BUENA VISTA CREEK 2023 ANNUAL REPORT

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Background

In the spring of 2019 Preserve Calavera created a program, the North San Diego County Watershed Monitoring Program (NSDCWMP) to carry on the decade-long work of San Diego Coastkeeper (SDCK) to assess the health of local surface waters. The three watersheds of Carlsbad's lagoons, all of which are part of the Carlsbad Hydrologic Unit, are evaluated for a number of parameters, physical, chemical and biological on a bimonthly basis.

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 (BVC) and Agua Hedionda Lagoon monitoring teams) and a representative from and leader of the Batiquitos Lagoon team. This effort wouldn't be possible without the dedication of all our volunteers: the BVC field team (Kathy Parker, Dan Keddy, Michelle Colvin, Bill Richman, Diane Lech, Nalleli Trejo, Sophie Hindaoui, and Celeste Medina) and lab workers (Karen Merrill, Janell Cannon, Scott Engel, Ellen Bartlett, Brennon Flahive, Sophie Hindaoui and Soren Scullion-Guerreiro). Our technical advisors are Erick Burres (CA Waterboard), Chad Loften (San Diego Regional Water Quality Control Board, and Brennon Flahive (retired Environmental Compliance Director at South Orange County Wastewater Authority). Data is posted at www.preservecalavera.org and will be on the CEDEN website and shared with SDRWCB and the city of Carlsbad, Oceanside and Vista. The program began testing in July 2019.

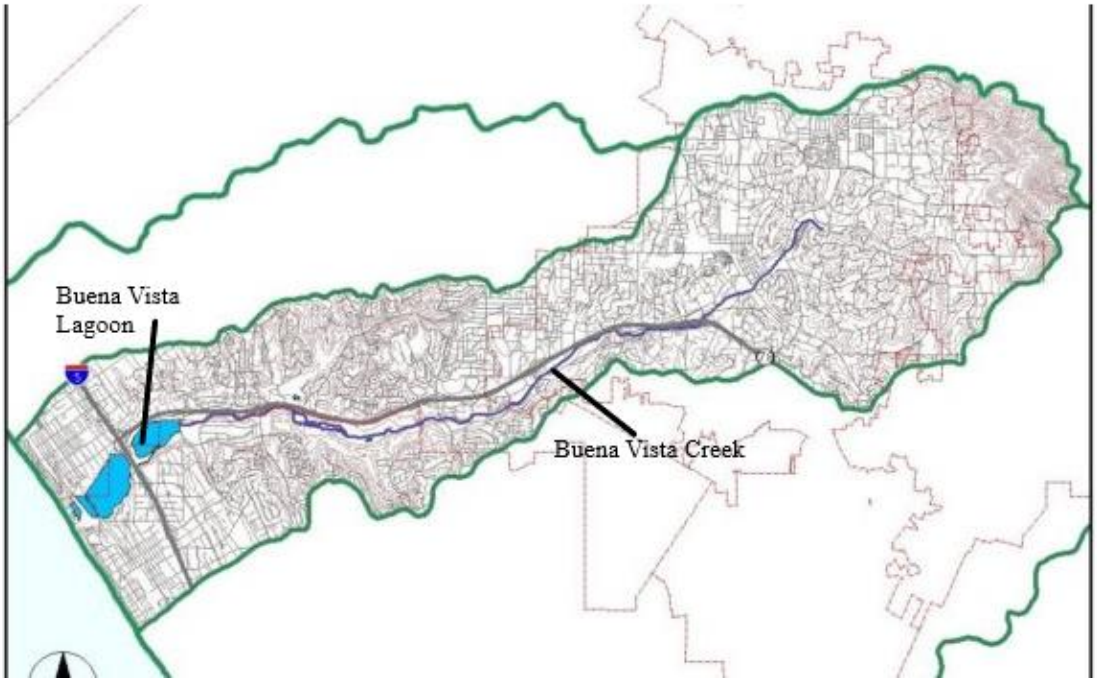


Figure 1 – Buena Vista Creek Watershed[1]

Buena Vista Lagoon which is part of both Oceanside and Carlsbad is fed by Buena Vista Creek whose headwaters are on the western slopes of the San Marcos Mountains. Buena Vista Creek is the only creek feeding Buena Vista Lagoon which opens to the Pacific Ocean. Currently, due

to a weir put in place in the 1940s near the mouth of the lagoon, it is freshwater and in a steady state of decline. In May 2020, the Final Environmental Impact Report prepared by The San Diego Association of Governments (SANDAG) was adopted by their Board of Directors. The consequence is that the lagoon will be returned to its historic saltwater state when funding becomes available.[2]

For 10 years SDCK monitored this watershed bimonthly, ending in December, 2018. Data for 2009-2016 is posted on the California Environmental Data Exchange Network (CEDEN). For calendar years 2017 and 2018 data has been provided to our program by SDCK. During the last year that SDCK produced annual reports for their watersheds, 2016, Buena Vista Creek's water quality was rated as 'fair'. NSDCWMP has not yet created a similar scorecard to assess the overall health of the watershed.

The purpose of this annual report is to 1) provide the public with water quality data, 2) interpret the health of Buena Vista Creek for the testing period in 2022 and 3) look at historic trends (2019-present). Each parameter will be evaluated for anomalies and trends and the overall state of the watershed will be summarized based upon these results. Monitoring was carried out in January, March, May, July, September and November of 2023.

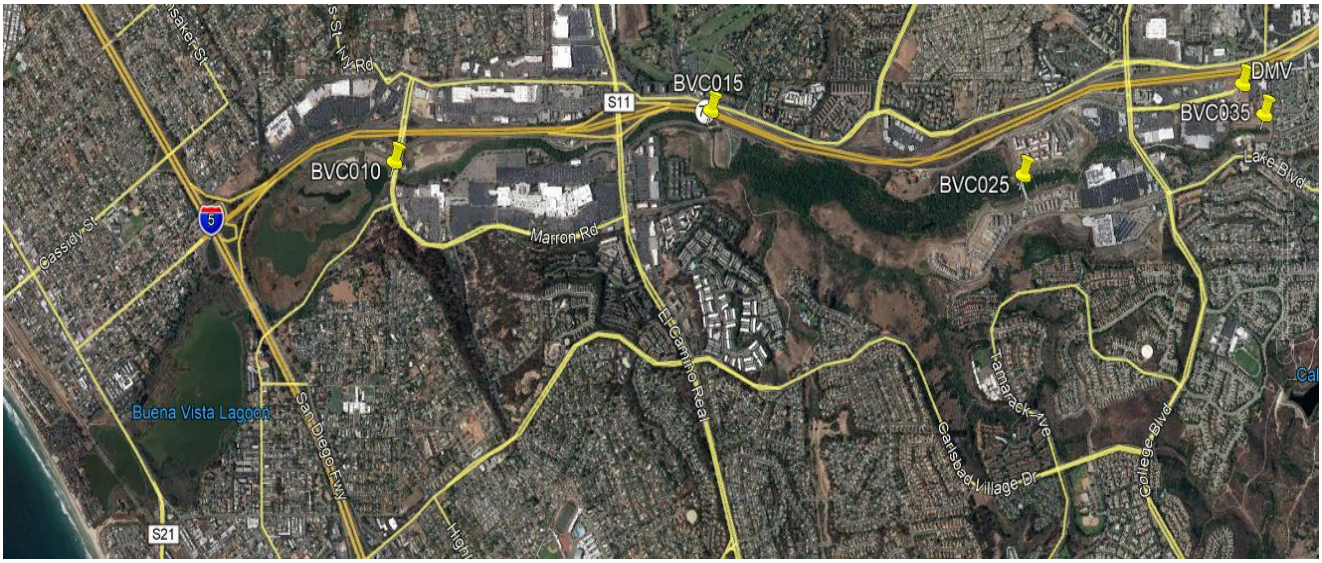
[1]https://scwrp.org/projects/buena-vista- icreek-watershed-plan/
[2]https://bvaudubon.org/bv-lagoon-enhancement/

Sampling Sites

The Buena Vista Creek team sampled the 4 sites along the creek (BVC010, BVC015, BVC025 and BVC035). The site identifications in the map below are the same as those used by SDCK at various times between 2009-2018. Site BVC025 within "The Preserve" housing development (formerly Quarry Creek) was added to our sampling regimen early in 2022 to monitor surface water quality in areas of significant unhoused encampments; we only sampled for bacteria at that site in January 2023 and begin a more comprehensive testing of the site starting in March. Therefore, many of the graphs are missing data for BVC025 in January.

During 2023 standard operating procedures were followed for all dates. For the sampling months of January, March and May, there was rain within 72 hours of testing.

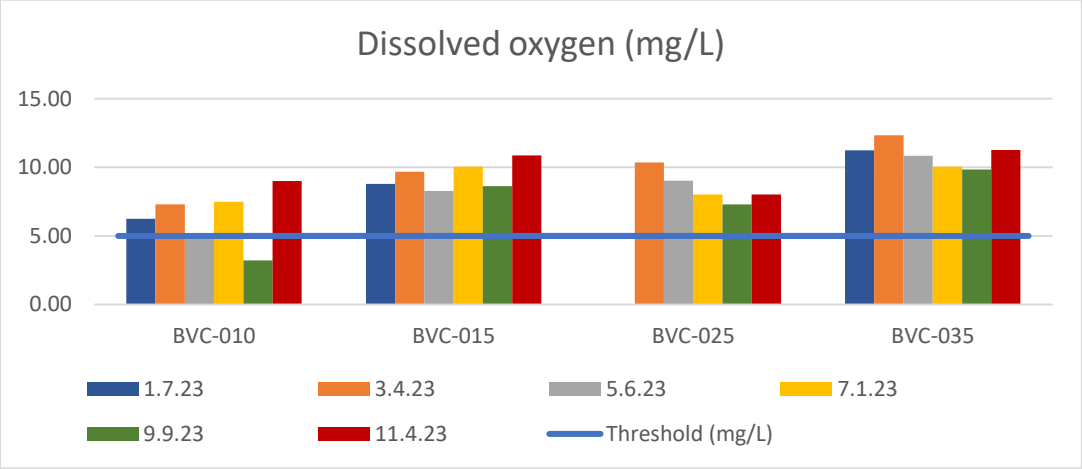
Figure 2 - Buena Vista Creek sampling sites



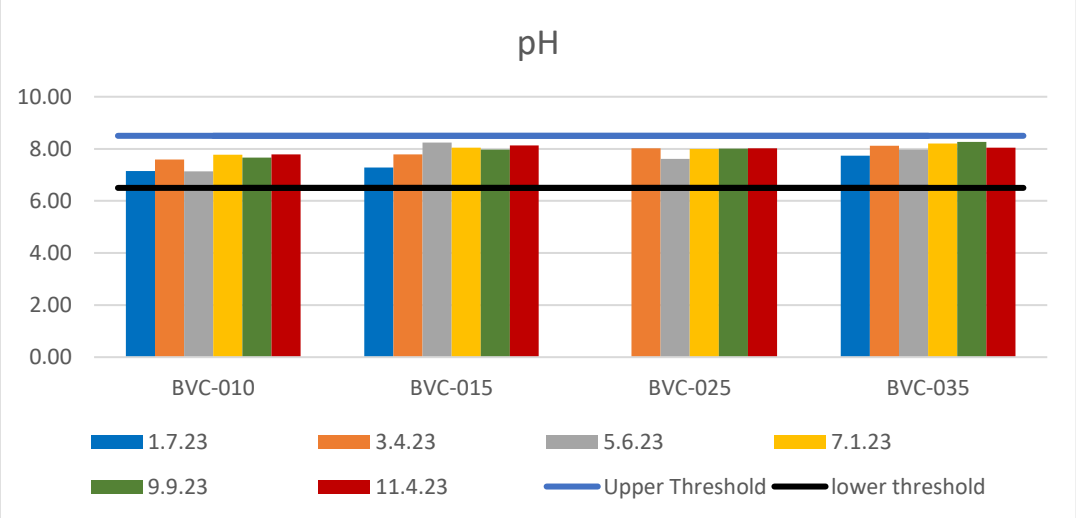
Field Parameters

Our field teams of 3-5 trained volunteers visit our sites within each watershed where water samples are collected for laboratory analysis and *in situ* measurements made for dissolved oxygen, conductivity, air and water temperature, and pH. One field sample is filtered for nutrient tests (reactive phosphorus and nitrate) and the other used for bacteria, turbidity, and total phosphorus measurements. Part of the filtered sample is added to a small bottle containing concentrated HCl (to lower the pH to ~2) for the ammonia assay.

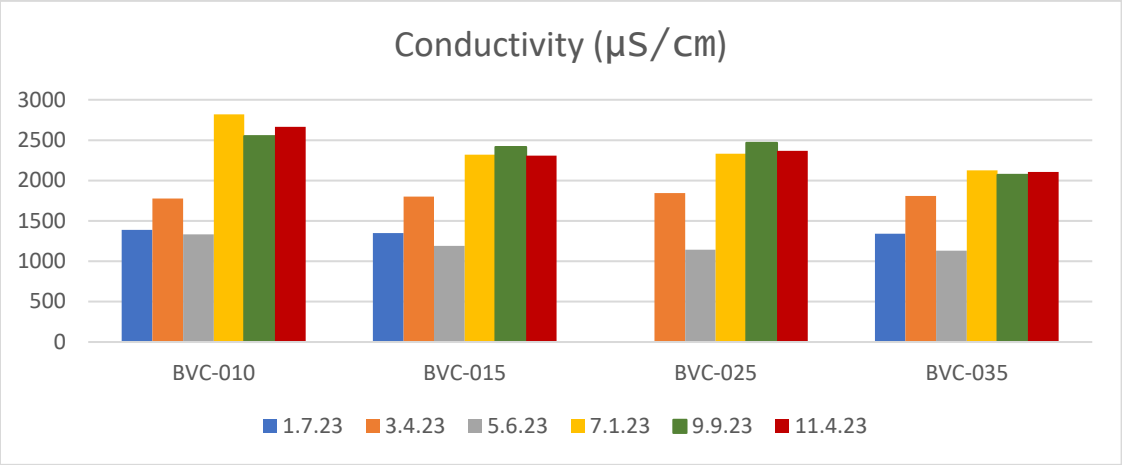
Dissolved oxygen (DO) was measured at all 4 sites and above the San Diego Basin Plan[3] threshold of 5.0 mg/L except site BVC010 in September. This site was consistently lower than other sites, probably due, in part, to the low flow rate.



The pH measurements in the field continued to be within acceptable limits, consistent with what we've seen in the past.



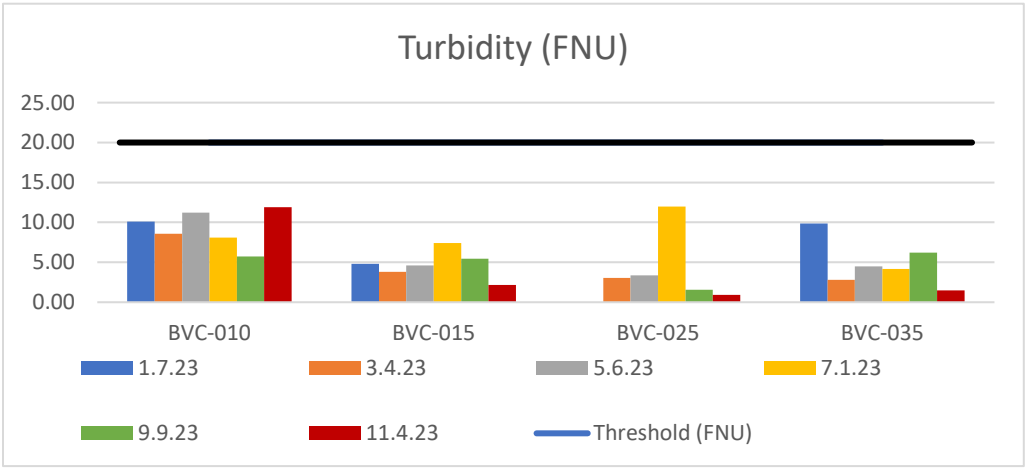
Conductivity fluctuated between about 1000 and 2800 µS/cm. For the most part when there was rain within 72 hours (January, March and May) the conductivity was lower than in drier months presumably because the



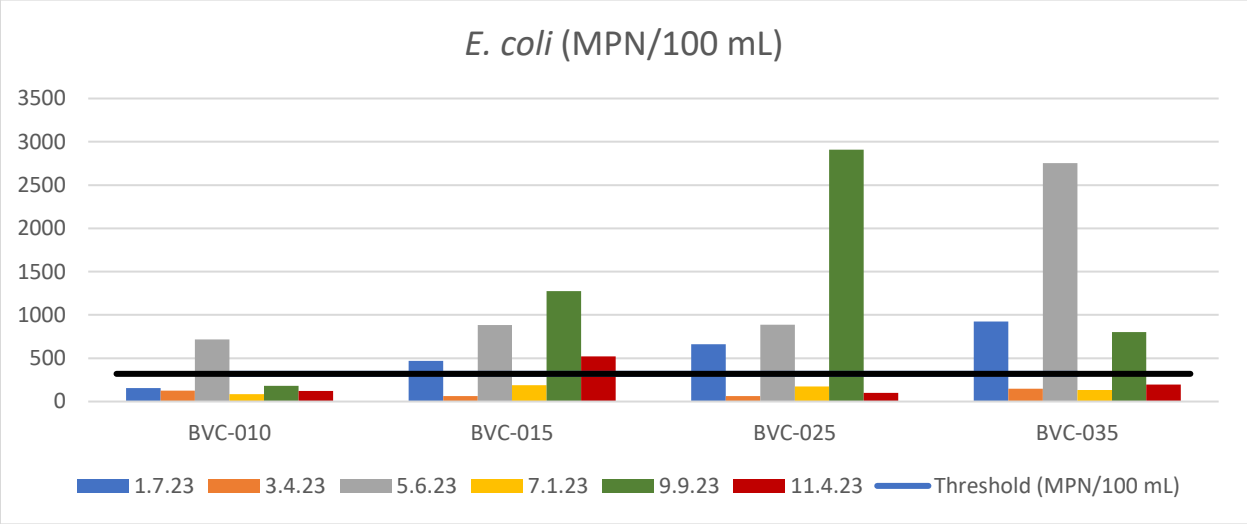
Laboratory tests

Turbidity (cloudiness), total coliform, *E. coli*, nitrates, total phosphorus, reactive phosphorus and ammonia are measured in the lab using 'grabbed' samples transported from the field. Trained volunteers then process the samples: unfiltered samples are used for total coliform and *E. coli* as well as turbidity and total phosphorus. The remaining filtered sample is used for reactive phosphorus, nitrate, and ammonia. For ammonia testing, because the samples aren't processed within 15' of collection, the pH is lowered to about 2 in the field. pH is titrated back to 6-8 before analysis in the lab. Concentrations are corrected for added volumes of HCl and NaOH.

High turbidity can hinder light penetrating water which may affect photosynthesis. The threshold is 20 FNU (~ 20 NTU when less than 40). For 2023 all sites remained below the threshold which was an improvement over 2022. Site BVC010 at the head of the lagoon was consistently the highest in turbidity (except for July).

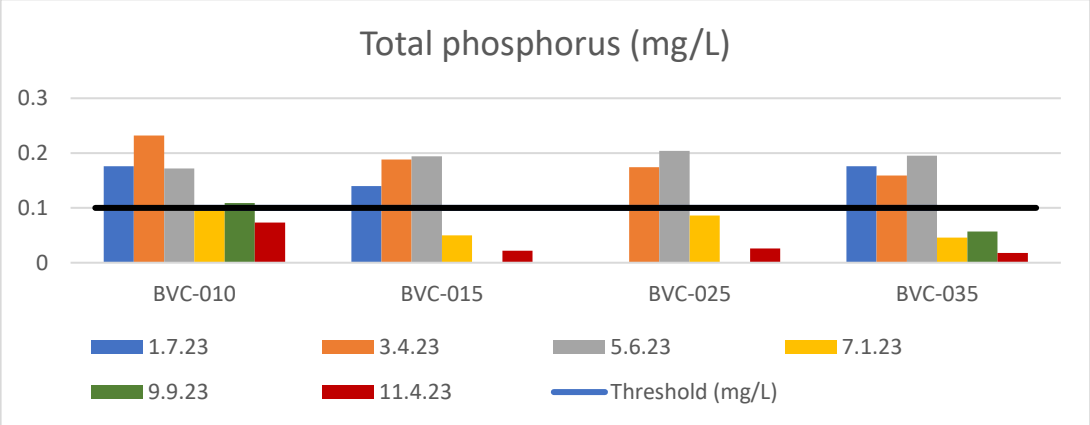


Coliforms are a group of bacteria found in the digestive tracts of animals, including humans and their wastes. They are also found in plant and soil material. They may or may not indicate pathogenic bacteria. There is no threshold for these bacteria due to the wide types of sources. *E. coli*, however, is much more indicative of potential concern as many strains are pathogenic. The test we run, using IDEXX Quanti-tray/Colilert, measures all *E. coli*, pathogenic or not. The threshold for this bacterium is 320 MPN/100 mL.[3] .



While there were some levels above threshold, we didn't see the huge spikes at most sites in September of 2022. Furthermore, they didn't really correspond to rain events. The most likely explanation is that the Jan-May samples may have been already flushed out from the previous September. And the later 3 samples were taken during dry periods where excess runoff containing fecal matter didn't occur.

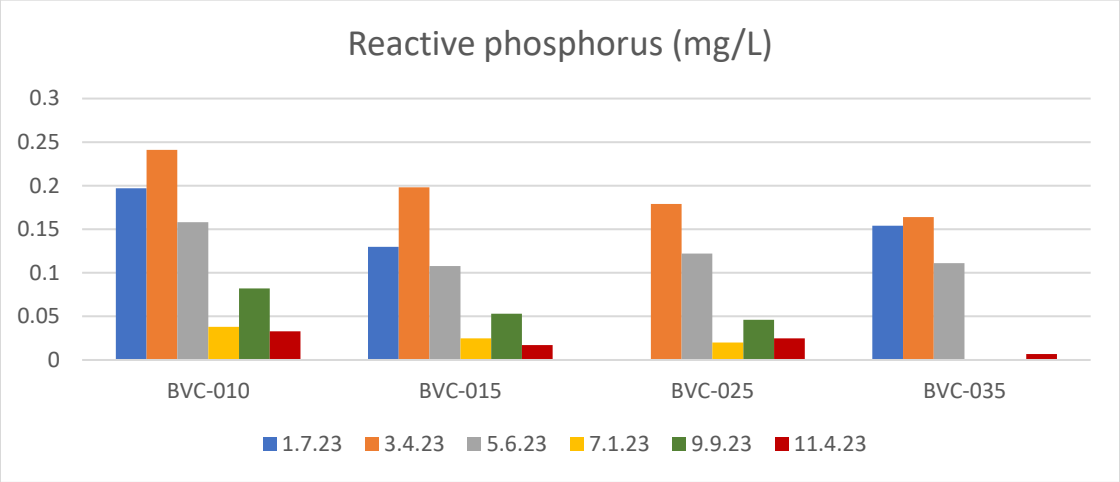
Phosphorus measurements are two-fold. We measure total phosphorus which includes the reactive phosphorus – that compound available to organisms to use. The total phosphorus also includes any other forms of phosphorus which are tied up and not readily available for organisms. The rain events for January, March, and May likely contributed to the increase in total phosphorus compared to the later months. We saw the same phenomenon in Sept. 2022.



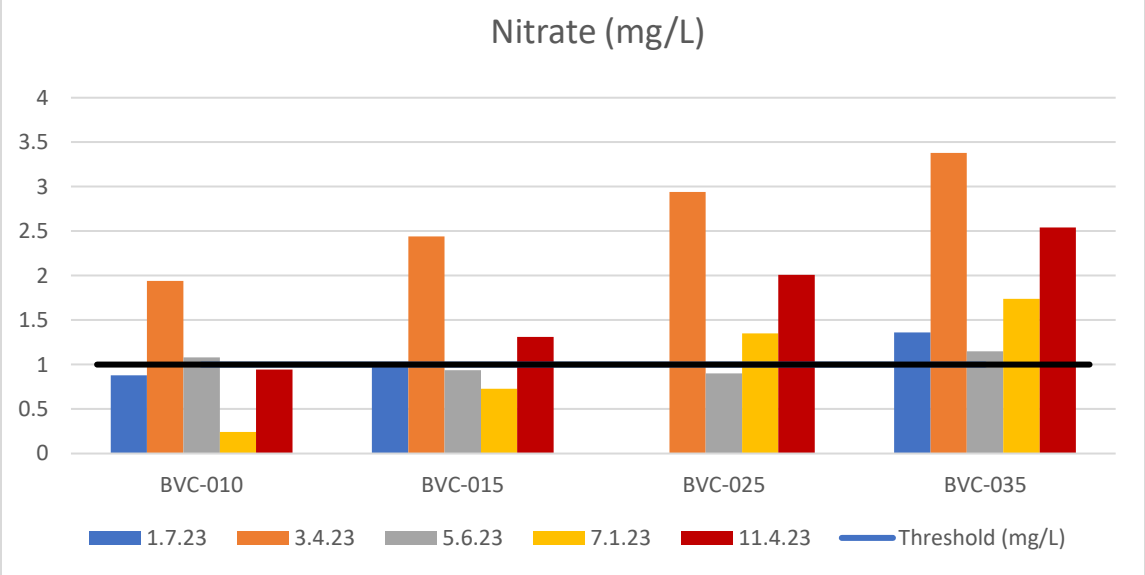
[3]https://www.waterboards.ca.gov/sandiego/water_issues/programs/basin_plan/docs/R9_Basin_Plan.pdf and discussion with technical advisor, Chad Loften 4/22/21.

Reactive phosphorus should be less than the total phosphorus since it is the phosphorus available for organisms to use. There is no threshold for this parameter.

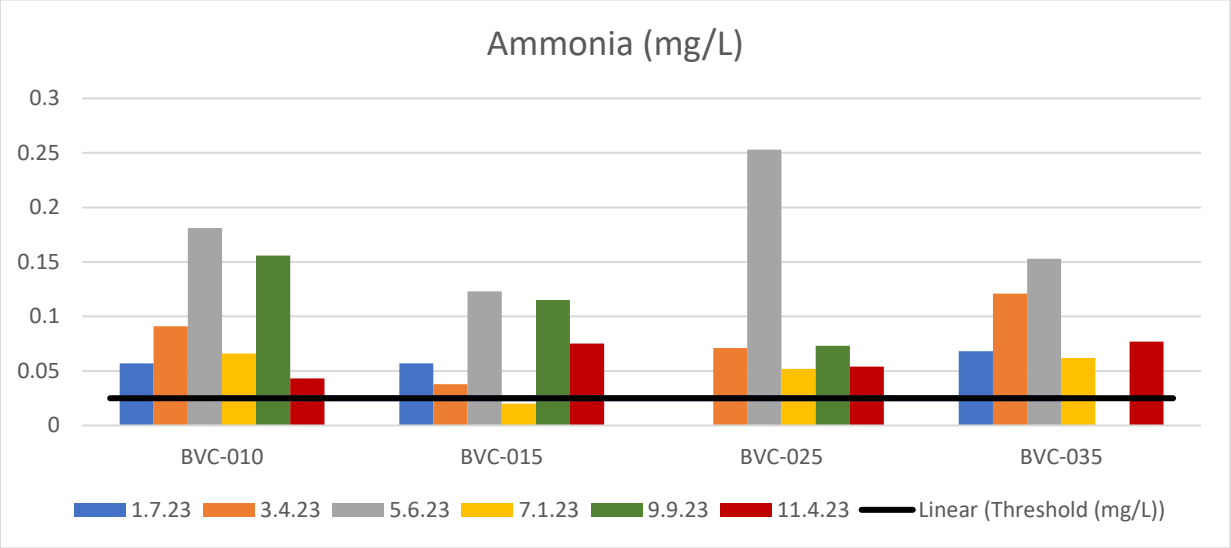
You can see the same overall pattern as with total phosphorus in that the levels are higher in the wet months and lower in the dry ones. For BVC010 in January we saw the anomaly of the reactive being greater than the total phosphorus. In February, all the reactive were just slightly above the total phosphorus for some unknown reason.



Nitrates, too, generally come from fertilizer runoff. Like 2022 the levels fluctuate in a manner that isn't necessarily correlated to rain events.



Lastly, ammonia[4], whose threshold is 0.025 mg/L was often above (significantly) this level. Natural sources of ammonia come from the breakdown of organic wastes, forest fires, animal from runoff and human waste, exchange with the atmosphere and nitrogen fixation. High ammonia levels can be toxic to wildlife. While variable over time and space, the levels of ammonia are of concern with levels sometimes up to 10 times above threshold. High ammonia levels are more the norm than exception for this watershed. When compared to 2021 and 2022, the overall profile for each site was similar.



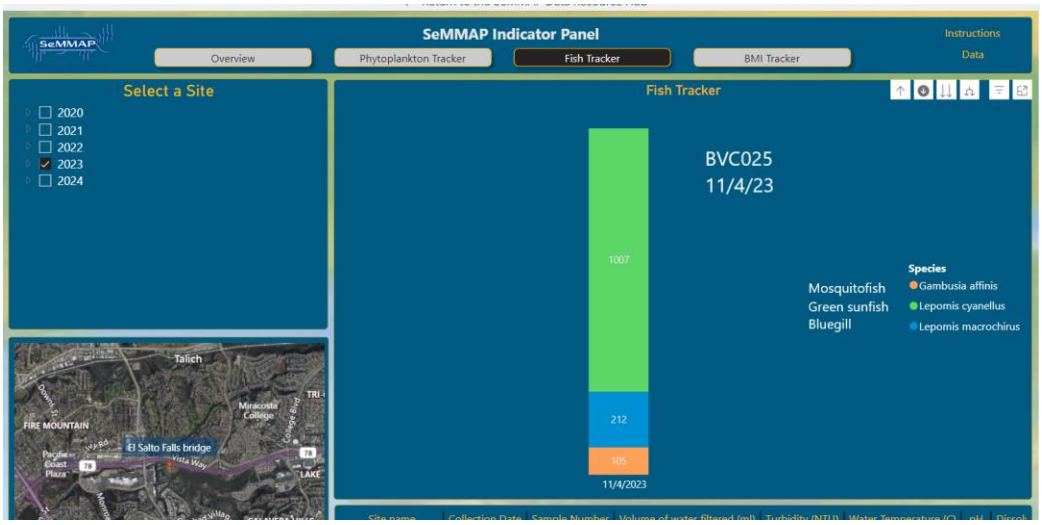
[4]The Hach methodology for measuring ammonia with their TNT830 kit requires the pH be adjusted in the field to ensure accuracy of the results. To the best of our knowledge SDCK did not follow this step nor have we to date. Starting in 2021 pH was adjusted in the field for the ammonia test procedures. See https://www.hach.com/asset-get.download-en.jsa?id=7639983749 for detailed procedures.

Environmental DNA (eDNA)

This year we partnered with a state program, the SWAMP eDNA Metabarcoding Monitoring and Analysis Project (SeMMAP) for a second year, to look for species of fish, macroinvertebrates and plankton at selected sampling sites. Samples were filtered in the field and sent to Jonah Labs in Colorado for analysis. For Buena Vista Creek watershed, we took samples only at BVC025 in November.

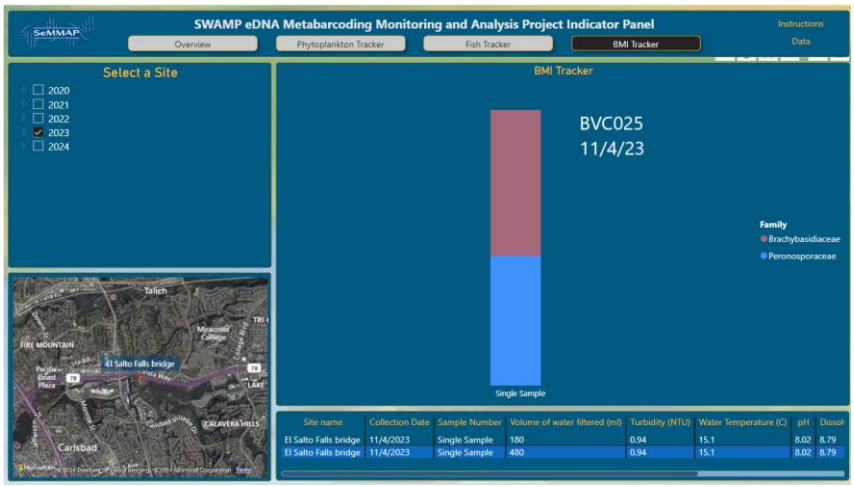
Fish species

In 2022 we found 3 different non-native species at BVC035 and BVC015. In 2023 we sampled the site in between these two (BVC025) and again came up with only 3 non-natives as shown in the figure below:



Benthic macroinvertebrates:

The only invertebrates (and technically not invertebrates) found at BVC025 were Brachybasidiaceae and Peronosporaeae both types of fungi which likely include some plant pathogens.



Analysis by Site

BVC010, closest to Buena Vista Lagoon and sampled from the edge of the cement sides, was generally within acceptable limits except for the first three sampling sessions when there were rain events, for total phosphorus. As with the other sites ammonia was over threshold. But of the four sites, BVC010 generally could be considered the 'cleanest'.

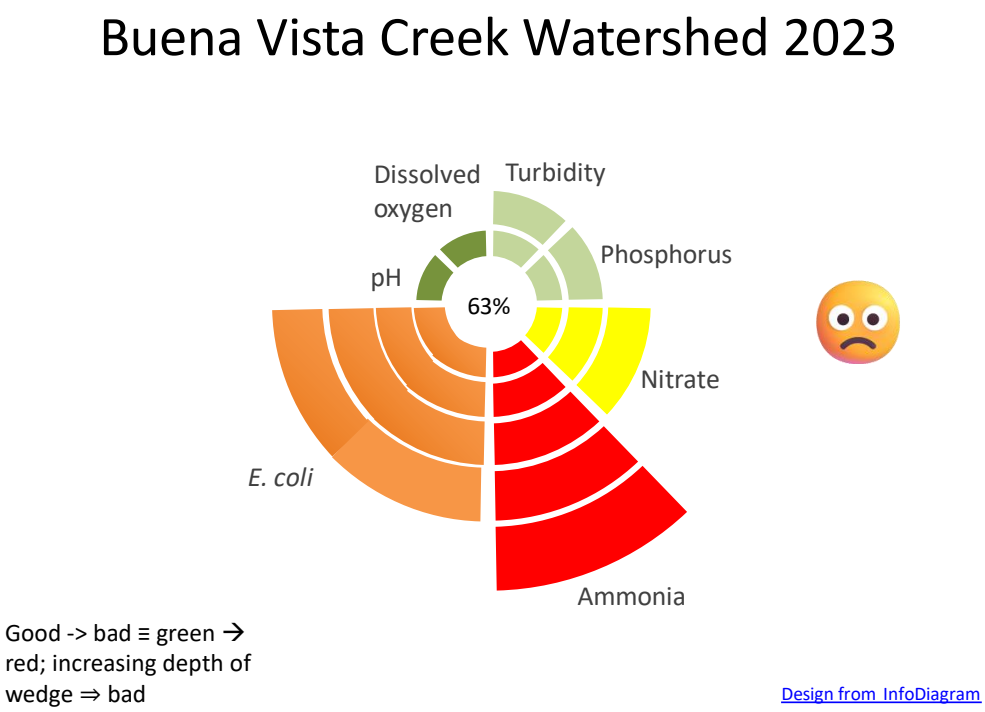
BVC015, near the driving range on Haymar and close to El Camino Real, also had elevated total phosphorus for the first 3 sessions. Compared to earlier years, while there were some high levels (most notably in July and September) they didn't really reach the same level of concern as in earlier years.

BVC025 underwent a full array of testing starting in March. This is our closest site downstream from El Salto Falls where homeless encampments have been an ongoing concern. Midway through the year more secure fencing was installed along both sides of the creek but there continues to be unhoused people living in the area with thousands of pounds of trash removed from the area semi-annually. This site chronically has high levels of nutrients, not unlike our other sites and had spikes of *E. coli* in parallel with BVC015 and BVC035.

BVC035 near the Oceanside DMV, was within acceptable range for all field tests. This site frequently has excessive trash and homeless encampments although we haven't seen a good correlation with any of our metrics and said encampments. In general, the nutrients are high. July had a spike in *E. coli* which wasn't really replicated at any other sites to the same level.

Final thoughts

The overall 'health' of this watershed remains poor similar to 2022.



The method we developed for our scorecard can be found in Appendix C.

We often can't pinpoint the pollution sources responsible for our data. The NSDCWMP is strictly a monitoring one but one would like to understand these sources. Excessive rainfall certainly contributes to spikes in *E. coli* and total phosphorus. At no time did we see any evidence of potential harmful discharge into Buena Vista Creek.

Again, we were dismayed not to find any native fish in our creek but that's not unexpected.

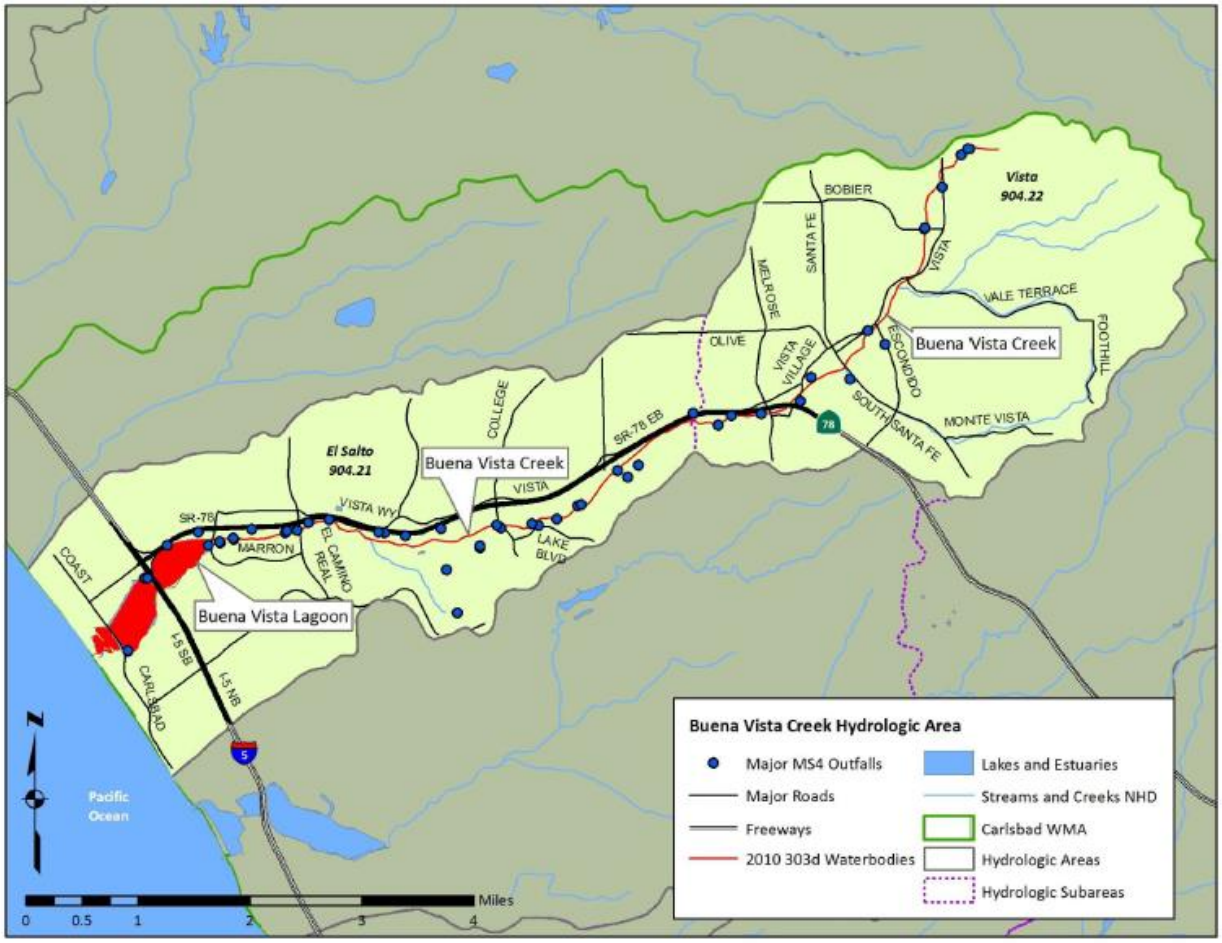
Preserve Calavera will continue to work with SDHC and CNLM as well as city stormwater managers to alert them of metrics of concern, especially *E. coli.* We have expanded our cleanup and monitoring efforts at/near El Salto Falls (BVC025) in conjunction with SDHC and hope to receive funding for more monitoring in the near future. The area around El Salto Falls continues to be a major area of concern for the city of Oceanside, SDHC and ourselves due to heavy encampments and trash.

A student from El Camino High School, started an AP Research project in December, 2023 to decide if there was any correlation between homeless encampments and *E.coli* levels. Her research should be completed early in 2024.

In closing, note that we began to collect samples in both 2022 and 2023 for microfiber analysis (a subset of microplastics). Those samples are still being analyzed.

APPENDIX A

Figure A-2: Buena Vista Creek HA – Major Outfall Information



From WQIP (2018) of Carlsbad Watershed Area, Appendix A, MS4 Outfalls.

APPENDIX B – Sample site photos

BVC010
Under Jefferson St bridge looking north from opposite side of collection site.

BVC015 – near Haymar driving range.

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BVC025 – Under El Salto Falls Rd bridge

BVC035 – On Thunder Dr, near Oceanside DMV

APPENDIX C

Scorecard parameters:

Assigned weight	Range relative to threshold
5	<50%
4	50-100%
3	101-150%
2	151-200%
1	201-300%
0	>301%

Metric (threshold)	5	4	3	2	1	0
DO (5.0)	>9.0	7.01-8.99	5.0-7.0	4.0-5.0	3.0-4.0	<3.0
pH (6.5-8.5)	6.5-8.5	6.3-6.49,8.5-8.7	6.1-6.29,8.71-8.9	5.9-6.09,8.91-9.10	5.7-5.89,9.1-9.5	<5.5 or >9.5
turbidity (20)	<5	5.1-20.0	20.1-30.0	30.1-40	40.1-60	>60.1
T phosphorus (0.1)	<.05	.05-0.10	0.101-.15	.151-.200	.201-.300	>.301
Nitrates (1.0)	.5	.61-1.0	1.01-1.50	1.51-2.00	2.01-3.00	>3.01
Ammonia (.025)	<0.0125	.0125-.025	0.026-.0375	0.0376-.050	0.0501-.075	>.0751
E. coli (320)	<160	160-320	321-480	481-640	641-960	>961

Blue indicates separate ranking than in table 1

E. coli was counted twice on the 'wheel' due to its pathogenic nature. All other parameters with thresholds within the San Diego Basin were counted once giving a total of 8 wedges in the wheel. The numbers (0-5) were added and compared to a perfect score of 40. We gave an overall score based upon the following ranking:

RANKINGS

- Excellent >90% 😀
- Good 80-89.5% 🙂
- Fair 70-79.5% 😑
- Poor 60-69.5% 😟
- Terrible <60% 😱