AGUA HEDIONDA 2019 ANNUAL REPORT

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We would also like to acknowledge the time and effort of our field volunteers who make this all possible: Scott Engel, Mary Anne Viney, Karen Merrill, Jan Neff-Sinclair, Janell Cannon and Keith Farnsworth

Background

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 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 variety of physical, chemical and biological parameters on a bi-monthly basis.

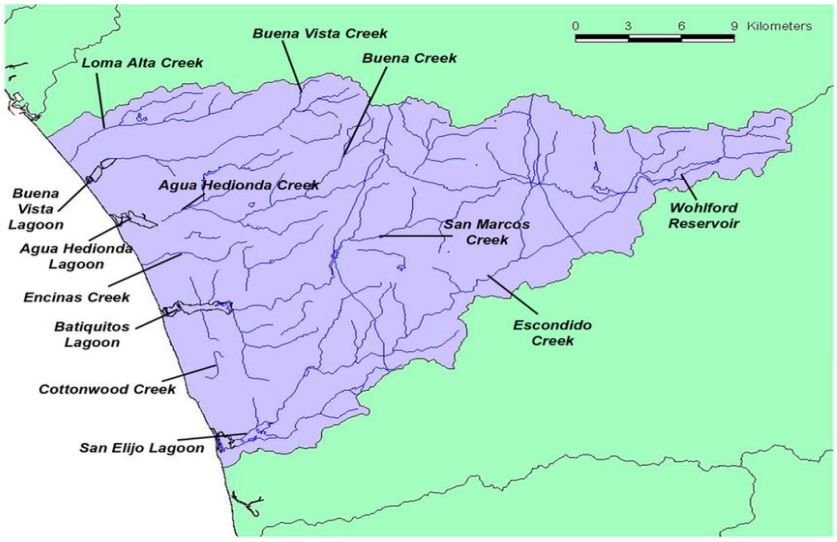
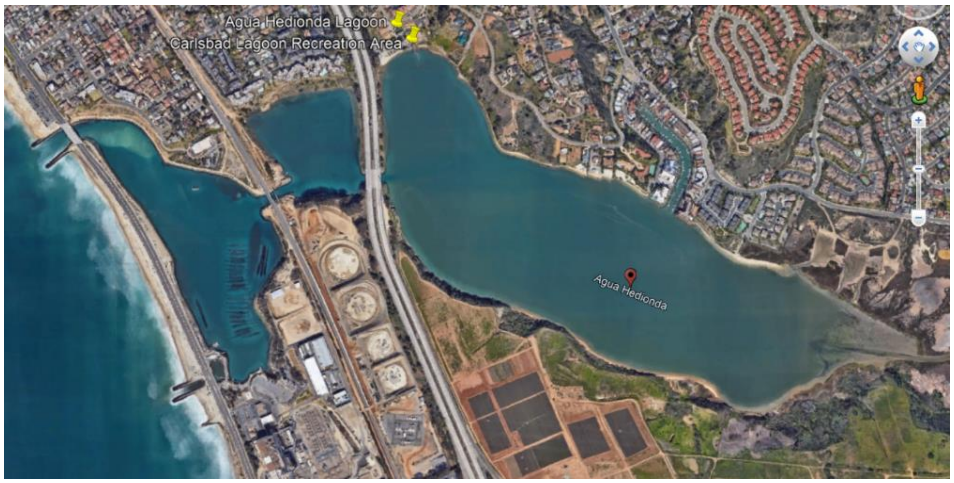


Figure 1 (right). The Carlsbad watershed, including major waterways. (Source: SWAMP)

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 Batiquitos Lagoon team. Our technical advisors are from the CA Waterboard and the San Diego Regional Water Quality Control Board (SDRWCB). Data is posted at www.preservecalavera.org. Monitoring data for the Carlsbad Watershed can also be accessed through the California Environmental Data Exchange Network (CEDEN) www.ceden.org or the WQIP Annual Reports. The program began testing in July 2019.

The Agua Hedionda Watershed begins along the southwestern slopes of the San Marcos Mountains and flows over 10 miles until discharging into the Pacific Ocean at the Agua Hedionda Lagoon in Carlsbad. The watershed includes portions of Carlsbad, Vista, Oceanside, and San Marcos, as well unincorporated portions of San Diego County. The Lagoon extends inland for about 1.7 miles and it is 0.5 miles wide at its widest point. As a result of Highway 101, Interstate 5 and Highway 101, the lagoon has been split into 3 waterway sections as you move inland from the coast: the outer, middle and inner lagoon.



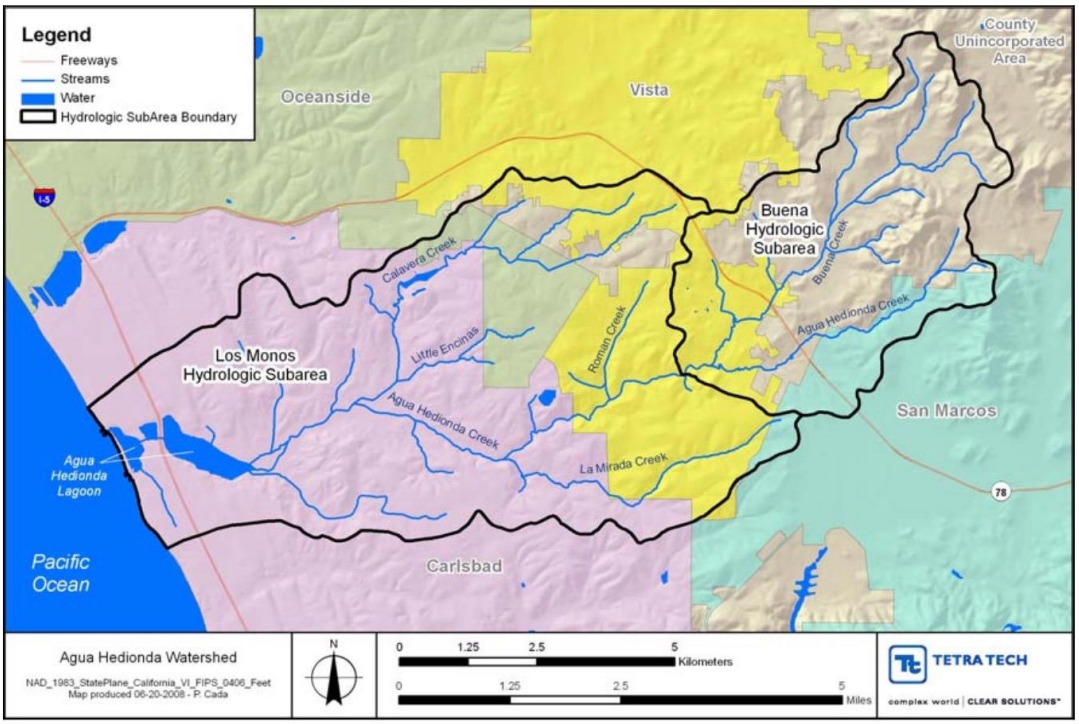


Figure 3: Agua Hedionda Watershed with subareas outlined(Agua Hedionda Watershed Management Plan)

Figure 2: Agua Hedionda Lagoon; It's three sections are visible (Source: Google Maps)

Agua Hedionda is the only lagoon in San Diego County that supports commercial and recreational uses. Carlsbad Desalinization Plant, Hubbs Seaworld fish hatchery and Carlsbad Aquafarm are at the west end; Ecke Family YMCA Aquatic Park, California Watersports and boat ramps are in the center section and a state ecological reserve and nature center are at the east end. The inner lagoon is designated REC-1 beneficial use (water sports) and the outer lagoon SHELL-1 for the aquafarm.

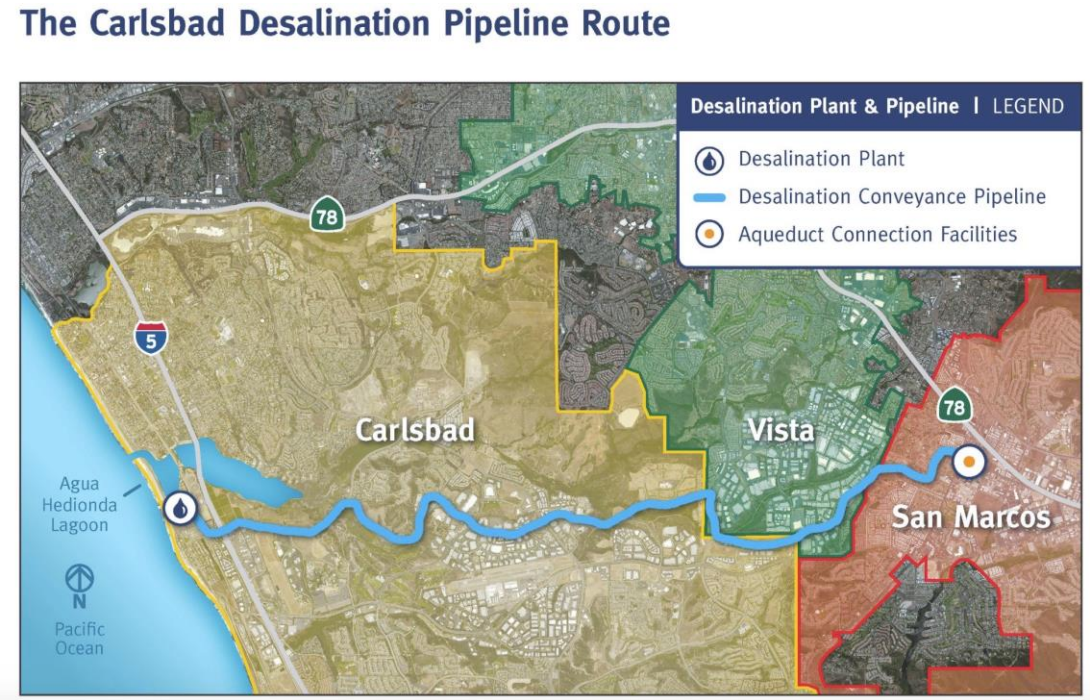
The watershed has two subareas which are noted in Figure 3.

The Creek itself has been listed as impaired under Section 303(d) of the Clean Water Act for heightened bacteria levels, toxicity, and elevated concentrations of manganese, phosphorus, selenium, nitrogen, and dissolved solids. The Agua Hedionda Lagoon, which had previously been listed as impaired,

has seen significant improvements in overall water quality over the last few years that warranted its removal from the 303(d) list of impaired water bodies.[1]

Lagoon Dredging:
As a result of accumulated sedimentation, and the absence of significant tidal flushing, the lagoon was becoming an increasingly restricted salt water marsh. The entire lagoon was dredged and permanently opened to the sea between 1952 to1954 to provide a tidal prism adequate enough to supply cooling water for the San Diego Gas and Electric Company's Encina Power Plant located on the south side of the outer lagoon. The resultant deepening and tidal flushing created a new deepwater bay environment.
Figure 4: Poseidon Water assumed stewardship of the lagoon in 2019. (Source: Carlsbad Desalination)

The lagoon has been dredged every one to four years since 1954 as part of the Encina power plant operations. Regular dredging is needed to remove sand that slowly enters the lagoon and forms a large sand bar in the western-most part of the lagoon. Now that the Encina plant has been retired, Poseidon Water has taken over the dredging, as part of an agreement when the seawater desalination plant was built and came online in 2015.[2]



Purpose:

The purpose of this annual report is to provide the water testing data for Agua Hedionda Creek Watershed that was collected during 2019. Each parameter will be evaluated for anomalies and the overall trends of the watershed will be summarized based upon this data. Monitoring was carried out in July, September and November of 2019. The data will also be compared with previous years' data, 2018 and 2017, that was collected by San Diego Coastkeeper utilizing the same volunteers currently working with the NSDWMP.

[1] *http://www.projectcleanwater.org/watersheds/carlsbad-wma/*
[2] *https://www.carlsbadca.gov/news/displaynews.asp?NewsID=2277&TargetID=1*

Sampling Sites

The Agua Hedionda Creek team sampled the sites AH010, AH020 and AH030 identified by the yellow pins in the map shown in Figure 5. A photograph of each site can be viewed in Appendix C:

- AHL010-Samples the convergence of Calavera Creek, Agua Hedionda Creek, and other tributaries. This site is located at the eastern end of lagoon before recreational areas; close to the intersection of Cannon Rd and El Camino Real. There is no public access in the sample area.
- AHL020-Samples Calavera Creek in the Lake Calavera Preserve in Carlsbad. This site is protected open space.
- AHL030-Samples Agua Hedionda Creek under south Melrose in Vista under the 78 Freeway bridge. This site is at the very eastern most edge of Buena Vista Park. There is residential development to the east and undeveloped lands to the west.

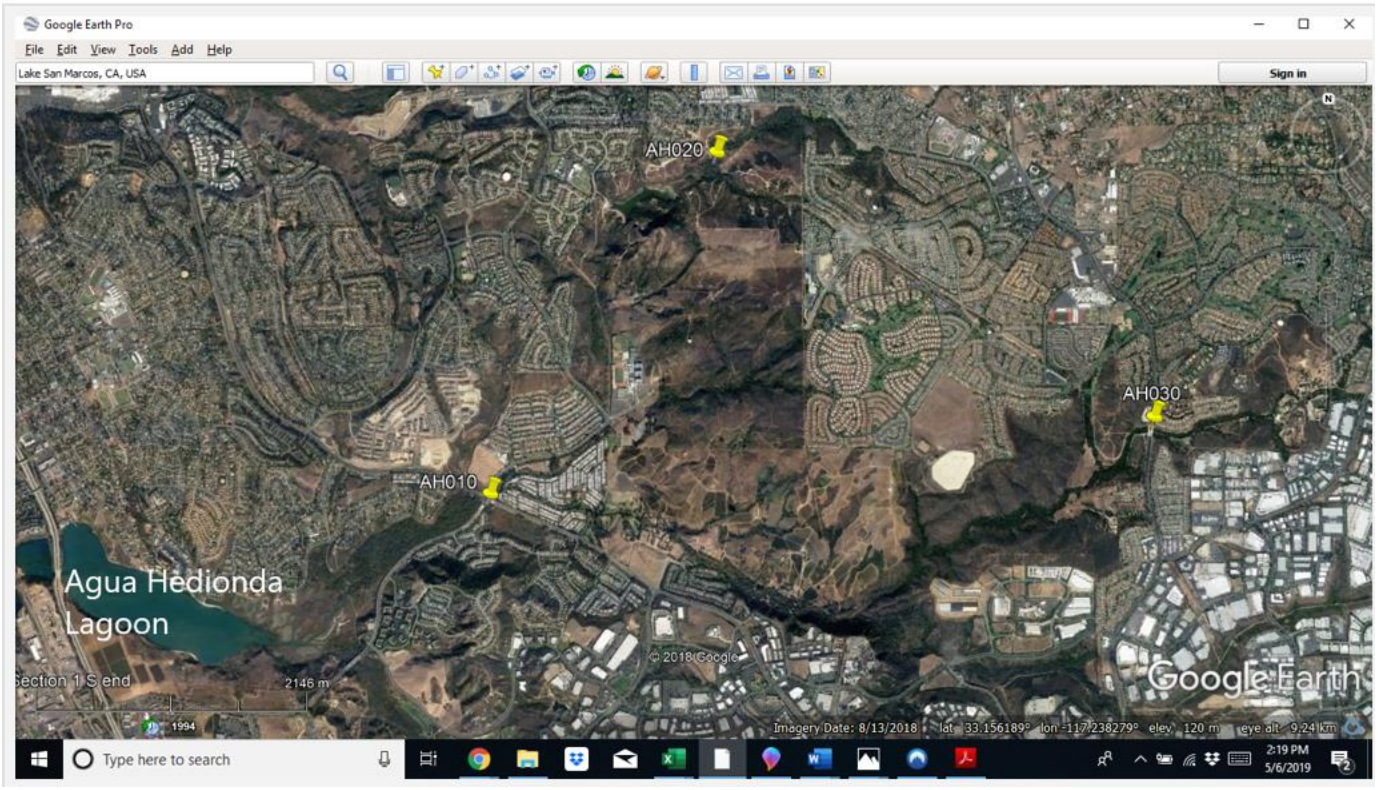
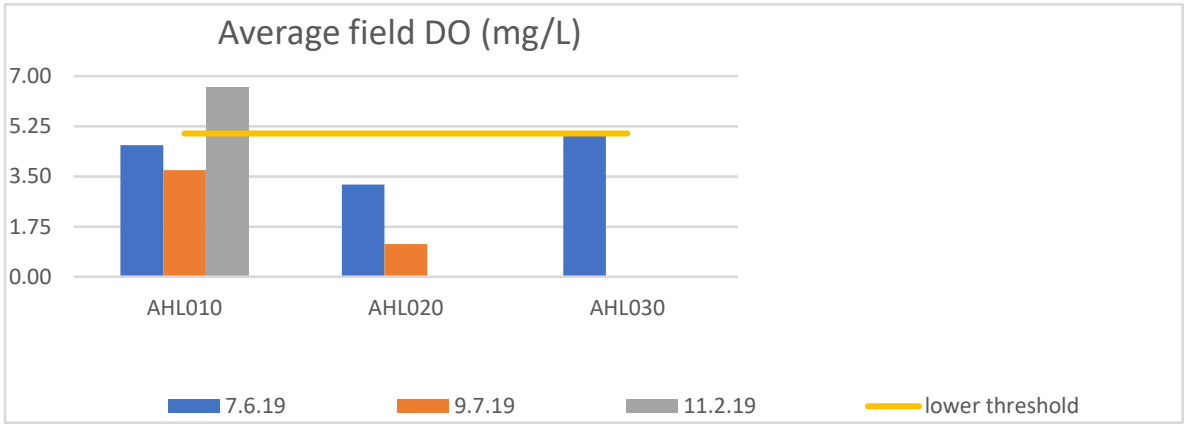


Figure 5 - Agua Hedionda Creek sampling sites (Source: Google maps)

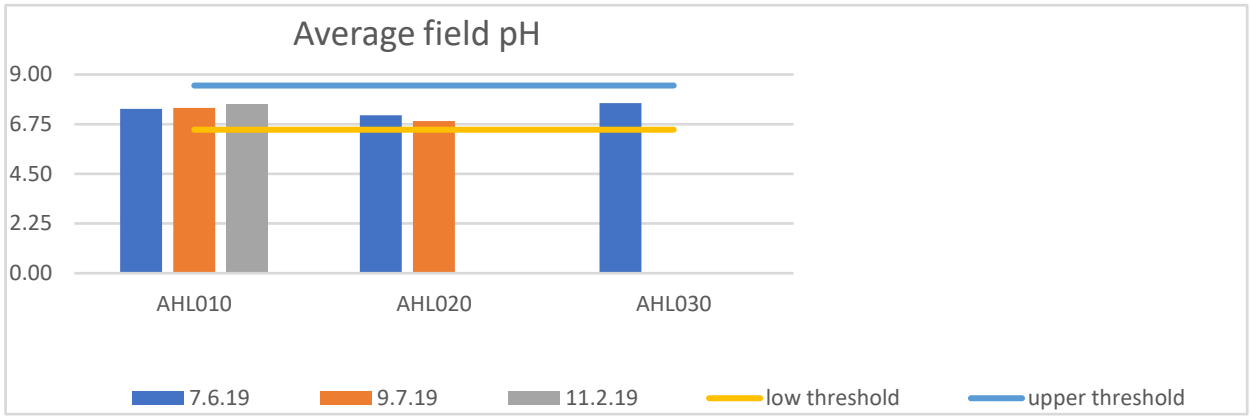
Test Data and Results: Data are missing for AHL020 on 11/02 and AHL030 on 9/07 and 11/02 This was due to the sites being dry on measurement dates.

Field Parameters

Dissolved Oxygen**:** Dissolved oxygen was at or below the San Diego Basin Plan[4] threshold of 5.0 mg/L, with the exception of AHL010 on 11/02. These levels generally do not represent a sufficient amount of oxygen in the water for a healthy ecosystem. Aquatic animals have a varied tolerance for low dissolved oxygen and anything below 5.0 mg/L can impact the creek's biodiversity.

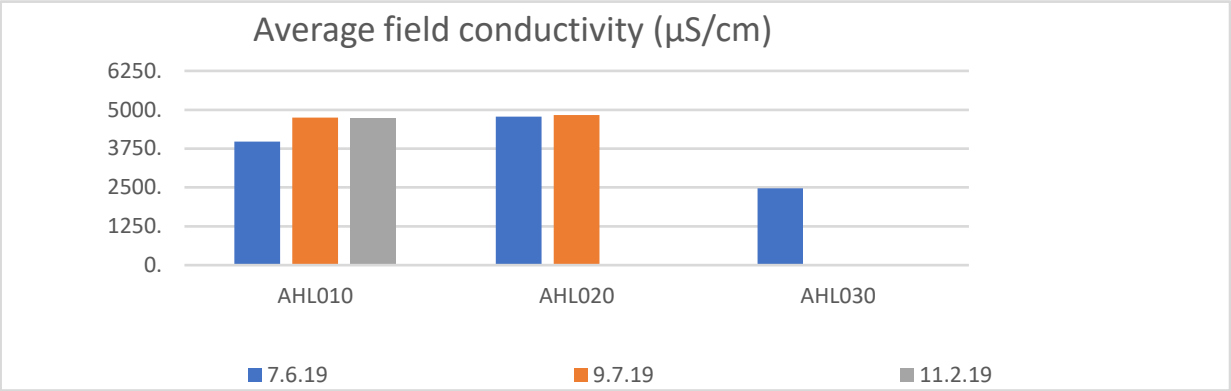


pH: The pH ranged from 6.9 to 7.7 for all sites. This falls within the acceptable range for the Basin Plan[3] of 6.5-8.5



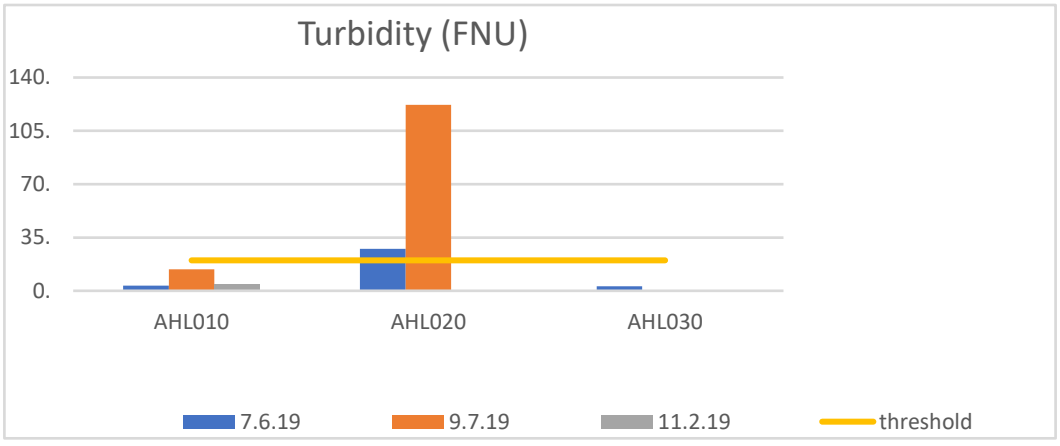
[3] https://www.waterboards.ca.gov/sandiego/water_issues/programs/basin_plan/docs/R9_Basin_Plan.pdf ; *Appendix C*

Conductivity: Conductivity fluctuated between 2500-4800 µS/cm. There is no threshold for conductivity, it merely reflects the amount of dissolved minerals in the water, however, the California Waterboard typically sees levels between 100-2000 µS/cm in freshwater streams (Electrical Conductivity/Salinity Fact Sheet).

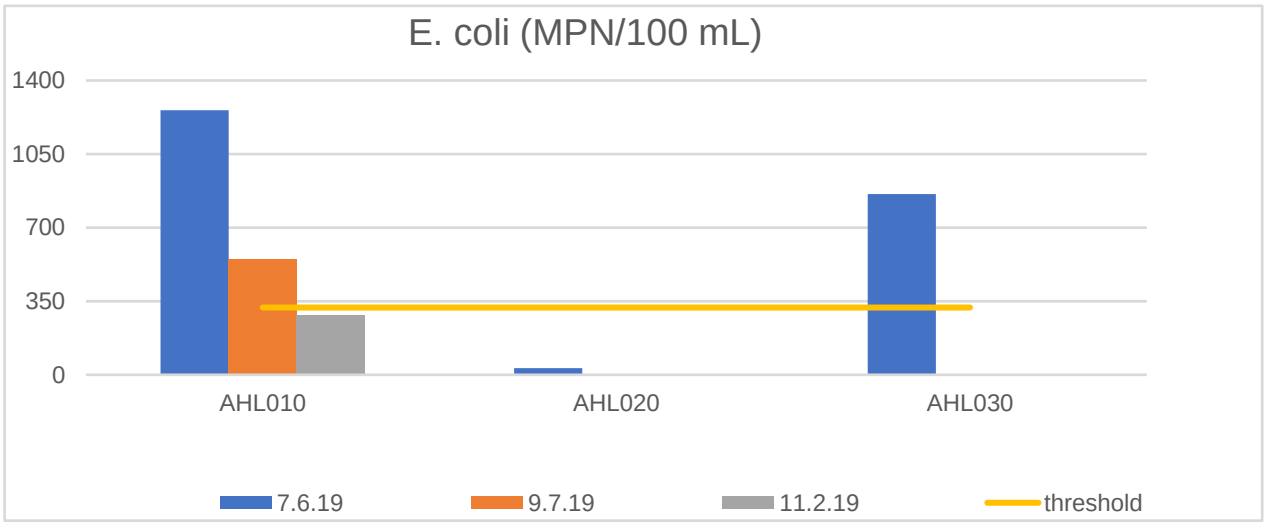


Laboratory Tests- Turbidity (cloudiness), total coliform, *Escherichia coli (E. coli)*, nitrates, total phosphorus, reactive phosphorus and ammonia are measured in the lab using 'grabbed' samples transported from the field.

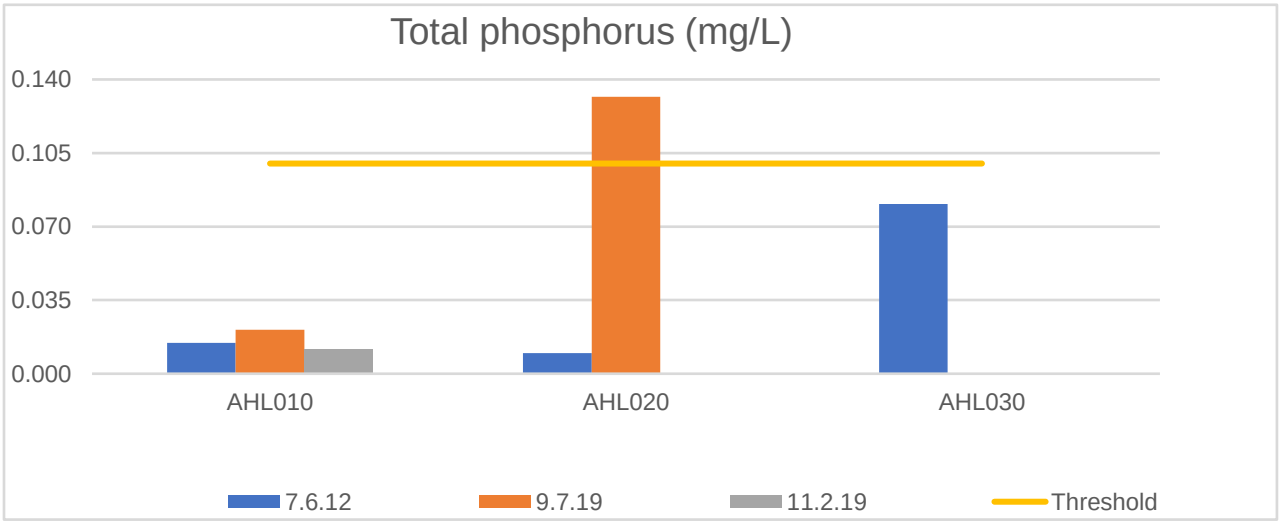
Turbidity: High turbidity can hinder the quantity light penetrating water which may affect photosynthesis. The threshold is 20 FNU. AHL010 was well within threshold level throughout 2019. AHL020 showed above threshold readings on both measured dates. On 9/07, the turbidity reading was more than 5X the threshold level. It was noted on the data sheet (see Appendix B) that the water was clearly rust colored and the collection site depth was only 3.5 inches making collection difficult without disturbing the bottom sediment.



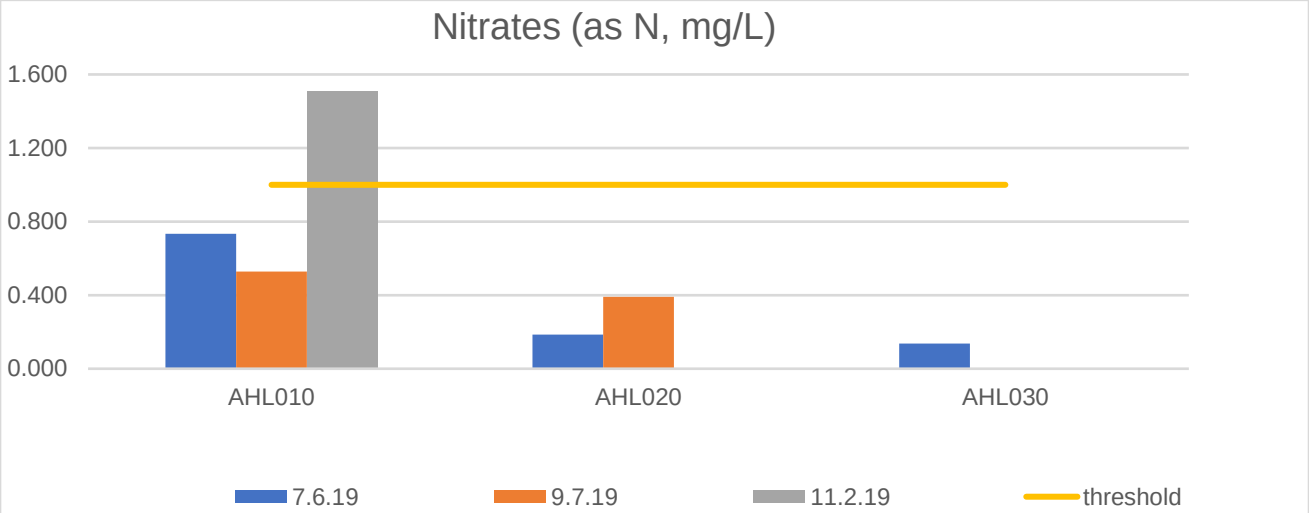
E. coli: Coliforms are a group of bacteria found in the digestive tracts of animals, including humans and their waste products. They are also found in plant and soil material. They may or may not indicate pathogenic bacteria. There is no threshold for these bacteria due to the wide types of sources. *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 bacteria is 320 MPN/100 mL[3]. *E. coli* levels at AHL010 were well above threshold levels at all two of the three testing dates as was the single testing date for AHL030. AHL020's single testing date showed *E. coli* levels were well below the threshold.



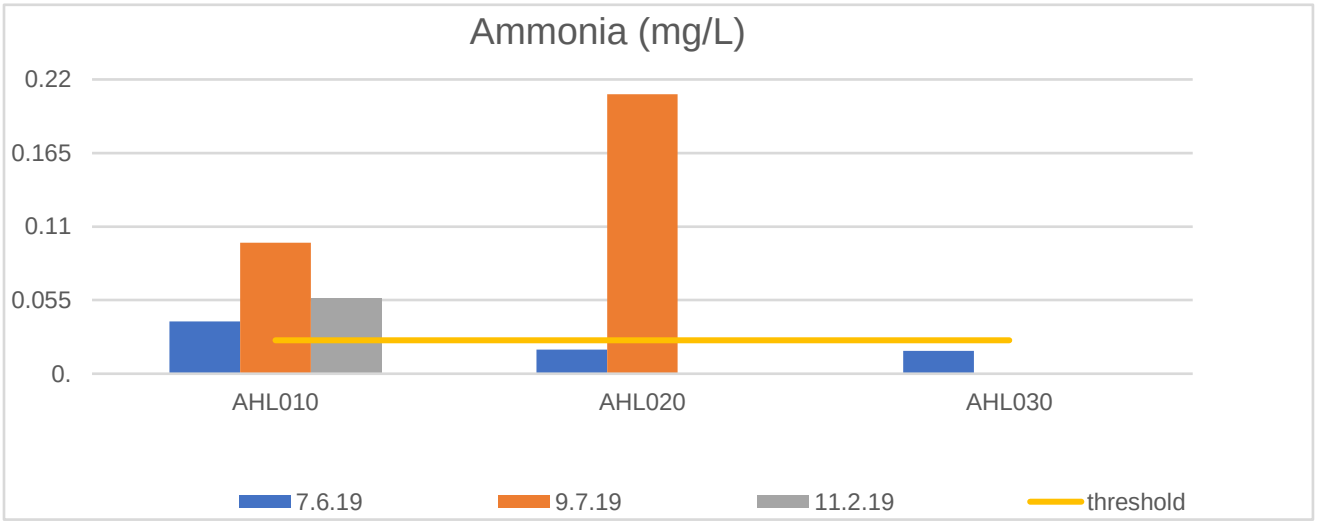
Total Phosphorus: Elevated phosphorus is often the result of fertilizer runoff and can lead to algal blooms. The threshold for San Diego watersheds is 0.1 mg/L[3]. At AHL010 total phosphorus was well below the threshold. The upstream sites had limited data available due to dry beds during parts of the year but phosphorus levels were above the threshold at AHL020 on 9/07.



Nitrates: Nitrates generally enter waterways from fertilizer runoff. Site levels were below threshold of 1.0 mg/L with the exception of the downstream site AHL010 which was above the threshold on 11/02. AHL010 overall had higher nitrate levels than the upstream sites.



Ammonia-Ammonia is another form of nitrogen. It can cause direct toxic effects on aquatic life. Ammonia can enter waterways through direct means such as municipal effluent discharges and the excretion of nitrogenous wastes from animals, and indirect means such as and runoff from agricultural lands. Ammonia's threshold is 0.025 mg/L. In the July testing, ammonia was below threshold for upstream sites but above the threshold for AHL010. Ammonia was over threshold, which is 0.025 at both sites tested in September and November. AHL020 measurement in September was an outlier and could be due to an error.



It should be noted that field samples gathered for ammonia testing did not have their pH lowered to below 2 as recommended by the manufacturer (Hach) as we followed SDCK procedures which also did not follow recommended protocol.

Data Comparison With Previous Years:
San Diego Coastkeeper's testing procedures and protocols were followed when the testing was taken over by NSDCWMP but the testing months were inconsistent among the three testing years. SD Coastkeeper conducted water testing during August, September, October, November and December in 2017 (there is no data during that year for AHL030) and testing was conducted during April, June, August, October and December of 2018. NSDCWMP conducted water testing during July, September and November of 2019.

Dissolved Oxygen - Trend generally shows below threshold levels during summer and fall testing possibly due to warmer weather and above threshold in November and December.

pH- pH continues to fall within the acceptable range for all three testing years.

Turbidity- All turbidity measurements for 2017 and 2018 were well below the Threshold. The results did show that AHL020 did have a higher FNU than AHL010. There was no data during 2017 nor 2018 for AHL030. Turbidity measurements taken in 2019 were higher overall than previous years; particularly site AHL020.

E. coli- During 2017, *E.coli* levels at site AHL010 were above threshold during the months of August and September, the levels went down below threshold in October and November and then over threshold in December. During 2018, *E. coli* levels at site AHL010 were above threshold on all testing dates during the months of April, June, August and October. The 2019 test levels were above threshold in July and September which does correspond with previous years. Test level for November 2019 is below threshold which does correspond with data taken in 2017. Site AHL020 showed *E. coli* levels within the acceptable range except for the Oct-2018 test date. There was only one measurement of site AHL20 during 2019. This measurement was taken in July and there are no corresponding measurements during 2017 or 2018. There are only two measurements available for AHL030, April 2018 and July 2019, and both were above threshold levels. For additional data regarding 2017 and 2018, see Appendix A.

Total Phosphorus- Total phosphorus levels were below the testing range for all data from 2017 and 2018 and site AHL010 2019. Site AHL020 was the only site above the threshold level in September, 2019.

Nitrates- Nitrate levels were similar across 2017, 2018 and 2019 with AHL010 consistently having the highest nitrate levels. All nitrate levels from all three years were below the threshold level of 1.0 mg/L with the exception being November of 2019 which was 1.5 mg/L.

Ammonia- Site AHL010 was consistently above the threshold level of 0.025 mg/L for all three testing years. Limited data for site AHL030 was below the threshold. Site AHL020 was above the threshold in October of 2018 with a measurement of 0.032 mg/L but far lower than the outlier measurement of September 2019.

Discussion Points:
The Agua Hedionda Creek posed some barriers to water testing in light of the fact that the upstream sites were frequently dry during testing periods. Historically these sites would have been ephemeral; only running during a rain event. In recent years due to urbanization/development these creeks sometimes run yea- round. During our testing period, possibly due to a lack of urban runoff, upstream sites have been dry. Also, homeless encampments at various times along upstream sites may have impacts on the water quality.

The data collected in 2019 are generally consistent with the data from 2017 and 2018. It is important going forward that we have a consistent schedule from year to year for taking measurements. Comparing past data has been difficult due to monitoring not being done on a regular schedule.

E.coli levels continue to be above the threshold in sites AHL010 and AHL030 which is cause for concern. This may be due to the fact that AHL010 is a convergence of all of the creeks and we only test two of the creeks. We don't test Little Encinas or other tributaries.

Below threshold levels of dissolved oxygen are cause for concern.

The turbidity of the water at site AHL020, appearing to be rust colored, should be monitored. The value and results of taking samples when the collection site depth is very low should also be evaluated.

The ratio of nitrate to total phosphorous is supposed to be no more than 10:1. As we examine the data, it is evident that the ratio of nitrate to total phosphorus fluctuated widely in 2019; ranging from almost as high as 50:1 and as low as 2:1. Wide fluctuations also occurred in 2017 and 2018. This may warrant further investigation.

Appendix A: San Diego Coastkeeper's Spreadsheet Data 2017 and 2018

San Diego Coastkeeper's data for Agua Hedionda Creek 2017

2017-mo	Site	DO mg/L	Con-duct µS/cm	PH	Turbid-ity (FNU)	Ttl Phosp mg/L	Reac Phos mg/L	Nitrate mg/L	Ammo nia mg/L	Total Colif MPN/100mL	E Coli MPN/100mL
Aug	AHL010	4.34	3536	7.53	1.2	0.001	0.015	0.477	-0.01	3873	166
Sept	AHL010	3.62	4273	7.7	1.34	0.012	0.039	0.371	0.057	2247	67
Oct	AHL010	4.57	4345	7.79	0.635	-0.073	0.123	0.271	0.056	2755	10
Nov	AHL010	5.84	4557	7.79	0.797	0.013	0.018	0.727	0.046	224	23
Nov	AHL020	4.36	5601	7.31	7.07	0.026	0.027	0.158	0.025	30	2
Dec	AHL010	7.71	4216	7.89	0.505	0.011	0.008	0.785	0.028	1285	61
Dec	AHL020	5.66	5190	7.47	6.35	0.025	0.015	0.049	0.014	771	9

Appendix A (continued)

San Diego Coastkeeper's data for Agua Hedionda Creek 2018

2018-mo	Site	DO mg/L	Con-duct µS/cm	PH	Tur-bidity FNU	Ttl Phosp mg/L	Reac Phos mg/L	Nitrate mg/L	Ammo nia mg/L	Total Colif MPN/ 100mL	E. Coli MPN/ 100mL
Apr	AHL010	5.94	3840	7.71	0.757	0.011	0.013	0.544	0.025	1483	38
	AHL020	5.18	4287	7.52	3.6	0.015	-0.094	0.145	0.011	51	
	AHL030	6.2	2370	7.87	0.71	0.064	0.065	0.22	0.004	1455	61
June	AHL010	4.82	4077	7.58		0.009	0.012	0.52	0.023	6867	90
	AHL020	3.81	4847	7.31		0.017	0.021	0.135	0.012	72	1
Aug	AHL010	3.32	4500	7.61	0.751	0.042	0.149	0.202	0.116	15531	313
Oct	AHL010	2.51	4227	7.51	1.14	0.043	0.044	0.506	0.088	15531	115
	AHL020	2.03	6927	6.36	6.53	0.02	0.03	0.155	0.032	1626	41
Dec	AHL010	7.34	2040	7.85							
Dec	AHL020	5.07	2860	7.25							
Dec	AHL030	6.32	914	7.63							

Appendix B: NSDCWMP Spreadsheet Data 2019:

2019-mo	Site	DO mg/L	Con-duct µS/cm	PH	Tur-bidity FNU	Ttl Phosp mg/L	Reac Phos mg/L	Nitrate mg/L	Ammonia mg/L	Total Colif MPN/ 100mL	E. Co MPN, 100m
July	AHL010	4.59	3980	7.45	3.32	0.015	0.015	0.734	0.039	>24196	1
	AHL020	3.22	4778	7.16	27.5	0.01	0.016	0.185	0.018	3968	
	AHL030	5.07	2470	7.70	3.05	0.081	0.086	0.136	0.017	4569	
Sept	AHD010	3.72	4750	7.48	14.1	0.021	0.02	0.529	0.098	>24196	
	AHD020	1.14	4830	6.89	122	0.132	0.127	0.390	0.209	2382	
	AHD030-dry										
Nov	AHL010	6.62	4723	7.65	4.07	0.012	0.01	1.51	0.056	24196	
	AHL020 - dry										
	AHL030 -dry										

Appendix B (continued)

Additional spreadsheet data and notes 2019

Date	Site	Collection time	Collection site depth (")	Flow (N,B,M,R,F)	Ppt within 72 hr?	notes
7/6/19	AHL010	11:56 AM	7	3.5	N	stream wider and deeper since 2018 after dredging
7/6/19	AHL020	10:50 AM	7	2	N	water higher than usual
7/6/19	AHL030	9:30 AM	13	2	N	water higher than usual
7/6/19	AHL020 Field blank					
9/7/19	AHD010	11:59 AM	9	3	y	near homeless encampment, sediment much greater than field duplicate (by eye)
9/7/19	AHD010 FD	12:01 PM	9	3	y	
9/7/19	AHD020	10:28 AM	3.5	1	y	water clearly rust colored
9/7/19	AHD030-dry					
11/2/19	AHL010	10:32 AM	8	2	N	
11/2/19	AHL010 lab duplicate	10:32 AM				
11/2/19	AHL020 - dry					
11/2/19	AHL030-dry					
11/2/19	AHL010	10:32 AM	8	2	N	
11/2/19	AHL010 lab duplicate	10:32 AM				

Appendix C: Site Photos taken April 19, 2021 Karen Merrill and Ellen Bartlett

Site AHL030

Site AHL020

Site AHL010