

AGUA HEDIONDA 2023 ANNUAL REPORT

Prepared by Ellen Bartlett and Karen Merrill, Preserve Calavera, North San Diego County Watershed Monitoring Program

We would also like to acknowledge the time and effort of our field volunteers who make this all possible: Janell Cannon, Scott Engel, Jan Neff-Sinclair, Diane Campbell, Karen Merrill, Kathy Parker, Layla Nazis, and Sophie Hindaoui.

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

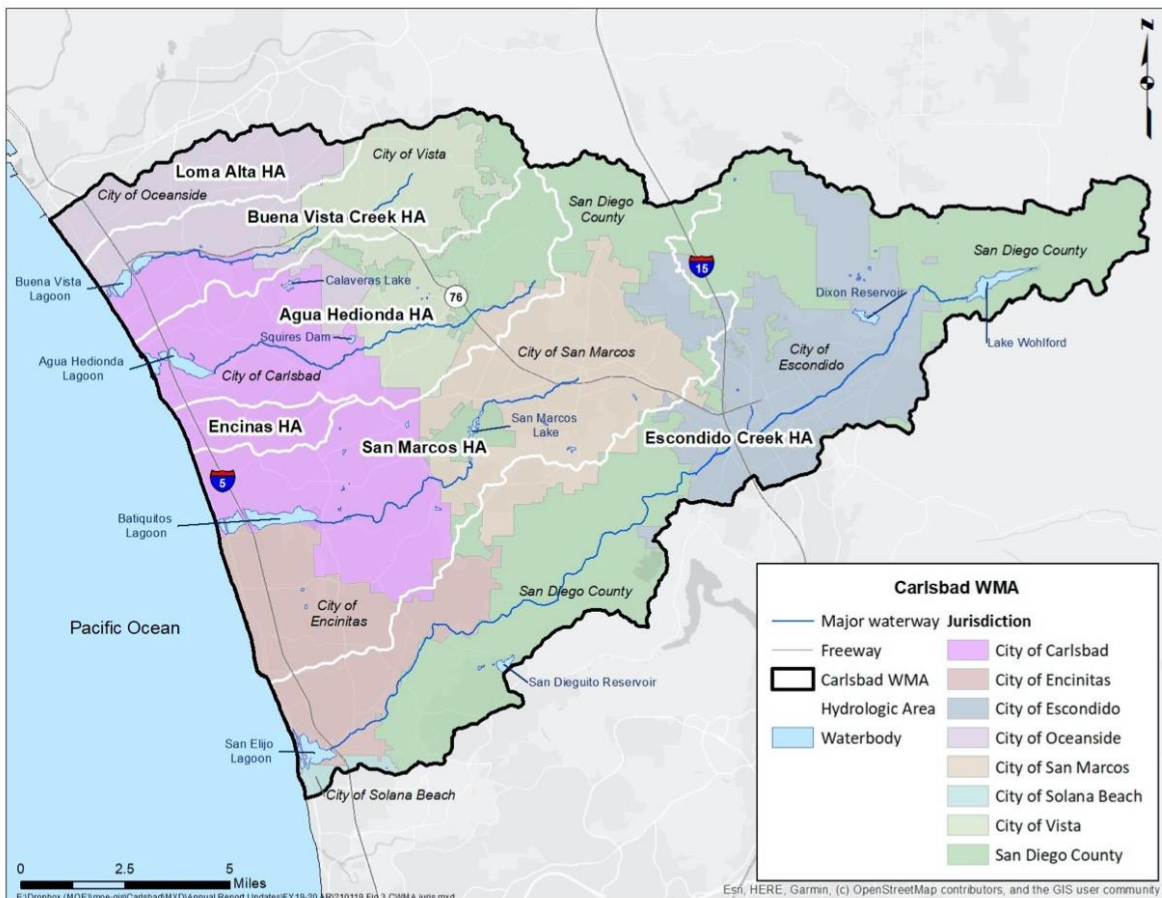


Figure ES-1: Carlsbad Watershed Management Area

Unit, are evaluated for a variety of physical, chemical and biological parameters on a bimonthly basis.

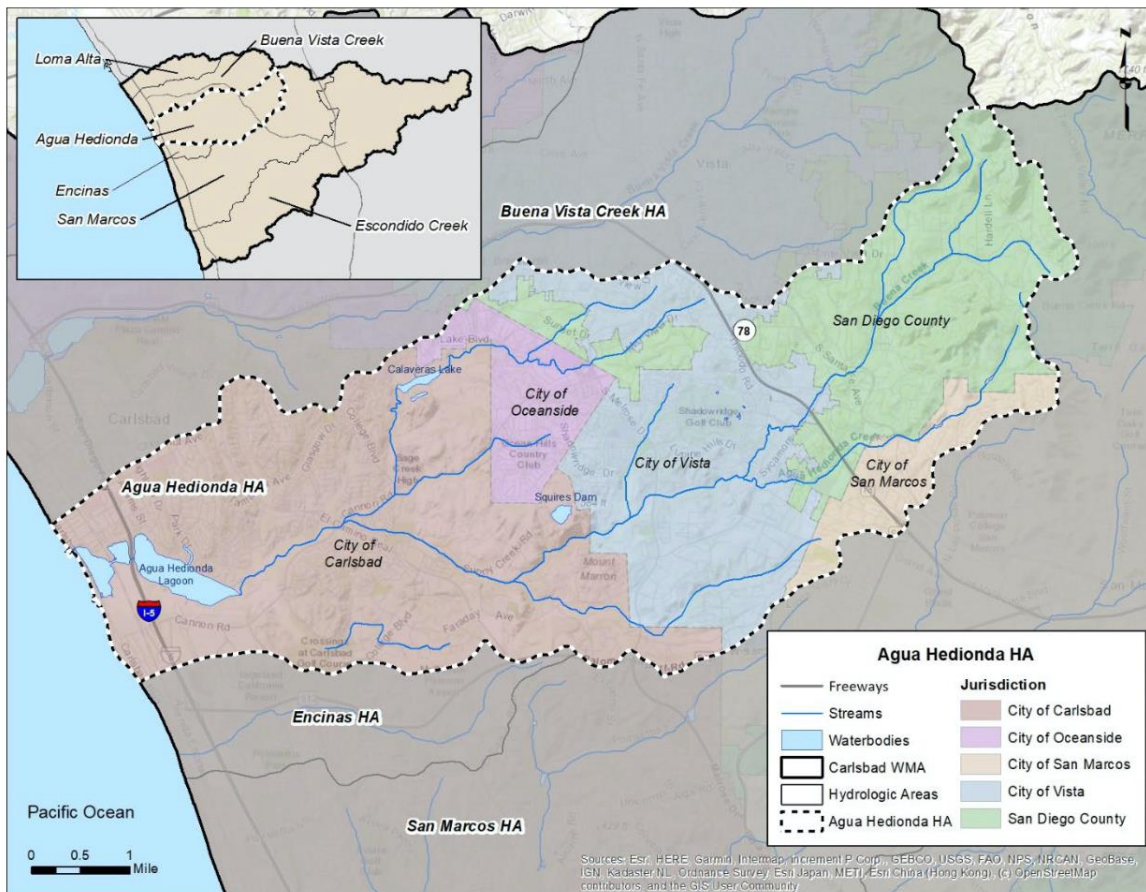
Figure 1: The Carlsbad Watershed Management Area. Source: [CWMA-Water Quality Improvement Plan](#) page ES-2

Agua Hedionda Creek Annual Report 2023

NSDCWMP is an all-volunteer citizen science effort with a leadership management team comprised of one Preserve Calavera board member (also leader of the Buena Vista Creek monitoring team) and one 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 and is about 18,800 acres in area. Most of the hydrologic area is in the City of Carlsbad (41%); the remainder is in Vista (24%) and San Diego County (24%) and there are also small portions in Oceanside and San Marcos. 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.

The diverse habitats of this hydrological area range from coastal sage scrub to salt marsh and mudflats. There



are over 650 acres of Ecological Reserve Land that supports numerous birds species (including the California gnatcatcher), mammals, amphibians, and reptiles.

Figure 2: Agua Hedionda Hydrologic Unit (Source: [Carlsbad Watershed Management Area-Annual Report](#) p.AHAA 14)

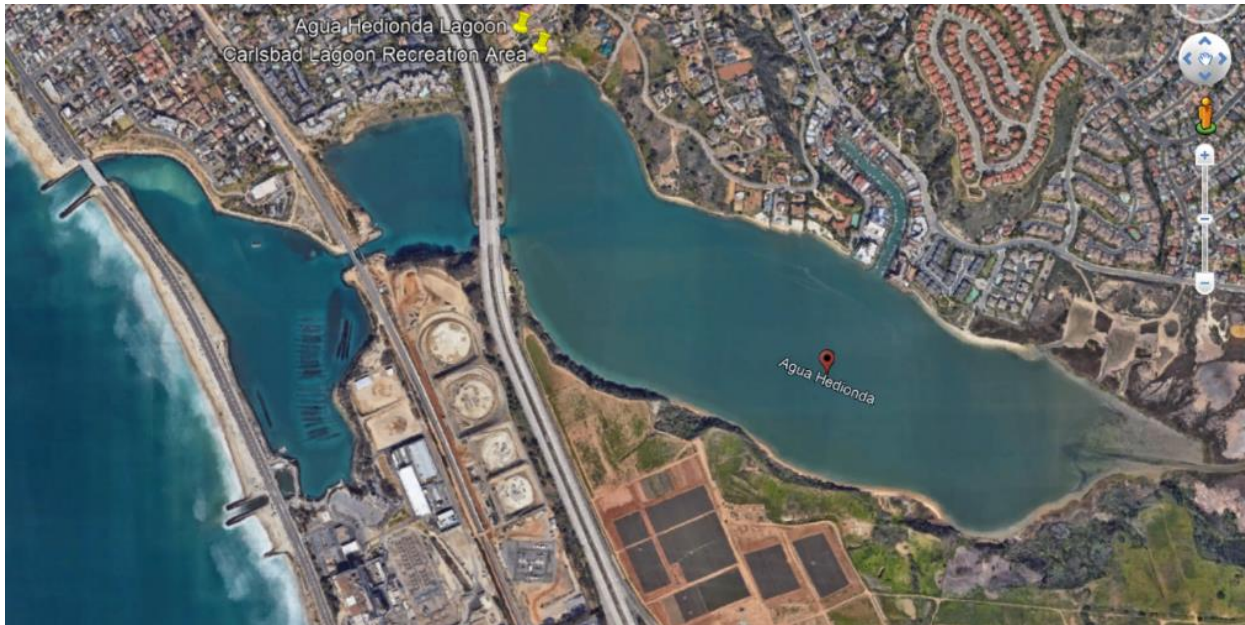


Figure 3: Agua Hedionda Lagoon; It's three sections are visible (Source: Google Maps)

Agua Hedionda is the only lagoon in San Diego County which supports commercial and recreational uses. Carlsbad Desalination 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.

In June of 2020, installation of new fish-friendly seawater intake pumps at the Carlsbad Desalination Plant was completed. The three intake pumps are part of a broader effort to ensure the long-term health of the marine environment near the Desalination Plant. And in September of 2020, AB-1949 Fisheries: California Ocean Resources Enhancement and Hatchery Program was passed. The Bill strengthens and expands the marine fish

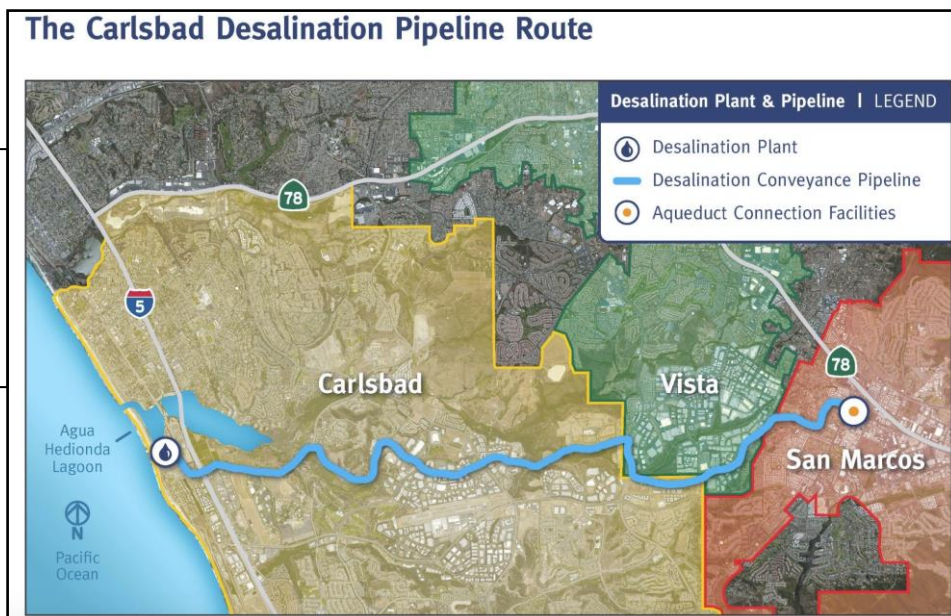


Figure 4: Poseidon Water assumed stewardship of the lagoon in 2019. (Source: [Carlsbad Desalination](#))

hatchery program at the lagoon's fish hatchery and aquafarm— allowing additional breeding of the native California species that have been depleted by commercial and recreational fishing.

Figure 5: Project Location Map for Dredging and Sand Replacement. Red outline indicates dredging area. (Source: [Agua Hedionda Lagoon - Outer Basin 2020-21 Maintenance Dredge/Beach Nourishment Cycle Sand Deposition Plan](#))



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 to 1954 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.

The lagoon has been dredged every one to four years since 1954. This began as part of the Encina power plant operations. 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 2015.¹ 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

¹ <https://www.carlsbadca.gov/news/displaynews.asp?NewsID=2277&TargetID=1>

lagoon. Dredging was last conducted from February of 2021 through mid-April of 2021. Dredging is scheduled to begin again in the fall of 2024. The dredged sand will be used for Carlsbad beaches.

Agua Hedionda Creek Annual Report 2023

Agua Hedionda Creek Restoration Project:

The City of Carlsbad’s Agua Hedionda’s Creek Restoration Project continues to focus on restoring riparian habitat areas to improve flood control, reduce erosion, stabilize riverbanks, increase habitat connectivity and quality, and improve water quality.

In FY 2023, the City of Carlsbad continued execution of a \$1.9 M contract to support the extension of College Boulevard, including creek restoration.

While progress toward creek restoration has occurred, the city recognizes that the Interim Goals were not achieved in 2023 FY. There is a lack of funds from residential development fees which is needed to help fund infrastructure—causing delay of the project overall. The final timeline for the project is unknown at this time.

Table 5: Agua Hedionda HA Progress toward Interim and Final Numeric Goals

Goals		Baseline	Reporting Period Results	Goal Achieved or In Progress?	
Dry and Wet Weather (City of Carlsbad)					
Riparian Habitat Degradation	2023 Interim Goal (2018-2023)	<i>50% of the Agua Hedionda Creek Restoration project schedule complete</i>	<i>0% of Agua Hedionda Creek Restoration Project Completed</i>	<i>During the reporting period, the City of Carlsbad completed permitting for geotechnical work.</i>	<i>In Progress</i> <i>Not Achieved in 2023</i>
	2028 Final Goal (2023-2028)	Completion of Agua Hedionda Creek Restoration project (8.81 acres of mitigated riparian and upland habitat) and long-term preservation through the City of Carlsbad’s Habitat Management Plan			In Progress
Dry and Wet Weather (City of Vista)					
Hydromodification Impacts	2023 Interim Goal (2020-2023)	50% of wetland creation completed adjacent to 700 feet of Roman Creek	<i>0% of wetland creation adjacent to Roman Creek</i>	<i>Solicitation of design-build services in FY 2021-22 resulted in a bid exceeding the project budget by over \$2 million. The available budget for the project was carried forward in the CIP budget into FY 2022-23. The project remained on hold. The project status was discussed with the Regional Board staff. The city initiated a review of alternative hydromodification characteristics and activities.</i>	<i>In Progress</i> <i>Not Achieved in 2023</i>
	2026 Final Goal (2023-2026)	Completion/creation of approximate 2-acre wetlands adjacent to Roman Creek in the City of Vista’s Buena Vista Park area			In Progress

Shaded italicized text denotes the selected compliance method to demonstrate progress for the interim goal.

Table 5 below is taken from p. 16 of the Carlsbad WQIP 2022-2023 Annual Report ([LINK](#))

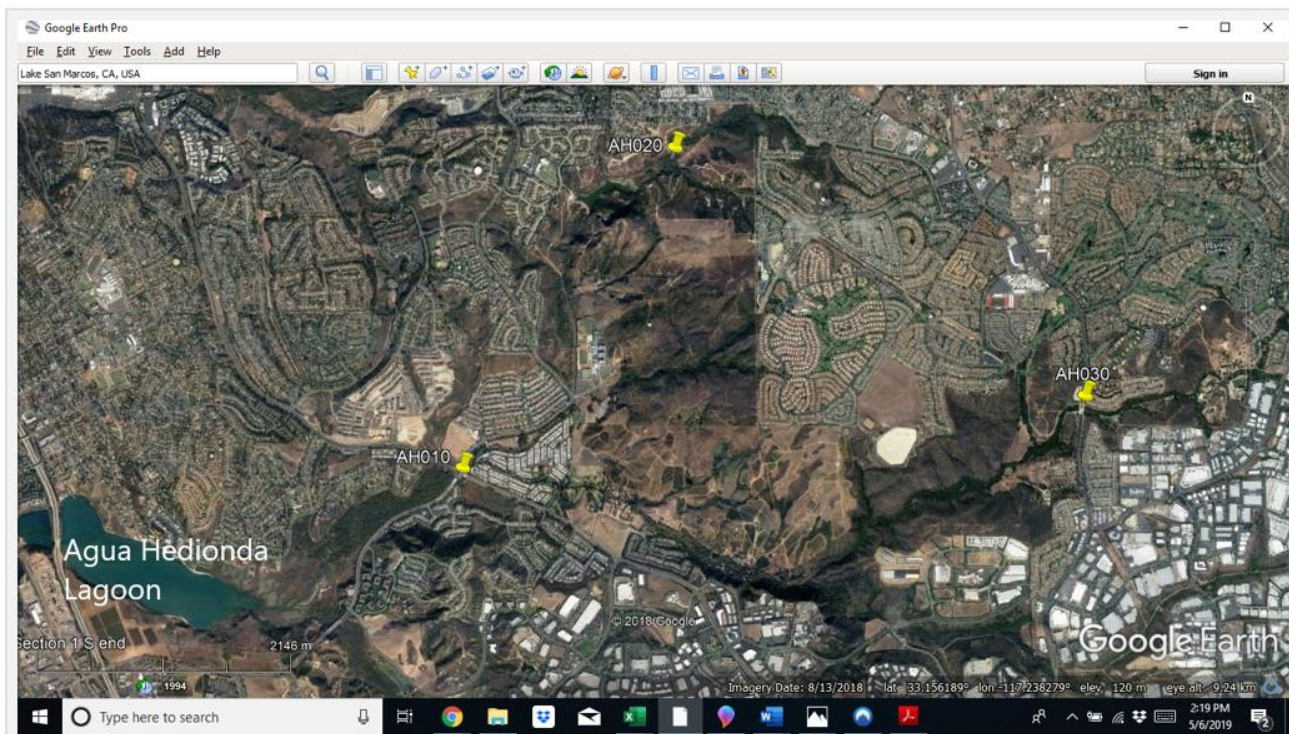
Purpose

The purpose of this annual report is to provide the water testing data for Agua Hedionda Creek Watershed that was collected during 2023. 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 January, March, July, September and November of 2023. The data will also be compared with our previous years of data from 2022, 2021, 2020 and 2019, as well as 2018 and 2017 data that was collected by [San Diego Coastkeeper](#). Environmental DNA (eDNA) was also collected at one testing site as part of a pilot program.

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 7. A photograph of each site can be viewed in Appendix A:

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

Test Data and Results: Testing was conducted bimonthly during 2023 beginning in January on the following dates: January 7, March 3, May 6, July 1, September 9 and November 4.

The following comments/observations were noted on the field data sheets.

January 7 -Several days of rain, at times heavy, prior to the sample date

SITE	Avg. Water Temp (°C)	Comment/Observation
010	11.60	debris was piled up south of Cannon Bridge which created a dam
020	10.87	water level was higher than noted by observer in the past 5 years
030	12.67	no comment

March 3 -Several days of rain, at times heavy, prior to the sample date

SITE	Avg. Water Temp (°C)	Comment/Observation
010	11.27	water level was too high to reach usual sampling site, sample approx. 30' downstream
020	13.73	bridge flooded- sampled north side shore, backed up water was stagnant but did not stink
030	11.47	no comment

May 6 -Several days of rain, at times heavy, prior to the sample date

SITE	Avg. Water Temp (°C)	Comment/Observation
010	17.50	no comments
020		bridge underwater, no testing
030	14.50	no comments

SITE	Avg. Water Temp (°C)	Comment/Observation
010	20.83	algae patches downstream of sample site
020	18.67	usual surface sheen absent

Agua Hedionda Creek Annual Report 2023

SITE	Avg. Water Temp (°C)	Comment/Observation
030	20.27	nice water level for July

July 1 -No weather events prior to test date

Agua Hedionda Creek Annual Report 2023

September 9 - Hurricane Hillary brought 2.25" of rain on August 20

SITE	Avg. Water Temp (°C)	Comment/Observation
010	22.40	clear water, lots of floating vegetative debris
020	20.87	evidence of record creek height due to hurricane
030	22.17	turbid water, horse fecal matter on trail

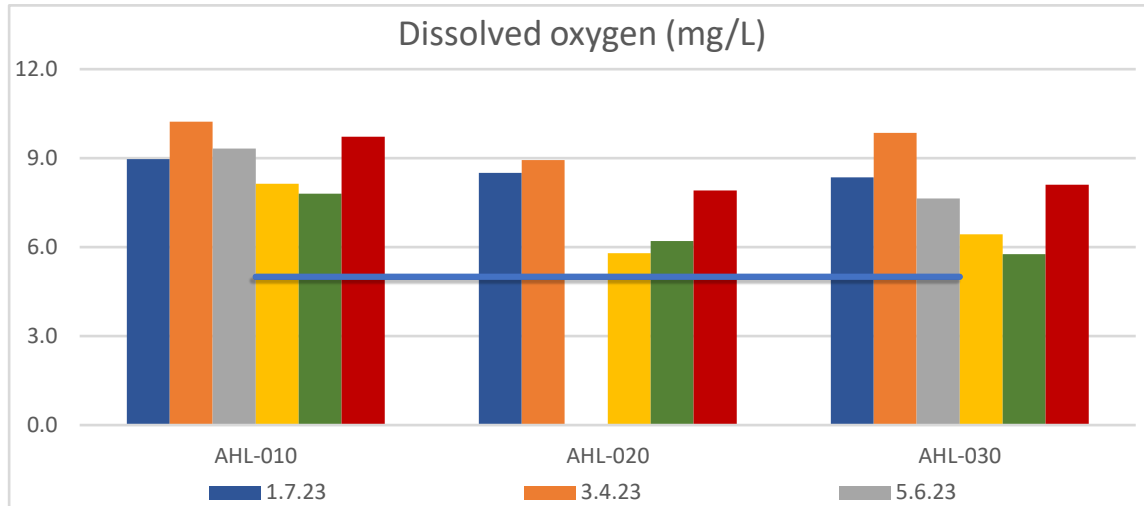
November 4 - no recent weather events

SITE	Avg. Water Temp (°C)	Comment/Observation
010	13.2	large sample bottle had small leak, black phoebe
020	11.9	fish, leaves floating, birds, gnats, white butterfly, recovering vegetation
030	12.8	water striders on water, gnats, butterfly, orb weavers

Parameters

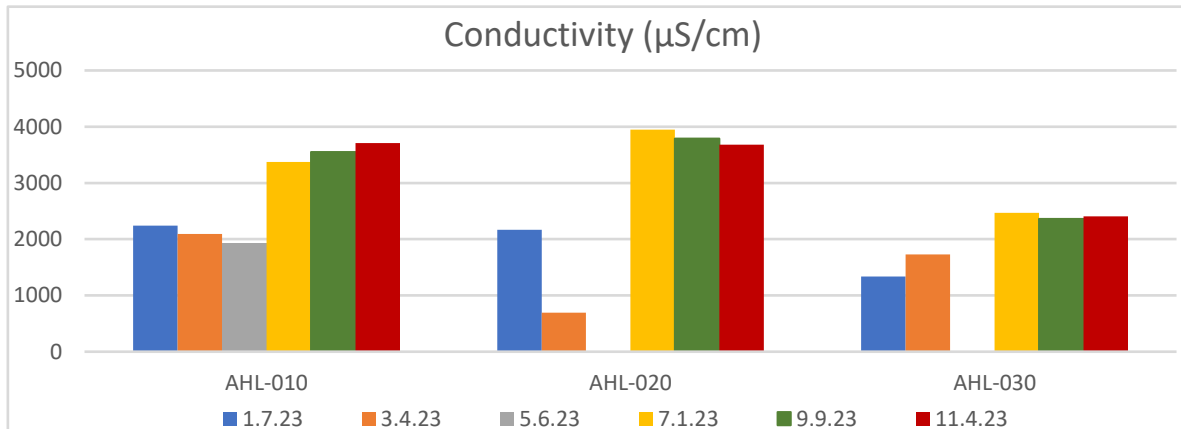
Dissolved Oxygen (DO): San Diego Basin Plan² threshold level for dissolved oxygen is 5.0 mg/L or above. Dissolved oxygen was well above the threshold levels throughout the year. During the warmer months of July and September the oxygen levels did decline as is the yearly pattern and rise again in November.

pH: The pH ranged from 7.01 to 8.5 for all sites. All values fall within the acceptable range for the San Diego Basin Plan of 6.5-8.5.



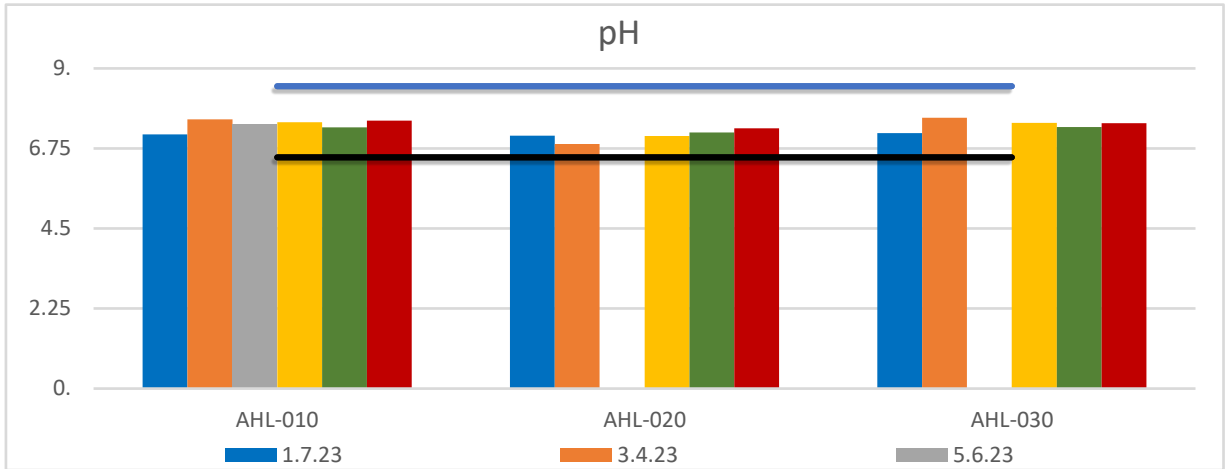
Conductivity: Conductivity fluctuated between 695 - 3950 $\mu\text{S}/\text{cm}$. There is no threshold for conductivity, it merely reflects the amount of dissolved minerals in the water, however, the California Waterboard typically sees levels between 100-2000 $\mu\text{S}/\text{cm}$ in freshwater streams ([Electrical Conductivity/Salinity Fact Sheet](#)).

Sites AHL010 and 020 showed higher values than those typically seen in other freshwater streams in California during the second half of the year. Site AHL030 had conductivity levels in the range more closely aligned with other freshwater streams in California.



² https://www.waterboards.ca.gov/sandiego/water_issues/programs/basin_plan/docs/R9_Basin_Plan.pdf, Appendix C

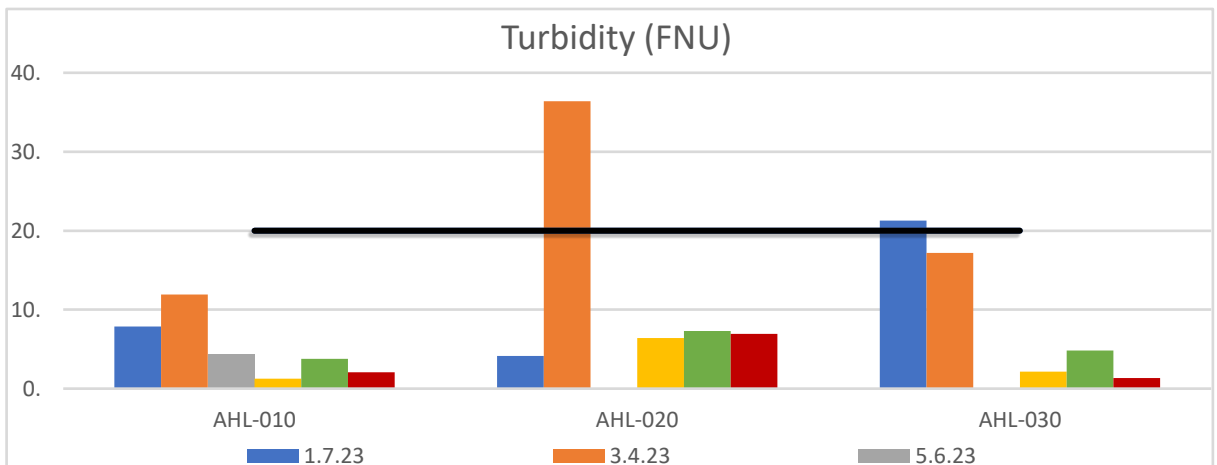
pH: The pH ranged from 7.01 to 8.5 for all sites. All values fall within the acceptable range or the San Diego Basin Plan of 6.5-8.5.



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.

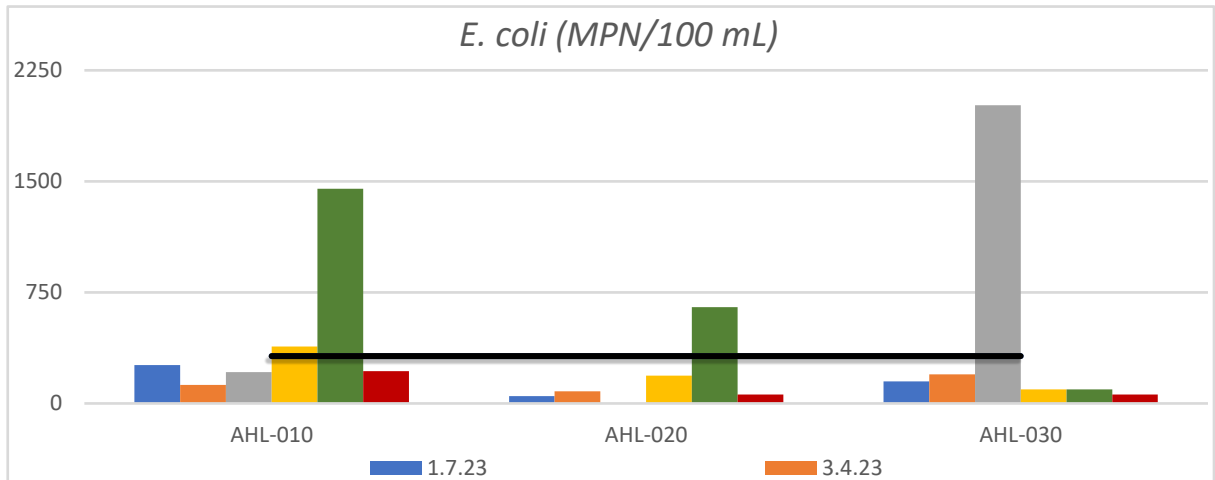
Turbidity was almost double threshold level (36.40) at site 020 in March. See comments on testing site for this date which describe flooded bridge and stagnant water. Turbidity was slightly above threshold at site 030 in January.



***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

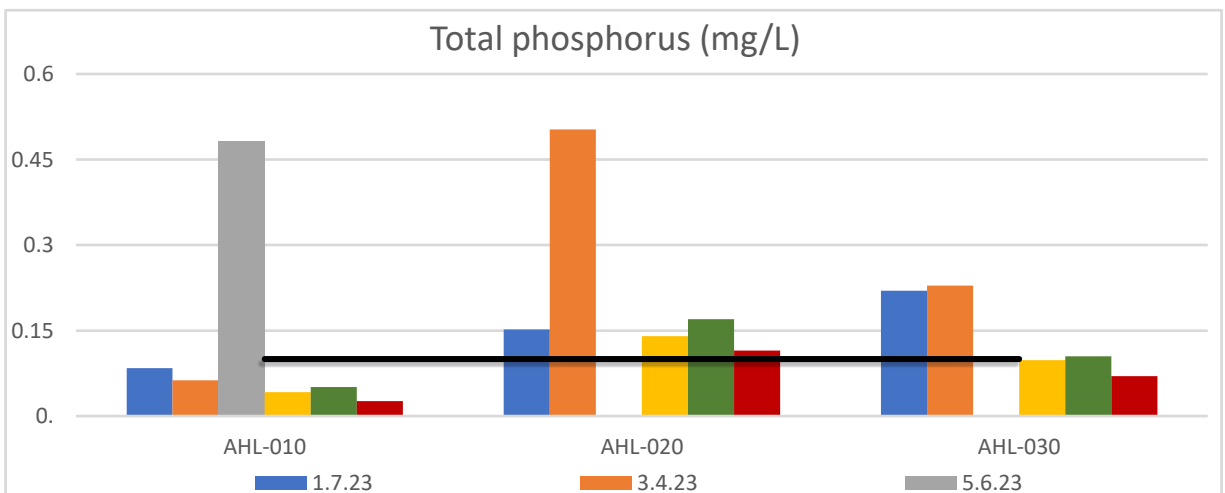
more indicative of potential concern as many strains are pathogenic. The test we run, using [IDEXX Quanti-tray/Colilert](#), measures all *E. coli*, pathogenic or not. The threshold for this bacterium is 320 MPN/100 mL³.

Site 010 had two readings above threshold level: July was slightly above threshold at 384 MPN/100 mL³ and September was well above threshold at 1450 MPN/100 mL³. Site 020 was above threshold in September, reading 650 MPN/100 mL³. Site 030 was well above threshold in September, reading 2014 MPN/100 mL³. There was nothing evident at the testing sites to suggest a reason for the above threshold readings.



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/L³.

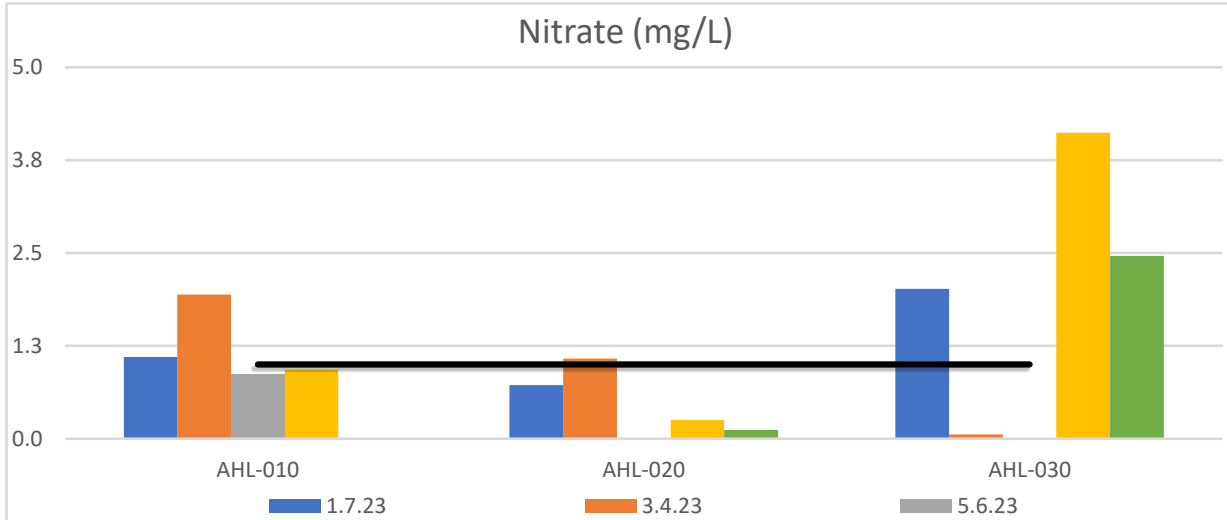
All sites had phosphorous levels that were above threshold levels. Site 010 reading was 0.4821 mg/L³ in July and site 020 reading was 0.503 mg/L³. Phosphorous levels at site 030 are also of concern for the first half of the year.



Nitrates: Nitrates generally enter waterways from fertilizer runoff. Threshold level for nitrates is 1.0 mg/L. Values for nitrates fluctuated among the three test sites.

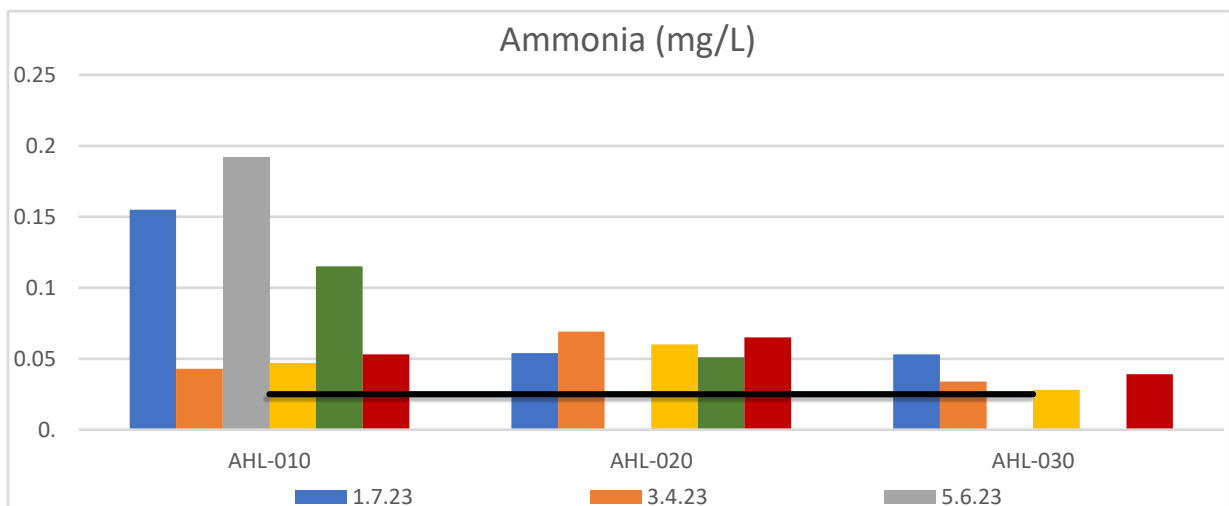
No nitrate testing was done for 9.9.23.

Nitrates values were well above threshold for site 030 for all test dates except for March 4.



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 runoff from agricultural lands. Ammonia's threshold is 0.025 mg/L.

All ammonia levels were above threshold except for site 030 on September 9 with a reading of zero.



Environmental DNA (eDNA) - Our water quality testing expanded in 2022 to include a pilot program collecting eDNA from our 3 watersheds. Our samples were tested for fish and phytoplankton.

No DNA of fish species were found in either sample AHL010 or AHL010 Duplicate.

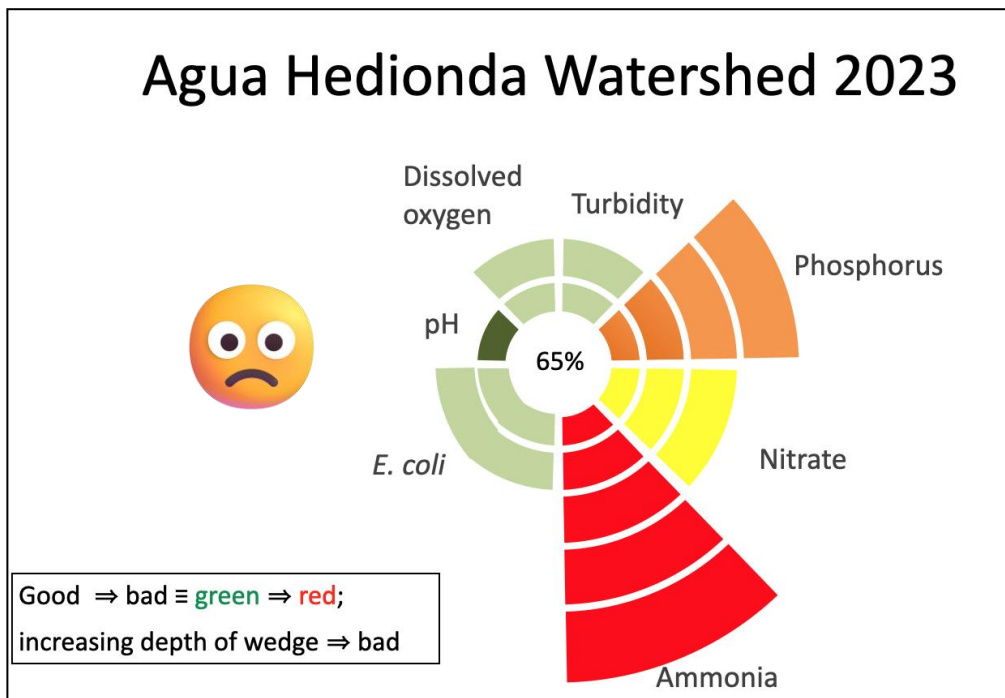
One Phytoplankton family was found in AHL010 Duplicate.

Date	Site	Phytoplankton family
11/04/2023	AHL010 Duplicate	Melosiraceae

Water Quality Report Card:

A composite of water quality data can be viewed in a “fan” diagram. A fan diagram is useful as a big picture of the watershed’s overall health, or it can be used to illustrate the health of each test site. The water quality fan diagram was generated from scores (0-5) for each of the seven parameters with an established threshold (pH, DO, turbidity, TP, nitrate, ammonia, and *E.coli*) for each site as well as the watershed as a whole. A composite ranking (as a percentage) is computed from the weighted averages of all parameter scores (with *E. coli* weighted double). Rankings are arbitrarily classified as follows: 90-100% (Excellent); 80-89% (Good); 70-79% (Fair); 60-69% (Poor); >60% (Terrible). The design for the Fan Diagrams is credited to [InfoDiagram](#). Fan diagrams were first added to the WQ Report in 2022.

A composite diagram for the Agua Hedionda Watershed for 2023 is displayed below. The diagram includes data from the three test sites and six test dates. Overall, the Agua Hedionda Watershed scored a grade of Poor. Ammonia stands out as the parameter most in need of improvement. Phosphorus and nitrogen also show a

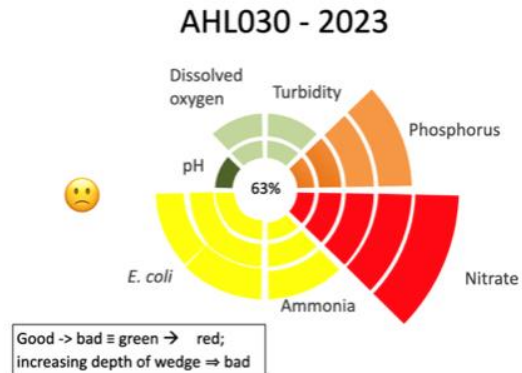


need for improvement.

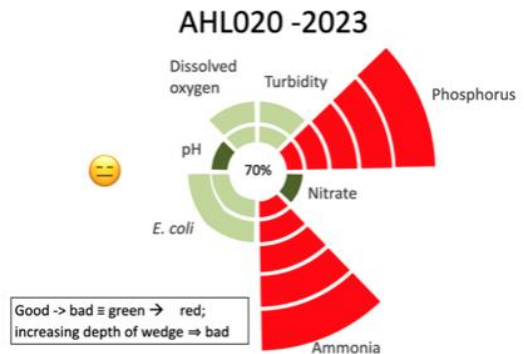
We chose to display the individual site fan diagrams from upstream to downstream so one can visual what happens as the water flows through the watershed. Site AHL030 (being the furthest inland) to AHL010 (most coastal). For more details on each site location, see page 6 of this report.

The fan diagrams help one to visual the differences among the three sites. This is especially evident for nitrate which has a red wedge site AHL030 but has green wedges at sites AHL010 and AHL020.

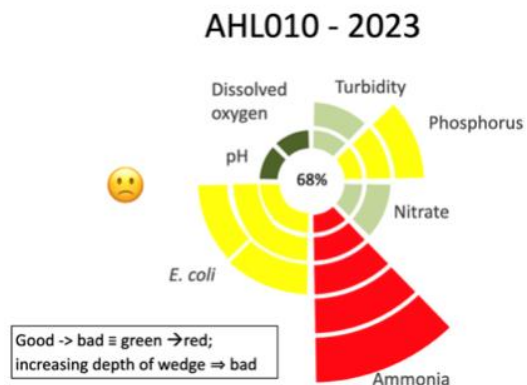
Site AHL030 had a score of Poor at 63% overall. This site is located at south Melrose in Vista under the 78 Freeway bridge. Nitrate is a parameter of highest concern which is denoted by the red wedge.



Site AHL020 has a score of Fair at 70% overall but phosphorus and ammonia are parameters of highest concern which are denoted by red wedges. This site is located at Calavera Creek in the Lake Calavera Preserve in Carlsbad.



Site AHL010 had a score of Poor at 68% overall. This site is located at the eastern end of lagoon before recreational areas. Ammonia is parameter of highest concern which is denoted by the red wedge.



The Water Quality Report Cards with accompanying Fan Diagrams are proving to be a useful tool for evaluating our watersheds and also making this data accessible to the general public.

Data Comparison With Previous Years

San Diego Coastkeeper's testing procedures and protocols continued to be followed after the testing was taken over by NSDCWMP.

Testing has become more consistent over the past 3 years which is important for data comparison with a few exceptions in 2020 and 2021 due to COVID restrictions at the time. Testing had been irregular from 2017 through 2019.

Dissolved Oxygen

Although DO did drop when water temperature was at its warmest in the months of July and September, DO remained above threshold for all readings throughout the 2023 year. This was in contrast to previous years when DO consistently dropped below threshold level in July and September. We examined specific water temperature data for past and present to determine if 2023 water temperatures may have been cooler in those months. After going back through prior years' water temperatures for July and September, that does not appear to be the cause of the above threshold readings.

pH

pH continued to fall within the acceptable range for all of 2023; which is consistent with all of the previous testing years. (There was one exception in 2020 as site AHL 010 had one measurement slightly below the acceptable range in September.)

Turbidity

Turbidity measurements for 2023 are similar to past years. The two values that were above threshold were within sites AHL020 (See comments on testing site for this date which describe flooded bridge and stagnant water) and AHL030. In previous years, one or two readings have been above threshold in sites AHL020 and/or AHL030. Site AHL010 continues to remain below threshold for all sampling data.

E. coli

This year showed above threshold for one date at each site but there is not an identifiable reason for the readings. This is similar to results from prior years.

Total Phosphorus

Total phosphorus continues to be difficult to compare time of year and over years. The measurements do not appear to follow any trends overtime. We continue to see over threshold values at all sites and varying times of year. This indicates non-point sources of pollution.

Nitrates

There does not appear to be any consistency or trends in nitrate values from year to year but each year continues to have values over threshold. This indicates non-point sources of pollution.

Ammonia

Above threshold values for ammonia continue to be a problem at all three test sites in 2023 as it has been in years past. This will continue to be a concern. There does not appear to be any consistency in the values which indicates non-point sources of pollution.

Water Quality Report Card

The overall water quality of the watershed dropped from a Fair rating to Poor. This is only the second year that we have used this evaluation tool so it is too early to look for trends but phosphorous and ammonia stand out in both report cards as the parameters most in need of improvement—though they are both worse in 2023. *E. coli* and DO improved in 2023 but nitrogen was worse.

The Water Quality Report Card is quite variable with each year and between 2022 and 2023. Hopefully some trends will become evident over the next few testing years. See **Appendix B** for 2022 report cards.

Appendix A: Site Photos taken by Volunteer Team

Site AHL010



July 1 2023



**November 4 2023: Left photo upstream, right photo downstream
Appendix A: Site Photos taken by Volunteer Team**

Site AHL020

Views from the bridge

Agua Hedionda Creek Annual Report 2023

July 1 2023



November 4 2023

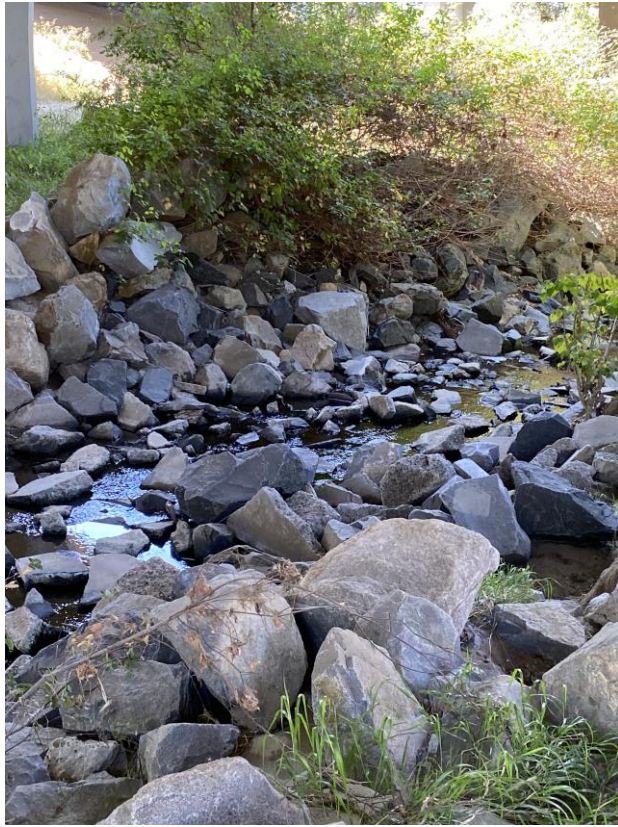


Appendix A: Site Photos taken by Volunteer Team



Site AHL030

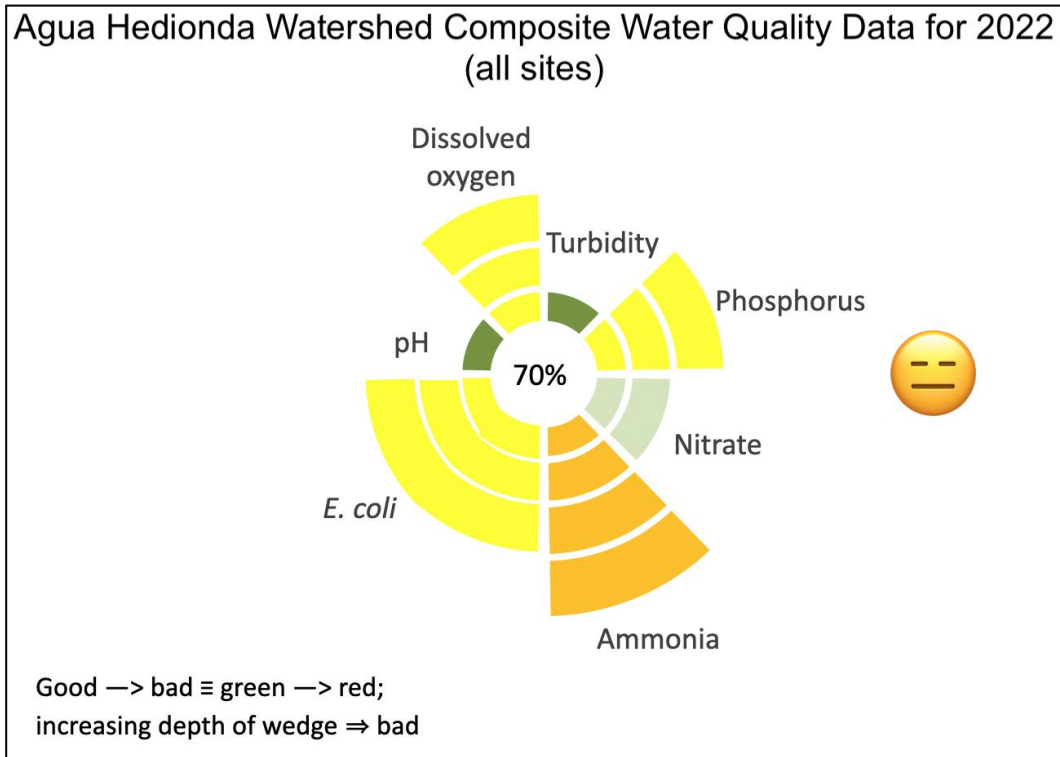
July 1 2023



November 4 2023

Appendix B: Radial Fan Diagram Report Card

A composite diagram for the Agua Hedionda Watershed for 2022 is displayed below. The diagram includes data from the three test sites and six test dates. Overall, the Watershed scored a grade of Fair. Ammonia stands out

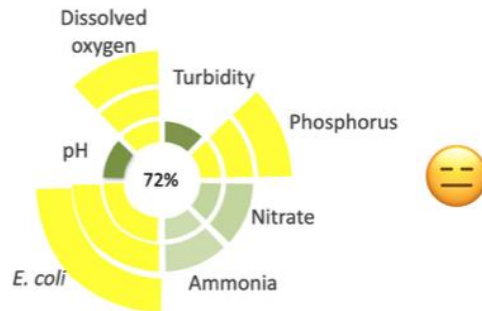


as the parameter most in need of improvement. E. coli, TP and DO are also in need of improvement.

Appendix B:
Diagram Report

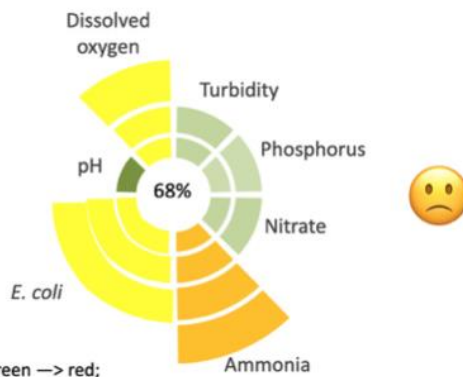
Radial Fan
Card

AHL030 Site 2022



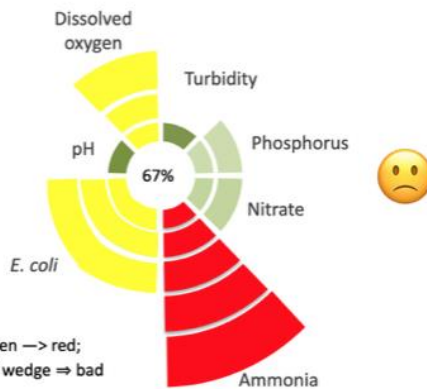
Good → bad ≡ green → red;
increasing depth of wedge ⇒ bad

AHL020 Site 2022



Good → bad ≡ green → red;
increasing depth of wedge ⇒ bad

AHL010 Site 2022



Good → bad ≡ green → red;
increasing depth of wedge ⇒ bad