2021 EAHCP Annual Expanded Water Quality Report

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1 | Introduction

The Edwards Aquifer Habitat Conservation Plan (EAHCP) Expanded Water Quality Monitoring Program was developed to monitor surface water and groundwater quality of the San Marcos and Comal spring systems and act as an early detection mechanism for water impairments that may negatively affect EAHCP Covered Species. From 2013 – 2016, the Expanded Water Quality Program deployed a broad range of sampling activities including surface water (base flow) sampling, groundwater sampling, sediment sampling, real-time water quality monitoring, and stormwater sampling. A Work Group was assembled in 2016 and charged to review the expanded water quality monitoring program and evaluate the recommendations from the National Academies of Sciences review of the EAHCP. The Work Group prepared a final report that included adjustments to the program including the incorporation of fish tissue analysis, reduced sampling frequency of sediment and stormwater sampling, removal of surface water and groundwater sampling, and the addition of one real-time water quality monitoring station per system. More information can be found in the *Report of the 2016 Expanded Water Quality Monitoring Program Work Group*. During the transition from Phase I to Phase II of the EAHCP, a second review of the program was conducted in 2020 that analyzed the results of contaminant detections among stormwater, sediment, and passive diffusion sampling activities and evaluated the parameters monitored in the real-time water quality network. Overall, the number of contaminant detections was low among sampling events 2013-2020. This is in part due to the focus on industrial and commercial contaminants that may not pose substantial risks to the Edwards Aquifer spring communities. Therefore, suggestions from the EAHCP Science Committee were implemented in 2021 that shifted sampling to focus on nutrients and pharmaceutical and personal care products (PPCPs). Additionally, sampling for sucralose, an artificial sweetener, was initiated in 2021 as measure of human and wastewater influence on the San Marcos and Comal spring systems. The current sampling type and activities can be viewed in Table 1-1. Sampling location and activity are displayed in Figure 1-1 for the San Marcos system and Figure 1-2 for the Comal system.

Table 1-1. EAHCP Expanded Water Quality Monitoring Program Sampling Activities

Sample Type	Activities and Sampling Locations
Real-Time Network	Continuous 15-minute interval, telemetered measurements Analytes include temperature, dissolved oxygen, and conductivity Locations include 3 San Marcos and 3 Comal stations
Surface water	Twice annual sampling in conjunction with Biological Monitoring activities Laboratory analyses are focused on nutrients including total phosphorus, orthophosphate, orthophosphate as P, TOC, DOC, DIC, kjeldahl nitrogen, nitrate at N, and ammonia Locations include upper and lower stations at each spring system
Groundwater	Twice annual sampling in conjunction with EAA springs sampling activities Laboratory analyses are focused on geochemical analytes and industrial, commercial, and emerging contaminants. The analytes include cations, anions, nutrients, metals, VOCs, SVOCs, herbicides, pesticides, bacteria, TOC, PCBs, and PPCPs Locations include Spring 1, Spring 3, and Spring 7 (Comal), Hotel, and Deep (San Marcos)
Sediment	Every other year sampling in even numbered years Laboratory analyses are focused on PAHs Locations include 6 San Marcos and 5 Comal stations
Fish Tissue	Every other year sampling in odd numbered years Laboratory analyses are focused on metals and PPCPs in two fish species Locations include upper and lower stations at each spring system

1.1 Real-Time Network

Real-time water quality (RTWQ) instruments have been deployed within the San Marcos and Comal systems for the entirety of the water quality monitoring program. From 2013-2020, real-time instruments consisted of Eureka Manta+ 30s containing five water quality sensors including, dissolved oxygen (mg/l), specific conductivity (µs/cm), turbidity (NTU), water temperature (°C), and pH (SU). Turbidity sensors were discontinued in 2020, excluding Sessom Creek, due to the high rate of malfunction and cost of replacement. In 2021, pH sensors were also discontinued due to the sensor variability being greater than environmental variability. In 2021, Eureka Manta+30s were replaced with InSitu AT 600 real-time instruments. Measurements are recorded every 15 minutes (excluding the Sessom Creek site that is measured every five minutes) and subjected to quality control measures prior to storage in EAHCP and EAA databases. Table 1-2 describes the stations within each river system including station ID, location from headwaters (i.e., Spring Lake Hotel at San Marcos and Headwaters of Landa Lake at Comal River), and period of data record.

Presently, three RTWQ sites are located in the San Marcos system, including Aquarena Springs Drive (ASD), Texas Parks and Wildlife Department (TPWD) hatchery, and Sessom Creek (Figure 1-1). ASD was deployed and brought online by late May 2013, the TPWD hatchery site was installed in January 2016, and the Sessom Creek station began collecting data in January 2018.

Three RTWQ sites are located in the Comal system, including two locations in Landa Lake (i.e., Spring run 3 (SR 3), and Spring run 7 (SR 7)), and one site in the Old Channel (OC, Figure 1-2). Spring run 3 and SR 7 were installed in 2013 whereas the OC station was installed in April 2018.

Table 1-2. EAA real-time water quality station ID, location, and period of record for the San Marcos and Comal spring systems.

River system	Station ID	Location (river km from headwaters)	Period of record
San Marcos	Sessom Creek	0.5 rkm from SMR confluence	1/1/2018 - present
	Aquarena Springs	0.8	5/30/2013 - present
	Rio Vista	1.9	5/30/2013 – 12/31/2020
	TPWD hatchery	4	1/8/2016 - present
Comal	Upper Spring Run	0.1	4/1/2019 – 12/31/2020
	Spring Run 7	1.0	9/10/2013 - present
	Spring Run 3	1.2	4/11/2013 - present
	Landa Lake	1.2	6/10/2013 – 3/31/2018
	Old Channel	1.5	4/20/2018 - present
	New Channel	2.7	5/30/2013 – 12/31/2020

Real-time water quality stations assist in discerning when and what river conditions result in water quality exceeding critical biological standards. One of EAHCP's long-term management objectives is to maintain water quality conditions that do not deviate > 10% from historical water quality conditions recorded during the EAA Variable Flow Study. Additionally, specific EAHCP water quality thresholds include, maintaining water temperature < 25°C as to not inhibit fountain darter reproduction and recruitment rates (McDonald et al. 2007) and maintaining dissolved oxygen concentrations > 4.0 mg/L throughout fountain darter habitat. EAHCP's RTWQ stations are designed to track water quality conditions within the San Marcos and Comal systems to monitor whether river conditions remain within historic conditions and under specific thresholds.

Figure 1-1. Expanded Water Quality Sampling Locations in the San Marcos system.

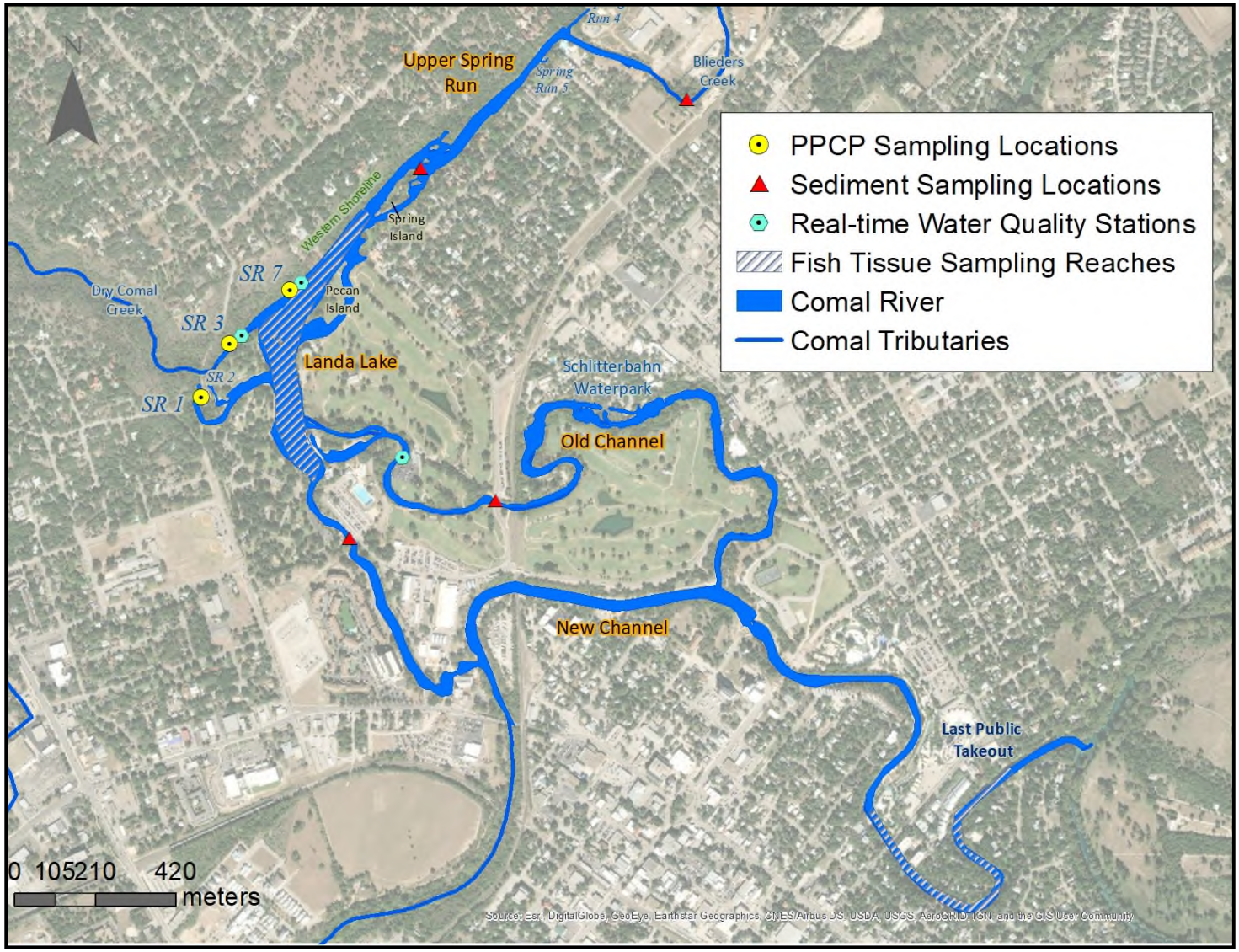

Figure 1-2. Expanded Water Quality Sampling Locations in the Comal system.

1.2 Surface water sampling

Monthly sucralose sampling occurs at one location in each spring system (i.e., Hotel Spring in San Marcos and Spring Run 3 in Comal). Sucralose, an artificial sweetener found in many diet beverages and candies, is not efficiently processed by the body, and subsequently ends up in septic and city wastewater effluent (Whitall et al. 2021). Sucralose has shown minimal degradation when processed through wastewater facilities, is relatively stable in the environment, and has demonstrated reliable detection rates (Oppenheimer et al. 2011). Therefore, monitoring the occurrence and levels of sucralose systems has proven to be a suitable indicator of wastewater input among rivers and groundwater systems.

Additional surface water samples are collected on a biannual basis under normal flow conditions in conjunction with the Biological Monitoring program (Spring and Fall). Sampling locations consist of upper and lower river stations in both systems. For the Comal system, Landa Lake near Spring Island serves as the upper location, and the lower station is located at the last public river take out just upstream of the confluence with the Guadalupe River. In San Marcos, Hotel Spring in Spring Lake serves as the upper location, and the downstream location is located at the most downstream real-time water quality monitoring station (i.e., TPWD hatchery). Samples are submitted to a laboratory for analysis of nutrients (Table 1-3). During the collection event, field parameters are collected that include dissolved oxygen, pH, conductivity, and temperature.

Table 1-3. List of Nutrients Analyzed during Surface Water Sampling

Analyte
Ortho-phosphate
Ortho-phosphate as P
Phosphorus (total)
Dissolved Inorganic Carbon (DIC)
Dissolved Organic Carbon (DOC)
Kjeldahl Nitrogen
Nitrate as N
Ammonia

1.3 Groundwater sampling

Groundwater sampling is conducted by the EAA Aquifer Science Division and is part of their routine water quality monitoring of streams, wells, and springs in the Edwards Aquifer Region (Edwards Aquifer Water Quality Summary 2020 Report). Two spring orifices in the San Marcos system (i.e., Hotel Spring and Deep Hole) and three springs within the Comal system (ie., Spring Run 1, Spring Run 3, and Spring Run 7) are sampled on a biannual basis in conjunction with the EAHCP Biological Monitoring program (i.e, Spring and Fall). Groundwater samples are submitted to a laboratory for analysis of cations, anions, nutrients, metals, VOCs, SVOCs, herbicides and pesticides, bacteria, TOC, PCBs, and PPCPs. The analyte list for laboratory analyses along with the methods are shown in Table 1-4. During the collection event, field parameters will be collected that include dissolved oxygen, pH, conductivity, temperature, and alkalinity.

Table 1-4. List of Items Analyzed during Groundwater Sampling

Analyte
Volatile Organic Compounds (VOCs)
Semi-volatile Organic Compounds (SVOCs)
Organochlorine Pesticides
Polychlorinated Biphenyls (PCBs)
Organophosphorous Pesticides
Herbicides
Metals (Al, Sb, As, Ba, Be, B, Cd, Cr (total), Cu, Fe, Pb, Mn, Hg, Ni, Se, Ag, Tl, V, and Zn)
General Chemistry (GWQP) Total Alkalinity (as CaCO3), Bicarbonate Alkalinity (as CaCO3), Carbonate Alkalinity (as CaCO3); (Cl, Br, NO_3, SO_4, Fl, pH, TDS, TSS, Ca, Mg, Na, K, Si, Sr, CO_3,)), and Total Suspended Solids (TSS).
Phosphorus (total)
Total Organic Carbon (TOC),
Dissolved Organic Carbon (DOC)
Kjeldahl Nitrogen
Bacteria Testing (*E coli*)
PPCPs

Method	**Method Description**	**Protocol**
8260B	Volatile Organic Compounds	(GC/MS) SW846
8270C	Semivolatile Organic Compounds	(GC/MS) SW846
8081B	Organochlorine Pesticides	(GC) SW846
8082A	Polychlorinated Biphenyls (PCBs)	by Gas Chromatography SW846
8141A	Organophosphorous Pesticides	(GC) SW846
8151A	Herbicides	(GC) SW846
6010B	Metals	(ICP) SW846
6020	Metals	(ICP/MS) SW846
7470A	Mercury	(CVAA) SW846
300.0	Anions,	Ion Chromatography
340.2	Fluoride	MCAWW
365.4	Phosphorus,	Total EPA
9040C	pH	SW846
9060	Organic Carbon,	Total (TOC) SW846
SM 2320B	Alkalinity	SM
SM 2540C	Solids,	Total Dissolved (TDS) SM
SM 2540D	Solids, Total Suspended (TSS)	SM
351.2	Nitrogen, Total Kjeldahl	MCAWW
1694	PPCPs	LC-MS/MS

Protocol References:
EPA = US Environmental Protection Agency

MCAWW = "Methods For Chemical Analysis Of Water And Wastes", EPA-600/4-79-020, March 1983 And Subsequent Revisions.
SM = "Standard Methods For The Examination Of Water And Wastewater",
SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

1.4 Sediment and Fish Tissue sampling

Sediment and fish tissue sampling occur on an every other year basis with sediment sampling completed in even years and fish tissue sampling in odd years. Sampling collections for sediment and fish tissue occur in the Spring during the EAHCP Biological Monitoring surveys.

Collection of sediment samples within in each spring system was included in the program to help determine potential effects on EAHCP covered species via direct or indirect exposure to sediment contaminants. Sediment samples are collected once from four locations within the Comal system and six locations in San Marcos system (Figures 1-1 and 1-2). Three samples will be collected at each sample site and composited into one sample for analysis. Sediment samples will be analyzed for polycyclic aromatic hydrocarbons (PAHs) and other contaminants listed in Table 1-5.

Table 1-5. List of Contaminants Analyzed during Sediment Sampling.

Analyte
Benzo[a]anthracene
Chrysene
Benzo[a]pyrene
Benzo[b]fluoranthene
Benzo[k]fluoranthene
Fluoranthene
Dibenz(a,h)anthracene
Indeno[1,2,3-cd]pyrene
Pyrene
Phenanthrene
Fluorene
Benzo[g,h,i]perylene
Anthracene
Acenaphthene
Acenaphthylene
Benzo[g,h,i]perylene
Carbazole
2-Methylnaphthalene
Naphthalene
Total Organic Carbon (TOC)

Fish tissue sampling within in each spring system was included to the program in 2017 to serve as a direct link between water quality impairments and their potential effects on EAHCP covered

species. Prior to 2017, the linkage between contaminants and metals found in the spring systems and their accumulation in EAHCP covered species was unknown. Surrogate species were selected to represent EAHCP covered species and the two species selected for analysis are *Gambusia* (mosquito fish) and *Micropterus salmoides* (largemouth bass). The mosquito fish serves as a short-lived species, similar to the EAHCP covered fountain darter whereas the largemouth bass represents the longer-lived species. Mosquito fish and largemouth bass are collected from upper and lower sections in both spring systems. In the San Marcos, fish are collected in Spring Lake (i.e., upper section) and in the San Marcos River near IH35 (i.e., lower section). For the Comal, both species are collected from Landa Lake (i.e., upper section) and in the Comal River near the last public take out (i.e., lower section). For each section, whole body organisms are combined to create a mosquito fish composite sample. Composites for largemouth bass are created from individual fillet aliquots from each fish. Tissue samples will be submitted to a laboratory and analyzed for metals and PPCP contaminants listed in Table 1-6.

Table 1-6. List of Metals and Contaminants Analyzed among Fish Tissue Samples.

Analyte
Metals (Al, Sb, As, Ba, Be, B, Cd, Cr (total), Cu, Fe, Pb, Mn, Hg, Ni, Se, Ag, Tl, V, and Zn)
PPCPs

Method	**Method Description**	**Protocol**
6010B	Metals	(ICP) SW846
6020	Metals	(ICP/MS) SW846
7470A	Mercury	(CVAA) SW846
1694	PPCPs	LC-MS/MS

Protocol References:
EPA = US Environmental Protection Agency
MCAWW = "Methods For Chemical Analysis Of Water And Wastes", EPA-600/4-79-020, March 1983 And Subsequent Revisions.
SM = "Standard Methods For The Examination Of Water And Wastewater",
SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates

2 | Methods

2.1 Real-Time Network

The near continuous (15-minute interval) raw data collected at San Marcos River and Comal system RTWQ sites underwent a quality assurance review process before being utilized for this assessment. Water quality sonde data was overlayed with river streamflow and precipitation data to verify significant increases and decreases in measured values. The data from each site within the basins were also compared to ensure validity. The multiparameter water quality instruments were switched out at 5 to 6-week intervals, with the unit returned to the EAA office for data download, calibration checks, and cleaning. Data obtained from independent field visit measurements and post-deployment sensor calibration checks were used to determine any necessary adjustments to the near continuous raw data sets in the AQUARIUS database.

Turbidity data recorded at Sessom Creek were edited for any values in the continuous raw data interpreted as not being representative of actual ambient water quality conditions. Instances of environmental interference as well as sensor error/malfunction posed a challenge for creating a final "clean" turbidity data set at any one RTWQ site. Sporadic spikes in turbidity values greater than 20 NTU that occurred without any corresponding change in other parameters (i.e. Specific Conductance, Temperature, or Dissolved Oxygen) were deleted from the finalized continuous data sets before their use in this assessment.

Mean daily, maximum daily, and minimum daily values for water quality parameters at each of the San Marcos River and Comal system RTWQ sites were exported from AQUARIUS database. Hydrographs since the start of the EAHCP (2013) for the two systems were constructed using surface water discharge data (recorded in 15 minute intervals) obtained for the San Marcos River at San Marcos (USGS Station 08170500) and the Comal River at New Braunfels (USGS Station 0816900). Mean daily springflow (cfs) for the San Marcos springs (USGS Station 08178710) and the Comal springs (USGS Station 0816900) were used to construct springflow hydrographs for 2013-2021. Differences in maximum daily temperatures and minimum daily dissolved oxygen among sites and seasons were assessed using boxplots. Seasons were defined as: Winter (January, February, December), Spring (March – May), Summer (June – August), and Fall (September – November). For sites exceeding water temperatures > 25°C, 15-minute interval data (5 minute interval data for Sessom Creek) were used to assess the number of days and percent of day a site exceeded 25°C. Similar analysis was completed for sites that dropped below the 4.0 mg/L dissolved oxygen threshold.

2.2 Surface water sampling

Water samples for sucralose were collected from Hotel Spring in the San Marcos system and Spring run 3 in the Comal system monthly January – December 2021. Prior to water sample collection, an Insitu AquaTroll 600 water quality sonde was placed directly in each location to measure water quality parameters (i.e., pH, specific conductivity, dissolved oxygen, and temperature) for a ten-minute period. Sample bottles were submerged directly into the springs to be filled. Field duplicates and field blanks (i.e., bottles filled with DI water) were also filled following sampling protocols. All sample bottles were kept chilled during transport in an ice chest frozen until later shipment to the laboratory that occurred on a quarterly basis.

Surface water samples for nutrient analysis were collected in April and September 2021 at upper and lower sites in the San Marcos and Comal systems. During sampling collections, water quality parameters were measured following same protocols as monthly sucralose sampling. Filtration for methods 6010B (metals), 6020 (metals), and 7470A (mercury) were performed at the sample locations by using a 0.45 micron high capacity cartridge filter inserted into syringe. Preservatives were placed in the bottles (as appropriate) by the contracted laboratory. Field duplicates and field blanks were also filled following sampling protocols. All sample bottles were kept chilled during transport in an ice chest frozen and immediately shipped to the contract laboratory for analysis.

All water quality data were exported to excel and medians values were calculated for water quality parameters collected during sucralose and bi-annual surface water sampling collections.

2.3 Groundwater sampling

Groundwater samples for PPCPs and other analyses were collected from Hotel and Deep Hole springs in the San Marcos system and from Spring Run 1, 3, and 7 within the Comal Spring system in April and September 2021. Prior to groundwater collections, an Insitu AquaTroll 600 water quality sonde was placed directly into the spring orifice to measure water quality parameters (i.e., pH, specific conductivity, dissolved oxygen, turbidity, and temperature). Sample bottles were then submerged directly into the spring to obtain samples, except for Deep Hole Spring where EAA staff utilized a peristaltic pump with 30 feet of sample tubing inserted into the spring orifice to collect field parameters and fill sample bottles. Samples were collected in accordance with the criteria set forth in the *EAA Groundwater Monitoring Plan*.

Filtration for methods 6010B (metals), 6020 (metals), 7470A (mercury) and field alkalinity were performed at the sample locations by utilizing a 0.45 micron high capacity cartridge filter inserted into a weighted single sample disposable bailer or sample tubing (if peristaltic pump was used). Preservatives were placed in the bottles (as appropriate) by the contracted laboratory. Ice was placed into the cooler immediately after sampling and later shipped to the contract laboratory.

When not in use or after collection, sampling equipment and/or coolers containing samples were secured inside the EAA vehicles to maintain appropriate sample custody and security.

Analyses for field alkalinity were conducted at EAA's Camden Building using Hach Titralab® AT1000. The method used for field alkalinity is discussed in detail in the *EAA Groundwater Monitoring Plan.*

A full report of groundwater sampling results at Hotel and Deep Hole springs will be available under the Science and Aquifer Protection section on the EAA website and entitled Water Quality Summary Report 2021. Sampling results for PPCPs are reported in Section 3.3.

2.4 Fish Tissue sampling

Fish tissue samples were collected in April-May 2021. Mosquito fish and largemouth bass were collected from the upper and lower sites in the San Marcos system (i.e., Spring Lake and the lower San Marcos River near IH35) and the Comal system (i.e., Landa Lake and Comal River near the last public take out). Mosquito fish were captured using dip nets and humanely euthanized by being placed in a cooler with ice. Largemouth bass were collected via hook and line and humanely euthanized by being placed in a cooler with ice. Collected specimens were frozen until further processing.

Prior to shipping, mosquito fish whole body composite samples were created by grinding frozen mosquito fish with stainless steel implements. Largemouth bass composite samples were made in a similar manner using fillet tissue aliquots from each individual fish. Processing implements were cleaned with Liquinox and rinsed with DI prior to use.

Fish tissue results are not reported in the results section due to COVID related issues that delayed transportation of samples and laboratory analysis. Results for fish tissue analysis will be included in the 2022 EAHCP Expanded Water Quality Report.

3 | Results and Discussion

3.1 Real-Time Network

3.1.1 San Marcos

Hydrology

Average springflow for the San Marcos Springs calculated from the period of record (i.e., 1956 – present) was 175 cfs. Since 2013, San Marcos springflow ranged from below average in 2013-2014 to above average from mid-2015-2017 (Figure 3-1). During 2013, the San Marcos springflow dropped down to as low as 99 cfs on May 21st. A flow pulse on October 30th, 2013, estimated at 5,400 cfs, resulted in a temporary spike in above average springflow. No substantial rain events occurred in 2014 and consequently, springflow dropped below average. Increased springflow in 2015 occurred following two large precipitation events in late May and October with above average springflow continued into 2016 - 2017. In 2018, springflows dropped below average, reaching 117 cfs in late August. However, several small rain events in the early fall resulted in springflows increasing and becoming above average (~250 cfs). Springflows were largely above average in 2019, but with a lack of large flow pulses (> 500 cfs), springflows lessened throughout the year and dropped just below average beginning in October. With no large flow pulses in 2020, springflows continued to decrease and dropped below 120 cfs by December. Springflow in early 2021 continued to decline and dropped briefly below 100 cfs in April before rain events in late spring resulted in springflow rising to average flows. Springflows dropped slightly during early fall but increased again after significant rain events (i.e., 1,070 cfs pulse on October) to end 2021 at average springflow.

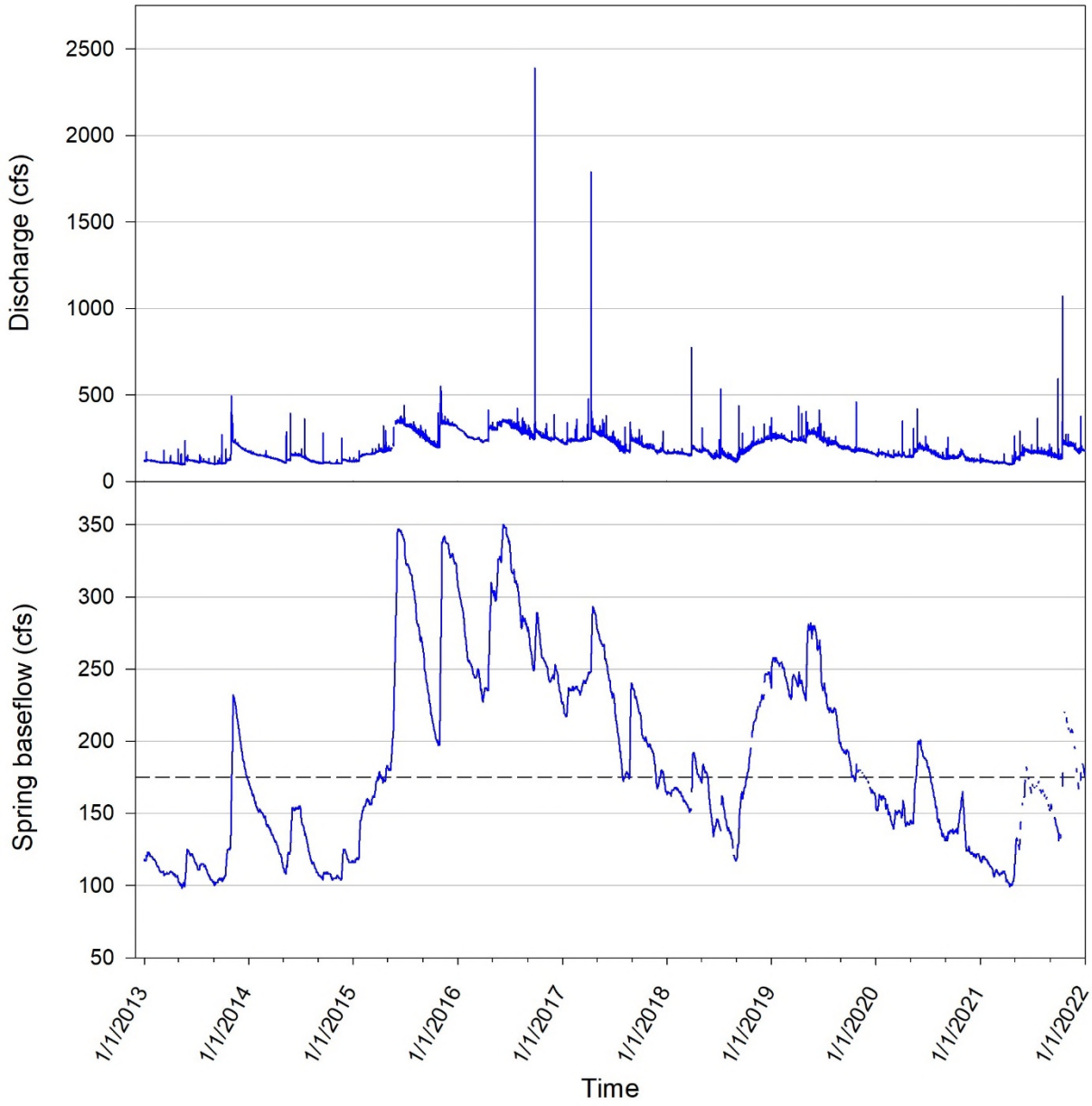

Figure 3.1-1. Hydrographs for the San Marcos River at San Marcos (USGS station 08170500) and mean daily springflow for the San Marcos springs (USGS Station 08170000) 2013 – 2021. Dashed line denotes the long-term average springflow (175 cfs) in the San Marcos River.

Temperature

Table 3.1-1 displays monthly summary statistics (i.e., monthly mean and 15 minute minimum and maximum values reported that month) for water temperatures recorded in 2021 at the San Marcos River RTWQ sites. In general, mean monthly water temperatures remained stable with variations averaging ~3 °C during the year. The TPWD hatchery site did display more variability in water temperature with minimum daily water temperatures reaching lower temperatures in winter months and maximum daily water temperatures increased during summer months. Maximum daily

water temperatures recorded in 2021 reached the 25°C threshold with the highest temperature (25.69°C) recorded at the TPWD hatchery in July. The lowest temperature (14.26°C) in 2021 was observed at the TPWD hatchery site in February.

Table 3.1-1. Monthly mean, minimum, and maximum water temperatures among San Marcos River RTWQ (2021).

	Water temperature (°C) at San Marcos Water Quality Sites					
Month (2021)	**Aquarena Springs Drive**			**TPWD hatchery**		
	Mean	Min	Max	Mean	Min	Max
Jan	20.73	18.78	22.51	19.86	14.45	22.27
Feb	20.44	16.66	23.24	19.11	14.26	22.79
Mar	21.61	20.02	23.75	21.19	17.03	23.44
Apr	22.08	19.93	24.42	21.89	19.15	24.27
May	22.73	21.37	24.59	22.76	20.77	25.20
Jun	23.05	22.00	24.62	23.22	21.98	25.03
Jul	23.08	22.23	24.64	23.23	22.10	25.69
Aug	23.05	22.11	24.69	23.38	22.19	25.33
Sept	22.73	21.30	24.29	22.98	20.92	24.87
Oct	22.23	20.93	23.61	22.36	20.68	24.67
Nov	21.61	20.90	22.75	21.36	19.27	22.98
Dec	21.68	20.69	22.60	21.51	19.61	22.99

Box plots for maximum daily temperatures (i.e., highest 15 minute interval recorded daily) observed at San Marcos RTWQ sites from time of equipment deployment (i.e., 2013 for Aquarena Springs Drive (ASD) and 2016 for TPWD hatchery) through 2021 compared to maximum daily temperature observed in 2021 are shown in Figure 3.1-2. The median of maximum daily temperatures for 2021 was slightly higher than the median of maximum daily temperatures from time of equipment deployment at the ASD site but the 2021 medians in maximum daily temperatures at the TPWD hatchery site were comparable to median maximum daily temperatures recorded since 2016.

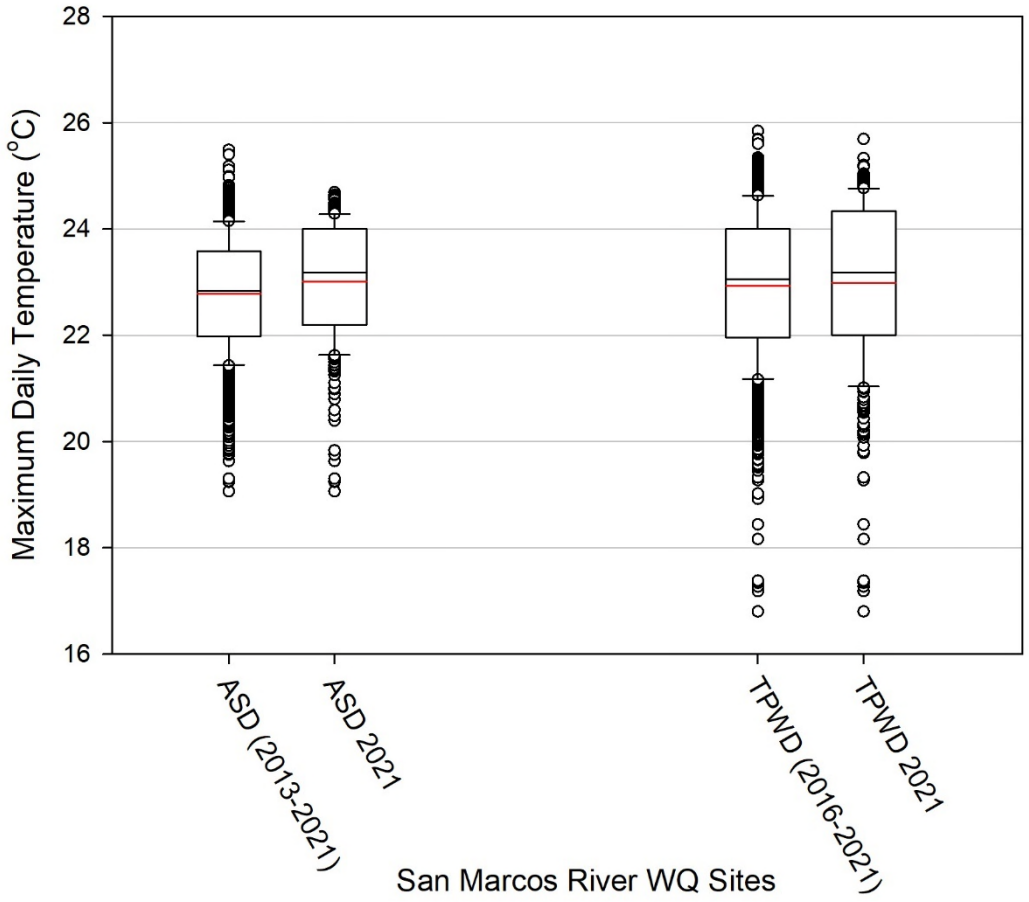

Figure 3.1-2. Box plots of maximum water daily temperatures (°C) among San Marcos River RTWQ sites from time of equipment deployment through 2021 compared to 2021 values. Black lines represent median values and red lines denote mean values. Whiskers represent maximum and minimum temperature values, excluding outliers (open circles).

Maximum daily water temperatures were plotted for San Marcos River RTWQ sites for 2021 (Figure 3.1-3). Throughout 2021, maximum daily temperatures were marginally more variable at the TPWD hatchery site with lower maximum daily temperatures during the winter and higher maximum daily temperatures in the spring and summer compared to the upstream ASD site. Both sites showed a drastic drop in maximum daily temperatures in mid-February when ambient temperatures remained below freezing for approximately seven days. Maximum daily temperatures reached or exceeded 25°C at the TPWD hatchery site for 12 days during the months of May - August in 2021. Among those 12 days, time spent at or above 25°C ranged from 0.25 hrs – 3.25 hrs (mean = 1.2 hrs).

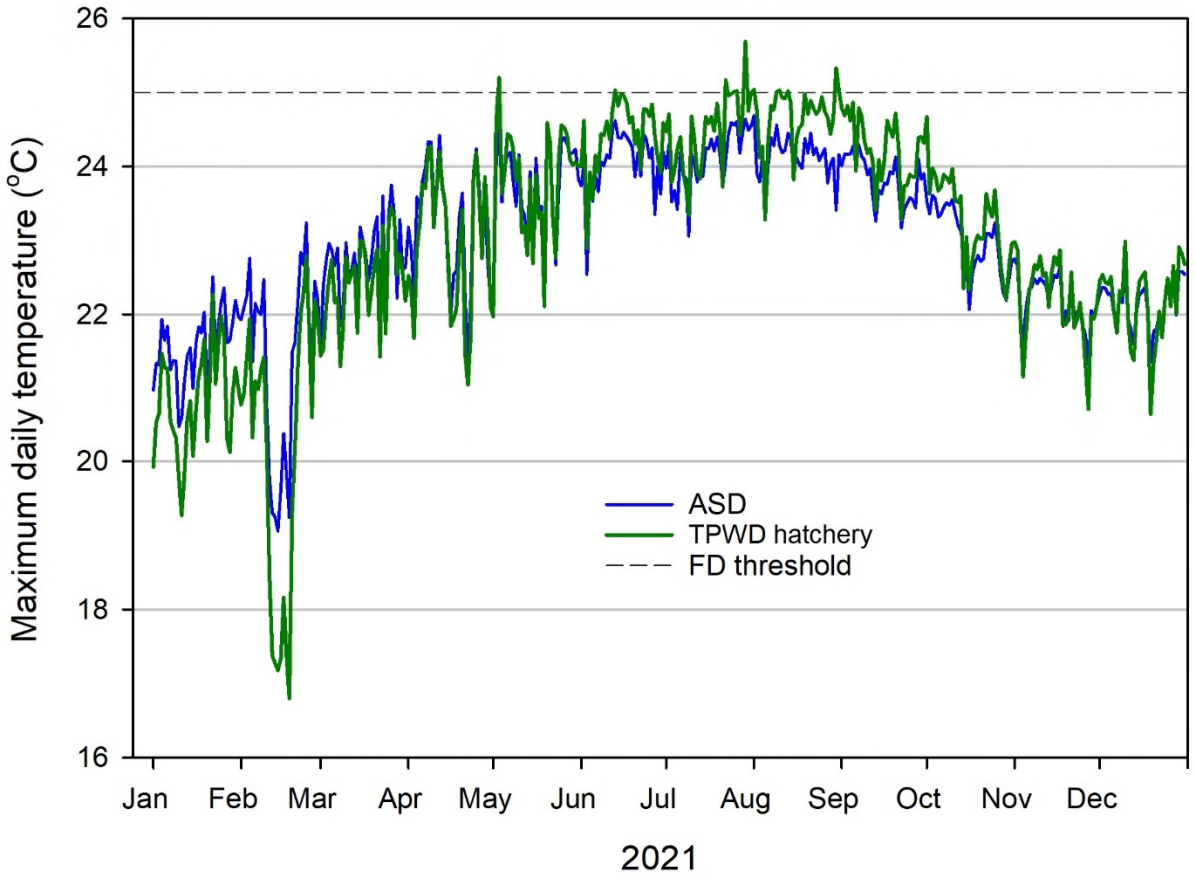

Figure 3.1-3. Maximum daily water temperatures (°C) among San Marcos River RTWQ sites (2021). Dashed line represents temperature threshold for reduced reproduction for the fountain darter.

Box plots for seasonal maximum daily water temperatures at San Marcos RTWQ sites for 2021 are shown in Figure 3.1-4. Across seasons, median maximum daily temperatures varied by ~2-3°C among San Marcos River WQ sites with some extreme outlier temperatures observed in winter. The extreme outliers and greater variability in maximum daily temperature observed during winter can be attributed to the extreme cold weather experienced in south Texas during February 2021. Spring and fall also showed variability in maximum daily temperature while summer months showed less variability but recorded the highest maximum daily temperatures for San Marcos WQ sites.

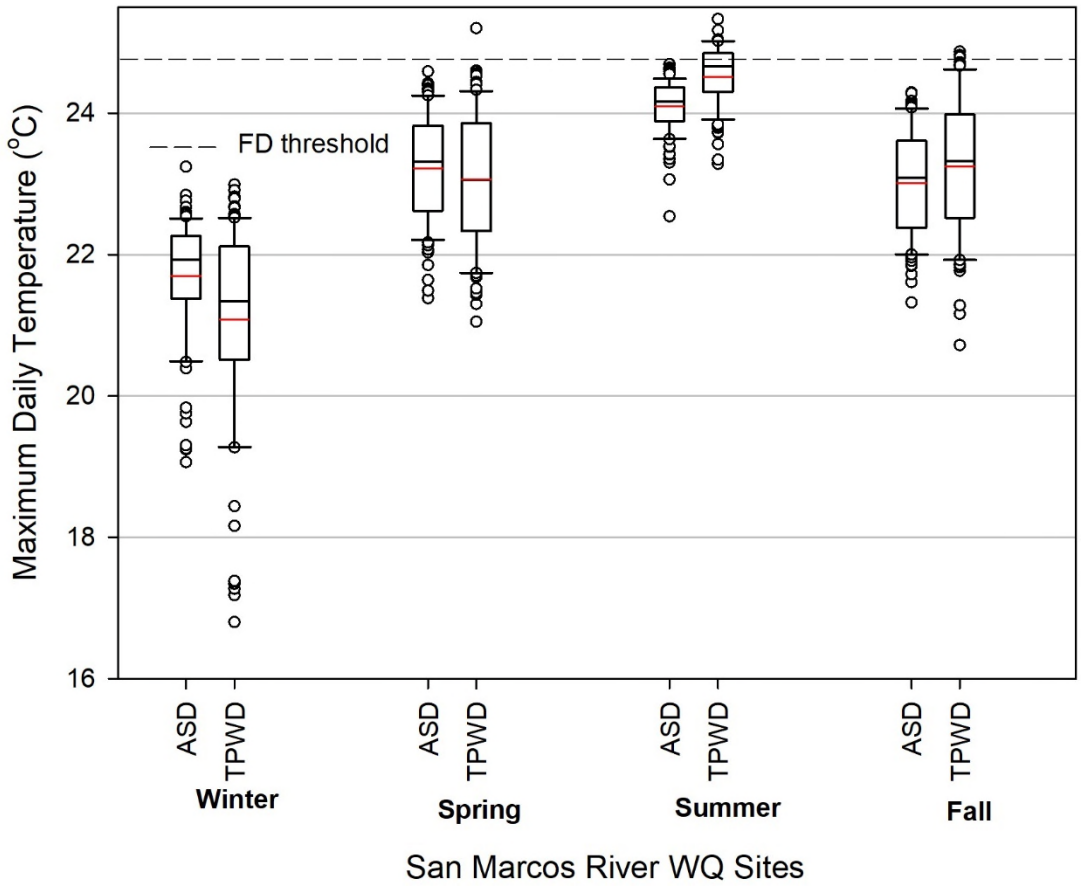

Figure 3.1-4. Box plots of maximum daily water temperatures (°C) among seasons at San Marcos River RTWQ sites in 2021. Black lines represent median values and red lines denote mean values. Whiskers represent maximum and minimum temperature values, excluding outliers (open circles).

Dissolved Oxygen

Table 3.1-2 displays monthly summary statistics for dissolved oxygen (DO) recorded in 2021 at the San Marcos River RTWQ sites. Mean monthly DO remained relatively consistent with variations averaging 1 mg/l within a site and did not vary greatly between the two sites. The TWPD hatchery site demonstrated greater variability in DO in 2021 with minimum DO at ~6 mg/l and maximum DOs slightly higher than 11 mg/l. The highest DO recorded in 2021 was 11.29 mg/l at TPWD hatchery in February, and the lowest DO (6.89mg/l) also occurred in April.

Table 3.1-2. Monthly mean, minimum, and maximum DO (mg/l) among San Marcos River RTWQ sites (2021).

	Dissolved oxygen (mg/l) at San Marcos Water Quality Sites					
Month (2021)	**Aquarena Springs Drive**			**TPWD hatchery**		
	Mean	Min	Max	Mean	Min	Max
Jan	8.33	7.33	9.85	8.78	7.49	10.95
Feb	8.5	7.25	10.27	8.97	7.5	11.29
Mar	8.26	6.98	10	8.69	7.3	10.97
Apr	8.01	6.9	10.04	8.24	6.89	10.46
May	7.91	7	9.28	8.24	7.23	9.68
Jun	7.77	7.02	9.01	8.24	7.35	9.54
Jul	7.77	6.99	8.93	8.19	7.16	9.36
Aug	7.76	7.06	8.94	8.2	7.04	9.46
Sept	7.81	7.05	9.14	8.25	7.28	9.63
Oct	7.81	7.11	8.93	8.24	7.35	9.26
Nov	7.92	7.31	9.04	8.48	7.84	9.64
Dec	7.83	7.24	9.08	8.29	7.32	9.64

Box plots for minimum daily DO (i.e., lowest DO reported for one 15 minute interval in a 24 hour period) observed at San Marcos RTWQ sites from time of equipment deployment (i.e., 2013 for ASD and 2016 for TPWD hatchery) through 2021 compared to minimum daily DO observed in 2021 are shown in Figure 3.1-5. The medians of minimum daily DO for 2021 were comparable to the medians of minimum daily DO from time of equipment deployment for San Marcos River RTWQ sites. Median minimum DO was slightly lower in 2021 at ASD compared to the comprehensive DO dataset whereas TPWD hatchery site had median minimum daily DO values very similar to previously recorded medians.

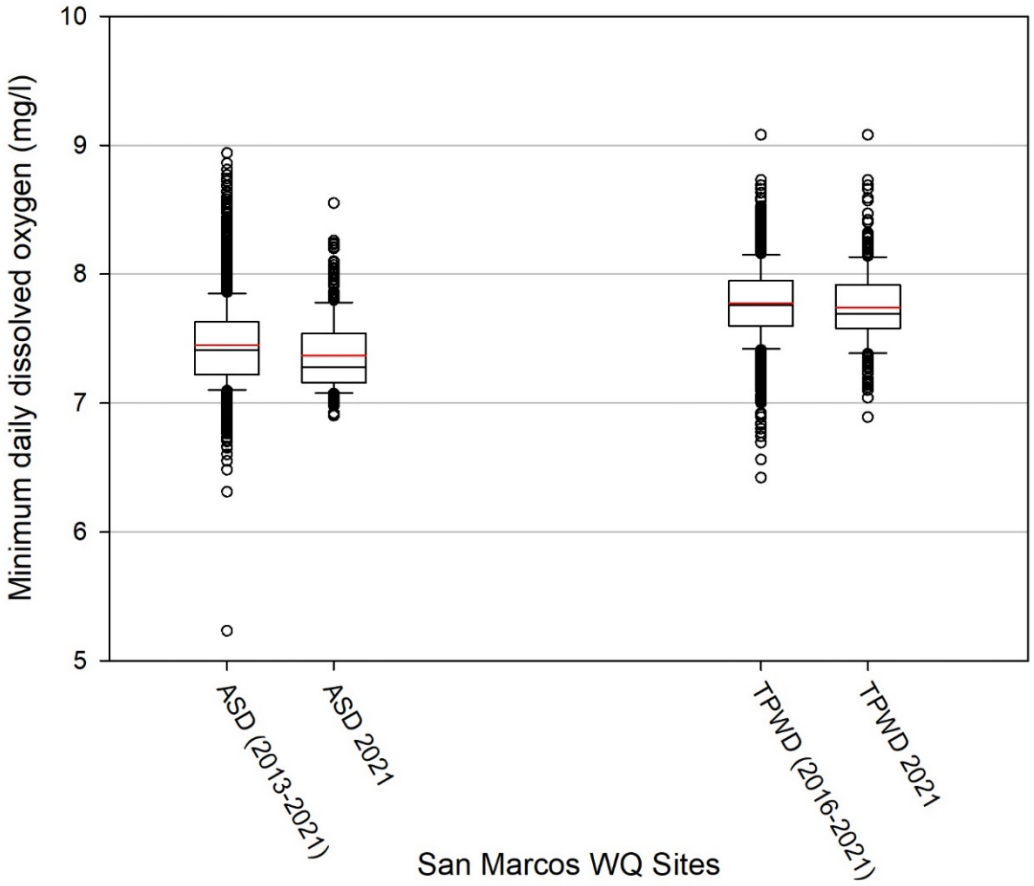

Figure 3.1-5. Box plots of minimum daily DO (mg/l) among RTWQ sites in the San Marcos River from time of equipment deployment through 2021 compared to 2021 only. Black lines represent median values and red lines denote mean values. Whiskers represent maximum and minimum DO values, excluding outliers (open circles).

Minimum daily DO recorded in 2021 were plotted for San Marcos River RTWQ sites (Figure 3.1-6). Similar to previous years, the TPWD hatchery site maintained higher minimum daily DO levels compared to the ASD site. An interesting observance in 2021 was the spike in minimum daily dissolved oxygen during the extreme cold air temperatures experienced in February. The minimum DO threshold (4 mg/l) was not reached among any San Marcos River RTWQ sites in 2021.

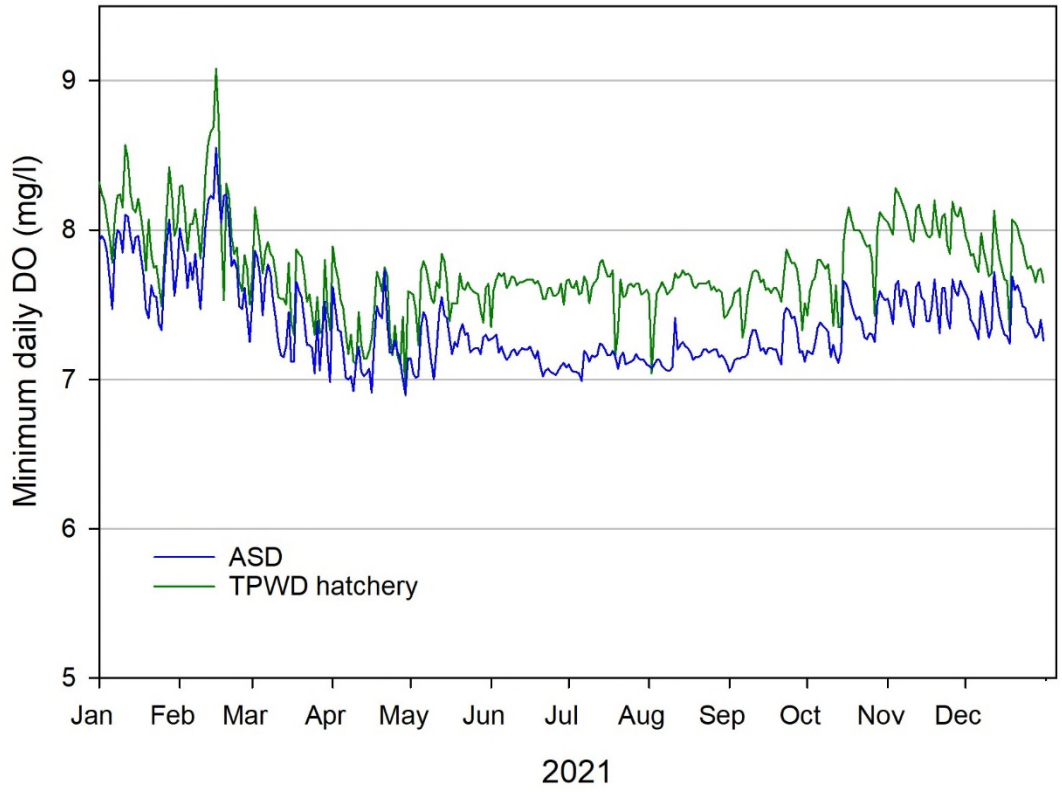

Figure 3.1-6. Minimum daily DO (mg/l) among San Marcos River water quality stations (2021).

Conductivity

Table 3.1-3 displays monthly summary statistics for conductivity (µs/cm) recorded in 2021 at the San Marcos River RTWQ sites. Mean monthly conductivity remained consistent among sites and throughout the year. The highest conductivity in 2020 was recorded at the TPWD hatchery in December (660 µs/cm) and the lowest conductivity (74 µs/cm) was observed in July and October, respectively at the TPWD hatchery location.

San Marcos River discharge and mean daily conductivity were plotted for San Marcos River RTWQ sites for 2021 (Figure 3.1-7). Mean daily conductivity was influenced by rain events in the San Marcos River with decreases in conductivity corresponding with influxes of run-off entering the river. Outside of rain events, mean conductivity generally ranged between 600-625 µs/cm among all San Marcos RTWQ sites.

Table 3.1-3. Monthly mean, minimum, and maximum conductivity (µs/cm) among San Marcos River RTWQ sites (2021).

	Conductivity (µs/cm) at San Marcos Water Quality Sites					
Month (2021)	**Aquarena Springs Drive**			**TPWD hatchery**		
	Mean	Min	Max	Mean	Min	Max
Jan	620	587	624	619	465	641
Feb	621	598	628	619	531	641
Mar	625	540	629	622	367	632
Apr	627	571	634	621	320	640
May	618	464	632	608	184	643
Jun	616	568	620	622	400	655
Jul	617	527	621	623	303	660
Aug	617	568	622	623	430	634
Sept	617	265	623	619	104	634
Oct	586	159	622	589	74	634
Nov	618	590	620	621	390	630
Dec	619	504	622	623	325	629

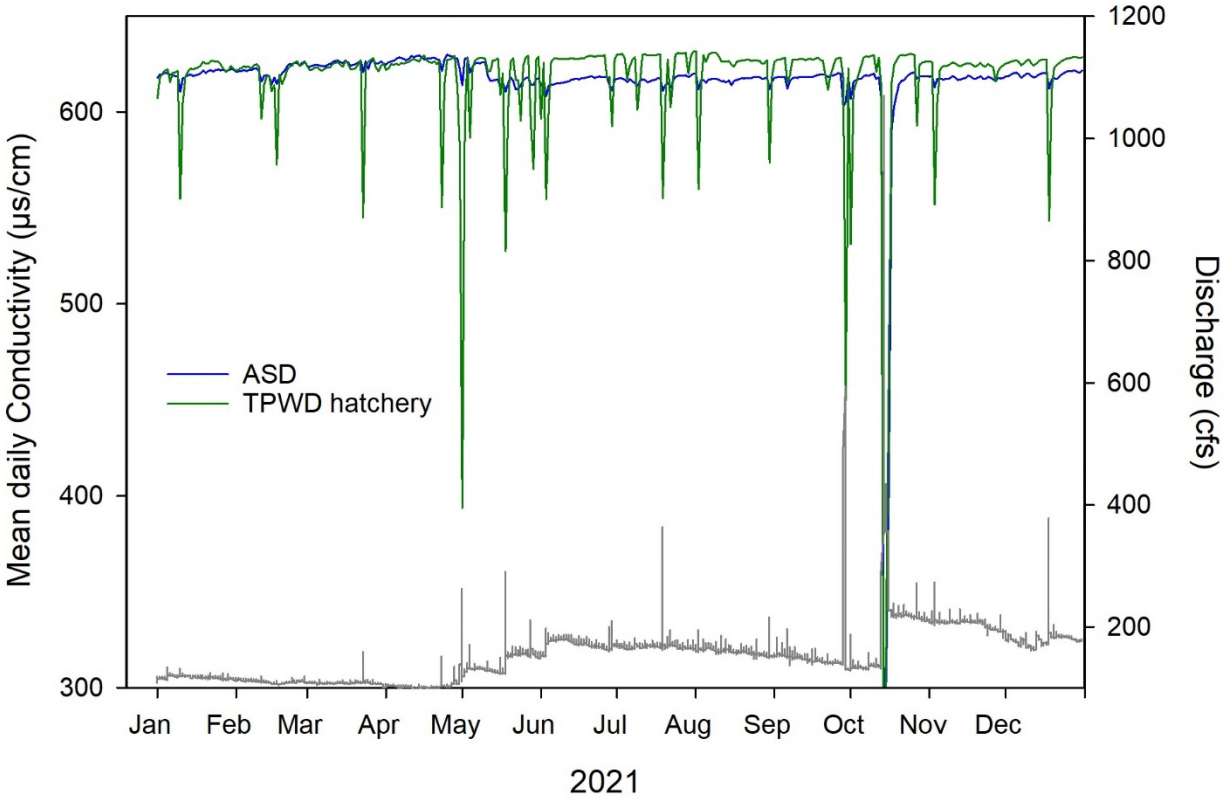

Figure 3.1-7. Mean daily conductivity (µs/cm) among San Marcos River RTWQ sites and San Marcos River discharge (USGS Gage#08170500) in 2021.

Sessom Creek Water Quality Characterization

Table 3.1-4 displays monthly summary statistics for water quality parameters measured in Sessom Creek for 2021. Figures 3.1-8 to 3.1-10 illustrate the daily values for water quality parameters in Sessom Creek (maximum daily temperature, minimum daily DO, mean daily conductivity and turbidity, respectively). Overall, Sessom Creek displayed more variability in water quality conditions than the San Marcos River RTWQ sites. Similar to the mainstream San Marcos River sites, a drop in maximum daily temperature was observed during the extreme cold temperatures experienced in February; however, a spike in DO was observed during the same time period. The highest maximum daily water temperature reported in Sessom Creek for 2021 was 31.90°C in July. Maximum daily water temperatures exceeded 25°C for 24 days (April – September) in 2021, ranging from 0.25 hours – 22.5 hours (mean = 5.7 hours, median = 4.5 hours) at or above 25°C during those 24 days. DO dropped below 4.0 mg/l in Sessom Creek only two days in 2021 during March and April.

Table 3.1-4. Monthly mean, minimum, and maximum for water quality parameters in Sessom Creek (2021).

Month (2021)	**Temperature (°C)**			**DO (mg/l)**			**Conductivity (µs/cm)**			**Turbidity (NTU)**		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Jan	19.26	6.18	22.08	6.11	4.51	12.44	640	74	665	1.80	0.20	69.00
Feb	17.68	2.44	22.93	7.14	4.75	13.47	607	77	663	4.81	0.16	275.87
Mar	20.89	16.95	23.50	6.12	3.84	9.60	642	46	665	3.25	0.56	811.12
Apr	21.40	17.20	25.04	5.68	3.84	8.95	619	42	662	3.78	0.57	440.12
May	22.37	19.88	26.53	6.32	5.00	8.90	592	33	657	6.14	0.92	738.90
Jun	23.30	21.67	28.04	6.38	5.39	8.41	620	42	647	2.79	1.13	420.07
Jul	23.23	22.70	31.90	6.25	5.42	8.30	628	39	657	4.15	1.33	497.48
Aug	23.29	22.76	29.58	6.37	5.43	7.94	638	45	666	4.13	1.42	350.83
Sept	22.94	21.68	28.12	6.32	5.07	8.80	650	39	669	6.35	1.70	822.15
Oct	22.66	19.52	24.27	6.23	5.03	8.96	644	41	681	8.51	1.70	960.19
Nov	21.87	14.85	22.59	6.48	5.61	10.00	645	72	659	6.35	0.00	518.11
Dec	21.66	16.82	22.56	6.36	4.92	9.36	642	44	669	2.52	0.11	936.43

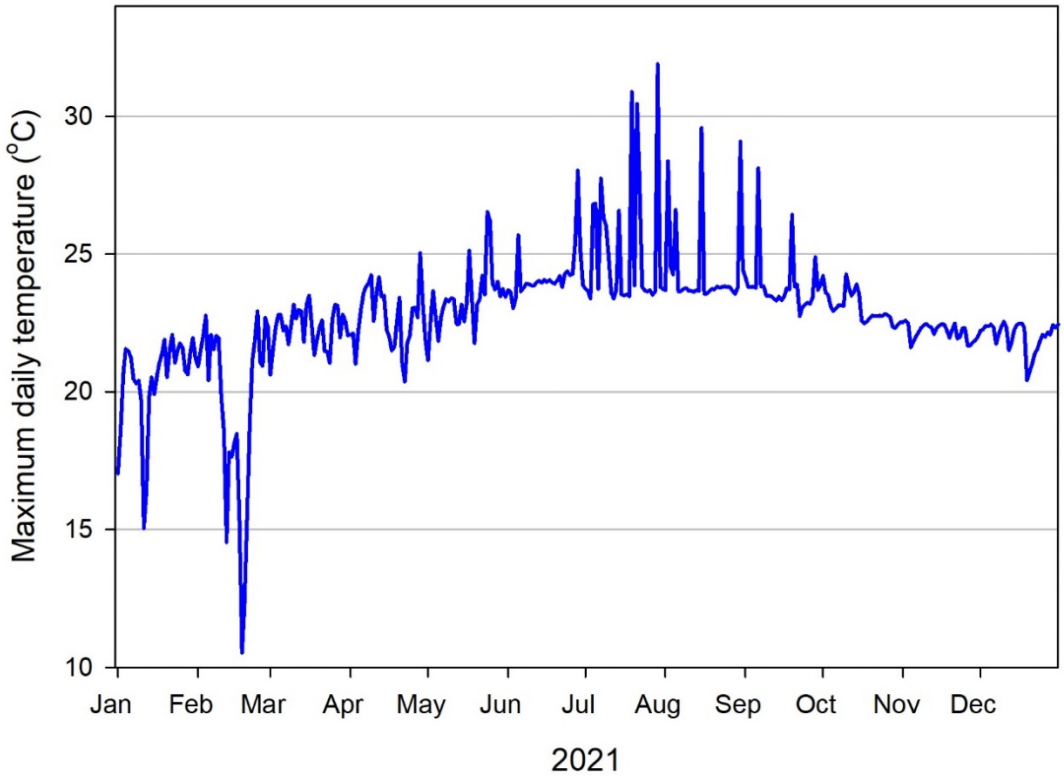

Figure 3.1-8. Maximum daily water temperatures (°C) in Sessom Creek (2021).

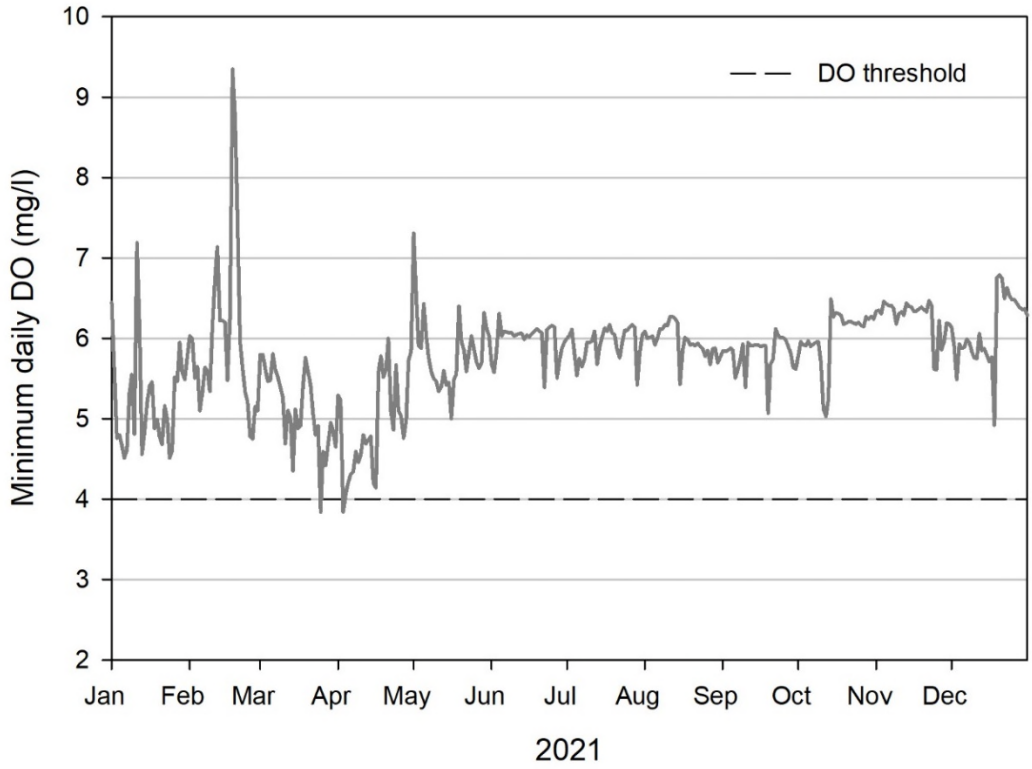

Figure 3.1-9. Minimum daily DO (mg/l) in Sessom Creek (2021).

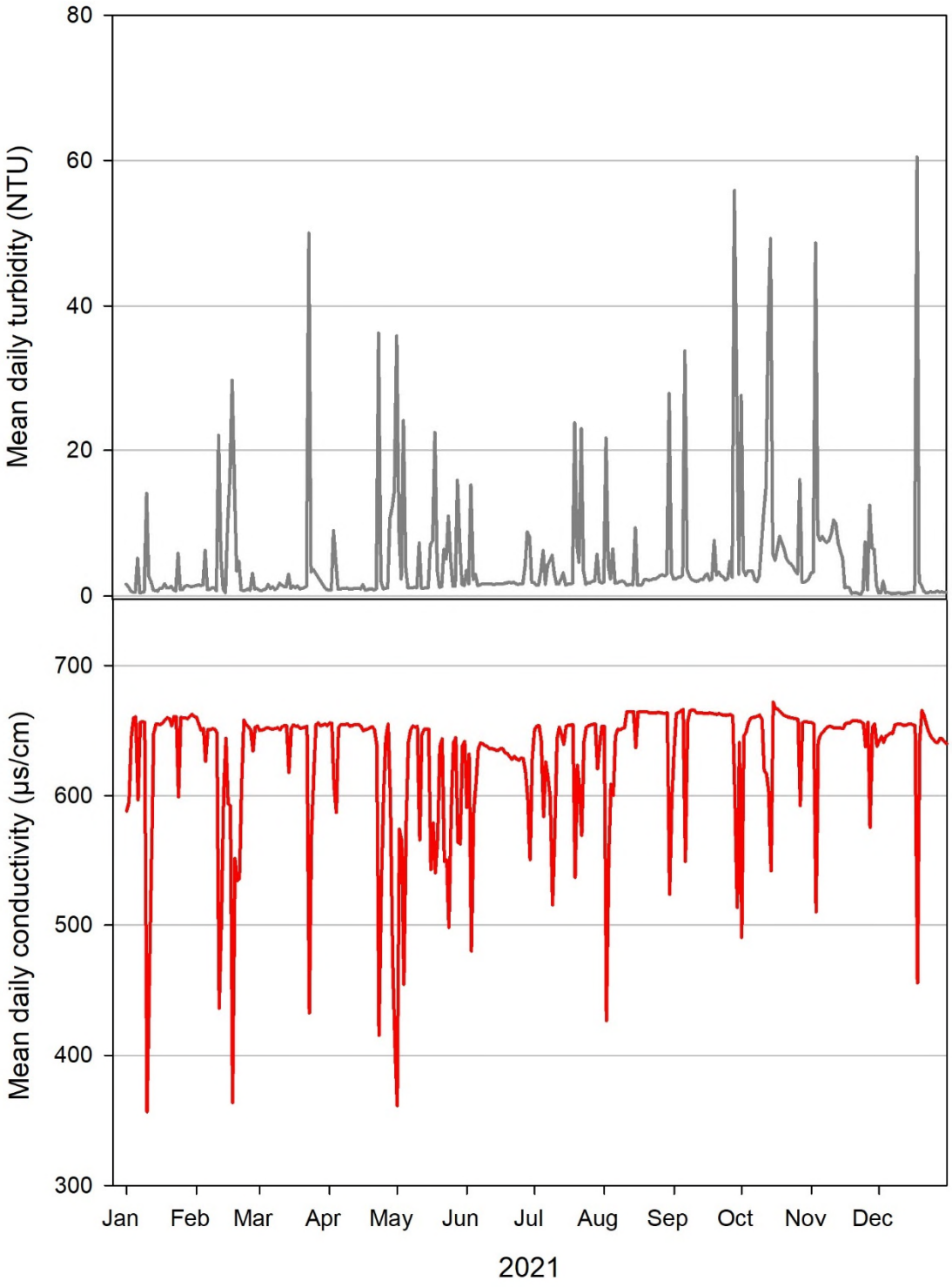

Figure 3.1-10. Mean daily turbidity (NTU) and mean daily conductivity (µs/cm) in Sessom Creek (2021).

3.1.2 Comal System

Hydrology

Average springflow at Comal Springs for the period of record (i.e., 1927 – present) was 288 cfs. Since 2013, Comal springflow ranged from below average in 2013-2014 to above average from mid-2015-2017 (Figure 3.1-11). Extended low flow conditions occurred in 2014 and Comal springflow dropped down to as low as 65 cfs on August 29, 2014. In 2015, rainfall throughout the course of the year, particularly two large precipitation events in late May and October, resulted in above average springflow. The large flood pulse on October 30, 2015 had a peak discharge reaching 14,100 cfs. Springflows remained above average in 2016 through 2017 due to several moderate rain events. In 2018, springflow dropped below average, reaching 161 cfs in late August. However, multiple rain events in the early fall resulted in increased springflow and subsequent above average springflow rates. Springflow in 2019 was generally above 350 cfs until July when springflow decreased to average by mid-August but rose above 300 cfs before the end of the year. No substantial flow events occurred in 2019. The absence of large flow event continued into 2020 and springflows continued to decrease, dropping below the long-term average from May to December. Sprinflows continued to decline in early 2021 to just below 200 cfs in April, but rain events in late spring resulted in sprinflows increasing to above average. Additional rain events in fall (i.e., 5,030 cfs pulse in October) helped maintain near average springflows through December 2021.

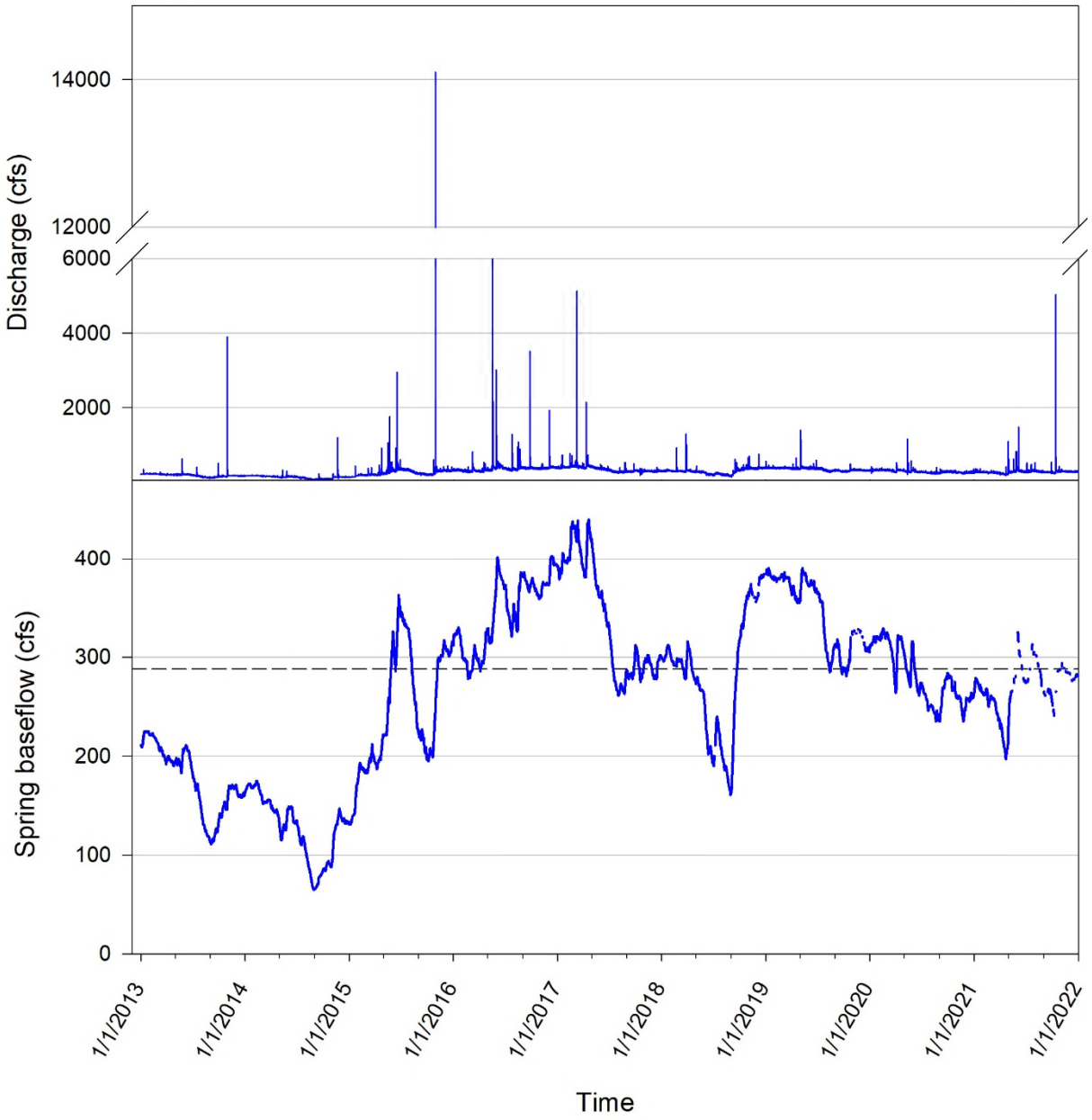

Figure 3.1-11. Hydrographs for the Comal River at New Braunfels (USGS station 08169000) and mean daily springflow for Comal springs (USGS Station 08168710) 2013 – 2021. Dashed line denotes long term average springflow (288 cfs) in the Comal River.

Temperature

Table 3.1-5 displays monthly summary statistics for water temperature at Comal RTWQ sites for 2021. In general, mean monthly water temperatures remained fairly stable within a site with deviations averaging ~1-2 °C and did not vary greatly among sites. Between Spring Run sites, water temperature at SR 7 is consistently slightly warmer than SR 3. Outside the direct influx of spring runs, the Old

Channel (OC) exhibits more variability in minimum and maximum monthly water temperatures. The highest water temperature recorded in 2021 was 25.97°C in the OC during July whereas the lowest temperature (19.94°C) occurred in the OC during February.

Table 3.1-5. Monthly mean, minimum, and maximum water temperatures (°C) among Comal RTWQ (2021).

Month (2021)	Spring Run 3			Spring Run 7			Old Channel		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Jan	23.43	23.24	23.48	23.82	23.71	23.83	22.76	21.59	24.34
Feb	23.39	23.27	23.46	23.78	23.71	23.8	22.58	19.94	24.63
Mar	23.42	23.37	23.56	23.83	23.79	23.91	23.25	21.63	25.1
Apr	23.55	23.48	23.63	23.84	23.69	23.88	23.48	21.61	25.62
May	23.59	23.27	23.64	23.84	23.84	23.85	23.84	21.74	25.85
Jun	23.6	23.57	23.64	23.84	23.84	23.85	24.17	23.19	25.76
Jul	23.6	23.58	23.64	23.85	23.84	23.85	24.24	23.47	25.97
Aug	23.61	23.59	23.65	23.85	23.84	23.85	24.31	23.54	25.81
Sept	23.6	23.53	23.65	23.85	23.84	23.85	24.12	22.82	25.71
Oct	23.59	23.28	23.63	23.85	23.71	23.85	23.75	22.57	25.25
Nov	23.57	23.52	23.61	23.85	23.84	23.85	23.18	22.18	24.63
Dec	23.58	23.53	23.61	23.84	23.83	23.86	23.27	22.01	24.43

Box plots for maximum daily water temperatures observed at Comal RTWQ sites from time of sensor deployment (i.e., 2013 for SR 3, SR 7 and 2018 for OC) through 2021 compared to maximum daily water temperatures observed in 2021 are shown in Figure 3.1-12. The medians of maximum daily temperatures for 2021 were consistent with the medians of maximum daily temperatures from time of equipment deployment at Comal RTWQ sites.

Maximum daily temperatures were plotted for Comal system RTWQ sites for 2021 (Figure 3.1-13). Throughout 2021, maximum daily water temperatures were more variable at the OC river site. Minimal seasonal variation in maximum daily water temperature was observed at SR 3 and SR 7 with maximum daily water temperatures remaining < 25°C year-round. Similar to previous years, maximum daily water temperatures in 2021 consistently reached and exceeded 25°C at the OC site in April through early October.

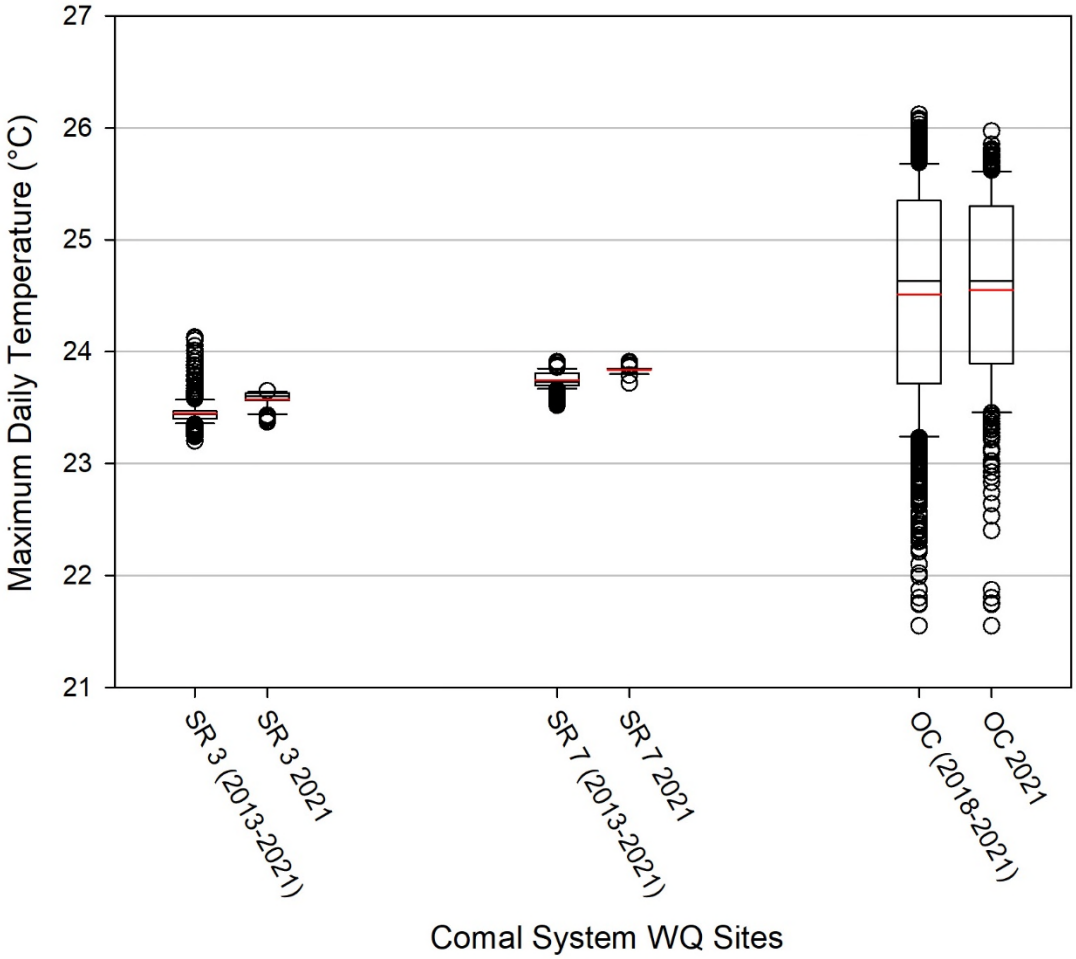

Figure 3.1-12. Box plots of maximum water daily temperatures (°C) among Comal system RTWQ sites from time of deployment through 2021 compared to 2021. Black lines represent median values and red lines denote mean values. Whiskers represent maximum and minimum temperature values, excluding outliers (open circles).

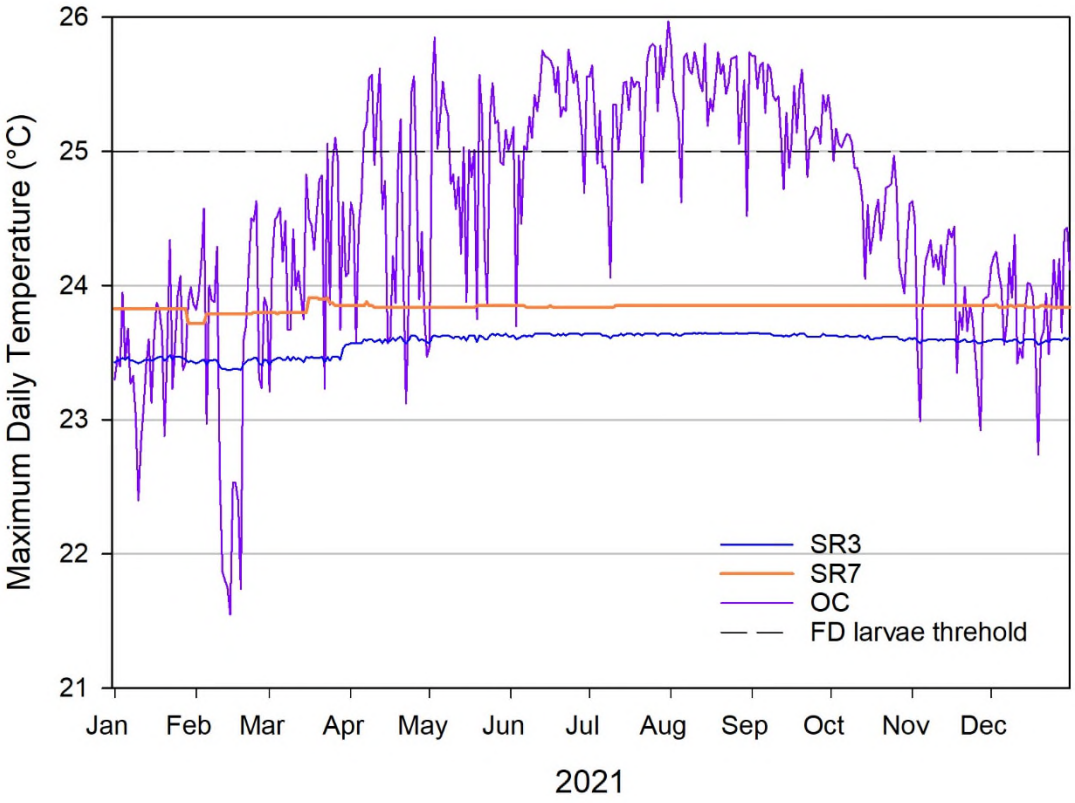

Figure 3.1-13. Maximum daily water temperature (°C) among Comal RTWQ sites (2021).

Box plots for seasonal maximum daily temperatures at the Comal system RTWQ sites for 2021 are shown in Figure 3.1-14. Little seasonal variation in maximum daily temperature (i.e., <0.05°C) was observed at the two spring run sites. However, the OC river site exhibited a wider range in seasonal variation with median values differing ~2 °C. Greater variability in maximum daily temperatures was observed in winter compared to previous years due to the extreme winter temperatures experienced in February. Spring and fall also showed variability in maximum daily temperature at the OC site while summer months showed less variability but recorded the highest maximum daily temperatures. In the OC, water temperature exceeded 25°C for 144 days in 2021, and of those 144 days, approximately 18% (mean = 4.33 hours, range = 0.25 – 7.5 hours) of the 24-hour day exceeded 25°C.

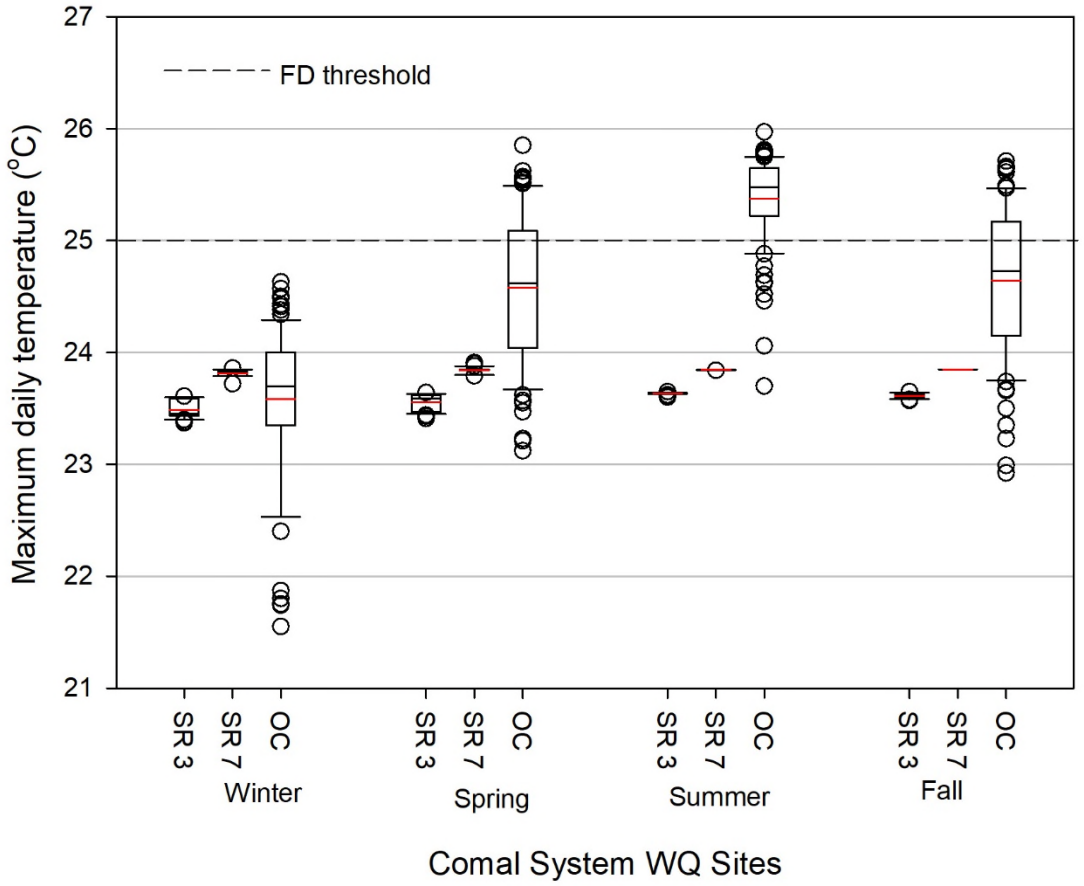

Figure 3.1-14. Box plots of maximum daily water temperatures (°C) among seasons at Comal system RTWQ sites in 2021. Black lines represent median values and red lines denotes mean values. Whiskers represent maximum and minimum temperature values, excluding outliers (open circles).

Dissolved Oxygen

Table 3.1-6 displays monthly summary statistics for dissolved oxygen (DO) recorded for Comal RTWQ sites in 2021. Mean monthly dissolved oxygen remained consistent within a site with variations averaging ~ 1 mg/l. Overall, mean monthly DO was lower in the spring run sites than the OC river site. The highest DO recorded in 2021 was 10.81 mg/l in the OC during March and the lowest DO (4.93 mg/l) occurred at SR 3 in March and SR 7 in January.

Table 3.1-6. Monthly mean, minimum, and maximum DO (mg/l) among Comal system RTWQ sites (2021).

Month (2021)	Spring Run 3			Spring Run 7			Old Channel		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Jan	5.09	5.00	5.25	4.95	4.93	4.98	6.97	5.73	9.95
Feb	5.16	5.09	5.33	5.05	5.03	5.07	7.71	6.18	10.30
Mar	5.14	4.93	5.43	5.05	5.03	5.10	7.82	5.96	10.81
Apr	5.23	5.05	5.44	5.07	5.00	5.09	7.37	5.85	10.55
May	5.15	5.08	5.40	5.10	5.07	5.12	7.12	5.95	9.31
Jun	5.11	5.06	5.24	5.10	5.08	5.12	7.07	5.84	9.04
Jul	5.09	5.04	5.20	5.10	5.09	5.11	7.08	5.82	9.30
Aug	5.08	5.03	5.20	5.10	5.07	5.11	6.93	5.82	8.87
Sept	5.08	5.02	5.20	5.08	5.07	5.10	7.00	5.79	9.03
Oct	5.08	5.02	5.25	5.07	5.06	5.09	6.96	5.93	8.81
Nov	5.07	5.00	5.16	5.08	4.95	5.11	7.16	6.09	9.10
Dec	5.06	5.01	5.16	5.09	5.00	5.12	7.04	6.02	9.05

Box plots for minimum daily DO observed at Comal system RTWQ sites from time of equipment deployment (i.e., 2013 for SR3, SR7 and 2018 for OC) through 2021 compared to minimum daily DO observed in 2021 are shown in Figure 3.1-15. The medians of minimum daily DO for 2021 were generally consistent with medians of minimum daily DO since time of sensor deployment at Comal system RTWQ sites. However, the median minimum daily DO in Spring Run 3 for 2021 was slightly lower than minimum daily DO observed since 2013, and the median minimum daily DO in Spring Run 7 was slightly higher.

Minimum daily DO was plotted for Comal RTWQ sites in 2021. (Figure 3.1-16). Spring run 3, and SR 7 demonstrated relatively constant DO whereas the OC river site was more variable in DO with seasonally drops in minimum daily DO during the summer months. Although greater in variability, the OC maintained higher minimum daily DO compared to the spring run sites and no sites recorded a minimum daily DO below 4.0 mg/l in 2021.

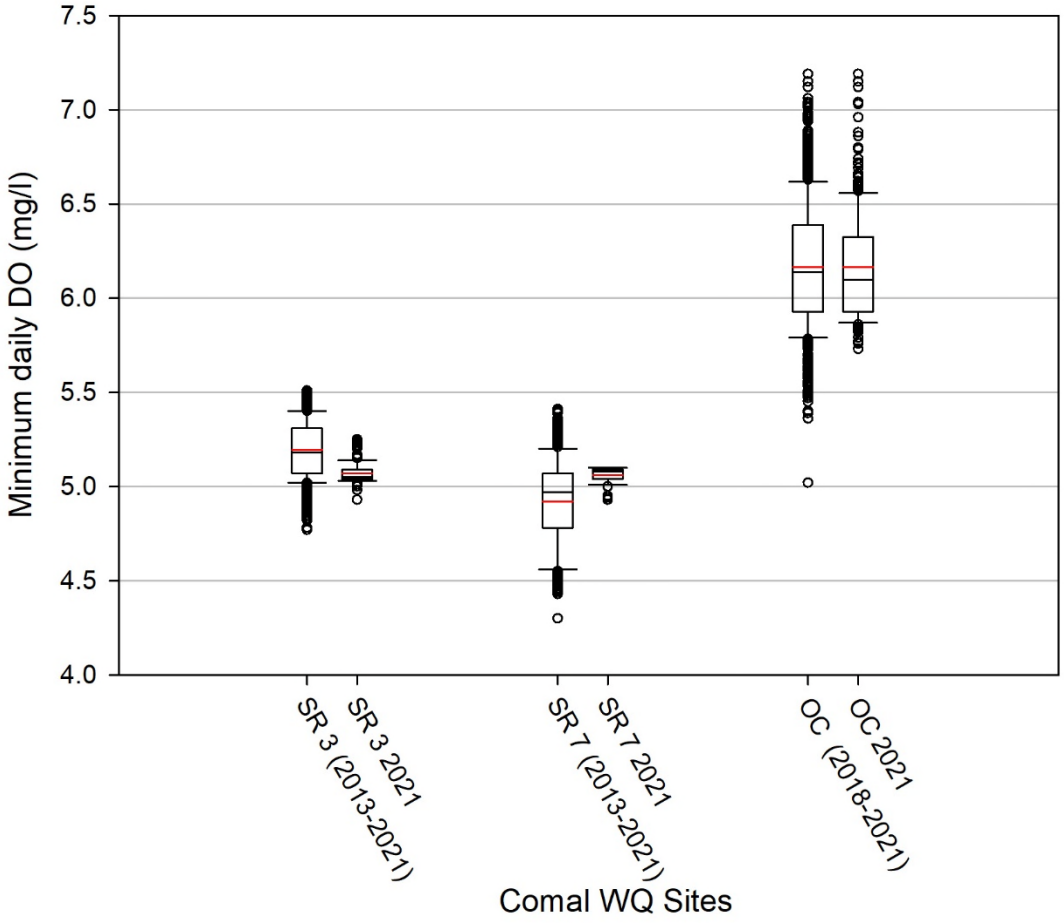

Figure 3.1-15. Box plots of minimum daily DO (mg/l) among Comal system RTWQ sites from time of equipment deployment through 2021 compared to 2021. Black lines represent median values and red lines denotes mean values. Whiskers represent maximum and minimum DO values, excluding outliers (open circles).

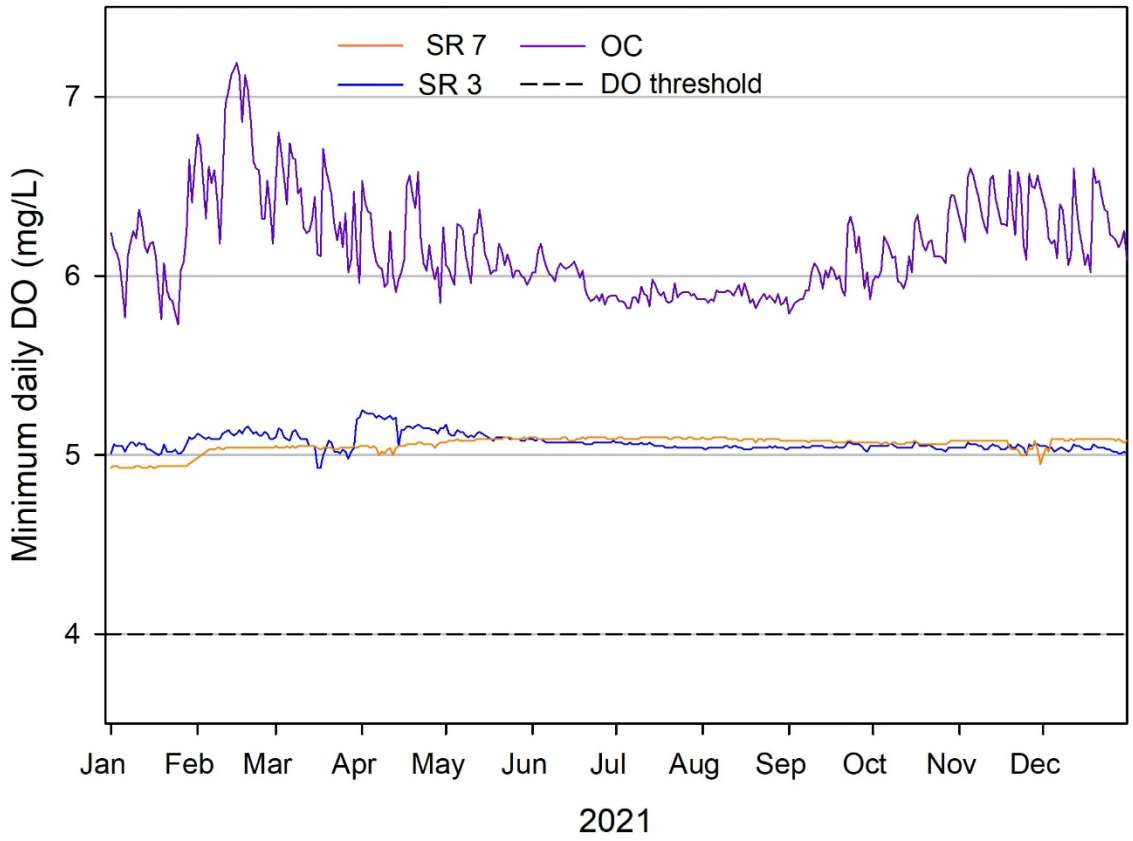

Figure 3.1-16. Minimum daily DO (mg/l) among Comal RTWQ sites (2021).

Conductivity

Table 3.1-7 displays monthly summary statistics for conductivity (µs/cm) recorded at Comal system RTWQ sites during 2021. In general, mean monthly conductivity remained consistent among the sites and throughout the year and little variability was observed at the three sites. The lowest conductivity in 2021 was recorded in the OC in May (273 µs/cm) during a run-off event (Figure 3.1-17).

Comal River discharge (cfs) and mean daily conductivity were plotted for Comal system RTWQ sites for 2021 (Figure 3.1-17). Little variation in mean daily conductivity for spring run sites occurred in 2021. However, mean daily conductivity in the OC was influenced by rain events with drops in conductivity values corresponding with influxes of run-off. Outside of rain events, mean conductivity generally ranged between 569-602 µs/cm among all Comal system RTWQ sites. Overall, the Comal River has slightly lower conductivity than the San Marcos River.

Table 3.1-7. Monthly mean, minimum, and maximum conductivity (µs/cm) among Comal system RTWQ sites (2021).

Month (2021)	Spring Run 3			Spring Run 7			Old Channel		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Jan	579	567	580	576	573	576	569	552	590
Feb	576	575	577	574	572	575	569	558	575
Mar	575	539	578	573	572	574	576	565	583
Apr	575	534	580	575	573	576	582	544	589
May	575	546	578	575	571	576	577	273	595
Jun	578	560	579	576	573	576	586	551	593
Jul	579	563	580	576	575	577	592	546	597
Aug	581	567	582	577	575	578	594	561	597
Sept	582	560	585	577	576	578	595	550	599
Oct	582	526	586	578	576	579	585	276	602
Nov	584	568	588	579	578	579	578	560	597
Dec	587	582	588	573	571	575	564	505	582

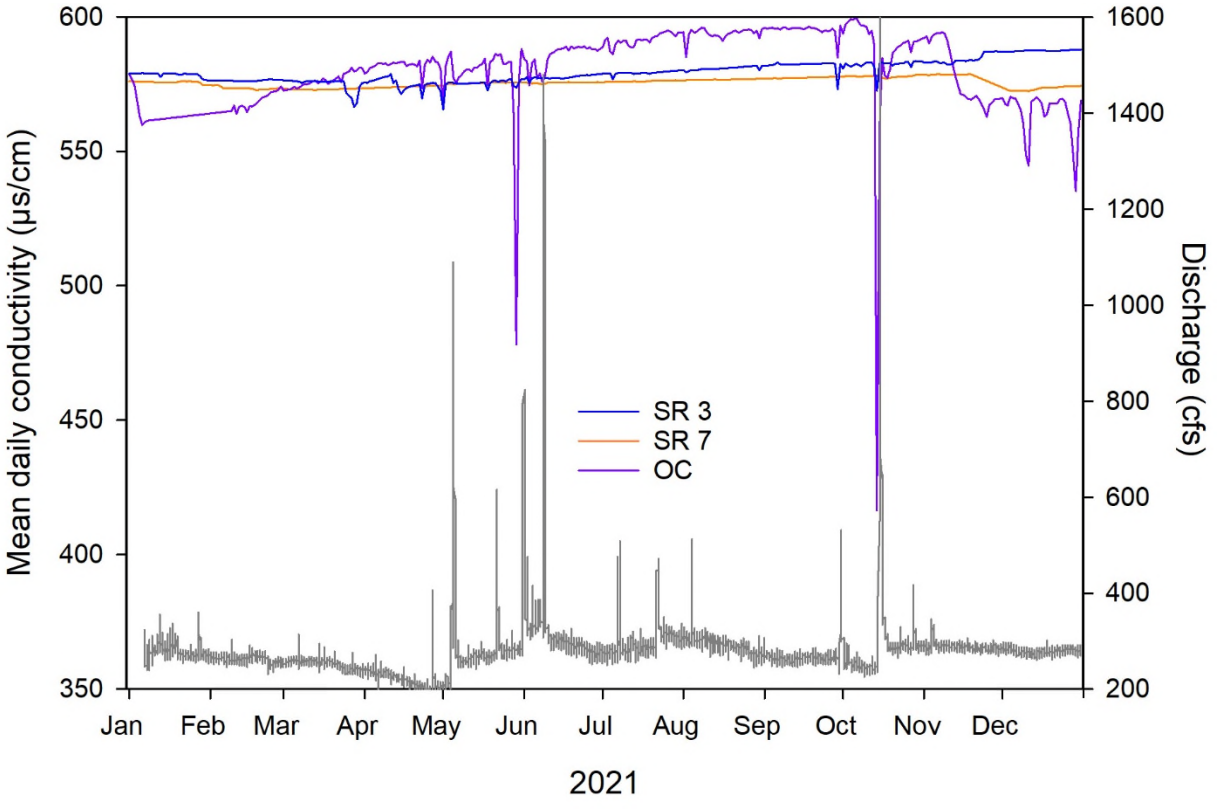

Figure 3.1-17. Mean daily conductivity (µs/cm) among Comal system RTWQ sites and Comal River discharge (Gage#08169000) in 2021.

3.2 Surface water sampling

3.2.1 San Marcos

Table 3.2-1 denotes the water quality parameters collected at Hotel Spring during monthly sucralose collections. Water quality parameters measured during monthly sampling events were consistent with measurements collected by the RTWQ network station at Aquarena Springs.

Table 3.2-1. Monthly (2021) water quality parameters measured at Hotel Spring (Spring Lake, San Marcos).

Month	Conductivity (µs/cm)	DO (mg/l)	pH (SU)	Temperature (°C)
Jan	620	4.82	7.17	21.85
Feb	593	4.77	7.11	21.86
Mar	590	4.67	7.04	21.86
Apr	598	4.93	7.29	21.87
May	593	4.77	7.15	21.83
Jun	582	4.47	7.14	21.63
Jul	583	3.99	7.15	21.58
Aug	577	3.94	7.16	21.60
Sep	579	4.25	7.14	21.72
Oct	576	4.29	7.07	21.75
Nov	573	3.93	7.06	21.76
Dec	567	3.75	6.97	21.86

A total of 12 sucralose samples were collected during monthly collections at Hotel Spring in 2021, including four field duplicate samples and four DI (i.e., deionized water) blanks. Sucralose was detected in five separate samples at Hotel Spring in 2021 (Table 3.2-2) with concentrations reported in April (103 ng/L), July (12.0 ng/L), August (8.33 ng/L), November (9.42 ng/L), and December (8.86 ng/L). Quality control spike recoveries for all sampling events were between 60.5 – 92.6 %. A full table including duplicate samples, field and laboratory blanks can be found in Table A-1 in appendix A.

Table 3.2-2. Sucralose concentrations (ng/L) measured at Hotel Springs in Spring Lake (2021). Samples with detectable concentrations denoted in bold.

Month	Sample (ng/L)
January	7.48[U]
February	8.02[UA]
March	7.74[U]
April	**103[B]**
May	15.9[UDA]
June	16.0[UD]
July	**12.0**
August	**8.33[B]**
September	8.05[U]
October	8.06[U]
November	**9.42**
December	**8.86**

[U] Non-detect at reporting limit

[A] Not detected in duplicate sample

[B] Detected in duplicate sample

[D] Dilution data

During Spring and Fall sampling events, nutrient samples and one duplicate sample per site were taken. An equipment blank and DI blank were collected at the upper site during Spring and Fall. Nutrient concentrations measured at the upper and lower sites (i.e., Hotel Springs and near the TPWD hatchery) in the San Marcos system during Spring and Fall are denoted in Table 3.2-3. In Spring, no detections for total phosphorous, orthophosphate, or orthophosphate as P were reported in 2021. Among nutrients detected, dissolved inorganic carbon and nitrate as N were reported among each sampling event in 2021. Total organic carbon was detected at the lower site in Spring and both sites in Fall. Other nutrients detected were total organic carbon at the lower site in Spring and both the upper and lower sites in Fall. Kjeldahl nitrogen was detected during the Fall but was also detected in the equipment or DI blank. Ammonia was detected in both upper and lower sites in the Spring and in the lower site during the Fall; however, during the Spring sampling events, ammonia was also detected in the equipment or DI blank and suggests a false positive. Additional results for duplicate samples, percent difference between sample and duplicate samples, and field and laboratory blank values can be found in Table A-3 and A-4 in appendix A.

Table 3.2-3. Nutrient concentrations measured at the upper and lower sites in the San Marcos system during Spring and Fall (2021). Samples with detectable concentrations denoted in bold.

		Spring		Fall	
Nutrients	**Units**	**Upper**	**Lower**	**Upper**	**Lower**
Total Phosphorus	ug/L	25[UA]	25[UA]	25[UA]	25[UA]
Orthophosphate	mg/L	0.02[UAH]	0.02[UAH]	0.02[UHAC]	0.02[UHAC]
Orthophosphate as P	mg/L	0.02[UAH]	0.02[UAH]	0.02[UHAC]	0.02[UHAC]
Total Organic Carbon	mg/L	0.29[UBD]	**0.31[JBD]**	**3.12[BD]**	**2.92[AD]**
Dissolved Inorganic Carbon	mg/L	**61.5[B]**	**60.2[B]**	**66.8[B]**	**67.3[B]**
Dissolved Organic Carbon	mg/L	0.29[UBD]	**0.84[JBDH]**	**1.01[BD]**	**2.42[AD]**
Kjeldahl Nitrogen	mg/L	0.1[UA]	0.1[UA]	**0.20[JACD]**	**0.11[JA]**
Nitrate as N	mg/L	**0.99[HB]**	**1.25[BH]**	**1.09[B]**	**1.41[AD]**
Ammonia	mg/L	**0.17[JF1BCD]**	**0.26[BCD]**	0.02[UA]	**0.05[JB]**

[U] Non-detect at reporting limit

[H] Sample was prepped and analyzed past holding time

[F1] MS and/or MSD recovery exceeds control limits

[J] Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

[A] Not detected in duplicate sample

[B] Detected in duplicate sample

[C] Detected in laboratory or field blank

[D] Greater than 20% Relative Percent Difference between sample and duplicate

3.2.2 Comal System

Table 3.2-4 denotes the water quality parameters collected at Spring Run 3 in Landa Lake during monthly sucralose collections in 2021. Water quality parameters measured during monthly sampling events were consistent with measurements collected by the RTWQ network station in Spring Run 3.

Table 3.2-4. Monthly (2021) water quality parameters measured at Spring Run 3 (Landa Lake).

Month	Conductivity (µs/cm)	DO (mg/l)	pH (SU)	Temperature (°C)
Jan	601	5.38	7.16	23.39
Feb	573	5.24	7.10	23.37
Mar	569	5.10	7.06	23.45
Apr	573	5.35	7.15	23.43
May	564	5.30	7.15	23.48
Jun	570	5.33	7.12	23.46
Jul	570	5.12	7.14	23.45
Aug	573	5.14	7.15	23.40
Sep	572	5.18	7.11	23.48
Oct	567	5.17	7.05	23.52
Nov	565	5.15	7.04	23.51
Dec	563	5.16	6.95	23.58

A total of 12 sucralose samples were collected during monthly collections at Spring Run 3 in 2021, including four field duplicate samples and four DI blanks. Among monthly collections, sucralose was detected during two sampling events at Spring Run 3 with a concentration of 17.6 ng/L recorded in July and 10.7 ng/L in December (Table 3.2-5). Quality control spike recoveries for all sampling events were between 62.3 – 87.4 %. A full table including duplicate samples, field and laboratory blanks can be found in Table A-2 appendix A.

Table 3.2-5. Sucralose concentrations (ng/L) and quality control spike recovery (%) measured at Spring Run 3 in Landa Lake (2021). Samples with detectable concentrations denoted in bold.

Month	Sample (ng/L)
January	7.84[U]
February	7.87[U]
March	7.70[UA]
April	8.07[U]
May	8.04[U]
June	**17.6[A]**
July	8.05[U]
August	8.01[U]
September	8.05[U]
October	8.06[UA]
November	7.91[U]
December	**10.7[B]**

[U] Non-detect at reporting limit

[A] Not detected in duplicate sample

During Spring and Fall sampling events, nutrient samples and one duplicate sample per site were taken. Nutrient concentrations measured at the upper and lower sites (i.e., Spring Run 3 and at the last public exit) in the Comal system during Spring and Fall are denoted in Table 3.2-6. No detections for total phosphorous, orthophosphate, orthophosphate as P, or Kjeldahl nitrogen were reported in 2021. Among nutrients detected, total organic carbon and dissolved inorganic carbon was reported among each sampling event in 2021. Dissolved organic carbon was detected at both sites during the Fall. Nitrate as N was detected at both sites during the Spring and at the lower site in the Fall. Ammonia was detected in both upper and lower sites in the Spring and Fall; however, during the Spring sampling events, ammonia was also detected in the laboratory or field blank that suggests a false positive. Results for duplicate samples, percent difference between sample and duplicate samples, and field and laboratory blank values can be found in Table A-5 and A-6 in appendix A.

Table 3.2-6. Nutrient concentrations measured at the upper and lower sites in the Comal system during Spring and Fall (2021). Samples with detectable concentrations denoted in bold.

		Spring		Fall	
Nutrients	**Units**	**Upper**	**Lower**	**Upper**	**Lower**
Total Phosphorus	ug/L	25^{UA}	25^{UA}	25^{UA}	25^{UA}
Orthophosphate	mg/L	0.02^{UA}	0.02^{UA}	0.02^{UHBD}	0.02^{UHA}
Orthophosphate as P	mg/L	0.02^{UA}	0.02^{UA}	0.02^{UHAD}	0.02^{UHA}
Total Organic Carbon	mg/L	**0.59^{JB}**	**1.04^{BD}**	**0.86^{JAD}**	**1.28^{AD}**
Dissolved Inorganic Carbon	mg/L	**57.5^{B}**	**56.1^{B}**	**62.0^{BD}**	**60.2^{B}**
Dissolved Organic Carbon	mg/L	0.29^{UA}	0.29^{UBD}	**0.58^{JA}**	**2.76^{AD}**
Kjeldahl Nitrogen	mg/L	0.1^{UA}	0.1^{UA}	0.1^{UA}	0.1^{UA}
Nitrate as N	mg/L	**1.77^{HB}**	**1.73^{HB}**	0.1^{UBD}	**2.05^{B}**
Ammonia	mg/L	**0.21^{BCD}**	**0.38^{BCD}**	**0.03^{JBD}**	**0.10^{AD}**

U Non-detect at reporting limit

H Sample was prepped and analyzed past holding time

F1 MS and/or MSD recovery exceeds control limits

J Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

A Not detected in duplicate sample

B Detected in duplicate sample

C Detected in laboratory or field blank

D Greater than 20% Relative Percent Difference between sample and duplicate

3.3 Groundwater sampling

3.3.1 San Marcos

A total of four PPCP samples (i.e., one sample at each sampling site and event) were collected during Spring and Fall collections in 2021, including field duplicate samples (i.e., one duplicate sample at Hotel in Spring and one duplicate sample for each Hotel and Deep in Fall) and equipment blanks (i.e., one equipment blank and one DI blank in Spring and one DI blank in Fall). The duplicate sample for Deep Hole collected in Fall was damaged during shipping and was not included in the results. Results for PPCP sampling at Hotel and Deep Hole Springs are denoted in Table 3.3-1 and 3.3-2. Overall, few PPCP detections at the reporting limit occurred in 2021 sampling events. DEET was detected at Hotel and Deep Hole Springs in Spring and Fall sampling events; however, it is likely a false positive because it was found in the blank in all sampling events. Penicillin G was detected during Spring and Fall sampling events at Deep Hole but was flagged as "R" in Fall, indicating that a peak concentration was detected but did not meet qualification criteria. Sulfamethoxazole was detected during Spring at Deep Hole spring. Results for samples, duplicate samples, equipment, DI, and laboratory blank values can be found in Table A-7 through A-10 in appendix A.

Table 3.3-1. PPCP concentrations (ng/L) measured at Hotel and Deep Hole Spring (Spring Lake, San Marcos) during Spring and Fall sampling events (2021). Samples with detectable concentrations denoted in bold.

	Spring		Fall	
PPCP list	Hotel spring	Deep Hole	Hotel spring	Deep Hole
Acetaminophen	14.7[UA]	14.7[U]	14.6[UA]	14.6[U]
Azithromycin	1.47[UA]	1.47[U]	1.46[UA]	1.46[U]
Caffeine	14.7[UB]	14.7[U]	14.6[UA]	14.6[U]
Carbadox	1.47[UA]	1.47[U]	1.46[UA]	1.46[U]
Carbamazepine	1.47[UA]	1.47[U]	1.46[UA]	1.46[U]
Cefotaxime	6.63[UA]	8.09[U]	5.84[UA]	5.83[U]
Ciprofloxacin	5.87[UA]	5.89[U]	5.84[UA]	5.83[U]
Clarithromycin	1.47[UA]	1.47[U]	1.46[UA]	1.46[U]
Clinafloxacin	6.46[UA]	5.89[U]	6.33[UA]	5.83[U]
Cloxacillin	2.94[UHA]	2.95[UH]	9.73[UHA]	9.72[UH]
Dehydronifedipine	1.96[UA]	1.96[U]	0.584[UA]	0.583[U]
Diphenhydramine	0.587[UA]	0.589[U]	0.584[UA]	0.595[U]
Diltiazem	0.294[UA]	0.295[U]	0.292[UA]	0.292[U]
Digoxin	5.87[UA]	5.89[U]	5.84[UA]	5.83[U]
Digoxigenin	5.87[UA]	5.89[U]	5.84[UA]	5.83[U]
Enrofloxacin	2.94[UA]	2.95[U]	2.92[UA]	2.92[U]
Erythromycin-H2O	2.25[UA]	2.26[U]	2.24[UA]	2.24[U]
Flumequine	1.47[UA]	1.47[U]	1.46[UA]	1.46[U]
Fluoxetine	1.47[UA]	1.47[U]	4.86[UA]	4.86[U]
Lincomycin	2.94[UA]	2.95[U]	2.92[UA]	2.92[U]
Lomefloxacin	9.79[UA]	9.82[U]	2.92[UA]	2.92[U]
Miconazole	1.47[UA]	1.47[U]	1.46[UA]	1.46[U]
Norfloxacin	14.7[UA]	14.7[U]	14.6[UA]	14.6[U]
Norgestimate	2.94[UA]	2.95[U]	2.92[UA]	2.92[U]
Ofloxacin	1.47[UA]	1.47[U]	1.46[UA]	1.46[U]
Ormetoprim	0.587[UA]	0.589[U]	0.584[UA]	0.583[U]
Oxacillin	2.94[UHA]	2.95[U]	9.73[UHA]	9.72[UH]
Oxolinic Acid	0.587[UA]	0.589[U]	0.584[UA]	0.583[U]
Penicillin G	2.94[UHB]	**255**	9.73[UHA]	**73.9[RH]**
Penicillin V	9.79[UA]	9.82[U]	2.92[UA]	11.4[U]
Roxithromycin	0.979[UA]	0.982[U]	0.292[UA]	0.292[U]
Sarafloxacin	14.7[UA]	14.7[U]	14.6[UA]	14.6[U]
Sulfachloropyridazine	1.47[UA]	1.47[U]	1.46[UA]	1.46[U]
Sulfadiazine	1.47[UA]	1.47[U]	1.46[UA]	1.46[U]
Sulfadimethoxine	0.294[UA]	0.295[U]	0.292[UA]	0.292[U]
Sulfamerazine	0.587[UA]	0.589[U]	0.584[UA]	0.583[U]
Sulfamethazine	0.587[UA]	0.589[U]	0.584[UA]	0.583[U]
Sulfamethizole	0.587[UA]	1.13[U]	0.584[UA]	0.583[U]
Sulfamethoxazole	0.587[UA]	**0.854**	0.584[UA]	0.583[U]
Sulfanilamide	14.7[UA]	14.7[U]	14.6[UA]	14.6[U]
Sulfathiazole	1.47[UA]	1.47[U]	1.46[UA]	1.46[U]
Thiabendazole	1.47[UA]	1.47[U]	1.46[UA]	1.46[U]
Trimethoprim	1.47[UA]	1.47[U]	1.46[UA]	1.46[U]
Tylosin	5.87[UA]	5.89[U]	5.84[UA]	5.83[U]
Virginiamycin M1	2.94[UA]	2.95[U]	2.92[UA]	2.92[U]
1,7-Dimethylxanthine	196[UA]	196[U]	58.4[UA]	58.3[U]

[U] Non-detect at reporting limit

[H] Concentration is estimated

[R] Peak detected but did not meet qualification criteria

[A] Not detected in duplicate sample

[B] Detected in duplicate sample

Table 3.3-2. PPCP concentrations (ng/L) measured at Hotel and Deep Hole Spring (Spring Lake, San Marcos) during Spring and Fall sampling events (2021). Samples with detectable concentrations denoted in bold.

	Spring		Fall	
PPCP List Continued	Hotel Spring	Deep Hole	Hotel Spring	Deep Hole
Alprazolam	0.294[UA]	0.295[U]	0.292[UA]	0.292[U]
Amitriptyline	0.294[UA]	0.295[U]	0.292[UA]	0.292[U]
Amlodipine	0.985[UA]	0.988[U]	0.979[UA]	0.978[U]
Benzoylecgonine	0.147[UA]	0.147[U]	0.146[UA]	0.146[U]
Benztropine	0.685[UA]	0.687[U]	0.681[UA]	0.680[U]
Betamethasone	1.47[UA]	1.47[U]	1.46[UA]	1.46[U]
Cocaine	0.147[UA]	0.147[U]	0.146[UA]	0.146[U]
DEET	**1.23[BC]**	**5.39[C]**	**2.23[BC]**	**4.01[C]**
Desmethyldiltiazem	0.147[UA]	0.147[U]	0.146[UA]	0.146[U]
Diazepam	0.491[UA]	0.493[U]	0.488[UA]	0.488[U]
Fluocinonide	1.97[UA]	1.97[U]	1.96[UA]	1.95[U]
Fluticasone propionate	1.97[UA]	1.97[U]	1.96[UA]	1.95[U]
Hydrocortisone	5.87[UA]	5.89[U]	5.84[UA]	5.83[U]
10-hydroxy-amitriptyline	0.147[UA]	0.147[U]	0.146[UA]	0.146[U]
Meprobamate	1.47[UA]	1.47[U]	1.46[UA]	1.46[U]
Methylprednisolone	3.92[UA]	3.93[U]	3.89[UA]	3.89[U]
Metoprolol	0.491[UA]	0.493[U]	0.488[UA]	0.488[U]
Norfluoxetine	0.491[UA]	0.493[U]	0.488[UA]	0.488[U]
Norverapamil	0.147[UA]	0.147[U]	0.146[UA]	0.146[U]
Paroxetine	0.985[UA]	0.988[U]	0.979[UA]	0.978[U]
Prednisolone	3.92[UA]	3.93[U]	3.89[UA]	3.89[U]
Prednisone	5.87[UA]	5.89[U]	5.84[UA]	5.83[U]
Promethazine	0.294[UA]	0.295[U]	0.292[UA]	0.292[U]
Propoxyphene	0.294[UA]	0.295[U]	0.292[UA]	0.292[U]
Propranolol	0.294[UA]	0.295[U]	0.292[UA]	0.292[U]
Sertraline	0.294[UA]	0.295[U]	0.292[UA]	0.292[U]
Simvastatin	1.97[UA]	1.97[U]	1.96[UA]	1.95[U]
Theophylline	5.87[UA]	5.89[U]	5.84[UA]	5.83[U]
Trenbolone	1.97[UA]	1.97[U]	1.96[UA]	1.95[U]
Trenbolone acetate	0.294[UA]	0.295[U]	0.292[UA]	0.292[U]
Valsartan	3.92[UA]	3.93[U]	3.89[UA]	3.89[U]
Verapamil	0.147[UA]	0.147[U]	0.146[UA]	0.146[U]

[U] Non-detect at reporting limit

[A] Not detected in duplicate sample

[B] Detected in duplicate sample

[C] Detected in laboratory or field blank

3.3.2 Comal System

A total of six PPCP samples were collected during Spring and Fall collections in 2021, including field duplicate samples (i.e., one duplicate sample at Spring Run 1 and Spring Run 3 during both Spring and Fall events). Results for PPCP sampling at Spring Runs 1, 3, and 7 are denoted in Table 3.3-3 and 3.3-4. Overall, few PPCP detections at the reporting limit occurred in 2021 sampling events. DEET was detected at all three sampling sites in Spring and Fall sampling events; however, it is likely a false positive because it was also found in the blank in all sampling events. Sulfamethoxazole was also detected among all sampling sites in Spring and Fall. Ciprofloxacin, Clinafloxacin, Enrofloxacin, and Ofloxacin were detected at Spring Run 3 in Fall. Results for samples, duplicate samples, equipment blank, DI blank, and laboratory blank values can be found in Table A-11 through A-14 in appendix A.

Table 3.3-3. PPCP concentrations (ng/L) measured at Spring Run 1, Spring Run 3, and Spring Run 7 (Landa Lake) during Spring and Fall sampling events (2021). Samples with detectable concentrations denoted in bold.

PPCP list	Spring			Fall		
	Spring run 1	Spring run 3	Spring run 7	Spring run 1	Spring run 3	Spring run 7
Acetaminophen	14.9[UA]	15[UA]	14.8[U]	14.9[UA]	14.6[UA]	14.9[U]
Azithromycin	1.49[UA]	1.5[UA]	1.48[U]	1.49[UA]	1.46[UA]	1.49[U]
Caffeine	14.9[UA]	15[UA]	14.8[U]	14.9[UA]	14.6[UA]	14.9[U]
Carbadox	1.49[UA]	1.5[UA]	1.48[U]	1.49[UA]	1.46[UA]	1.49[U]
Carbamazepine	1.49[UA]	1.5[UA]	1.48[U]	1.49[UA]	1.46[UA]	1.49[U]
Cefotaxime	5.94[UA]	5.99[UA]	7.06[U]	5.95[UA]	5.85[UA]	5.95[U]
Ciprofloxacin	5.94[UA]	5.99[UA]	5.93[U]	5.95[UA]	**7.72[A]**	5.95[U]
Clarithromycin	1.49[UA]	1.5[UA]	1.48[U]	1.49[UA]	1.46[UA]	1.49[U]
Clinafloxacin	5.94[UA]	5.99[UA]	5.93[U]	5.95[UA]	**6.79[A]**	5.95[U]
Cloxacillin	2.97[UHA]	3.0[UHA]	2.97[UH]	9.92[UHA]	9.75[UHA]	9.92[UH]
Dehydronifedipine	1.98[UA]	2.0[UA]	1.98[U]	0.595[UA]	0.585[UA]	0.595[U]
Diphenhydramine	0.594[UA]	0.599[UA]	0.593[U]	0.595[UA]	0.585[UA]	0.595[U]
Diltiazem	0.297[UA]	0.3[UA]	0.297[U]	0.298[UA]	0.293[UA]	0.298[U]
Digoxin	5.94[UA]	5.99[UA]	5.93[U]	5.95[UA]	5.85[UA]	5.95[U]
Digoxigenin	5.94[UA]	5.99[UA]	5.93[U]	5.95[UA]	5.85[UA]	5.95[U]
Enrofloxacin	2.97[UA]	3.0[UA]	2.97[U]	2.98[UA]	**3.05[A]**	2.98[U]
Erythromycin-H2O	2.28[UA]	2.3[UA]	2.27[U]	2.28[UA]	2.24[UA]	2.28[U]
Flumequine	1.49[UA]	1.5[UA]	1.48[U]	1.49[UA]	1.46[UA]	1.49[U]
Fluoxetine	1.49[UA]	1.5[UA]	1.48[U]	1.49[UA]	4.88[UA]	4.96[U]
Lincomycin	2.97[UA]	3.0[UA]	2.97[U]	2.98[UA]	2.93[UA]	2.98[U]
Lomefloxacin	9.91[UA]	9.98[UA]	9.88[U]	2.98[UA]	2.93[UA]	2.98[U]
Miconazole	1.49[UA]	1.5[UA]	1.48[U]	1.49[UA]	1.46[UA]	1.49[U]
Norfloxacin	14.9[UA]	15.0[UA]	14.8[U]	14.9[UA]	14.6[UA]	14.9[U]
Norgestimate	2.97[UA]	3.0[UA]	3.05[U]	2.98[UA]	2.93[UA]	2.98[U]
Ofloxacin	1.49[UA]	1.5[UA]	1.48[U]	1.49[UA]	**1.51[A]**	1.49[U]
Ormetoprim	0.594[UA]	0.599[UA]	0.593[U]	0.595[UA]	0.585[UA]	0.595[U]
Oxacillin	2.97[UA]	3.0[UHA]	2.97[UH]	9.92[UHA]	9.75[UHA]	9.92[UH]
Oxolinic Acid	0.594[UA]	0.599[UA]	0.593[U]	0.595[UA]	0.585[UA]	0.595[U]
Penicillin G	2.97[UA]	3.0[UHA]	2.97[UH]	9.92[UHA]	9.75[UHA]	9.92[UH]
Penicillin V	9.91[UA]	9.98[UA]	9.88[U]	2.98[UA]	2.93[UA]	2.98[U]
Roxithromycin	0.991[UA]	0.998[UA]	0.988[U]	0.298[UA]	0.293[UA]	0.298[U]
Sarafloxacin	14.9[UA]	15.0[UA]	14.8[U]	14.9[UA]	14.6[UA]	14.9[U]
Sulfachloropyridazine	1.49[UA]	1.5[UA]	1.48[U]	1.49[UA]	1.46[UA]	1.49[U]
Sulfadiazine	1.49[UA]	1.5[UA]	1.48[U]	1.49[UA]	1.46[UA]	1.49[U]
Sulfadimethoxine	0.297[UA]	0.3[UA]	0.297[U]	0.298[UA]	0.293[UA]	0.298[U]
Sulfamerazine	0.594[UA]	0.599[UA]	0.593[U]	0.595[UA]	0.585[UA]	0.595[U]
Sulfamethazine	0.594[UA]	0.599[UA]	0.593[U]	0.595[UA]	0.585[UA]	0.595[U]
Sulfamethizole	0.594[UA]	0.599[UA]	0.641[U]	0.595[UA]	0.585[UA]	0.595[U]
Sulfamethoxazole	**0.707[B]**	**0.871[B]**	**0.848**	**0.755[B]**	**0.93[B]**	**0.848**
Sulfanilamide	14.9[UA]	15.0[UA]	14.8[U]	14.9[UA]	14.6[UA]	14.9[U]
Sulfathiazole	1.49[UA]	1.5[UA]	1.48[U]	1.49[UA]	1.46[UA]	1.49[U]
Thiabendazole	1.49[UA]	1.5[UA]	1.48[U]	1.49[UA]	1.46[UA]	1.49[U]
Trimethoprim	1.49[UA]	1.5[UA]	1.48[U]	1.49[UA]	1.46[UA]	1.49[U]
Tylosin	5.94[UA]	5.99[UA]	5.93[U]	5.95[UA]	5.85[UA]	5.95[U]
Virginiamycin M1	2.97[UA]	3.0[UA]	2.97[U]	2.98[UA]	2.93[UA]	2.98[U]
1,7-Dimethylxanthine	198[UA]	200[UA]	198[U]	59.5[UA]	58.5[UA]	59.5[U]

[U] Non-detect at reporting limit

[H] Concentration is estimated

[A] Not detected in duplicate sample

[B] Detected in duplicate sample

Table 3.3-4. PPCP concentrations (ng/L) measured at Spring Run 1, Spring Run 3, and Spring Run 7 (Landa Lake) during Spring and Fall sampling events (2021). Samples with detectable concentrations denoted in bold.

	Spring			Fall		
PPCP List	Spring Run 1	Spring Run 3	Spring Run 7	Spring Run 1	Spring Run 3	Spring Run 7
Alprazolam	0.297[UA]	0.3[UA]	0.297[U]	0.298[UA]	0.293[UA]	0.298[U]
Amitriptyline	0.297[UA]	0.3[UA]	0.297[U]	0.298[UA]	0.293[UA]	0.298[U]
Amlodipine	0.997[UA]	1.0[UA]	0.994[U]	0.998[UA]	0.981[UA]	0.998[U]
Benzoylecgonine	0.149[UA]	0.15[UA]	0.148[U]	0.149[UA]	0.146[UA]	0.149[U]
Benztropine	0.694[UA]	0.699[UA]	0.692[U]	0.694[UA]	0.683[UA]	0.695[U]
Betamethasone	1.49[UA]	1.5[UA]	1.48[U]	1.49[UA]	1.46[UA]	1.49[U]
Cocaine	0.149[UA]	0.15[UA]	0.148[U]	0.149[UA]	0.146[UA]	0.149[U]
DEET	**1.20[BC]**	**1.33[BC]**	**1.13[C]**	**2.39[BC]**	**2.44[BC]**	**2.37[C]**
Desmethyldiltiazem	0.149[UA]	0.15[UA]	0.148[U]	0.149[UA]	0.146[UA]	0.149[U]
Diazepam	0.497[UA]	0.501[UA]	0.496[U]	0.498[UA]	0.489[UA]	0.498[U]
Fluocinonide	1.99[UA]	2.01[UA]	1.99[U]	1.99[UA]	1.96[UA]	1.99[U]
Fluticasone propionate	1.99[UA]	2.01[UA]	1.99[U]	1.99[UA]	1.96[UA]	1.99[U]
Hydrocortisone	5.94[UA]	5.99[UA]	5.93[U]	5.95[UA]	5.85[UA]	5.95[U]
10-hydroxy-amitriptyline	0.149[UA]	0.15[UA]	0.148[U]	0.149[UA]	0.146[UA]	0.149[U]
Meprobamate	1.49[UA]	1.5[UA]	1.48[U]	1.49[UA]	1.46[UA]	1.49[U]
Methylprednisolone	3.96[UA]	3.99[UA]	3.95[U]	3.97[UA]	3.90[UA]	3.97[U]
Metoprolol	0.497[UA]	0.501[UA]	0.496[U]	0.498[UA]	0.489[UA]	0.498[U]
Norfluoxetine	0.497[UA]	0.501[UA]	0.496[U]	0.498[UA]	0.489[UA]	0.498[U]
Norverapamil	0.149[UA]	0.15[UA]	0.148[U]	0.149[UA]	0.146[UA]	0.149[U]
Paroxetine	0.997[UA]	1.0[UA]	0.994[U]	0.998[UA]	0.981[UA]	0.998[U]
Prednisolone	3.96[UA]	3.99[UA]	3.95[U]	3.97[UA]	3.90[UA]	3.97[U]
Prednisone	5.94[UA]	5.99[UA]	5.93[U]	5.95[UA]	5.85[UA]	5.95[U]
Promethazine	0.297[UA]	0.3[UA]	0.297[U]	0.298[UA]	0.293[UA]	0.298[U]
Propoxyphene	0.297[UA]	0.3[UA]	0.297[U]	0.298[UA]	0.293[UA]	0.298[U]
Propranolol	0.297[UA]	0.3[UA]	0.297[U]	0.298[UA]	0.293[UA]	0.298[U]
Sertraline	0.297[UA]	0.3[UA]	0.297[U]	0.298[UA]	0.293[UA]	0.298[U]
Simvastatin	1.99[UA]	2.01[UA]	1.99[U]	1.99[UA]	1.96[UA]	1.99[U]
Theophylline	5.94[UA]	5.99[UA]	5.93[U]	5.95[UA]	5.85[UA]	5.95[U]
Trenbolone	1.99[UA]	2.01[UA]	1.99[U]	1.99[UA]	1.96[UA]	1.99[U]
Trenbolone acetate	0.297[UA]	0.3[UA]	0.297[U]	0.298[UA]	0.293[UA]	0.298[U]
Valsartan	3.96[UA]	3.99[UA]	3.95[U]	3.97[UA]	3.90[UA]	3.97[U]
Verapamil	0.149[UA]	0.15[UA]	0.148[U]	0.149[UA]	0.146[UA]	0.149[U]

[U] Non-detect at reporting limit

[A] Not detected in duplicate sample

[B] Detected in duplicate sample

[C] Detected in laboratory or field blank

4 | References

Oppenheimer, J., A. Eaton, M. Badruzzaman, A. W. Haghani, and J. G. Jacangelo. 2011. Occurrence and suitability of sucralose as an indicator compound of wastewater loading to surface waters in urbanized regions. Water Research 45(13): 4019-4027.

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Appendix A – Laboratory Quality Control Results

Table A-1. Sucralose concentrations (ng/L) for samples, duplicate samples, DI lab blanks, and spiked matrices measured at Hotel Springs in Spring Lake (2021. Quality control spike recoveries (%) are reported to the right of each sample and samples with detectable concentrations are denoted in bold.

Month	Sample (ng/L)	QC Spike Recovery (%)	Duplicate (ng/L)	QC Spike Recovery (%)	DI Blank (ng/L)	QC Spike Recovery (%)	Lab Blank (ng/L)	QC Spike Recovery (%)	Spiked Matrix (ng/L)	Spiked Recovery (%)
January	7.48[U]	80.1	NA	NA	NA	NA	10.1[U]	85.5	1.01	93.4
February	8.02[U]	82.6	8.05[U]	72	NA	NA	10.1[U]	85.5	1.01	93.4
March	7.74[U]	75.5	NA	NA	7.72[U]	75.2	10.1[U]	85.5	1.01	93.4
April	**103**	88.2	**12.8**	76.9	NA	NA	10.1[U]	82.6	1.01	98.1
May	15.9[UD]	92.6	16.1[UD]	85.2	NA	NA	10.1[U]	82.6	1.01	98.1
June	16.0[UD]	70.2	NA	NA	8.06[U]	80.5	10.1[U]	82.6	1.01	98.1
July	**12.0**	86.2	NA	NA	NA	NA	10.1[U]	86.5	1.01	97.4
August	**8.33**	86.6	**9.26**	95.5	NA	NA	10.1[U]	86.5	1.01	97.4
September	8.05[U]	91	NA	NA	NA	NA	10.1[U]	86.5	1.01	97.4
October	8.06[U]	70.8	NA	NA	8.02[U]	60.6	8.08[U]	60.2	1.01	108
November	7.93[U]	60.5	NA	NA	NA	NA	8.08[U]	60.2	1.01	108
December	**8.86**	63.4	NA	NA	8.06[U]	63.7	8.08[U]	60.2	1.01	108

[U] Non-detect at reporting limit

[D] Dilution data

Table A-2. Sucralose concentrations (ng/L) for samples, duplicate samples, DI blanks, lab blanks, and spiked matrices measured for Spring Run 3 in Landa Lake (2021. Quality control spike recoveries (%) are reported to the right of each sample and samples with detectable concentrations are denoted in bold.

Month	Sample (ng/L)	QC Spike Recovery (%)	Duplicate (ng/L)	QC Spike Recovery (%)	DI Blank (ng/L)	QC Spike Recovery (%)	Lab Blank (ng/L)	QC Spike Recovery (%)	Spiked Matrix (ng/L)	QC Spiked Recovery (%)
January	7.84[U]	68.7	NA	NA	NA	NA	10.1[U]	85.5	1.01	93.4
February	7.87[U]	74.3	NA	NA	8.46[U]	74.8	10.1[U]	85.5	1.01	93.4
March	7.70[U]	87.4	7.88[U]	80	NA	NA	10.1[U]	85.5	1.01	93.4
April	8.07[U]	71.3	NA	NA	8.05[U]	82.1	10.1[U]	82.6	1.01	98.1
May	8.04[U]	79.4	NA	NA	16.0[UD]	82.7	10.1[U]	82.6	1.01	98.1
June	**17.6**	75.9	16.1[UD]	79.4	NA	NA	10.1[U]	82.6	1.01	98.1
July	8.05[U]	80	NA	NA	NA	NA	10.1[U]	86.5	1.01	97.4
August	8.01[U]	85.5	NA	NA	8.08[U]	88.5	10.1[U]	86.5	1.01	97.4
September	8.05[U]	85.3	NA	NA	NA	NA	10.1[U]	86.5	1.01	97.4
October	8.06[U]	70.8	7.94[U]	65.9	NA	NA	8.08[U]	60.2	1.01	108
November	7.91[U]	62.3	NA	NA	NA	NA	8.08[U]	60.2	1.01	108
December	**10.7**	64.4	**9.64**	74.7	NA	NA	8.08[U]	60.2	1.01	108

[U] Non-detect at reporting limit

[D] Dilution data

Table A-3. Nutrient concentrations reported for samples, duplicate samples, lab blanks, and field blanks, and the relative percent difference between sample and duplicate sample concentrations (%) at the San Marcos River upper and lower sites for Spring 2021. Samples with detectable concentrations denoted in bold.

Nutrients	Units	Upper	Upper Duplicates	Relative Percent Difference	Laboratory Blank	Field Blank
Total Phosphorus	ug/L	25[U]	25[U]	NA	25[U]	25[U]
Orthophosphate	mg/L	0.02[UH]	0.02[UH]	NA	0.02[UH]	0.02[UH]
Orthophosphate as P	mg/L	0.02[UH]	0.02[UH]	NA	0.02[UH]	0.02[UH]
Total Organic Carbon	mg/L	0.29[U]	**0.78[J]**	91.59%	0.29[U]	0.29[U]
Dissolved Inorganic Carbon	mg/L	**61.5**	**62.1**	0.97%	0.29[U]	0.29[U]
Dissolved Organic Carbon	mg/L	0.29[U]	**0.96[J]**	107.20%	0.29[U]	0.29[U]
Kjeldahl Nitrogen	mg/L	0.1[U]	0.1[U]	NA	0.1[U]	0.1[U]
Nitrate as N	mg/L	**0.99[H]**	**1.01[H]**	2.00%	0.1[UH]	0.1[UH]
Ammonia	mg/L	**0.17[JF1]**	**0.24**	34.15%	**0.22**	**0.25**
Nutrients	**Units**	**Lower**	**Lower Duplicates**	**Relative Percent Difference**	**Laboratory Blank**	**Field Blank**
Total Phosphorus	ug/L	25[U]	25[U]	NA	25[U]	25[U]
Orthophosphate	mg/L	0.02[UH]	0.02[UH]	NA	0.02[UH]	0.02[UH]
Orthophosphate as P	mg/L	0.02[UH]	0.02[UH]	NA	0.02[UH]	0.02[UH]
Total Organic Carbon	mg/L	**0.31[J]**	**0.71[J]**	78.43%	0.29[U]	0.29[U]
Dissolved Inorganic Carbon	mg/L	**60.2**	**60**	0.33%	0.29[U]	0.29[U]
Dissolved Organic Carbon	mg/L	**0.84[JH]**	**0.52[JH]**	47.06%	0.29[U]	0.29[U]
Kjeldahl Nitrogen	mg/L	0.1[U]	0.1[U]	NA	0.1[U]	0.1[U]
Nitrate as N	mg/L	**1.25[H]**	**1.22[H]**	2.43%	0.1[UH]	0.1[UH]
Ammonia	mg/L	**0.26**	**0.32**	20.69%	**0.22**	**0.25**

[U] Non-detect at reporting limit

[H] Sample was prepped and analyzed past holding time

[J] Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Table A-4. Nutrient concentrations reported for samples, duplicate samples, lab blanks, and field blanks, and the relative percent difference between sample and duplicate sample concentrations (%) at the San Marcos upper and lower sites for Fall 2021. Samples with detectable concentrations denoted in bold.

Nutrients	Units	Upper	Upper Duplicates	Relative Percent Difference	Laboratory Blank	Field Blank
Total Phosphorus	ug/L	25[U]	25[U]	NA	25[U]	25[U]
Orthophosphate	mg/L	0.02[UH]	0.02[UH]	NA	**0.04[J]**	0.02[UH]
Orthophosphate as P	mg/L	0.02[UH]	0.02[UH]	NA	**0.04[J]**	0.02[UH]
Total Organic Carbon	mg/L	**3.12**	**7.27**	79.88%	0.29[U]	0.29[U]
Dissolved Inorganic Carbon	mg/L	**66.8**	**66.1**	1.05%	**0.84[J]**	0.29[U]
Dissolved Organic Carbon	mg/L	**1.01**	**4.89**	131.53%	0.29[U]	0.29[U]
Kjeldahl Nitrogen	mg/L	**0.20[J]**	0.1[U]	66.67%	**0.15[J]**	0.1[U]
Nitrate as N	mg/L	1.09	1.09	0.00%	0.1[UH]	0.1[UH]
Ammonia	mg/L	0.02[U]	0.02[U]	NA	0.02[U]	0.02[U]
Nutrients	**Units**	**Lower**	**Lower Duplicates**	**Relative Percent Difference**	**Laboratory Blank**	**Field Blank**
Total Phosphorus	ug/L	25[U]	25[U]	NA	25[U]	25[U]
Orthophosphate	mg/L	0.02[UH]	0.02[UH]	NA	**0.04[J]**	0.02[UH]
Orthophosphate as P	mg/L	0.02[UH]	0.02[UH]	NA	**0.04[J]**	0.02[UH]
Total Organic Carbon	mg/L	**2.92**	0.29[U]	163.86%	0.29[U]	0.29[U]
Dissolved Inorganic Carbon	mg/L	**67.3**	**65.9**	2.10%	**0.84[J]**	0.29[U]
Dissolved Organic Carbon	mg/L	**2.42**	0.29[U]	157.20%	0.29[U]	0.29[U]
Kjeldahl Nitrogen	mg/L	**0.11[J]**	0.1[U]	9.52%	**0.15[J]**	0.1[U]
Nitrate as N	mg/L	**1.41**	0.1[U]	173.51%	0.1[UH]	0.1[UH]
Ammonia	mg/L	**0.05[J]**	**0.06[J]**	18.18%	0.02[U]	0.02[U]

[U] Non-detect at reporting limit

[H] Sample was prepped and analyzed past holding time

[J] Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Table A-5. Nutrient concentrations reported for samples, duplicate samples, lab blanks, and field blanks, and the relative percent difference between sample and duplicate sample concentrations (%) at the Comal upper and lower sites for Spring 2021. Samples with detectable concentrations denoted in bold.

Nutrients	Units	Upper	Upper Duplicates	Relative Percent Difference	Laboratory Blank	Field Blank
Total Phosphorus	ug/L	25[U]	25[U]	NA	25[U]	25[U]
Orthophosphate	mg/L	0.02[U]	0.02[U]	NA	0.02[U]	0.02[U]
Orthophosphate as P	mg/L	0.02[U]	0.02[U]	NA	0.02[U]	0.02[U]
Total Organic Carbon	mg/L	**0.59[J]**	**0.67[J]**	12.70%	0.29[U]	0.29[U]
Dissolved Inorganic Carbon	mg/L	**57.5**	**52.7**	8.71%	0.29[U]	0.29[U]
Dissolved Organic Carbon	mg/L	0.29[U]	0.29[U]	NA	0.29[U]	0.29[U]
Kjeldahl Nitrogen	mg/L	0.1[U]	0.1[U]	NA	0.1[U]	0.1[U]
Nitrate as N	mg/L	**1.77[H]**	**1.7[H]**	4.03%	0.1[U]	0.1[U]
Ammonia	mg/L	**0.21**	**0.29**	32.00%	**0.22**	**0.25**
Nutrients	**Units**	**Lower**	**Lower Duplicates**	**Relative Percent Difference**	**Laboratory Blank**	**Field Blank**
Total Phosphorus	ug/L	25[U]	25[U]	NA	25[U]	25[U]
Orthophosphate	mg/L	0.02[U]	0.02[U]	NA	0.02[U]	0.02[U]
Orthophosphate as P	mg/L	0.02[U]	0.02[U]	NA	0.02[U]	0.02[U]
Total Organic Carbon	mg/L	**1.04[J]**	**1.92[J]**	59.46%	0.29[U]	0.29[U]
Dissolved Inorganic Carbon	mg/L	**56.1**	**56.9**	1.42%	0.29[U]	0.29[U]
Dissolved Organic Carbon	mg/L	0.29[U]	**1.17**	120.55%	0.29[U]	0.29[U]
Kjeldahl Nitrogen	mg/L	0.1[U]	0.1[U]	NA	0.1[U]	0.1[U]
Nitrate as N	mg/L	**1.73[H]**	**1.70[H]**	1.75%	0.1[U]	0.1[U]
Ammonia	mg/L	**0.38**	**0.53**	32.97%	**0.22**	**0.25**

[U] Non-detect at reporting limit

[H] Sample was prepped and analyzed past holding time

[J] Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Table A-6. Nutrient concentrations reported for samples, duplicate samples, lab blanks, and field blanks, and the relative percent difference between sample and duplicate sample concentrations (%) at the Comal upper and lower sites for Fall 2021. Samples with detectable concentrations denoted in bold.

Nutrients	Units	Upper	Upper Duplicates	Relative Percent Difference	Laboratory Blank	Field Blank
Total Phosphorus	ug/L	25[U]	25[U]	NA	25[U]	25[U]
Orthophosphate	mg/L	0.02[UH]	**1.10[H]**	192.86%	**0.04[J]**	0.02[UH]
Orthophosphate as P	mg/L	0.02[UH]	**1.10[H]**	192.86%	**0.04[J]**	0.02[UH]
Total Organic Carbon	mg/L	**0.86[J]**	0.29[U]	99.13%	0.29[U]	0.29[U]
Dissolved Inorganic Carbon	mg/L	**62.0**	**60.0**	3.28%	0.84[J]	0.29[U]
Dissolved Organic Carbon	mg/L	0.58[U]	0.29[U]	68.18%	0.29[U]	0.29[U]
Kjeldahl Nitrogen	mg/L	0.10[U]	0.10[U]	NA	**0.15[J]**	0.1[U]
Nitrate as N	mg/L	0.10[U]	**0.17[JF1]**	51.85%	0.1[UH]	0.1[UH]
Ammonia	mg/L	**0.03[J]**	**0.06[J]**	66.67%	0.02[U]	0.02[U]
Nutrients	**Units**	**Lower**	**Lower Duplicates**	**Relative Percent Difference**	**Laboratory Blank**	**Field Blank**
Total Phosphorus	ug/L	25[U]	25[U]	NA	25[U]	25[U]
Orthophosphate	mg/L	0.02[UH]	0.02[UH]	NA	**0.04[J]**	0.02[UH]
Orthophosphate as P	mg/L	0.02[UH]	0.02[UH]	NA	**0.04[J]**	0.02[UH]
Total Organic Carbon	mg/L	**1.28**	0.29[U]	126.11%	0.29[U]	0.29[U]
Dissolved Inorganic Carbon	mg/L	**60.2**	**60.2**	0.00%	**0.84[J]**	0.29[U]
Dissolved Organic Carbon	mg/L	**2.76**	0.29[U]	161.97%	0.29[U]	0.29[U]
Kjeldahl Nitrogen	mg/L	0.1[U]	0.1[U]	NA	**0.15[J]**	0.1[U]
Nitrate as N	mg/L	**2.05**	**1.99**	2.97%	0.1[UH]	0.1[UH]
Ammonia	mg/L	**0.1**	0.02[U]	133.33%	0.02[U]	0.02[U]

[U] Non-detect at reporting limit
[H] Sample was prepped and analyzed past holding time
[F1] MS and/or MSD recovery exceeds control limits
[J] Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Table A-7. PPCP concentrations reported for samples, duplicate samples, equipment blank, DI blank, and lab blank at the San Marcos groundwater sites (i.e., Hotel and Deep Hole springs) in Spring. Samples with detectable concentrations denoted in bold.

PPCP List	Hotel Spring	Hotel Spring Duplicate	Deep Hole	Equipment Blank	DI Blank	Lab Blank
Alprazolam	0.294[U]	0.295[U]	0.295[U]	0.295[U]	0.297[U]	0.3[U]
Amitriptyline	0.294[U]	0.295[U]	0.295[U]	0.295[U]	0.297[U]	0.3[U]
Amlodipine	0.985[U]	0.988[U]	0.988[U]	0.988[U]	0.984[U]	1.01[U]
Benzoylecgonine	0.147[U]	0.147[U]	0.147[U]	0.147[U]	0.148[U]	0.15[U]
Benztropine	0.685[U]	0.687[U]	0.687[U]	0.687[U]	0.692[U]	0.7[U]
Betamethasone	1.47[U]	1.47[U]	1.47[U]	1.47[U]	1.48[U]	1.5[U]
Cocaine	0.147[U]	0.147[U]	0.147[U]	0.147[U]	0.148[U]	0.15[U]
DEET	**1.23**	**1.36**	**5.39[C]**	**11.8**	**2.34**	**1.4**
Desmethyldiltiazem	0.147[U]	0.147[U]	0.147[U]	0.147[U]	0.148[U]	0.15[U]
Diazepam	0.491[U]	0.493[U]	0.493[U]	0.493[U]	0.496[U]	0.502[U]
Fluocinonide	1.97[U]	1.97[U]	1.97[U]	1.97[U]	1.99[U]	2.01[U]
Fluticasone propionate	1.97[U]	1.97[U]	1.97[U]	1.97[U]	1.99[U]	2.01[U]
Hydrocortisone	5.87[U]	5.89[U]	5.89[U]	5.89[U]	5.93[U]	6.0[U]
10-hydroxy-amitriptyline	0.147[U]	0.147[U]	0.147[U]	0.147[U]	0.148[U]	0.15[U]
Meprobamate	1.47[U]	1.47[U]	1.47[U]	1.47[U]	1.48[U]	1.5[U]
Methylprednisolone	3.92[U]	3.93[U]	3.93[U]	3.93[U]	3.95[U]	4.0[U]
Metoprolol	0.491[U]	0.493[U]	0.493[U]	0.493[U]	0.496[U]	0.502[U]
Norfluoxetine	0.491[U]	0.493[U]	0.493[U]	0.493[U]	0.496[U]	0.502[U]
Norverapamil	0.147[U]	0.147[U]	0.147[U]	0.147[U]	0.148[U]	0.15[U]
Paroxetine	0.985[U]	0.988[U]	0.988[U]	0.988[U]	0.984[U]	1.01[U]
Prednisolone	3.92[U]	3.93[U]	3.93[U]	3.93[U]	3.95[U]	4.0[U]
Prednisone	5.87[U]	5.89[U]	5.89[U]	5.89[U]	5.93[U]	6.0[U]
Promethazine	0.294[U]	0.295[U]	0.295[U]	0.295[U]	0.297[U]	0.3[U]
Propoxyphene	0.294[U]	0.295[U]	0.295[U]	0.295[U]	0.297[U]	0.3[U]
Propranolol	0.294[U]	0.295[U]	0.295[U]	0.295[U]	0.297[U]	0.3[U]
Sertraline	0.294[U]	0.295[U]	0.295[U]	0.295[U]	0.297[U]	0.3[U]
Simvastatin	1.97[U]	1.97[U]	1.97[U]	1.97[U]	1.99[U]	2.01[U]
Theophylline	5.87[U]	5.89[U]	5.89[U]	5.89[U]	5.93[U]	6.0[U]
Trenbolone	1.97[U]	1.97[U]	1.97[U]	1.97[U]	1.99[U]	2.01[U]
Trenbolone acetate	0.294[U]	0.295[U]	0.295[U]	0.295[U]	0.297[U]	0.3[U]
Valsartan	3.92[U]	3.93[U]	3.93[U]	3.93[U]	3.95[U]	4.0[U]
Verapamil	0.147[U]	0.147[U]	0.147[U]	0.147[U]	0.148[U]	0.15[U]

[U] Non-detect at reporting limit

Table A-8. PPCP concentrations reported for samples, duplicate samples, equipment blank, DI blank, and Lab blank at the San Marcos groundwater sites (i.e., Hotel and Deep Hole springs) in Spring. Samples with detectable concentrations denoted in bold.

PPCP list continued	Hotel spring	Hotel Spring Duplicate	Deep Hole	Equipment Blank	DI Blank	Lab Blank
Acetaminophen	14.7[U]	14.7[U]	14.7[U]	14.7[U]	14.8[U]	15[U]
Azithromycin	1.47[U]	1.47[U]	1.47[U]	1.47[U]	1.48[U]	1.5[U]
Caffeine	14.7[U]	14.7[U]	14.7[U]	**15**	14.8[U]	15[U]
Carbadox	1.47[U]	1.47[U]	1.47[U]	1.47[U]	1.48[U]	1.5[U]
Carbamazepine	1.47[U]	1.47[U]	1.47[U]	1.47[U]	1.48[U]	1.5[U]
Cefotaxime	6.63[U]	8.09[U]	8.09[U]	5.89[U]	7.39[U]	6.0[U]
Ciprofloxacin	5.87[U]	5.89[U]	5.89[U]	5.89[U]	5.93[U]	6.0[U]
Clarithromycin	1.47[U]	1.47[U]	1.47[U]	1.47[U]	1.48[U]	1.5[U]
Clinafloxacin	6.46[U]	5.89[U]	5.89[U]	5.89[U]	10.4[U]	6.0[U]
Cloxacillin	2.94[UH]	2.95[UH]	2.95[UH]	2.95[UH]	2.97[UH]	3.0[UH]
Dehydronifedipine	1.96[U]	1.96[U]	1.96[U]	1.96[U]	1.98[U]	2.0[U]
Diphenhydramine	0.587[U]	0.589[U]	0.589[U]	0.589[U]	0.593[U]	0.63[U]
Diltiazem	0.294[U]	0.295[U]	0.295[U]	0.295[U]	0.297[U]	0.3[U]
Digoxin	5.87[U]	5.89[U]	5.89[U]	5.89[U]	5.93[U]	6.0[U]
Digoxigenin	5.87[U]	5.89[U]	5.89[U]	5.89[U]	5.93[U]	6.0[U]
Enrofloxacin	2.94[U]	2.95[U]	2.95[U]	2.95[U]	2.97[U]	3.0[U]
Erythromycin-H2O	2.25[U]	2.26[U]	2.26[U]	2.26[U]	2.27[U]	2.3[U]
Flumequine	1.47[U]	1.47[U]	1.47[U]	1.47[U]	1.48[U]	1.5[U]
Fluoxetine	1.47[U]	1.47[U]	1.47[U]	1.47[U]	1.48[U]	1.5[U]
Lincomycin	2.94[U]	2.95[U]	2.95[U]	2.95[U]	2.97[U]	3.0[U]
Lomefloxacin	9.79[U]	9.82[U]	9.82[U]	9.82[U]	9.88[U]	10.0[U]
Miconazole	1.47[U]	1.47[U]	1.47[U]	1.47[U]	1.48[U]	1.5[U]
Norfloxacin	14.7[U]	14.7[U]	14.7[U]	14.7[U]	**24.8**	15[U]
Norgestimate	2.94[U]	2.95[U]	2.95[U]	2.95[U]	3.2[U]	3.0[U]
Ofloxacin	1.47[U]	1.47[U]	1.47[U]	1.47[U]	1.48[U]	1.5[U]
Ormetoprim	0.587[U]	0.589[U]	0.589[U]	0.589[U]	0.593[U]	0.6[U]
Oxacillin	2.94[UH]	2.95[UH]	2.95[U]	2.95[UH]	2.97[UH]	3.0[UH]
Oxolinic Acid	0.587[U]	0.589[U]	0.589[U]	0.589[U]	0.593[U]	0.6[U]
Penicillin G	2.94[UH]	2.95[UH]	**255**	**397**	2.97[UH]	3.0[UH]
Penicillin V	9.79[U]	9.82[U]	9.82[U]	9.82[U]	9.88[U]	10.0[U]
Roxithromycin	0.979[U]	0.982[U]	0.982[U]	0.982[U]	0.988[U]	1.0[U]
Sarafloxacin	14.7[U]	14.7[U]	14.7[U]	14.7[U]	**23.7**	15[U]
Sulfachloropyridazine	1.47[U]	1.47[U]	1.47[U]	1.47[U]	1.48[U]	1.5[U]
Sulfadiazine	1.47[U]	1.47[U]	1.47[U]	1.47[U]	1.48[U]	1.5[U]
Sulfadimethoxine	0.294[U]	0.295[U]	0.295[U]	0..375[U]	0.297[U]	0.297[U]
Sulfamerazine	0.587[U]	0.589[U]	0.589[U]	0.589[U]	0.593[U]	0.6[U]
Sulfamethazine	0.587[U]	0.589[U]	0.589[U]	0.589[U]	0.593[U]	0.6[U]
Sulfamethizole	0.587[U]	0.589[U]	1.13[U]	1.13[U]	0.635[U]	0.635[U]
Sulfamethoxazole	0.587[U]	0.589[U]	**0.854**	0.589[U]	0.593[U]	0.6[U]
Sulfanilamide	14.7[U]	14.7[U]	14.7[U]	14.7[U]	14.8[U]	15[U]
Sulfathiazole	1.47[U]	1.47[U]	1.47[U]	1.47[U]	1.48[U]	1.5[U]
Thiabendazole	1.47[U]	1.47[U]	1.47[U]	1.47[U]	1.48[U]	1.5[U]
Trimethoprim	1.47[U]	1.47[U]	1.47[U]	1.47[U]	1.48[U]	1.5[U]
Tylosin	5.87[U]	5.89[U]	5.89[U]	5.89[U]	5.93[U]	6.0[U]
Virginiamycin M1	2.94[U]	2.95[U]	2.95[U]	2.95[U]	2.97[U]	3.0[U]
1,7-Dimethylxanthine	196[U]	196[U]	196[U]	196[U]	198[U]	200[U]

[U] Non-detect at reporting limit

[H] Concentration is estimated

Table A-9. PPCP concentrations reported for samples, duplicate samples, equipment blank, DI blank, and lab blank at the San Marcos groundwater sites (i.e., Hotel and Deep Hole springs) in Fall. Samples with detectable concentrations denoted in bold.

PPCP List	Hotel Spring	Hotel Spring Duplicate	Deep Hole	DI Blank	Lab Blank
Alprazolam	0.292[U]	0.293[U]	0.292[U]	0.318[U]	0.3[U]
Amitriptyline	0.292[U]	0.293[U]	0.292[U]	0.318[U]	0.3[U]
Amlodipine	0.979[U]	0.983[U]	0.978[U]	1.07[U]	1.01[U]
Benzoylecgonine	0.146[U]	0.147[U]	0.146[U]	0.159[U]	0.15[U]
Benztropine	0.681[U]	0.684[U]	0.680[U]	0.742[U]	0.7[U]
Betamethasone	1.46[U]	1.47[U]	1.46[U]	1.59[U]	1.5[U]
Cocaine	0.146[U]	0.147[U]	0.146[U]	0.159[U]	0.15[U]
DEET	**2.23**	**2.32**	**4.01**	**2.48**	**2.51**
Desmethyldiltiazem	0.146[U]	0.147[U]	0.146[U]	0.159[U]	0.15[U]
Diazepam	0.488[U]	0.491[U]	0.488[U]	0.532[U]	0.502[U]
Fluocinonide	1.96[U]	1.96[U]	1.95[U]	2.13[U]	2.01[U]
Fluticasone propionate	1.96[U]	1.96[U]	1.95[U]	2.13[U]	2.01[U]
Hydrocortisone	5.84[U]	5.86[U]	5.83[U]	6.36[U]	6.0[U]
10-hydroxy-amitriptyline	0.146[U]	0.147[U]	0.146[U]	0.159[U]	0.15[U]
Meprobamate	1.46[U]	1.47[U]	1.46[U]	1.59[U]	1.5[U]
Methylprednisolone	3.89[U]	3.91[U]	3.89[U]	4.24[U]	4.0[U]
Metoprolol	0.488[U]	0.491[U]	0.488[U]	0.532[U]	0.502[U]
Norfluoxetine	0.488[U]	0.491[U]	0.488[U]	0.532[U]	0.502[U]
Norverapamil	0.146[U]	0.147[U]	0.146[U]	0.159[U]	0.15[U]
Paroxetine	0.979[U]	0.983[U]	0.978[U]	1.07[U]	1.01[U]
Prednisolone	3.89[U]	3.91[U]	3.89[U]	4.24[U]	4.0[U]
Prednisone	5.84[U]	5.86[U]	5.83[U]	6.36[U]	6.0[U]
Promethazine	0.292[U]	0.293[U]	0.292[U]	0.318[U]	0.3[U]
Propoxyphene	0.292[U]	0.293[U]	0.292[U]	0.318[U]	0.3[U]
Propranolol	0.292[U]	0.293[U]	0.292[U]	0.318[U]	0.3[U]
Sertraline	0.292[U]	0.293[U]	0.292[U]	0.318[U]	0.3[U]
Simvastatin	1.96[U]	1.96[U]	1.95[U]	2.13[U]	2.01[U]
Theophylline	5.84[U]	5.86[U]	5.83[U]	6.36[U]	10.0[R]
Trenbolone	1.96[U]	1.96[U]	1.95[U]	2.13[U]	2.01[U]
Trenbolone acetate	0.292[U]	0.293[U]	0.292[U]	0.318[U]	0.3[U]
Valsartan	3.89[U]	3.91[U]	3.89[U]	4.24[U]	4.0[U]
Verapamil	0.146[U]	0.147[U]	0.146[U]	1.59[U]	0.15[U]

[U] Non-detect at reporting limit

[R] Peak detected but did not meet qualification criteria

Table A-10. PPCP concentrations reported for samples, duplicate samples, equipment blank, DI blank, and lab blank at the San Marcos groundwater sites (i.e., Hotel and Deep Hole springs) in Fall. Samples with detectable concentrations denoted in bold.

PPCP list continued	Hotel spring	Hotel Spring Duplicate	Deep Hole	DI Blank	Lab Blank
Acetaminophen	14.6[U]	14.7[U]	14.6[U]	15.9[U]	15[U]
Azithromycin	1.46[U]	1.47[U]	1.46[U]	1.59[U]	1.5[U]
Caffeine	14.6[U]	14.7[U]	14.6[U]	15.9[U]	**20**
Carbadox	1.46[U]	1.47[U]	1.46[U]	1.59[U]	1.5[U]
Carbamazepine	1.46[U]	1.47[U]	1.46[U]	1.59[U]	1.5[U]
Cefotaxime	5.84[U]	5.86[U]	5.83[U]	6.36[U]	6.0[U]
Ciprofloxacin	5.84[U]	5.86[U]	5.83[U]	6.36[U]	6.0[U]
Clarithromycin	1.46[U]	1.47[U]	1.46[U]	1.59[U]	1.5[U]
Clinafloxacin	6.33[U]	5.86[U]	5.83[U]	6.36[U]	6.0[U]
Cloxacillin	9.73[UH]	9.77[UH]	9.72[UH]	10.6[UH]	10.0[UH]
Dehydronifedipine	0.584[U]	0.586[U]	0.583[U]	0.636[U]	0.6[U]
Diphenhydramine	0.584[U]	0.586[U]	0.595[U]	0.636[U]	0.6[U]
Diltiazem	0.292[U]	0.293[U]	0.292[U]	0.318[U]	0.3[U]
Digoxin	5.84[U]	5.86[U]	5.83[U]	6.36[U]	6.0[U]
Digoxigenin	5.84[U]	5.86[U]	5.83[U]	6.36[U]	6.0[U]
Enrofloxacin	2.92[U]	2.93[U]	2.92[U]	3.18[U]	3.0[U]
Erythromycin-H2O	2.24[U]	2.25[U]	2.24[U]	2.44[U]	2.3[U]
Flumequine	1.46[U]	1.47[U]	1.46[U]	1.59[U]	1.5[U]
Fluoxetine	4.86[U]	4.89[U]	4.86[U]	5.3[U]	1.5[U]
Lincomycin	2.92[U]	2.93[U]	2.92[U]	3.18[U]	3.0[U]
Lomefloxacin	2.92[U]	2.93[U]	2.92[U]	3.18[U]	3.0[U]
Miconazole	1.46[U]	1.47[U]	1.46[U]	1.59[U]	1.5[U]
Norfloxacin	14.6[U]	14.7[U]	14.6[U]	15.9[U]	15[U]
Norgestimate	2.92[U]	2.93[U]	2.92[U]	3.18[U]	3.0[U]
Ofloxacin	1.46[U]	1.47[U]	1.46[U]	1.5[U]	1.5[U]
Ormetoprim	0.584[U]	0.586[U]	0.583[U]	0.6[U]	0.6[U]
Oxacillin	9.73[UH]	9.77[UH]	9.72[UH]	3.0[UH]	10.0[UH]
Oxolinic Acid	0.584[U]	5.86[U]	0.583[U]	0.6[U]	0.6[U]
Penicillin G	9.73[UH]	9.77[UH]	73.9[RH]	3.0[UH]	10.0[UH]
Penicillin V	2.92[U]	2.93[U]	11.4[U]	10.0[U]	3.0[U]
Roxithromycin	0.292[U]	0.293[U]	0.292[U]	1.0[U]	0.3[U]
Sarafloxacin	14.6[U]	14.7[U]	14.6[U]	15.9[U]	15[U]
Sulfachloropyridazine	1.46[U]	1.47[U]	1.46[U]	1.59[U]	1.5[U]
Sulfadiazine	1.46[U]	1.47[U]	1.46[U]	1.59[U]	1.5[U]
Sulfadimethoxine	0.292[U]	0.293[U]	0.292[U]	0.318[U]	0.3[U]
Sulfamerazine	0.584[U]	0.586[U]	0.583[U]	0.636[U]	0.6[U]
Sulfamethazine	0.584[U]	0.586[U]	0.583[U]	0.636[U]	0.6[U]
Sulfamethizole	0.584[U]	0.586[U]	0.583[U]	0.636[U]	0.6[U]
Sulfamethoxazole	0.584[U]	0.586[U]	0.583[U]	0.636[U]	0.6[U]
Sulfanilamide	14.6[U]	14.7[U]	14.6[U]	15.9[U]	15[U]
Sulfathiazole	1.46[U]	1.47[U]	1.46[U]	1.59[U]	1.5[U]
Thiabendazole	1.46[U]	1.47[U]	1.46[U]	1.59[U]	1.5[U]
Trimethoprim	1.46[U]	1.47[U]	1.46[U]	1.59[U]	1.5[U]
Tylosin	5.84[U]	0.586[U]	5.83[U]	6.36[U]	6.0[U]
Virginiamycin M1	2.92[U]	2.93[U]	2.92[U]	3.18[U]	3.0[U]
1,7-Dimethylxanthine	58.4[U]	58.6[U]	58.3[U]	63.6[U]	60[U]

[U] Non-detect at reporting limit

[H] Concentration is estimated

[R] Peak detected but did not meet qualification criteria

Table A-11. PPCP concentrations reported for samples, duplicate samples, and lab blanks at the Comal groundwater sites (i.e., Spring run 1, 3 and 7) in Spring. Samples with detectable concentrations denoted in bold.

PPCP List	Spring Run 1	Spring Run 1 Duplicate	Spring Run 3	Spring Run 3 Duplicate	Spring Run 7	Lab Blank
Alprazolam	0.297U	0.296U	0.3U	0.297U	0.297U	0.3U
Amitriptyline	0.297U	0.296U	0.3U	0.297U	0.297U	0.3U
Amlodipine	0.997U	0.991U	1.0U	0.996U	0.994U	1.01U
Benzoylecgonine	0.149U	0.148U	0.15U	0.149U	0.148U	0.15U
Benztropine	0.694U	0.69U	0.699U	0.692U	0.692U	0.7U
Betamethasone	1.49U	1.48U	1.5U	1.48U	1.48U	1.5U
Cocaine	0.149U	0.148U	0.15U	0.148U	0.148U	0.15U
DEET	**1.2**	**1.37**	**1.33**	**1.32**	**1.13**	**1.4**
Desmethyldiltiazem	0.149U	0.148U	0.15U	0.149U	0.148U	0.15U
Diazepam	0.497U	0.495U	0.501U	0.497U	0.496U	0.502U
Fluocinonide	1.99U	1.98U	2.01U	1.99U	1.99U	2.01U
Fluticasone propionate	1.99U	1.98U	2.01U	1.99U	1.99U	2.01U
Hydrocortisone	5.94U	5.91U	5.99U	5.94U	5.93U	6.0U
10-hydroxy-amitriptyline	0.149U	0.148U	0.15U	0.149U	0.148U	0.15U
Meprobamate	1.49U	1.48U	1.5U	1.49U	1.48U	1.5U
Methylprednisolone	3.96U	3.94U	3.99U	3.96U	3.95U	4.0U
Metoprolol	0.497U	0.495U	0.501U	0.497U	0.496U	0.502U
Norfluoxetine	0.497U	0.495U	0.501U	0.497U	0.496U	0.502U
Norverapamil	0.149U	0.148U	0.15U	0.149U	0.148U	0.15U
Paroxetine	0.997U	0.991U	1.0U	0.996U	0.994U	1.01U
Prednisolone	3.96U	3.94U	3.99U	3.96U	3.95U	4.0U
Prednisone	5.94U	5.91U	5.99U	5.94U	5.93U	6.0U
Promethazine	0.297U	0.296U	0.3U	0.297U	0.297U	0.3U
Propoxyphene	0.297U	0.296U	0.3U	0.297U	0.297U	0.3U
Propranolol	0.297U	0.296U	0.3U	0.297U	0.297U	0.3U
Sertraline	0.297U	0.296U	0.3U	0.297U	0.297U	0.3U
Simvastatin	1.99U	1.99U	2.01U	1.99U	1.99U	2.01U
Theophylline	5.94U	5.94U	5.99U	5.94U	5.93U	6.0U
Trenbolone	1.99U	1.98U	2.01U	1.99U	1.99U	2.01U
Trenbolone acetate	0.297U	0.296U	0.3U	0.297U	0.297U	0.3U
Valsartan	3.96U	3.94U	3.99U	3.96U	3.95U	4.0U
Verapamil	0.149U	0.148U	0.15U	0.149U	0.148U	0.15U

U Non-detect at reporting limit

Table A-12. PPCP concentrations reported for samples, duplicate samples, and lab blanks at the Comal groundwater sites (i.e., Spring run 1, 3 and 7) in Spring. Samples with detectable concentrations denoted in bold.

PPCP list	Spring run 1	Spring run 1 duplicate	Spring run 3	Spring run 3 duplicate	Spring run 7	Lab Blank
Acetaminophen	14.9[U]	14.8[U]	15[U]	14.9[U]	14.8[U]	15[U]
Azithromycin	1.49[U]	1.48[U]	1.5[U]	1.49[U]	1.48[U]	1.5[U]
Caffeine	14.9[U]	14.8[U]	15[U]	14.9[U]	14.8[U]	15[U]
Carbadox	1.49[U]	1.48[U]	1.5[U]	1.49[U]	1.48[U]	1.5[U]
Carbamazepine	1.49[U]	1.48[U]	1.5[U]	1.49[U]	1.48[U]	1.5[U]
Cefotaxime	5.94[U]	5.96[U]	5.99[U]	5.94[U]	7.06[U]	6.0[U]
Ciprofloxacin	5.94[U]	5.91[U]	5.99[U]	5.94[U]	5.93[U]	6.0[U]
Clarithromycin	1.49[U]	1.48[U]	1.5[U]	1.49[U]	1.48[U]	1.5[U]
Clinafloxacin	5.94[U]	5.91[U]	5.99[U]	5.94[U]	5.93[U]	6.0[U]
Cloxacillin	2.97[UH]	2.96[UH]	3.0[UH]	2.97[UH]	2.97[UH]	3.0[UH]
Dehydronifedipine	1.98[U]	1.97[U]	2.0[U]	1.98[U]	1.98[U]	2.0[U]
Diphenhydramine	0.594[U]	0.591[U]	0.599[U]	0.594[U]	0.593[U]	0.63[U]
Diltiazem	0.297[U]	0.296[U]	0.3[U]	0.297[U]	0.297[U]	0.3[U]
Digoxin	5.94[U]	5.91[U]	5.99[U]	5.94[U]	5.93[U]	6.0[U]
Digoxigenin	5.94[U]	5.91[U]	5.99[U]	5.94[U]	5.93[U]	6.0[U]
Enrofloxacin	2.97[U]	2.96[U]	3.0[U]	2.97[U]	2.97[U]	3.0[U]
Erythromycin-H2O	2.28[U]	2.27[U]	2.3[U]	2.28[U]	2.27[U]	2.3[U]
Flumequine	1.49[U]	1.48[U]	1.5[U]	1.49[U]	1.48[U]	1.5[U]
Fluoxetine	1.49[U]	1.48[U]	1.5[U]	1.49[U]	1.48[U]	1.5[U]
Lincomycin	2.97[U]	2.96[U]	3.0[U]	2.97[U]	2.97[U]	3.0[U]
Lomefloxacin	9.91[U]	9.85[U]	9.98[U]	9.91[U]	9.88[U]	10.0[U]
Miconazole	1.49[U]	1.48[U]	1.5[U]	1.49[U]	1.48[U]	1.5[U]
Norfloxacin	14.9[U]	14.8[U]	15.0[U]	14.9[U]	14.8[U]	15[U]
Norgestimate	2.97[U]	2.96[U]	3.0[U]	2.97[U]	3.05[U]	3.0[U]
Ofloxacin	1.49[U]	1.48[U]	1.5[U]	1.49[U]	1.48[U]	1.5[U]
Ormetoprim	0.594[U]	0.591[U]	0.599[U]	0.594[U]	0.593[U]	0.6[U]
Oxacillin	2.97[U]	2.96[UH]	3.0[UH]	2.97[U]	2.97[UH]	3.0[UH]
Oxolinic Acid	0.594[U]	0.591[U]	0.599[U]	0.594[U]	0.593[U]	0.6[U]
Penicillin G	2.97[U]	2.96[UH]	3.0[UH]	2.97[U]	2.97[UH]	3.0[UH]
Penicillin V	9.91[U]	9.85[U]	9.98[U]	9.91[U]	9.88[U]	10.0[U]
Roxithromycin	0.991[U]	0.985[U]	0.998[U]	0.991[U]	0.988[U]	1.0[U]
Sarafloxacin	14.9[U]	14.8[U]	15.0[U]	14.9[U]	14.8[U]	15[U]
Sulfachloropyridazine	1.49[U]	1.48[U]	1.5[U]	1.49[U]	1.48[U]	1.5[U]
Sulfadiazine	1.49[U]	1.48[U]	1.5[U]	1.49[U]	1.48[U]	1.5[U]
Sulfadimethoxine	0.297[U]	0.296[U]	0.3[U]	0.297[U]	0.297[U]	0.297[U]
Sulfamerazine	0.594[U]	0.591[U]	0.599[U]	0.594[U]	0.593[U]	0.6[U]
Sulfamethazine	0.594[U]	0.591[U]	0.599[U]	0.594[U]	0.593[U]	0.6[U]
Sulfamethizole	0.594[U]	0.591[U]	0.599[U]	0.606[U]	0.641[U]	0.635[U]
Sulfamethoxazole	**0.707**	**0.779**	**0.871**	**0.706**	**0.848**	0.6[U]
Sulfanilamide	14.9[U]	14.8[U]	15.0[U]	14.9[U]	14.8[U]	15[U]
Sulfathiazole	1.49[U]	1.48[U]	1.5[U]	1.49[U]	1.48[U]	1.5[U]
Thiabendazole	1.49[U]	1.48[U]	1.5[U]	1.49[U]	1.48[U]	1.5[U]
Trimethoprim	1.49[U]	1.48[U]	1.5[U]	1.49[U]	1.48[U]	1.5[U]
Tylosin	5.94[U]	5.91[U]	5.99[U]	5.94[U]	5.93[U]	6.0[U]
Virginiamycin M1	2.97[U]	2.96[U]	3.0[U]	2.97[U]	2.97[U]	3.0[U]
1,7-Dimethylxanthine	198[U]	197[U]	200[U]	198[U]	198[U]	200[U]

[U] Non-detect at reporting limit

[H] Concentration is estimated

Table A-13. PPCP concentrations reported for samples, duplicate samples, and lab blanks at the Comal groundwater sites (i.e., Spring run 1, 3 and 7) in Fall. Samples with detectable concentrations denoted in bold.

PPCP List	Spring Run 1	Spring Run 1 Duplicate	Spring Run 3	Spring Run 3 Duplicate	Spring Run 7	Lab Blank
Alprazolam	0.298U	0.291U	0.293U	0.296U	0.298U	0.3U
Amitriptyline	0.298U	0.291U	0.293U	0.296U	0.298U	0.3U
Amlodipine	0.998U	0.977U	0.981U	0.992U	0.998U	1.01U
Benzoylecgonine	0.149U	0.146U	0.146U	0.148U	0.149U	0.15U
Benztropine	0.694U	0.68U	0.683U	0.69U	0.695U	0.7U
Betamethasone	1.49U	1.46U	1.46U	1.48U	1.49U	1.5U
Cocaine	0.149U	0.146U	0.146U	0.148U	0.149U	0.15U
DEET	**2.39**	**2.57**	**2.44**	**2.87**	**2.37**	**2.51**
Desmethyldiltiazem	0.149U	0.146U	0.146U	0.148U	0.149U	0.15U
Diazepam	0.498U	0.488U	0.489U	0.495U	0.498U	0.502U
Fluocinonide	1.99U	1.95U	1.96U	1.98U	1.99U	2.01U
Fluticasone propionate	1.99U	1.95U	1.96U	1.98U	1.99U	2.01U
Hydrocortisone	5.95U	5.83U	5.85U	5.92U	5.95U	6.0U
10-hydroxy-amitriptyline	0.149U	0.146U	0.146U	0.148U	0.149U	0.15U
Meprobamate	1.49U	1.46U	1.46U	1.48U	1.49U	1.5U
Methylprednisolone	3.97U	3.89U	3.90U	3.94U	3.97U	4.0U
Metoprolol	0.498U	0.488U	0.489U	0.495U	0.498U	0.502U
Norfluoxetine	0.498U	0.488U	0.489U	0.495U	0.498U	0.502U
Norverapamil	0.149U	0.146U	0.146U	0.148U	0.149U	0.15U
Paroxetine	0.998U	0.977U	0.981U	0.992U	0.998U	1.01U
Prednisolone	3.97U	3.89U	3.90U	3.94U	3.97U	4.0U
Prednisone	5.95U	5.83U	5.85U	5.92U	5.95U	6.0U
Promethazine	0.298U	0.291U	0.293U	0.296U	0.298U	0.3U
Propoxyphene	0.298U	0.291U	0.293U	0.296U	0.298U	0.3U
Propranolol	0.298U	0.291U	0.293U	0.296U	0.298U	0.3U
Sertraline	0.298U	0.291U	0.293U	0.296U	0.298U	0.3U
Simvastatin	1.99U	1.95U	1.96U	1.98U	1.99U	2.01U
Theophylline	5.95U	5.83U	5.85U	5.92U	5.95U	**10.0R**
Trenbolone	1.99U	1.95U	1.96U	1.98U	1.99U	2.01U
Trenbolone acetate	0.298U	0.291U	0.293U	0.296U	0.298U	0.3U
Valsartan	3.97U	3.89U	3.90U	3.94U	3.97U	4.0U
Verapamil	0.149U	0.146U	0.146U	0.148U	0.149U	0.15U

U Non-detect at reporting limit

R Peak detected but did not meet qualification criteria

Table A-14. PPCP concentrations reported for samples, duplicate samples, and lab blanks at the Comal groundwater sites (i.e., Spring run 1, 3 and 7) in Fall. Samples with detectable concentrations denoted in bold.

PPCP list continued	Spring run 1	Spring run 1 duplicate	Spring run 3	Spring run 3 duplicate	Spring run 7	Lab Blank
Acetaminophen	14.9[U]	14.6[U]	14.6[U]	14.8[U]	14.9[U]	15[U]
Azithromycin	1.49[U]	1.46[U]	1.46[U]	1.48[U]	1.49[U]	1.5[U]
Caffeine	14.9[U]	14.6[U]	14.6[U]	14.8[U]	14.9[U]	**20**
Carbadox	1.49[U]	1.46[U]	1.46[U]	1.48[U]	1.49[U]	1.5[U]
Carbamazepine	1.49[U]	1.46[U]	1.46[U]	1.48[U]	1.49[U]	1.5[U]
Cefotaxime	5.95[U]	5.83[U]	5.85[U]	5.92[U]	5.95[U]	6.0[U]
Ciprofloxacin	5.95[U]	5.83[U]	**7.72**	5.92[U]	5.95[U]	6.0[U]
Clarithromycin	1.49[U]	1.46[U]	1.46[U]	1.48[U]	1.49[U]	1.5[U]
Clinafloxacin	5.95[U]	5.83[U]	**6.79**	5.92[U]	5.95[U]	6.0[U]
Cloxacillin	9.92[UH]	9.71[UH]	9.75[UH]	9.86[UH]	9.92[UH]	10.0[UH]
Dehydronifedipine	0.595[U]	5.83[U]	0.585[U]	0.592[U]	0.595[U]	0.6[U]
Diphenhydramine	0.595[U]	5.83[U]	0.585[U]	0.592[U]	0.595[U]	0.6[U]
Diltiazem	0.298[U]	0.291[U]	0.293[U]	0.296[U]	0.298[U]	0.3[U]
Digoxin	5.95[U]	5.83[U]	5.85[U]	5.92[U]	5.95[U]	6.0[U]
Digoxigenin	5.95[U]	5.83[U]	5.85[U]	5.92[U]	5.95[U]	6.0[U]
Enrofloxacin	2.98[U]	2.91[U]	**3.05**	2.96[U]	2.98[U]	3.0[U]
Erythromycin-H2O	2.28[U]	2.23[U]	2.24[U]	2.27[U]	2.28[U]	2.3[U]
Flumequine	1.49[U]	1.46[U]	1.46[U]	1.48[U]	1.49[U]	1.5[U]
Fluoxetine	1.49[U]	4.86[U]	4.88[U]	4.93[U]	4.96[U]	1.5[U]
Lincomycin	2.98[U]	2.91[U]	2.93[U]	2.96[U]	2.98[U]	3.0[U]
Lomefloxacin	2.98[U]	2.91[U]	2.93[U]	2.96[U]	2.98[U]	3.0[U]
Miconazole	1.49[U]	1.46[U]	1.46[U]	1.48[U]	1.49[U]	1.5[U]
Norfloxacin	14.9[U]	14.6[U]	14.6[U]	14.8[U]	14.9[U]	15[U]
Norgestimate	2.98[U]	2.91[U]	2.93[U]	2.96[U]	2.98[U]	3.0[U]
Ofloxacin	1.49[U]	1.46[U]	**1.51**	1.48[U]	1.49[U]	1.5[U]
Ormetoprim	0.595[U]	0.585[U]	0.585[U]	0.592[U]	0.595[U]	0.6[U]
Oxacillin	9.92[UH]	9.71[UH]	9.75[UH]	9.86[UH]	9.92[UH]	10.0[UH]
Oxolinic Acid	0.595[U]	0.583[U]	0.585[U]	0.592[U]	0.595[U]	0.6[U]
Penicillin G	9.92[UH]	9.71[UH]	9.75[UH]	9.86[UH]	9.92[UH]	10.0[UH]
Penicillin V	2.98[U]	2.91[U]	2.93[U]	9.88[U]	2.98[U]	3.0[U]
Roxithromycin	0.298[U]	0.291[U]	0.293[U]	2.96[U]	0.298[U]	0.3[U]
Sarafloxacin	14.9[U]	14.6[U]	14.6[U]	14.8[U]	14.9[U]	15[U]
Sulfachloropyridazine	1.49[U]	1.46[U]	1.46[U]	1.48[U]	1.49[U]	1.5[U]
Sulfadiazine	1.49[U]	1.46[U]	1.46[U]	1.48[U]	1.49[U]	1.5[U]
Sulfadimethoxine	0.298[U]	0.291[U]	0.293[U]	0.296[U]	0.298[U]	0.3[U]
Sulfamerazine	0.595[U]	0.583[U]	0.585[U]	0.592[U]	0.595[U]	0.6[U]
Sulfamethazine	0.595[U]	0.583[U]	0.585[U]	0.592[U]	0.595[U]	0.6[U]
Sulfamethizole	0.595[U]	0.583[U]	0.585[U]	0.592[U]	0.595[U]	0.6[U]
Sulfamethoxazole	**0.755**	**0.863**	**0.93**	**0.875**	**0.848**	0.6[U]
Sulfanilamide	14.9[U]	14.6[U]	14.6[U]	14.8[U]	14.9[U]	15[U]
Sulfathiazole	1.49[U]	1.46[U]	1.46[U]	1.48[U]	1.49[U]	1.5[U]
Thiabendazole	1.49[U]	1.46[U]	1.46[U]	1.48[U]	1.49[U]	1.5[U]
Trimethoprim	1.49[U]	1.46[U]	1.46[U]	1.48[U]	1.49[U]	1.5[U]
Tylosin	5.95[U]	5.85[U]	5.85[U]	5.92[U]	5.95[U]	6.0[U]
Virginiamycin M1	2.98[U]	2.91[U]	2.93[U]	2.96[U]	2.98[U]	3.0[U]
1,7-Dimethylxanthine	59.5[U]	58.3[U]	58.5[U]	59.2[U]	59.5[U]	60[U]

[U] Non-detect at reporting limit
[H]Concentration is estimated