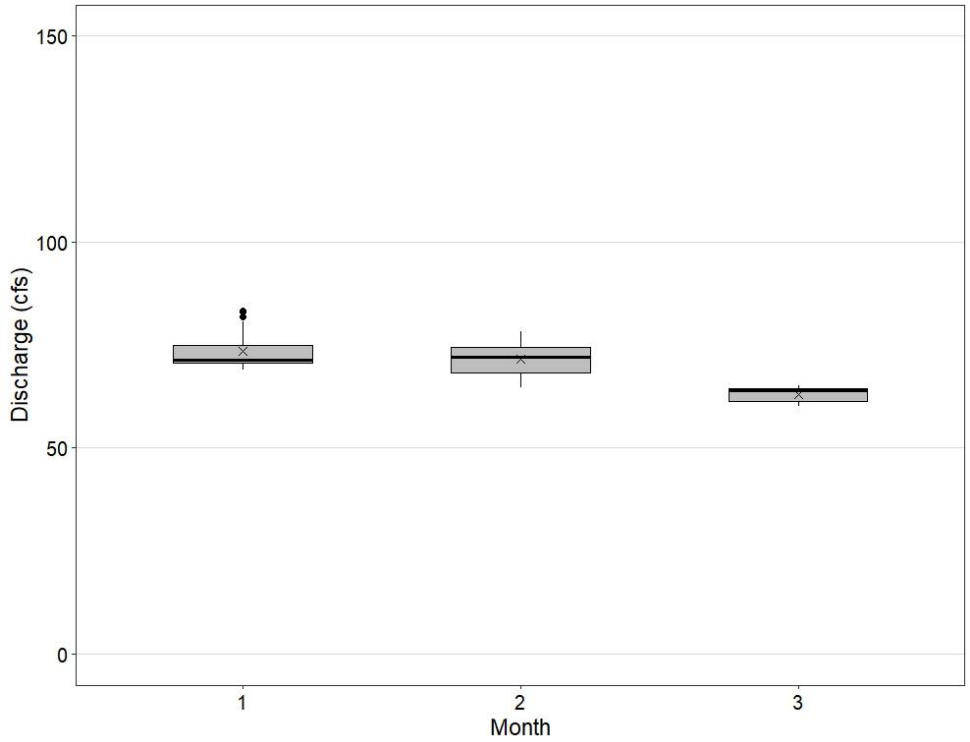

Figure 1. Boxplots displaying Comal River mean daily discharge among January (1), February (2), and March (3) 2026 (USGS 08169000 Comal River at New Braunfels, Texas). The thick horizontal line in each box is the median, x represents the mean, and the upper/lower bounds of each box represent the interquartile range. Whiskers represent minimum/maximum values up to 1.5 times the interquartile range, and outliers beyond this are designated with solid black circles.

Recent 60-day trends in water temperature (°C) were assessed using temperature data loggers (HOBO Tidbit v2 Temp Loggers) at 12 permanent monitoring stations in the Comal Springs/River. This included a second monitoring station at Upper Spring Run that was established in 2026. Hereafter, Heidelberg-1 refers to the original Upper Spring Run station and Heidelberg-2 denotes the new station. Heidelberg-2 was located across from the Heidelberg lodges and placed at a greater depth than Heidelberg-1 to better capture changes in water temperature in the upper spring run area. Trends in 2026 were examined from January 6th – March 6th for all stations except Spring Run 2 (1/30 – 2/17; n = 19 days) and New Channel Downstream (1/6 – 2/17; n = 43 days). Water temperature trends at each station were compared to long-term (2000-2025) water temperature data measured from January – March. All 2026 and long-term data used were based on water temperature measurements at 4-hour intervals. For analysis, 60-day trends in 2026 were compared with long-term data (except for Heidelberg-2) using boxplots to visualize differences in central tendency (i.e., median) and variation (e.g., interquartile range). Figure 2 displays boxplots comparing recent 60-day trends with long-term data for January – March and Table 1 summarizes the descriptive statistics associated with each boxplot.

Results suggest that between approximately 60 to 70 cfs from January – March, median water temperatures were generally stable and similar to or below long-term medians across all stations except Booneville Far and New Channel Downstream. Median water temperatures at both stations exceeded their respective long-term medians. Furthermore, median water temperatures at both stations exceeded fountain darter larval (25°C) and egg (26°C) production thresholds. Higher temperatures at Booneville Far represents a continuation of the increasing trend observed in upper spring areas, which began in 2024, and is likely associated with reductions in springflow.

Table. 1 **Summary of boxplot descriptive statistics comparing recent 60-day (January 6 – March 6) and long-term (2000-2025 from January - March) trends in water temperature (°C) at 12 monitoring stations in the Comal Springs/River.**

Station	Period	Minimum	Lower Whisker	Lower Box	Median	Upper Box	Lower Whisker	Maximum	Interquartile Range
Blieders	60-day	6.59	6.59	14.91	17.87	20.66	25.82	25.82	5.74
Blieders	Long-term	6.28	16.68	20.2	21.49	22.56	26.04	26.99	2.36
Heidelberg-1	60-day	10.35	10.35	16.32	19.33	21.75	25.5	25.5	5.43
Heidelberg-1	Long-term	11.57	22.08	23.09	23.58	23.76	24.77	27.43	0.68
Heidelberg-2	60-day	9.04	9.04	16.36	18.91	21.25	25.31	25.31	4.9
Heidelberg-2	Long-term	-	-	-	-	-	-	-	-
Booneville Near	60-day	23.57	23.69	23.76	23.79	23.81	23.83	23.83	0.05
Booneville Near	Long-term	22.88	23.38	23.52	23.57	23.64	23.81	24.9	0.12
Booneville Far	60-day	24.75	25.23	27.13	27.88	28.39	30.22	30.39	1.26
Booneville Far	Long-term	16.13	21.32	22.56	22.97	23.39	24.63	31.03	0.83
Spring Run 1	60-day	22.8	22.92	23.28	23.42	23.55	23.67	23.67	0.27
Spring Run 1	Long-term	22.27	23.34	23.45	23.49	23.52	23.63	23.82	0.07
Spring Run 2	60-day	15.8	16.2	19.21	20.22	21.31	22.66	22.66	2.1
Spring Run 2	Long-term	7.02	22.82	23.23	23.4	23.51	23.92	23.98	0.28
Spring Run 3	60-day	22.61	23.52	23.59	23.62	23.64	23.69	24.2	0.05
Spring Run 3	Long-term	22.94	23.16	23.38	23.5	23.55	23.79	24.1	0.17
Old Channel	60-day	18.99	18.99	21.27	22.3	23.04	25.43	25.72	1.77
Old Channel	Long-term	17.13	20.13	21.97	22.62	23.19	25.03	26.43	1.22
New Channel Upstream	60-day	20.27	20.84	23.37	24.35	25.1	26.92	26.92	1.73
New Channel Upstream	Long-term	10.44	21.75	22.85	23.21	23.59	24.68	29.62	0.74
New Channel Downstream	60-day	22.2	22.2	25.28	26.28	27.36	28.67	28.67	2.08
New Channel Downstream	Long-term	10.32	18.91	21.43	22.37	23.11	25.6	26.01	1.68
Other Place	60-day	15.01	15.01	19.4	21.18	22.61	24.92	24.92	3.21
Other Place	Long-term	10.08	19.75	21.77	22.51	23.12	25.14	25.53	1.35

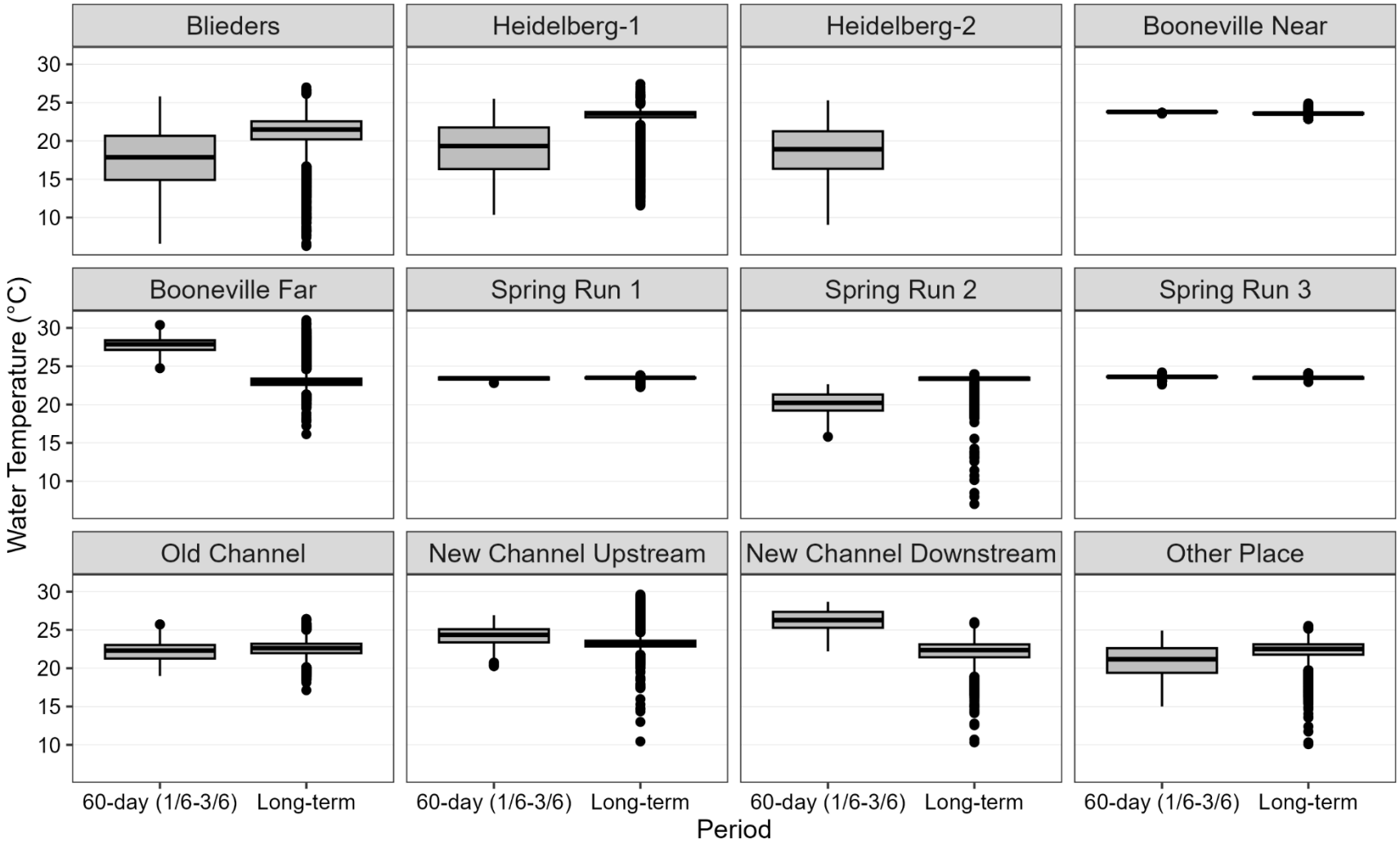

Figure 2. **Boxplots statistics comparing recent 60-day (January 6 – March 6) and long-term (2000-2025 from January - March) trends in water temperature (°C) at 12 monitoring stations in the Comal Springs/River. The thick horizontal line in each box is the median and the upper/lower bounds of each box 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.**

Water quality was analyzed at 12 sites along the Comal River during Critical Period sampling at ~70 cfs on January 22nd. Despite sustained low flows, results from water quality analysis demonstrated typical water quality conditions (Table 2). Nitrate concentrations were similar to historical data (0.77-1.76 mg/L; Crowe and Sharp 1997). Ammonia and Total Phosphorus remained below detectable levels at most stations, and Alkalinity and Total Suspended Solids were similar to previous low flow events. Furthermore, parameters at all sites were well below the Texas Commission on Environmental Quality (TCEQ) criteria designated in the TCEQ Surface Water Quality Standards.

Table 2. Summary of water quality analysis from 12 sites along the Comal River on January 22nd, 2026.

Site	Nitrate (mg/L)	Total N (mg/L)	Ammonia (mg/L)	Total Phosphorus (mg/L)	Alkalinity (mg/L)	Total Suspended Solids (mg/L)
Blieder's Creek	1.57	1.57	<0.0400U	<0.0100U	236	<1.00
Heidelberg Main Channel	1.49	1.49	<0.0400U	<0.0100U	238	<1.00
Island Park Far	1.69	1.69	<0.0400U	<0.0100U	243	<1.00
Island Park Near	1.78	1.78	<0.0400U	0.0107	239	<1.00
Landa Lake	1.74	1.74	<0.0400U	<0.0100U	235	<1.00
Spring Run 3	1.82	1.82	<0.0400U	<0.0100U	239	<1.00
Spring Run 2	1.8	1.80	<0.0400U	<0.0100U	239	1.58
Spring Run 1	1.7	1.7	<0.0400U	<0.0100U	240	4.11
New Channel Upstream	1.6	1.60	<0.0400U	<0.0100U	243	<1.00
Old Channel Upstream	1.65	1.65	<0.0400U	<0.0100U	241	2.00
Old Channel Downstream	1.59	1.59	<0.0400U	<0.0100U	244	1.58
New Channel Downstream	1.52	1.52	<0.0400U	<0.0100U	239	<1.00

*U denotes non-detected compound

At approximately 70 cfs, noticeable declines in wetted area were observed primarily at areas near the upper springs and new channel. Upper Spring Run near the Heidelberg Cabins remained very shallow with dry streambed exposed along the river-left bank. Very little rooted vegetation was observed in this section of the study reach, though filamentous algae was abundant (Figure 3). Rooted vegetation was limited to the lower half of the study reach and consisted of *Sagittaria* and *Chara*.

Comal Springs riffle beetle (CSRB) and Comal Springs salamander habitat declined at Spring Island and the spring runs. Spring Island demonstrated greater declines in wetted area at ~70 cfs compared to the Upper Spring Run, Landa Lake, and the Old Channel (Figure 4). Across the three cotton lure low-flow sampling events for CSRB, a total of 18 beetles were observed on 15 lures at Spring Island, 25 beetles were observed on 16 lures at Western Shoreline, and 0 beetles were observed on 15 lures at Spring Run 3. The Comal Springs salamander sampling area at Spring Run 1 and Spring Run 2 remained dry, and wetted area at Spring Run 3 was greatly reduced (Figures 5-7). On March 6th when total river discharge was approximately 60 cfs, Spring

Run 3 was flowing at only 0.59 cfs, down from 2.18 cfs when total river discharge was ~ 70 cfs (Figure 8). Comal Springs salamander surveys conducted in January and March yielded a total of 4 salamanders observed at Spring Island and 1 salamander observed at Spring Run 3. A majority of the sampling area at Spring Island was dry with algae and detritus covering rocks throughout the available wetted habitat.

Figure 3. Filamentous algae at the upstream area of the Upper Spring Run study reach on March 6th, 2026.

Figure 4. Dewatered areas at Spring Island on March 6th, 2026.

Figure 5. Dry area at Spring Run 1 at ~70 cfs on February 10th, 2026.

Figure 6. Dry area at Spring Run 2 at ~70 cfs on February 10th, 2026.

Figure 7. Reduced flow at Spring Run 3 at ~70 cfs on February 10th, 2026.

Figure 8. Reduced flow in Spring Run 3 at ~60 cfs during Comal Springs salamander sampling on March 6th, 2026.

During this time, Landa Lake maintained a diversity of vegetation types including *Cabomba*, *Ludwigia*, *Sagittaria*, and *Vallisneria*. Bryophyte abundance has been low in Landa Lake since spring 2025 and declined further following two large floods that summer. In 2026, total bryophyte coverage in the lake remains low (~50 m^2). Filamentous algae coverage increased in areas previously dominated by bryophytes (e.g., around the island in upper Landa Lake). However, other quality fountain darter habitat has persisted as *Cabomba* and *Ludwigia* maintained high coverages throughout the lake (Figure 9). The Old Channel continued to operate as anticipated during low flows. Median discharge through the Old Channel was ~50 cfs from January-March. High quality fountain darter habitat in this reach increased from fall 2025, as ~213 m^2 of bryophytes and ~46 m^2 of *Cabomba* re-established (Figure 10). Although bryophytes re-established this winter, total coverage was considerably lower than winter 2025 (427 m^2). Similar to previous years, *Ludwigia* was the most dominant taxa (Figure 11). The New Channel was dominated by *Cabomba* with *Hygrophila* also present. More filamentous algae was also observed throughout the upper and lower New Channel reaches. Similar to the upper spring areas, the New Channel exhibited large reductions in wetted area compared to typical flow levels. At the Upper New Channel, much of the streambed along the river-right bank has been exposed for so long that it now consists of terrestrial vegetation where *Hygrophila* and *Cabomba* once occurred (Figure 12).

Figure 9. Example of *Cabomba* in Landa Lake at ~70 cfs on March 5th, 2026.

Figure 10. Example of bryophytes re-establishing in the Old Channel study reach on March 5th, 2026.

Figure 11. Example of *Ludwigia* persisting in the Old Channel study reach on March 5th, 2026.

Figure 12. Dewatered area along the right bank at the Upper New Channel at ~70 cfs on February 5th, 2026.

In addition to mapping fountain darter habitat, fountain darters were sampled using timed/random dip-net and drop-net survey methods. A total of 99 fountain darters were observed during 5 person-hours (p-h) of effort during timed dip-netting. Median catch per unit effort (18 darters/p-h) was lower than winter 2025 (32 darters/p-h). During random dip-netting, fountain darters were detected at 23 (46%) and 25 (50%) stations out of the 50 stations sampled in February and March, respectively. Across 26 drop-net sites, overall median fountain darter density was 0.00 darters/m^2, which was lower than the median density observed in January 2025 (0.50 darters/m^2). Across study reaches, median density was 0.00 darters/m^2 at Upper Spring Run and Old Channel, 0.25 darters/m^2 at Landa Lake, and 3.25 darters/m^2 at Upper New Channel. Based on historical sampling events during winter, lower densities during winter are generally expected compared to other seasons. Although densities were low, recent recruits (≤20 mm) were observed during all drop-netting and dip-netting activities and high quality fountain darter habitat still persists in most reaches.

In summary, total system discharge in the Comal System remained approximately 60-70 cfs from January 6th through March 6th, 2026. Water quality and water temperature conditions were generally stable throughout the system, though Booneville Far and New Channel Downstream demonstrated increased water temperatures. Habitat conditions remained less suitable in several locations, primarily at the upper spring areas and the New Channel. Spring Runs 1 and 2 were not flowing and discharge at Spring Run 3 was greatly reduced with a majority of the channel being dry. Comal Springs salamander and Comal Springs riffle beetle counts were low, though individuals were still observed during each sampling event. Similar to previous evaluations at

~70 cfs, emergent aquatic vegetation and increased filamentous algae were observed throughout all reaches and were most noticeable at Upper Spring Run, around the Landa Lake Islands, and at Upper New Channel. Despite lower fountain darter densities, high quality fountain darter habitat still remains in the Old Channel and throughout much of Landa Lake. It remains important to continue tracking the system-wide fountain darter and the surface-dwelling invertebrate's habitat conditions as these low discharge conditions persist into the summer.