BATIQUITOS 2020 WATER QUALITY ANNUAL REPORT

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Background

The Batiquitos Lagoon in north San Diego County consists of 610 acres with a drainage basin of about 55,000 acres. The watershed basin includes the cities of Carlsbad, San Marcos, and Encinitas, with its primary freshwater tributaries being San Marcos Creek from the east and Encinitas Creek which flows north along Green Valley, entering the lagoon under El Camino Real and La Costa Avenue, respectively.[1] A dam built in 1952 to create Lake San Marcos in the upper watershed dramatically reduced the amount of freshwater flow into San Marcos creek and subsequently the lagoon. Consequently, accumulated silt has been filling up Batiquitos Lagoon, and the lagoon was expected to fill up within 50 years. In response, a dredging and enhancement project began in 1994 to allow tidal exchange with the ocean, thus slowing down the siltation process. Completed in 1997, the dredging project was funded by the Port of Los Angeles. Even so, Batiquitos Lagoon remains listed as a 303(D) - impaired waterbody under federal and state Clean Water Act regulations for sedimentation.

In addition, there have been numerous concerns regarding water quality in San Marcos Creek as a result of the release of water from Lake San Marcos. For example, during rainstorm events, lake operators have released "acre-feet of polluted water into the lower San Marcos Creek, ending up in the Batiquitos Lagoon Ecological Reserve and ocean".[2] The Batiquitos Lagoon Foundation believes the Lake San Marcos dam operations and water releases are among the most significant ongoing threats to the lagoon's water quality.[2] These concerns have been brought to the attention of the San Diego Regional Water Quality Control Board, underscoring the need for on-going water quality monitoring in the Batiquitos watershed (or "BTQ").

For the 10-year period 2009-2018, San Diego Coastkeeper (SDCK) monitored BTQ on a regular schedule. Data for 2009-2016 are posted on the California Environmental Data Exchange Network (CEDEN). In the spring of 2019, Preserve Calavera created the North San Diego County Watershed Monitoring Program (NSDCWMP) to carry on the decade-long work of SDCK of assessing the health of local surface waters. Water quality in three coastal watersheds, all of which are part of the Carlsbad Hydrologic Unit (Fig. 1) and including BTQ (Fig. 2), is evaluated by sampling water at multiple locations on a bimonthly basis and measuring basic physical (temperature, conductivity, turbidity), chemical (pH, dissolved oxygen, nutrient and ammonia), and biological (total and pathogenic coliform bacteria) parameters.

NSDCWMP is an all-volunteer citizen science effort with a leadership management team comprised of two Preserve Calavera board members (also leaders of the Buena Vista Creek and Agua Hedionda Lagoon monitoring teams) and a representative from and leader of the BTQ team. Technical advisors from the California Water Resources Control Board as well as the San Diego Regional Water Quality Control Board (SDRWCB) provide guidance to the NSDCWMP. Data are posted at www.preservecalavera.org and on the CEDEN website and shared with SDRWCB and the city of Carlsbad.

Historically, SDCK monitored three sample sites within the BTQ (Fig. 3); two located on San Marcos Creek (BTQ020 and BTQ030), and the third on Encinitas Creek (BTQ010). Water is typically present year-round at BTQ010 and BTQ020; in contrast, BTQ030 is often dry during the summer and fall seasons. When water is present at BTQ030 during the dry season, it is likely the result of overflow or release from the San Marcos Lake Dam.

The NSDCWMP began in July 2019, with BTQ samples collected in July, September and November of that year. Although dissolved oxygen, pH and conductivity were within ranges considered "normal" for such watersheds, some exceedances of macronutrients (nitrogen and phosphorus) and bacterial indicators were observed.[3] No samples were collected from BTQ030 due to lack of water at this site.

The purpose of this annual report is to 1) interpret the health of Batiquitos Lagoon for the testing period in 2020 and 2) look at historic trends (2009-present). Monitoring was conducted on a bimonthly schedule over the entire year (January, March, July, September, and November). No monitoring was conducted in May due to restrictions imposed because of the COVID-19 pandemic. As an additional personnel safety precaution for the July, September and November sampling events, dissolved oxygen was not measured in the field, and conductivity and pH were later measured from the field samples in the lab. Each water quality parameter was measured using standardized procedures and evaluated for anomalies against pre-established quality assurance/quality control (QA/QC) guidelines, including the analysis of field and lab blanks and sample duplicates. The overall state of the watershed compared with the previous year's (2019) monitoring data was summarized below for each parameter.

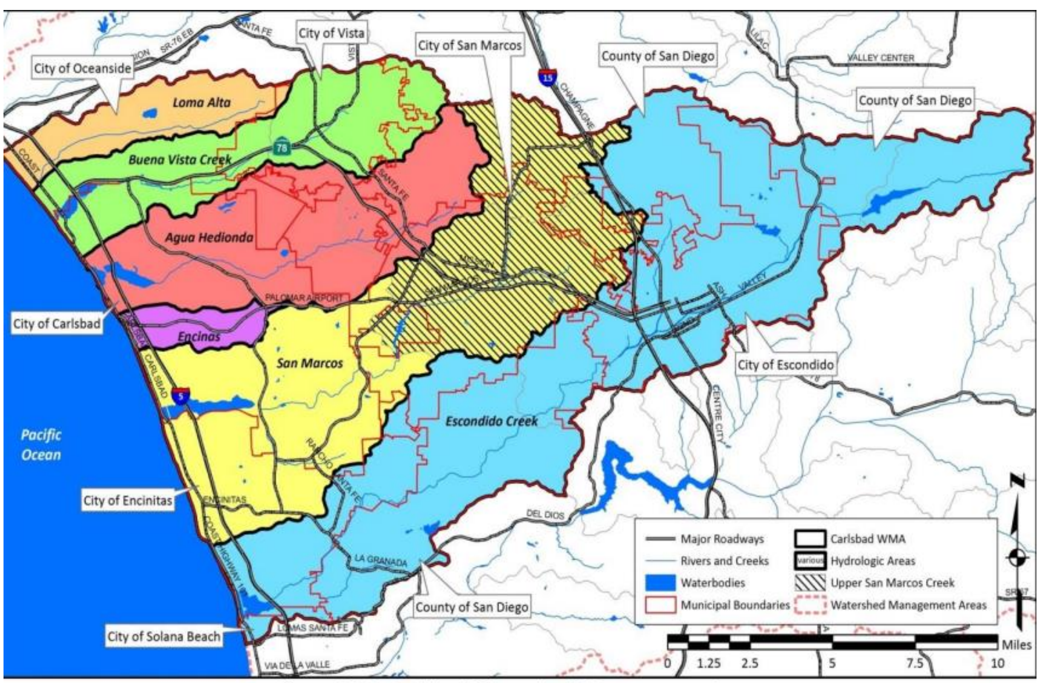


Figure ES-1: Carlsbad Watershed Management Area

Figure 1. Image from Prioritizing Invasive Species Management in the Carlsbad Hydrologic Unit
http://www.escondido.org/Data/Sites/1/media/pdfs/pubworks/carlsbad/150423_Final_Draft_Carlsbad_WQIP_Submittal.pdf

Figure 2. Image from Batiquitos Lagoon Ecological Reserve
https://wildlife.ca.gov/Lands/Places-to-Visit/Batiquitos-Lagoon-ER

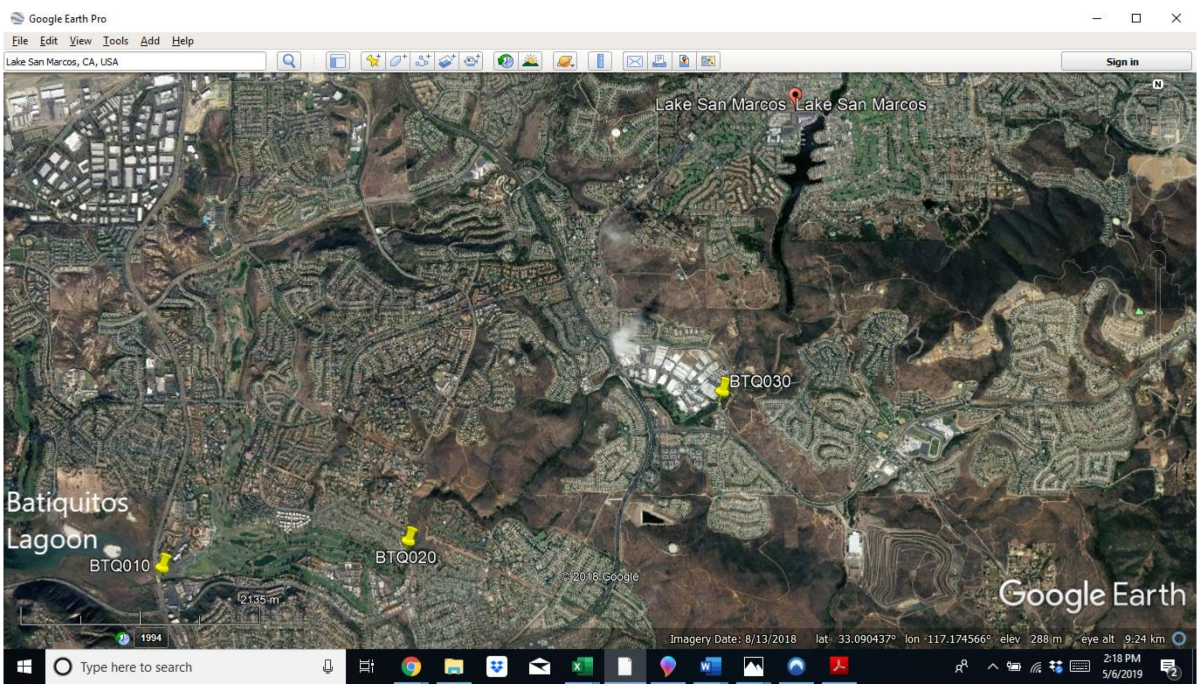


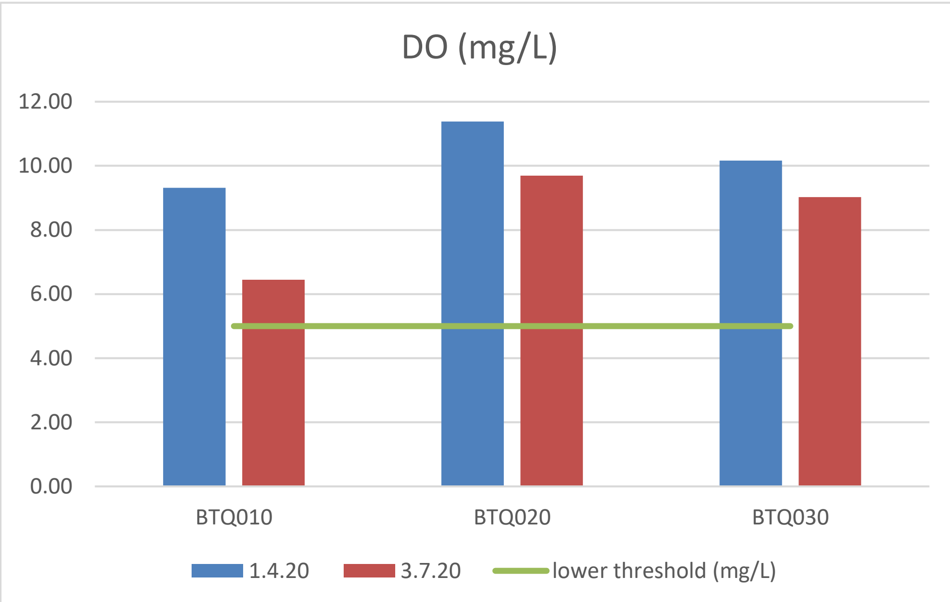
Figure 3. Batiquitos sampling sites.

Sampling Sites

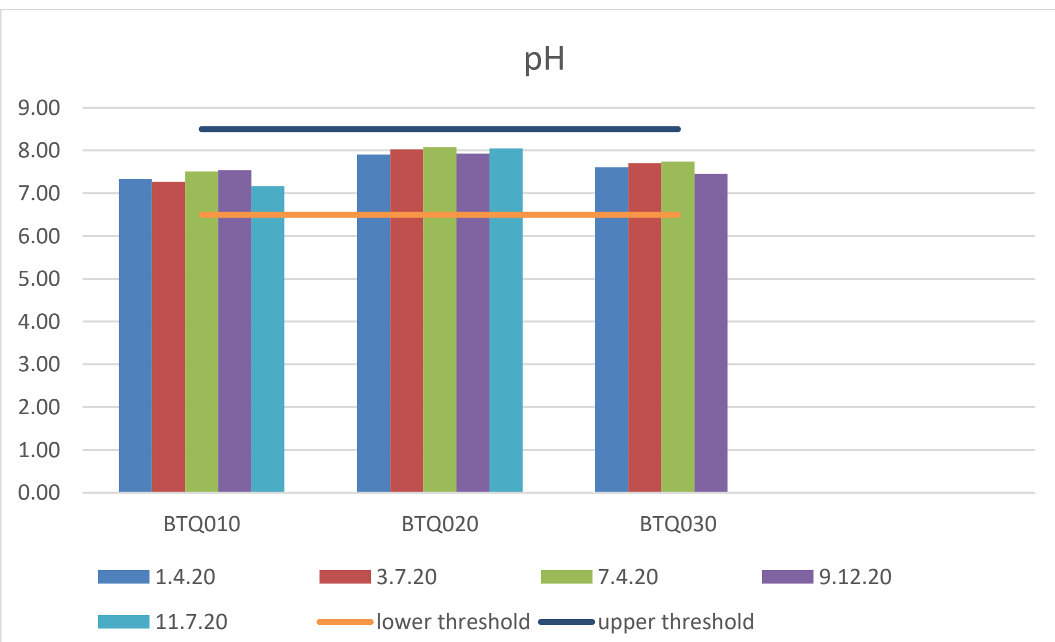
The Batiquitos team sampled the same sites (BTQ 010, BTQ020, and BTQ030) as had been tested by SDCK (Fig. 3). Water samples were collected at all 3 sites for each sampling event, except for the November sampling event for BTQ 030, which was dry. As a result, no data were presented for BTQ030 for the 11.7.20 sampling event.

Field Parameters

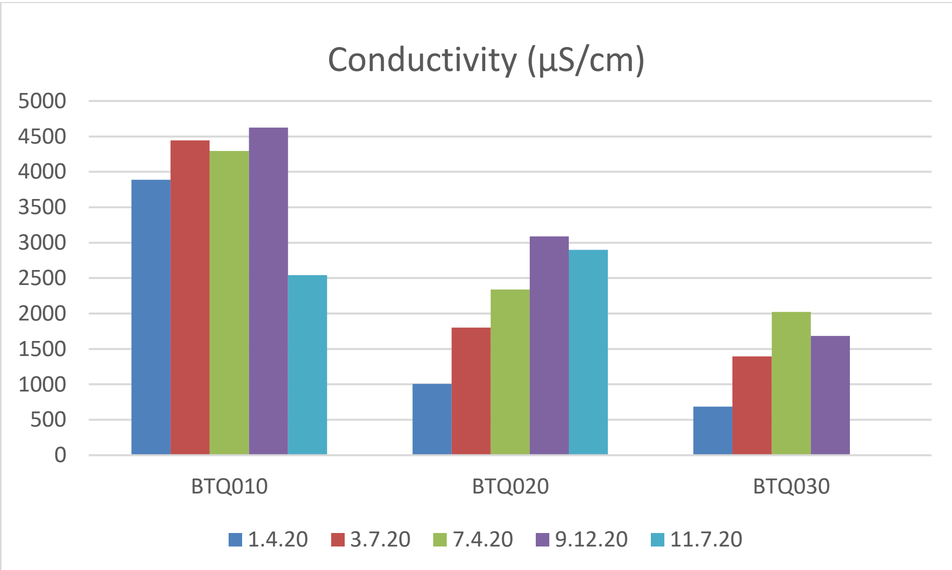
Dissolved oxygen was measured only for the January and March sampling events, and was greater than the San Diego Basin Plan 3 threshold of 5.0 mg/L for all measurements. These results suggest a healthy amount of oxygen in the water for aquatic animals for the period covered by these sampling events.



The pH ranged between 7.3 and 8.1 across all 3 sites for the entire year, well within the acceptable range for the Basin Plan 3 of 6.5-8.5. The pH was not measured in November for BTQ030 due to a lack of flow.



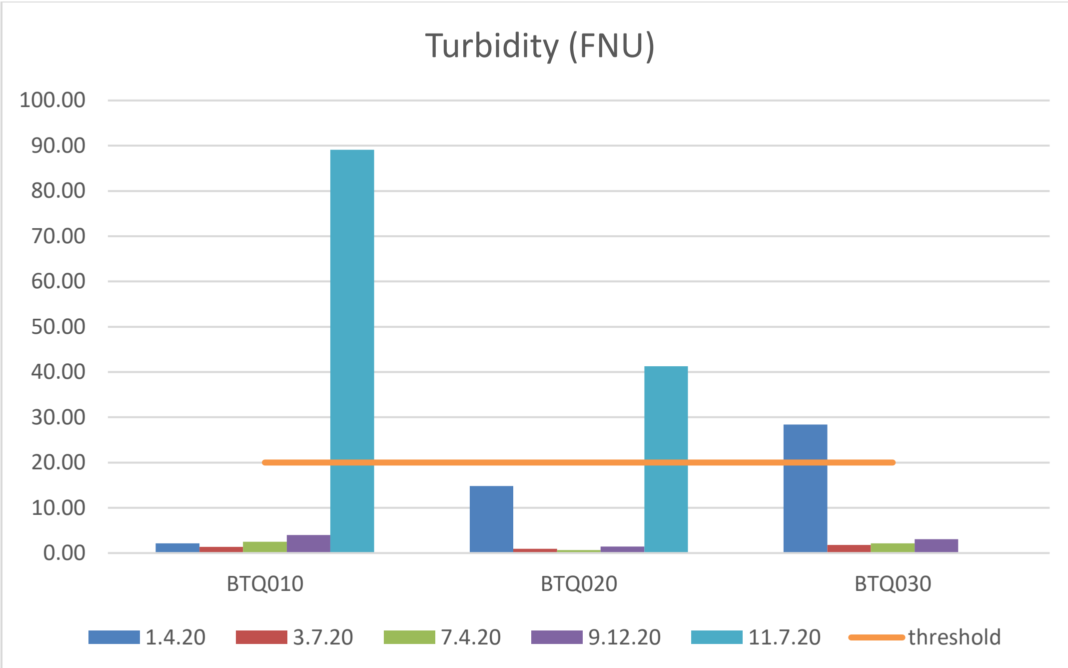
Conductivity fluctuated between 2500-4600 μS/cm for BTQ010; 1000-3100 μS/cm for BTQ020; and 700-2000 μS/cm for BTQ030 (no measurement in November due to lack of flow). Conductivity appeared to increase through September, perhaps due to a corresponding decrease in freshwater runoff into the dry season. The relatively low conductivity for November was probably a result of dilution from the precipitation recorded during this event. The variability across sampling events was greater than for 2019, for which sampling was limited to 3 events during the summer and fall months (July, September, November). There is no threshold for conductivity, as it merely reflects the amount of dissolved minerals in the water.



Laboratory tests

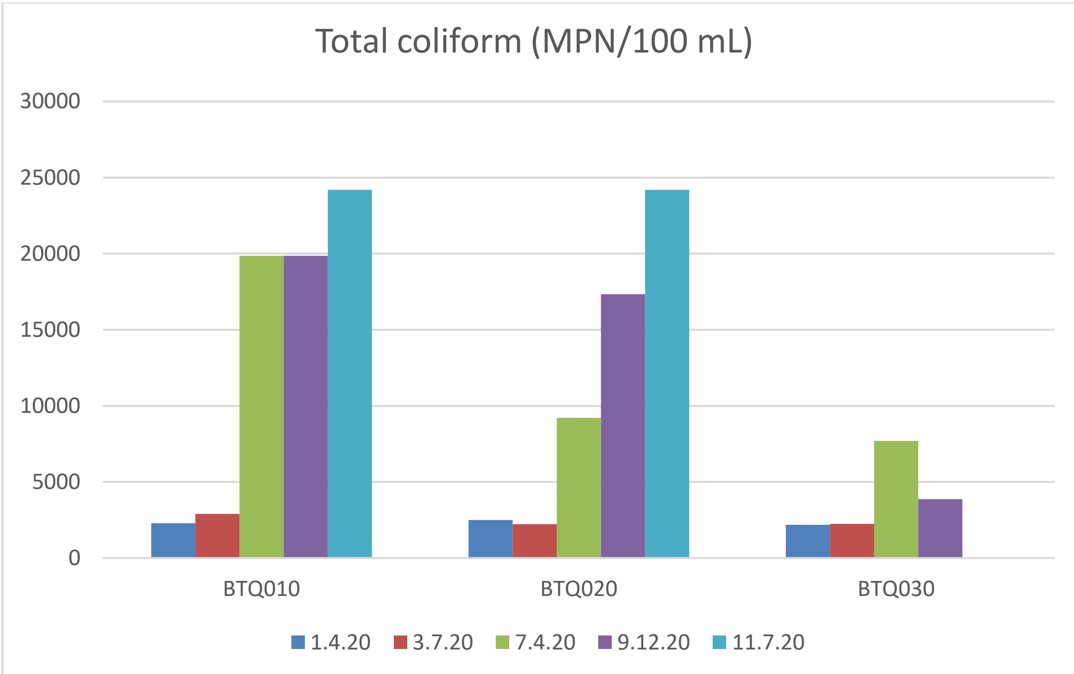
Turbidity (cloudiness), total coliform, *E. coli*, nitrates, total and reactive phosphorus, and ammonia are measured in the lab on grab samples collected in the field.

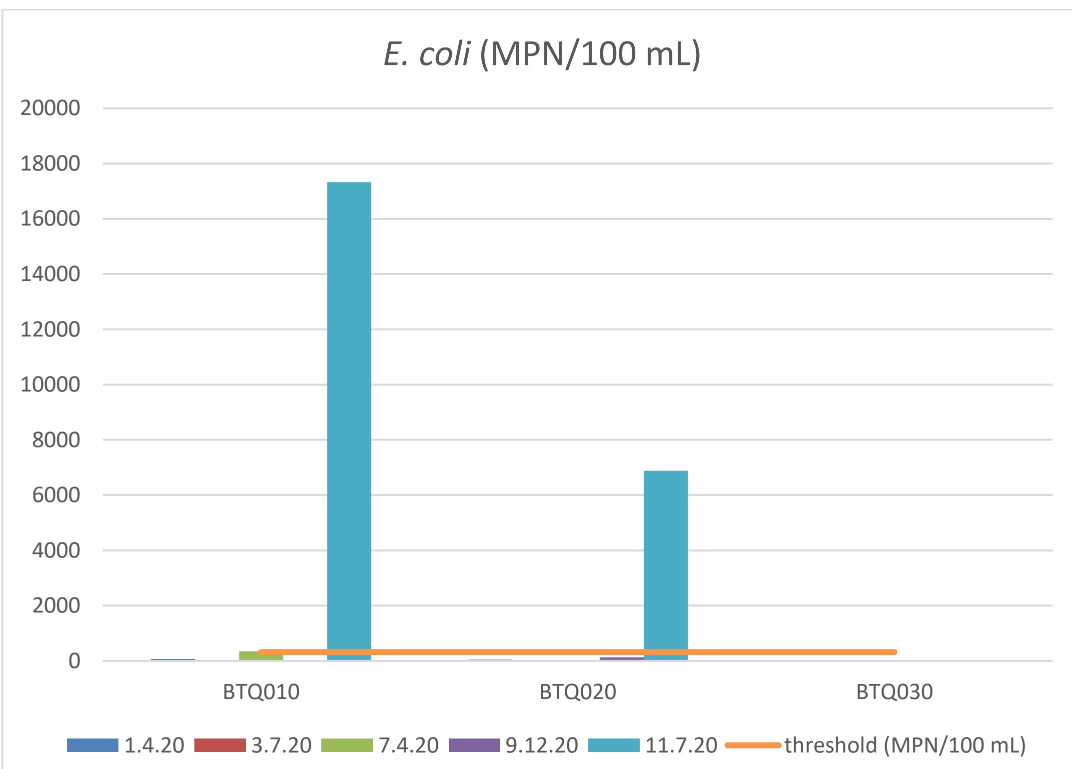
High <u>turbidity</u> can hinder light penetrating water which may affect photosynthesis. The threshold is 20 FNU. Turbidity spiked for BTQ010 and BTQ020 in November corresponding to the recorded precipitation (and subsequent increased runoff flow) during this event, and to a lesser extent for BTQ020 and BTQ030 in January. All other measurements were well under threshold. In 2019, the lone exceedance was observed for BTQ020 in July. No data were available for November at BTQ030 due to lack of flow.



Coliforms are a group of bacteria found in the digestive tracts of animals, including humans and their wastes. They are also found in plant and soil material. Because they are not reliable indicators of pathogenic bacteria and/or origin, there is no threshold for the measurement of total coliform. Total coliform jumps noticeably between March and July and remains elevated through November for BTQ010 and BTQ020, and was relatively lower for BTQ030. A similar bi-monthly trend was observed across stations in 2019, except for a noticeable drop off in November.[3]

E. coli is a better, but not perfect, indicator of pathogenic bacteria. The IDEXX Quanti-tray/Colilert method utilized in this program measures all *E. coli* (pathogenic or not). The threshold for *E. coli* is 320 MPN/100 mL[4]. Three of 14 measurements were above threshold, with the November values well above the threshold (6900 to 17000) during a rain event with elevated runoff most likely containing fecal matter. A similar number of exceedances was reported for these sites in 2019, with the timing of exceedances also following a similar pattern, specifically, in the warmer (May through November) months.

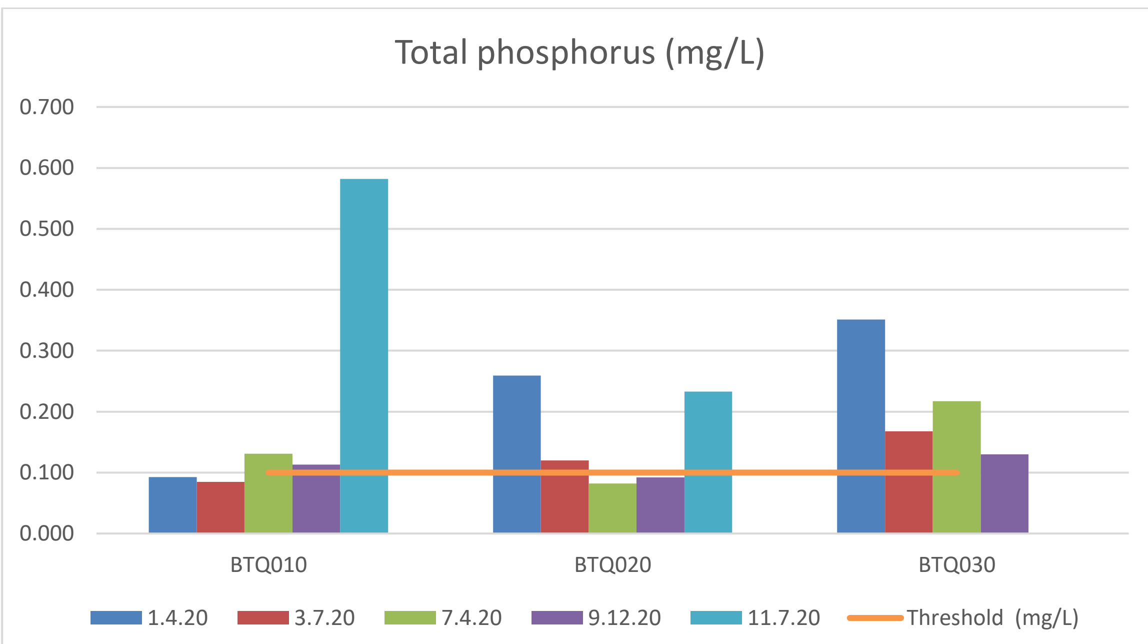

Total coliform (MPN/100 mL)
30000
25000
20000
15000
10000
5000
0
BTQ010
BTQ020
BTQ030
1.4.20
3.7.20
7.4.20
9.12.20
11.7.20

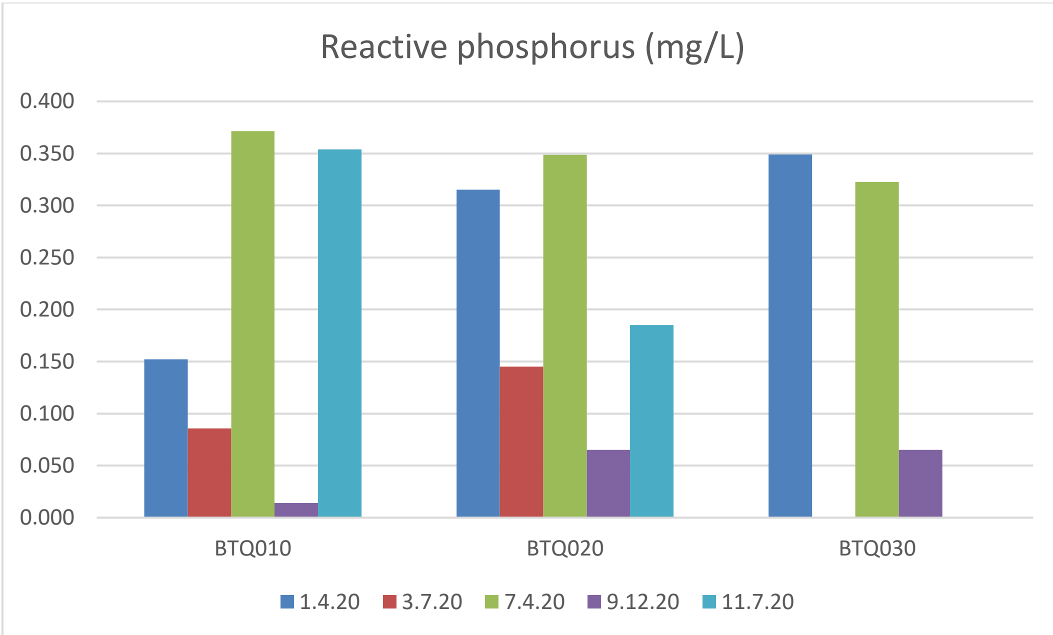

E. coli (MPN/100 mL)
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
BTQ010
BTQ020
BTQ030
1.4.20
3.7.20
7.4.20
9.12.20
11.7.20
threshold (MPN/100 mL)

Elevated total phosphorus is often the result of fertilizer runoff and can lead to algal blooms. The threshold for total phosphorus in San Diego watersheds is 0.1 mg/L[4]. For 2020, the range for total phosphorus was 0.082 to 0.582 mg/L with several measurements at or above the threshold, most notably the measurements for BTQ010 and BTQ020 associated with the precipitation recorded for the November event. As was observed in 2019, total phosphorus was most frequently exceeded at BTQ030, perhaps indicating its enrichment in water released from Lake San Marcos.

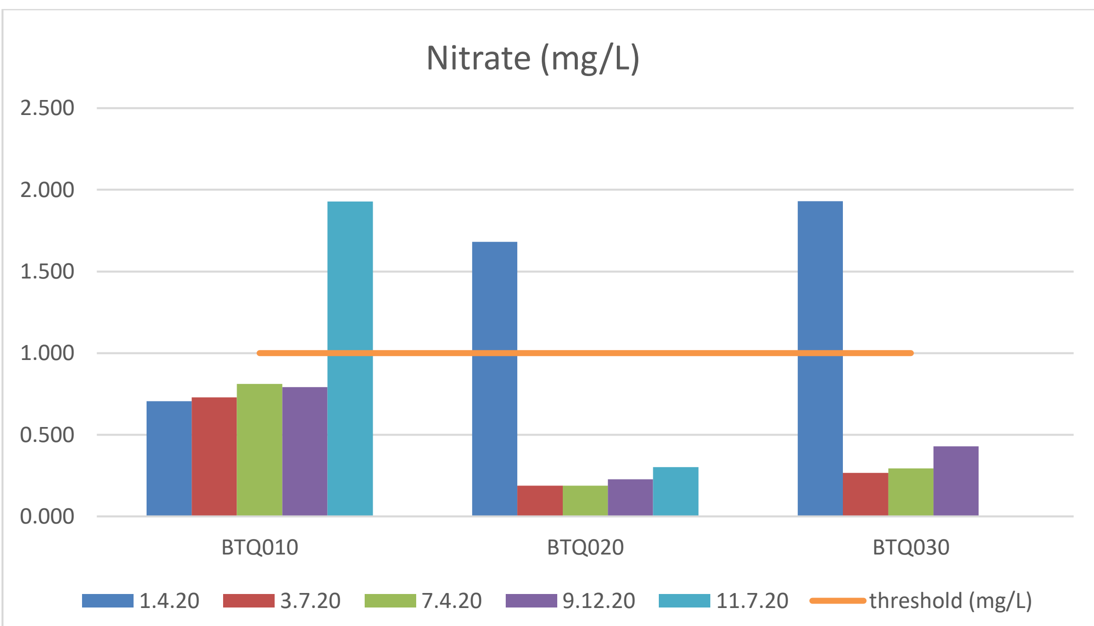
Reactive phosphorus (aka "polyphosphates") is the ionic form of this element that is preferred by living organisms, otherwise known as "bioavailable" phosphorus. There is no water quality threshold for reactive phosphorus. No apparent trend by site or sampling event was observed for the 2020 data.

It should also be noted that reactive phosphorus values exceeded total phosphorus values for the January and July sampling events, a discrepancy that was not easily explained by results from QA samples. As a result, these data should be interpreted with caution.

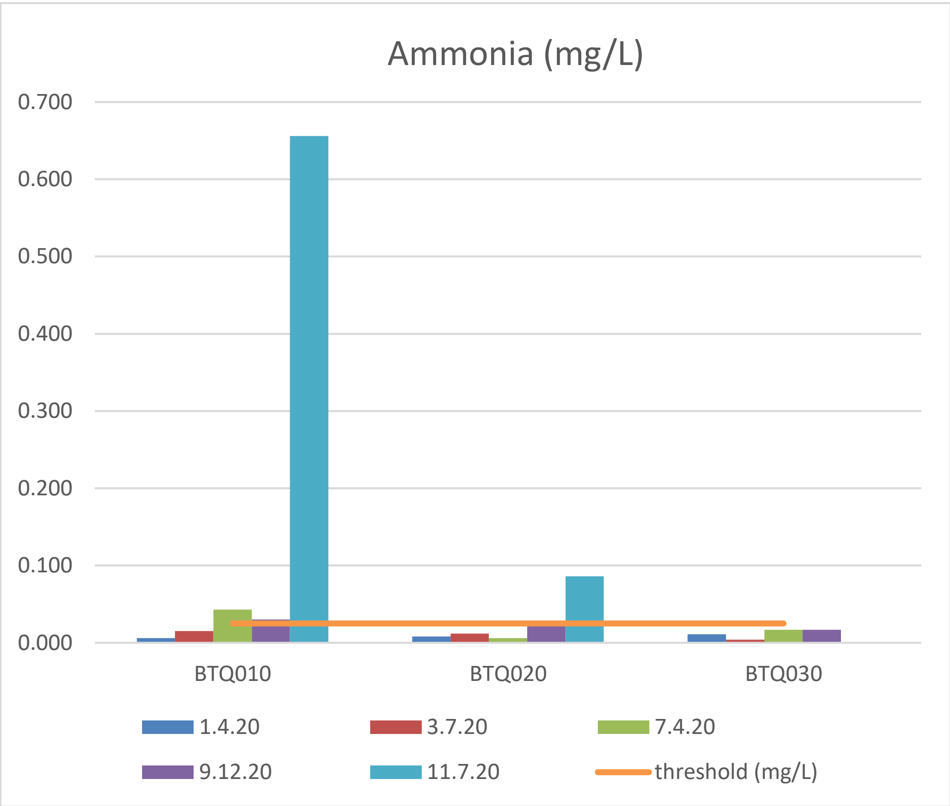




As with phosphorus, nitrate also enters waterways via fertilizer runoff. Similar to 2019, BTQ010 had higher levels of nitrate compared to the two other sites, with the notable exception of the January sampling event, where this trend was reversed (i.e., BTQ010 < BTQ020, BTQ030). Most nitrate values, however, remain below the threshold of 1.0 mg/L.[4]



Lastly, for ammonia, the threshold is 0.025 mg/L. As in 2019, the exceedances (5 of 14 total measurements) were observed at BTQ010 and BTQ020 in summer and fall, with no exceedances at BTQ030. Like many of the other parameters, the highest concentrations observed for BTQ010 and BTQ020 in November could be traced to the precipitation and resulting increased runoff occurring during this event.



Final thoughts

Threshold exceedances for turbidity, bacteria, nutrients and ammonia for November at BTQ010 and BTQ020 implicate runoff from precipitation recording during this sampling as the primary driver. These noteworthy spikes can be explained by the increased levels of sediment, soil and road dust particles mobilized by rainfall and subsequently flushed into the creek (measured as turbidity). The magnitude of such spikes in turbidity as well as other "particle reactive" water quality parameters (e.g., phosphorus, nitrate and bacteria) is dependent on the length of time between precipitation and/or other watershed flushing events as well as rainfall intensity and duration. Further evidence of the typical seasonal pattern in creek water levels was the increase in conductivity throughout the summer, followed by a decrease when measurable precipitation occurred in November. Thus, a general trend of increasing concentrations for these parameters throughout the dry season before winter storm fronts arrive (May-September) is not surprising.

Compared to the 2019 results, no notable differences or trends were discernable for the 2020 data. When analyzed in conjunction with the current parameter list, water temperature, stream flow rate and meteorological (time from last measurable precipitation) data may help with the interpretation of core measurements and/or trends in water quality parameters across sites and sampling events. Lastly, NSDCWMP should continue to emphasize the importance of standardized procedures in their training of field and lab personnel to minimize measurement artifacts and anomalies (e.g., for nutrients).

[1]https://batiquitoslagoon.org/about.html
[2]https://batiquitoslagoon.org/blf_newsletter_2-2018.pdf
[3]Batiquitos 2019 Annual Report
[4]https://www.waterboards.ca.gov/sandiego/water_issues/programs/basin_plan/docs/R9_Basin_Plan.pdf

Acknowledgements

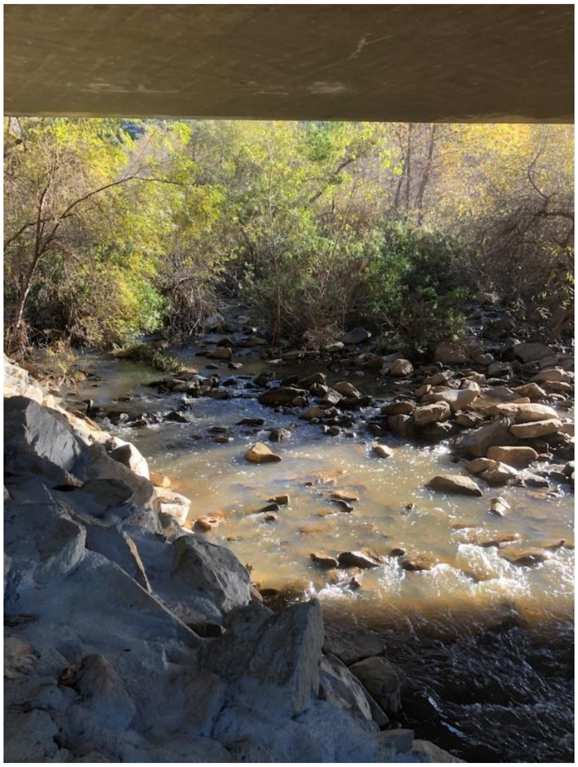
The authors thank Paige DeCino, coordinator for the NSDCWMP, and her team of volunteers.

APPENDIX A

Sampling Site BTQ020 (end of Gibraltar Ave) - January 2020.

July 2020

Sampling Site BTQ030 (Melrose Ave bridge), January 2020.



July 2020