



Coastal Water Quality Report

2016 | 2021

'A 'ohe hana nui ke alu 'ia

No task is too big when done together by all

('Ōlelo No'eau 142)

the quality of our water = the quality of life



Authors:

Dana Reed, Quality Assurance Officer, Hui O Ka Wai Ola

Kim Falinski, Coastal and Estuarine Scientist, The Nature Conservancy

Tiara Stark, Senior Team Lead, Hui O Ka Wai Ola

Tova Callender, Watershed and Coastal Management Coordinator, West Maui Ridge to Reef Initiative

© 2022 Hui O Ka Wai Ola

Reproduction of this publication for educational or other non-commercial purposes is authorized without prior permission. Reproduction for resale or other commercial purposes is prohibited without prior written permission. Photographs are subject to copyright laws.

Suggested citation: Hui O Ka Wai Ola. 2022. Coastal Water Quality Report 2016-2021. 34 pp.

Table of Contents



Summary	4
Key Findings	5
Turbidity	6
Nitrates	7
Key Findings: West Maui	9
Honolua to Kahana	10
Kā'anapali	13
Lāhaina	16
Olowalu to Pāpalaua	18
Key Findings: South Maui	20
Mā'alaea to North Kīhei	21
South Kīhei	25
Wailea to 'Āhihi-Kīna'u	
Natural Area Reserve	28
What You Can Do	31
Mahalo	32
References	33

Summary



© Polanui Hiu



© Bill Rathfon



© Bruce Forrester

Our health and quality of life are directly tied to the health of the ocean.

We rely on coastal waters and coral reefs for flood protection, food, jobs, and recreation. In turn, coral reefs and the marine life they support rely on healthy coastal waters.

These waters, however, are often degraded by land-based pollutants, including sediments, fertilizers, and wastewater. Ongoing water quality testing allows us to monitor these pollutant levels and focus efforts to reduce them in the places that need it most.

Hui O Ka Wai Ola (Association Of The Living Waters) – a group of scientists and community volunteers – monitor water quality along 40 miles of Maui’s leeward coast, from Honolua Bay to Pāpalaua and from Mā’alaea to ‘Āhihi-Kīna’u Natural Area Reserve. Our efforts are coordinated by the Maui Nui Marine Resource Council (MNMRC), The Nature Conservancy (TNC), and West Maui Ridge to Reef Initiative (R2R) and supplement Hawai’i Department of Health (DOH) monitoring. Our work is funded by generous individuals, businesses, and organizations.

Since 2016, we have collected and analyzed over 3,200 water quality samples from 48 sites, confirming that high levels of turbidity and nitrates are prevalent along the leeward Maui coast. This report summarizes our findings and includes recommendations for reducing pollutant levels.

Hui O Ka Wai Ola testing protocols align with DOH standards. The data we collect supplements DOH data for expanded understanding of coastal waters. Our data is available to researchers, advocacy groups, and the public at huiokawaiola.com, PaclOOS, and Zenodo.

Key Findings

Turbidity levels *always exceed* DOH standards.

Turbidity is a measure of water clarity. High turbidity levels in leeward Maui are associated with coastal erosion and rains that carry sediments from streams and gulches to coastal waters. Turbidity levels can also be elevated when previously deposited sediments are disturbed and recirculate (aka resuspension). Elevated turbidity associated with rainfall often prompts brown water advisories, and consistently high turbidity is damaging to corals.

Nitrate levels *often exceed* DOH standards.

Elevated nitrate levels at leeward Maui sites are associated with fertilizers and wastewater that seep into groundwater systems and emerge through springs on the ocean floor. Elevated nitrate levels can cause algae blooms and smother, weaken, and kill coral reefs.

Turbidity in West Maui

- Far exceeds DOH standards from Honolulu to Pāpalaua.
- Increasing over time in northern West Maui, as coastal erosion worsens with sea level rise.
- Pōhaku has highest level of turbidity driven solely by coastal erosion in West Maui.
- Declined at Camp Olowalu.
- Increased at Ukumehame.

Turbidity in South Maui

- Moderately high from Mā'alaea Harbor to South Kīhei.
- Much lower from Wailea to Mākena, yet still exceed DOH standards.
- Highest at Waipu'ilani Park, where levels are 2x higher than other South Maui sites.
- Brown water caused by coastal erosion and storms is a concern from Mā'alaea to North Kīhei.

Nitrates in West Maui

- Far exceed DOH standards at Kapalua, Ka'ōpala, Nāpili, Pōhaku, and Hanaka'ō'ō (Canoe Beach), though levels at Kapalua have dropped significantly in the last two years.

Nitrates in South Maui


- High from Mā'alaea Harbor to South Kīhei.
- Highest at Cove Park, where levels are more than 2x higher than any other leeward Maui site.
- Levels from Mā'alaea to North Kīhei are second only to Cove Park.
- Consistently low at Keālia Pond.

Turbidity in Leeward Maui

At-A-Glance



0.31 NTU



The DOH standard for turbidity is 0.2 NTU. Our data show levels of 6.0 NTU or higher at five West Maui sites.



1.14 NTU

Our monitoring over the past six years (2016-2021) has confirmed high rates of turbidity in leeward Maui coastal waters. High turbidity diminishes water quality and threatens coral reefs.

Turbidity is a measure of water clarity. High turbidity levels in leeward Maui are associated with coastal erosion, rains that carry sediments to coastal waters, and resuspension.

Agriculture, ungulates, and wildfire disturb soils, which are deposited into streams and gulches and carried to coastal waters by rains.



Coastal erosion – the wearing away of land, wetlands, beaches, and dunes – is exacerbated by the impacts of climate change, including sea level rise and more intense weather events (e.g., storms, extreme tides, etc).



Resuspension occurs when previously deposited sediment is agitated (e.g., by tides, waves, etc.) and redistributed in the water column.



Turbidity levels across leeward Maui are higher than the DOH standard (indicated by the dotted red line on bar charts throughout this report), with the highest levels in West Maui from Honolua to Pāpalaua and the lowest levels in South Maui from Wailea to 'Āhihi-Kīna'u Natural Area Reserve.

Nitrates in Leeward Maui *At-A-Glance*



© Jolene Dorné



© R2R



© Liz Foote



© Wendy Osher

Our testing revealed nitrate levels often exceed the DOH standard. Elevated levels of nitrates (short for nitrate-nitrite nitrogen) promotes the growth of algae, which competes with coral and can weaken or smother the coral reef structure.

Elevated nitrates in leeward Maui are associated with fertilizer use and contamination from wastewater. Nitrates seep into groundwater systems and enter coastal waters through springs in the ocean floor. They can also be carried to coastal waters in streams and runoff.

Nitrates associated with historic or legacy agriculture can take decades to make their way through groundwater systems, and there are no proven ways to reduce their levels or impacts.



Studies show evidence of wastewater in coastal waters in proximity to aging sewage infrastructure (e.g., cesspools, septic systems, injection wells, wastewater treatment facilities).



Nitrate levels across leeward Maui often exceed the DOH standard (indicated by the dotted red line on bar charts throughout this report), with the highest levels in South Maui at Cove Park (twice as high as other sites) and the lowest levels at Keālia Pond and Mākena State Park.

Our Data

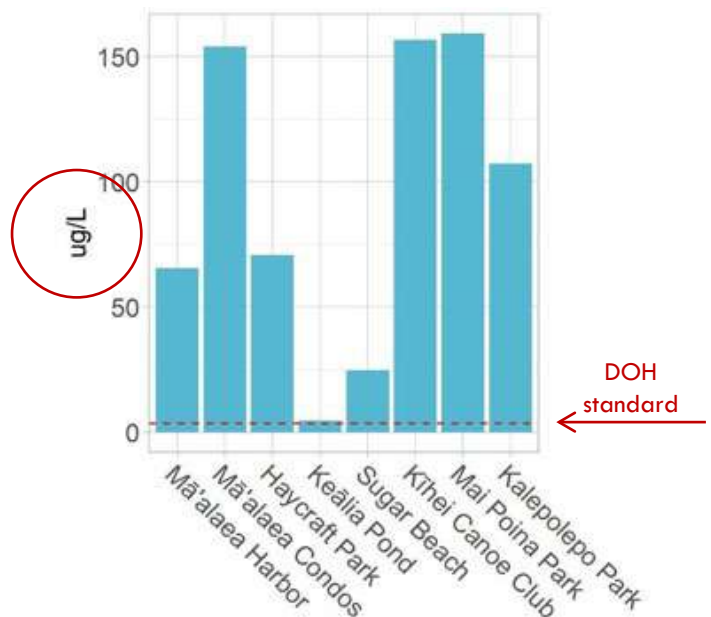
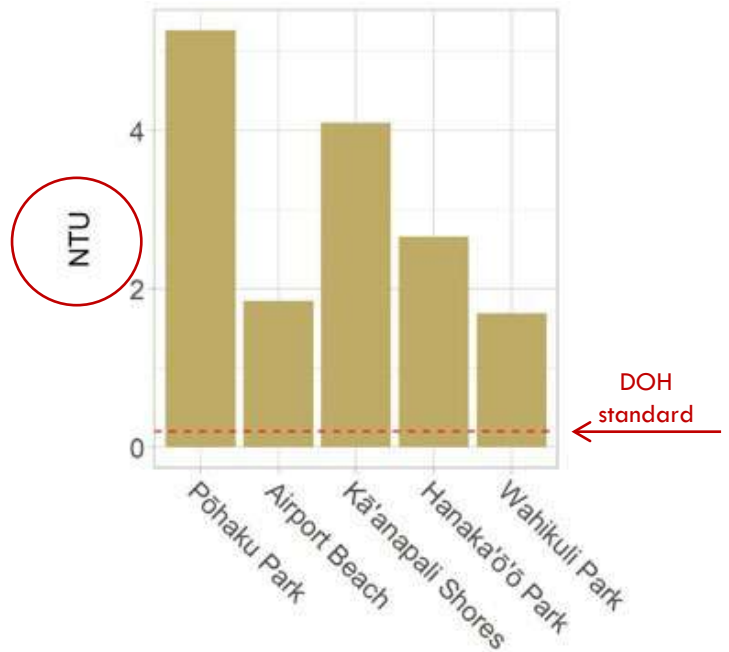
Turbidity and nitrate data are presented in bar charts (like those at right) using measurements consistent with DOH protocol – NTU, ug/L, and geomean, the preferred method for calculating the average.

Trained water quality monitoring volunteers use a hand-held electronic instrument to measure nephelometric turbidity units or NTU, a common measure of turbidity.

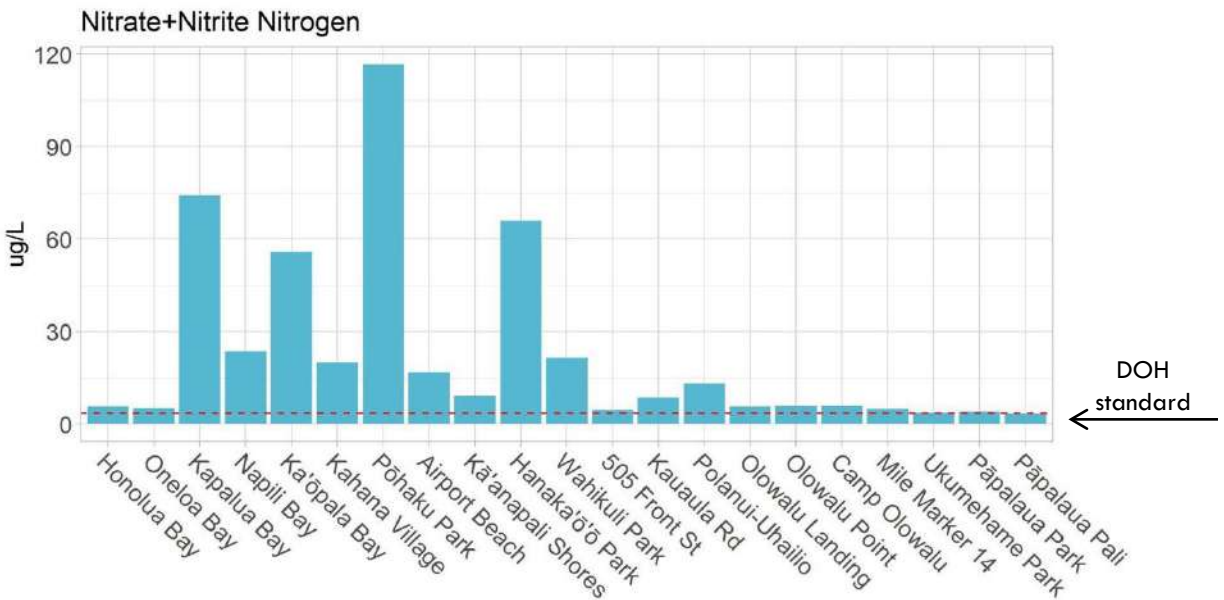
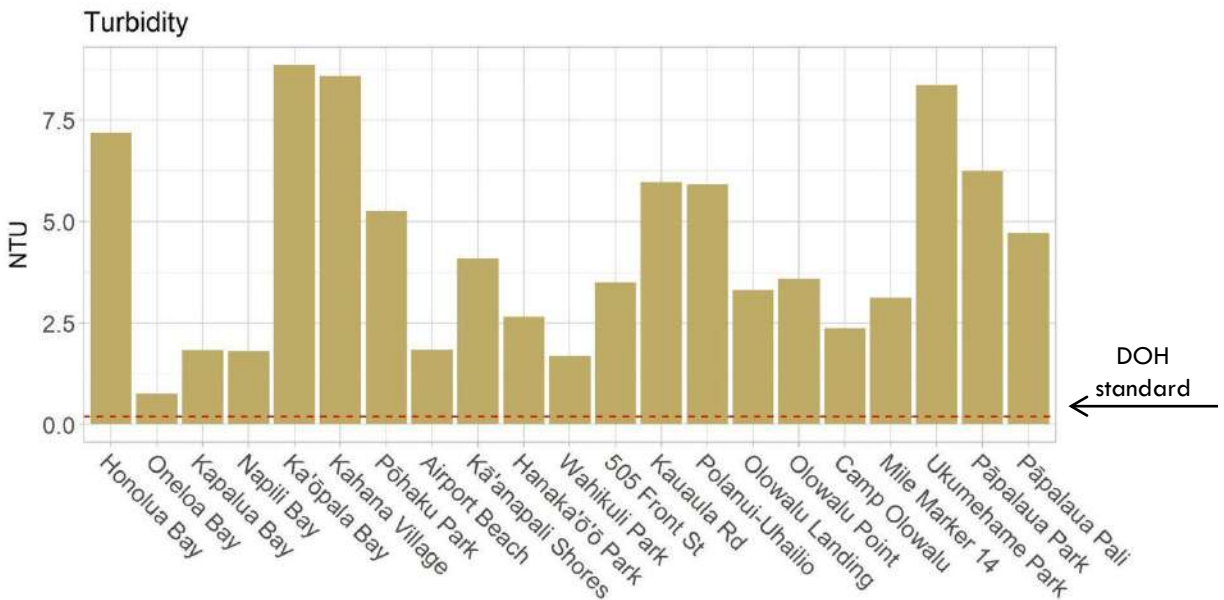
Water samples are sent to labs where nitrate-nitrite nitrogen levels are measured. The geomeans represent ug/L, or micrograms per liter.

The DOH standard for these pollutants – indicated by the dotted red line on each graph – reflect minimal pollutants and pose no threats to marine or human life.

While elevated levels of turbidity and nitrates may occasionally prompt brown water advisories in leeward Maui, they generally do not pose a threat to human health. However, consistently elevated levels do promote algae growth and coral disease, which diminish the health and structure of coral reefs. High turbidity can smother a reef and prevent juveniles from settling.



Turbidity levels far exceed the DOH standard in West Maui. In contrast nitrate levels far exceed in only a few places, but overall are closer to the DOH standard. The following pages include highlights of our findings and recommendations for reducing turbidity and nitrate levels.



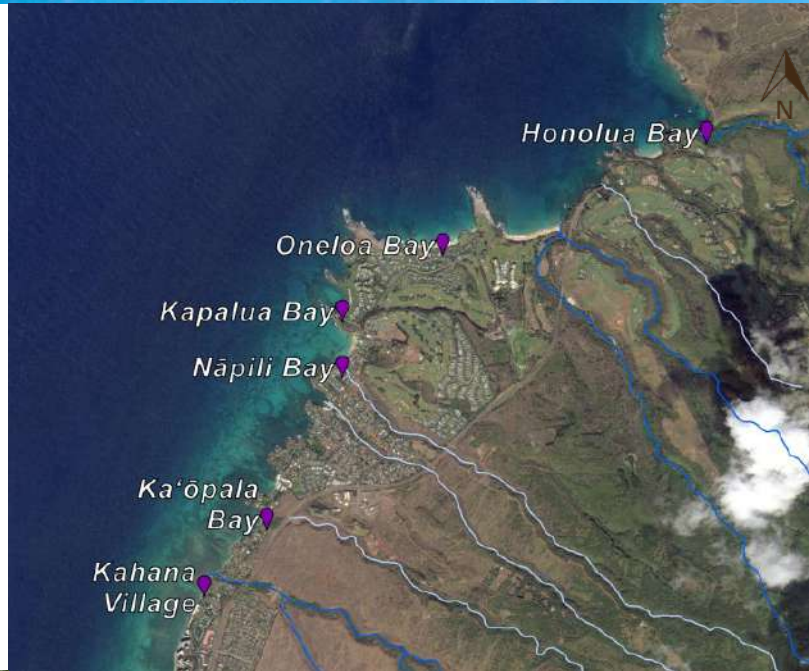
Honolua to Kahana At-A-Glance

Partners in Action

- The West Maui Ridge to Reef Initiative
- Nāpili Bay and Beach Foundation
- Pu'u Kukui Watershed Preserve

Coastal Areas

Six sites (see map at right) in the Honolua, Honokahua, and Kahana watersheds.



Common Features

- Limited coastal development
- Higher rainfall
- Concentration of legacy agriculture and elevated nitrates
- Remnant coral reef with extensive reef loss, evidenced by remaining hard bottom structure
- Series of bays

Key Findings

- Turbidity levels are highest at Honolua, Kahana, and Ka'ōpala Streams.
- Fertilizer and wastewater are likely reasons for elevated nitrates at Kapalua, Ka'ōpala, and Nāpili.
- Turbidity at Nāpili and Kapalua is increasing as coastal erosion worsens.
- Nitrates at Kapalua Bay have dropped following sewage upgrades.

DID YOU KNOW?

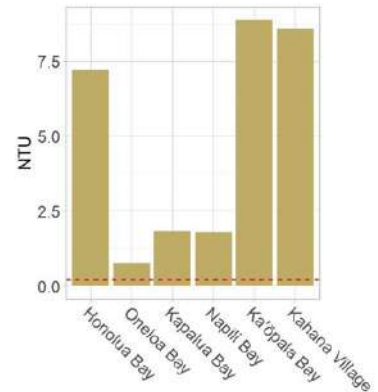
Agricultural practices used for 100+ years introduced more than 10x the naturally occurring levels of sediment into stream beds and banks.

This sediment likely led to extensive reef loss, evidenced by remaining hard bottom structure, and will continue to make its way through the system for an unknown period.



AREAS OF CONCERN

- ✓ Honolua Stream
- ✓ Kahana Stream
- ✓ Ka'ōpala Stream



WHAT WE CAN DO

Work with the County to retrofit basins to trap additional sediment at Ka'ōpala and Kahana, recognizing that this entails high permitting, construction, and maintenance costs.

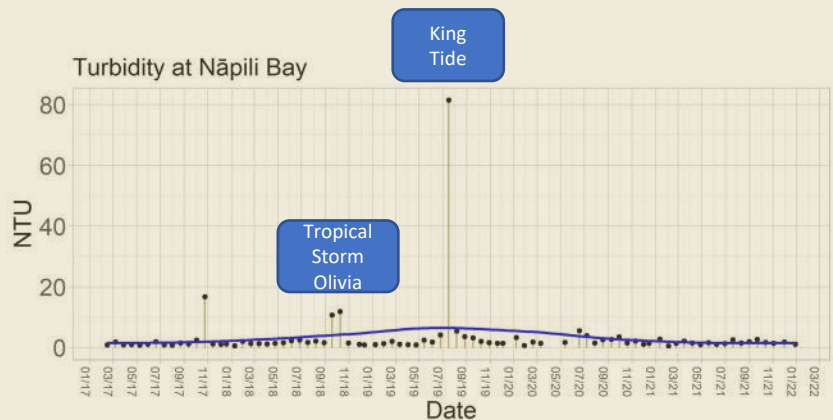
Develop and maintain a culturally appropriate sediment capture system in the dry gulch of Papua, which connects to Honolua Stream.

AND...

Wave run-up events, such as king tides and high surf, exacerbate coastal erosion and turbidity, both of which are increasing as sea level rises.



TREND OVER TIME



Spikes in turbidity at Nāpili (above) are increasing due to coastal erosion, not storms.

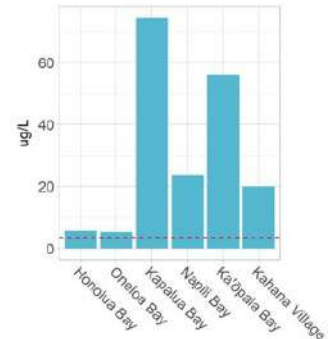
DID YOU KNOW?

There are no proven approaches to reduce nitrates from legacy agriculture that are in groundwater.



AREAS OF CONCERN

- ✓ Kapalua
- ✓ Ka'ōpala
- ✓ Nāpili



WHAT WE CAN DO

Collaborate with researchers on additional testing to confirm the source of nitrates (e.g., legacy agriculture vs. current fertilizer use or sewage infrastructure, which can be managed).

Continue testing to confirm the decreasing trend at Kapalua.

AND...

Excess nitrates promote the growth of turf algae and weaken the reef structure, which reduces its resilience.



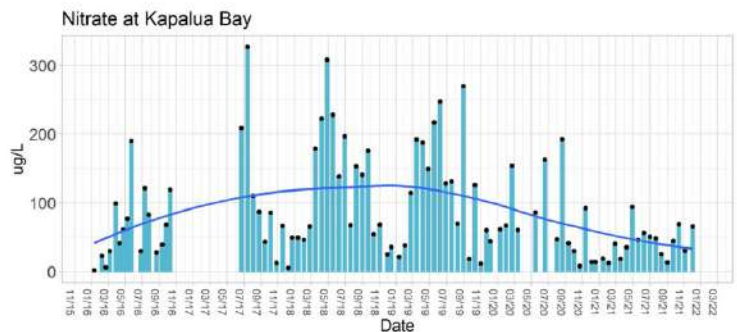
© R2R

AND...

Aging sewage infrastructure along the Nāpili coast was believed to be leaking. Water quality testing confirmed the presence of wastewater at Kapalua and Nāpili.



TREND OVER TIME



Nitrate levels at Kapalua dropped significantly since early 2019, when the County replaced aging sewer lines and lift stations.

Kā'anapali

At-A-Glance

Partners in Action

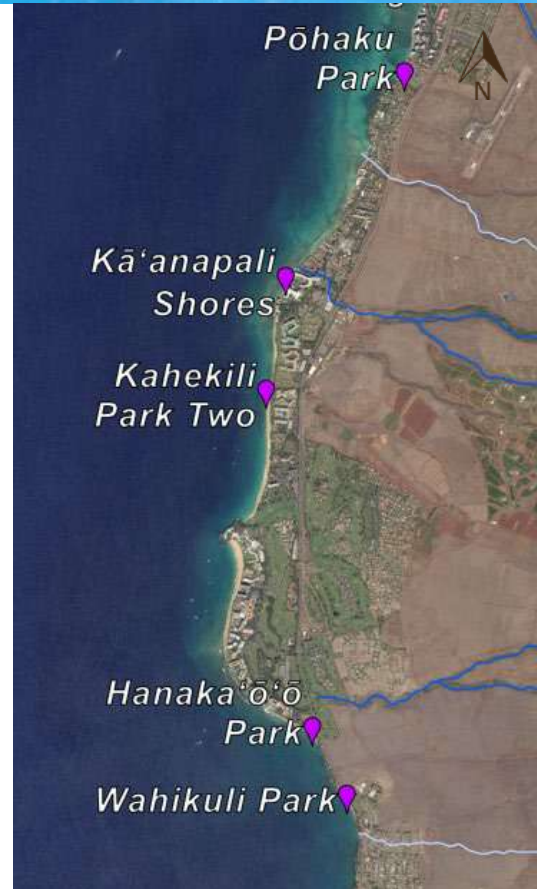
- The West Maui Ridge to Reef Initiative
- Mauna Kahālāwai Watershed Partnership
- The Coral Reef Alliance
- Ridge to Reefs

Coastal Areas

Five sites (see map at right) in the Honokōwai and Wahikuli watersheds.

Common Features

- Moderate coastal development
- Less rainfall at lower elevations
- Long, open stretches of coastline with select areas of high coastal erosion



Key Findings

- Pōhaku Park has the highest levels of turbidity and nitrates.
- Turbidity at Kā'anapali Shores is high, but declining.
- Nitrate levels at Hanaka'ō'ō (Canoe Beach) are second only to Pōhaku Beach Park.

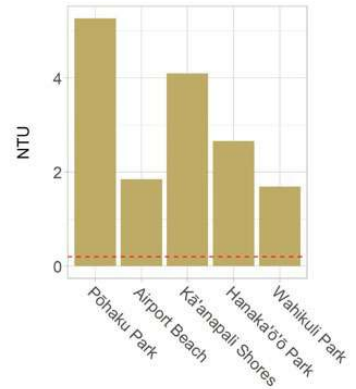
DID YOU KNOW?

The pace of coastal erosion and shoreline destabilization in this area is accelerating. Costly and complex short-term solutions to address this, such as shoreline hardening, result in beach loss and negative impacts on water quality and marine life. Further, the sea will continue to rise, so long-term solutions will need to be developed.



AREAS OF CONCERN

- ✓ Pōhaku
- ✓ Kā'anapali

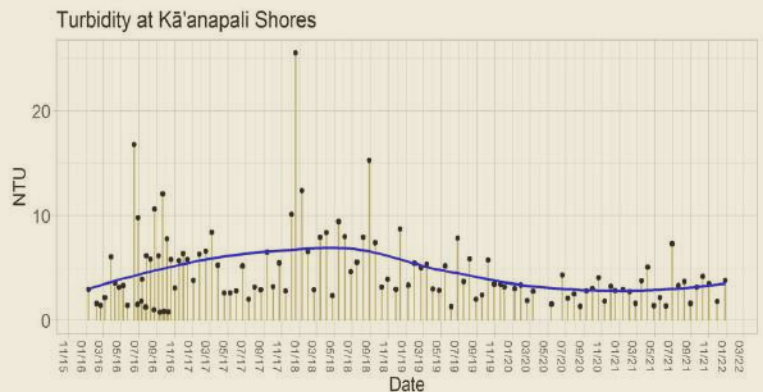


WHAT WE CAN DO

Stabilize the Pōhaku shoreline. An environmental review is underway to explore options for regional solutions for coastal erosion that could effectively lock-in the coastal soil deposits driving coastal erosion.

The County and agency partners are evaluating a retrofit to enable the retention basin above the highway to trap more fine particles since these are most damaging to coral health.

Turbidity in Honokōwai (at right) – driven by a combination of coastal erosion and storm runoff – is high but declining.



Possible reasons for declining turbidity in north Kā'anapali, especially at Honokōwai, include increased County maintenance of Honokōwai Dam (left) and, to a greater degree, temporary shoreline stabilization along the coast (right).



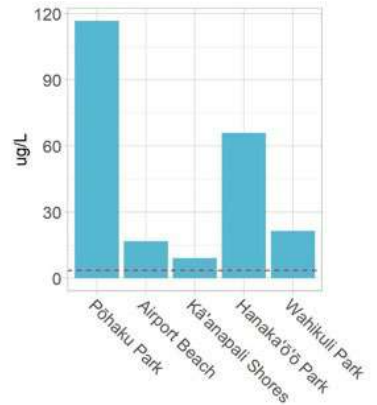
DID YOU KNOW?

Legacy nitrates from plantation agriculture that dominated the area's mid-elevation landscape continue to make their way to coastal waters, contributing to the elevated nitrate levels. This contribution will decline over time, as it did from Lāhaina to the Pali after sugarcane production ceased.



AREAS OF CONCERN

- ✓ Pōhaku (highest nitrates in West Maui)
- ✓ Hanaka'ō'ō (Canoe Beach)



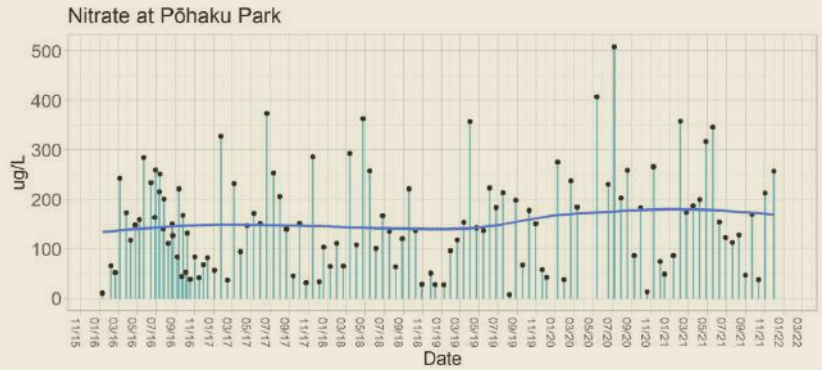
WHAT WE CAN DO

Collaborate with researchers on additional testing to confirm sources of nitrates and identify possible solutions for wastewater inputs.

Water quality testing indicates wastewater may also be contributing to high nitrates at Pōhaku.



TREND OVER TIME



Nitrate levels should continue to be stable year-over-year.



Lāhaina

At-A-Glance

Partners in Action

- Mauna Kahālāwai Watershed Partnership
- Polanui Hiu
- Lāhui Ho'okaulike I Ke Kai

Coastal Areas

Three sites (see map at right) in the Kaua'ula and Launiupoko watersheds.



Common Features

- Legacy agriculture (sugar) stopped ~30 years ago; no nutrient hot spots
- Moderate coastal development
- Relatively high turbidity, driven by stream input and low ocean circulation
- Relatively dry landscape
- Shore faces southwest

Key Findings

- There are high turbidity levels at all three sites.
- There are low and stable nitrate levels at all three sites.

Lāhaina

Turbidity & Nitrates

DID YOU KNOW?

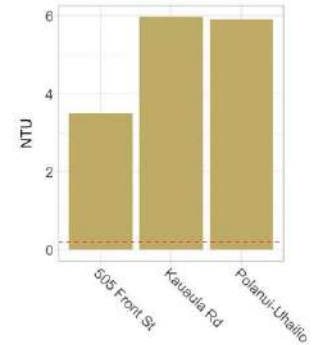
Kaua'ula stream contributes to turbidity in the Lāhaina area. Yet even with a reduction of sediment from the stream, turbidity will remain a problem for an extended period, as fine particles that become trapped in remnant reef structures near Kaua'ula Rd. are resuspended in the area between the reef and the beach.



Variability in turbidity is driven primarily by rainfall and resuspension of sediments from various nearshore activities.

AREAS OF CONCERN

- ✓ Kaua'ula Rd.
- ✓ Polanui-Uhailio



WHAT WE CAN DO

Include turbidity reduction goals in Lāhaina Watershed project led by the Soil and Water Conservation District that is rerouting Kaua'ula stream further south.

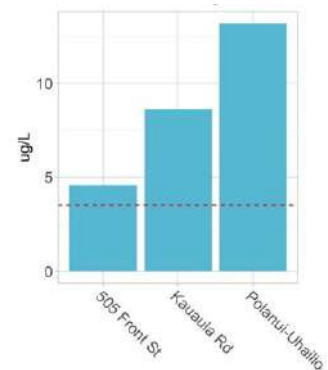
Increase circulation of water trapped on the coastal side of the reef to reduce resuspension of fine sediment.



© Dana Reed

TREND OVER TIME

Continuing low and stable nitrate levels, as we have seen moving south where plantation agriculture also stopped decades ago.



Olowalu to Pāpalaua

At-A-Glance

Partners in Action

- Mauna Kahālāwai Watershed Partnership
- The Nature Conservancy
- Kīpuka Olowalu



Coastal Areas

Seven sites (see map above) in the Olowalu, Ukumehame, and Pāpalaua watersheds.

Common Features

- Sugarcane farming stopped several decades ago; no nutrient hot spots – nutrients stable and low, low groundwater inputs
- Limited coastal development
- Relatively high turbidity caused by a combination of stream inputs, coastal erosion, and low ocean circulation
- Relatively dry landscape at lower elevations, with perennial streams upland
- Shore faces southwest

Key Findings

- This area has high turbidity, with the highest levels from Ukumehame to the Pali.
- Turbidity has increased at Ukumehame.
- Turbidity has decreased at Camp Olowalu.
- Nitrate levels in the area are low and stable.



Olowalu to Pāpalaua

Turbidity

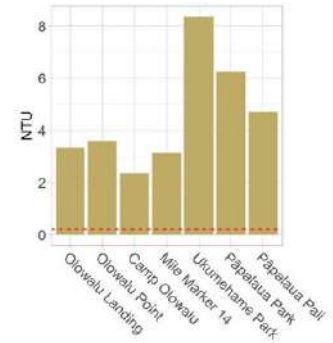
DID YOU KNOW?

Though sediment from Ukumehame and Olowalu Streams can be reduced, the recirculation or resuspension of sediments already in the water will continue to result in moderately high turbidity levels year-round. In addition, coastal erosion from waves will continue to contribute to turbidity.



AREAS OF CONCERN

- ✓ Ukumehame
- ✓ Pāpalaua Park



WHAT WE CAN DO

Improve upland management, including fire control and ungulate (especially axis deer) management, to prevent additional sediment inputs during storms.

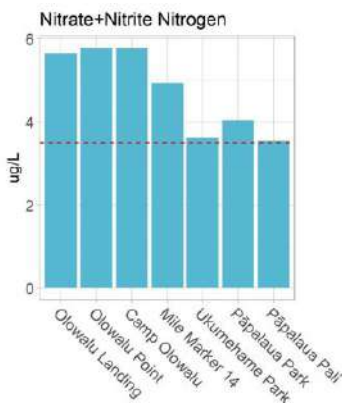
Advocate for the restoration of wetlands and retention basins to capture sediment in the Olowalu-Pāpalaua area.

Continue monitoring to detect changes in nitrate levels as ongoing development in the area may result in an increase of nitrates.

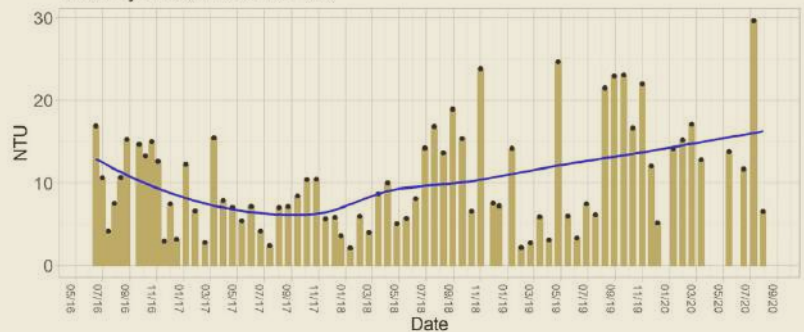
TRENDS OVER TIME

Current turbidity and historic nitrate trends suggest:

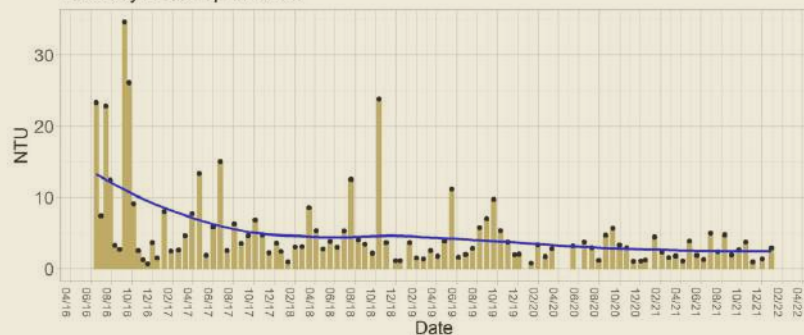
- ✓ Continued high turbidity at Ukumehame (top right)
- ✓ Continued low turbidity at Camp Olowalu (bottom right)
- ✓ Continued low and stable nitrate levels (below)



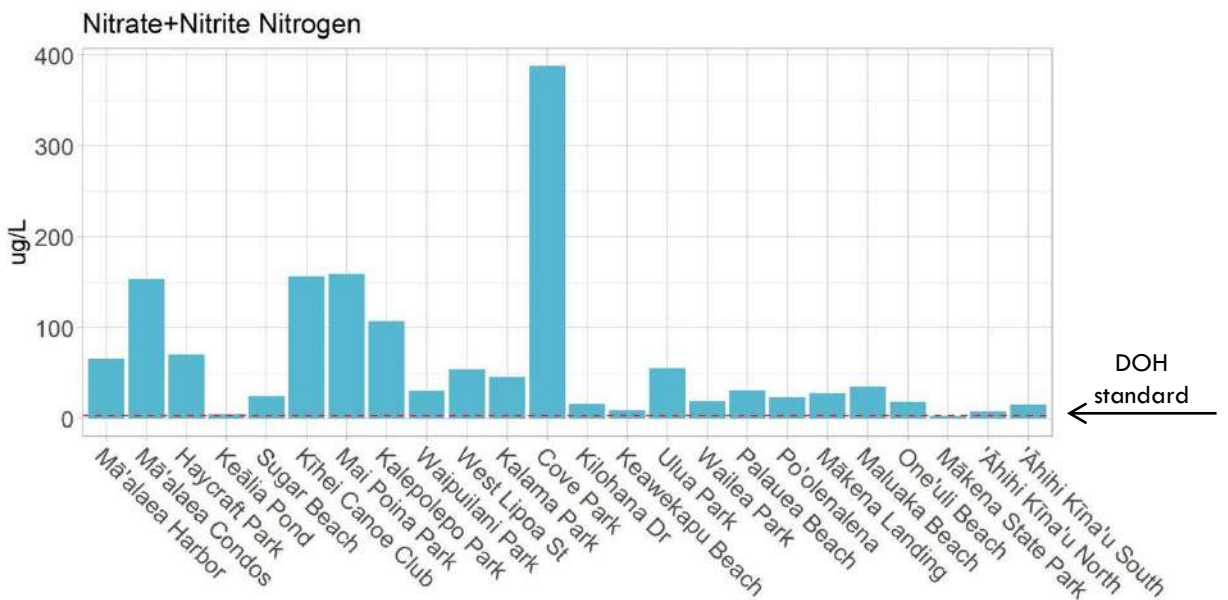
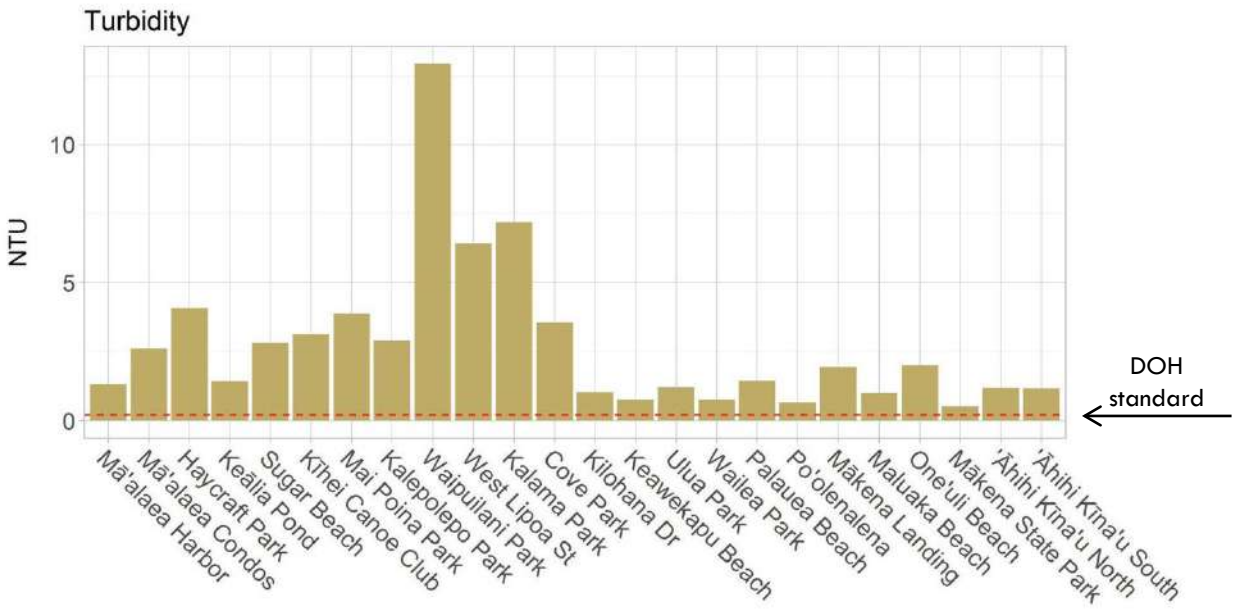
Turbidity at Ukumehame Park



Turbidity at Camp Olowalu



Nitrate levels often exceed DOH standards in South Maui. Our data confirmed high nitrate levels from Mā'alaea to South Kīhei, peaking with very high levels at Cove Park, as well as moderately high turbidity across this same area. Though levels still exceed DOH standards, overall water quality is much better from Wailea to 'Āhihi-Kīna'u Natural Area Reserve. The following pages include highlights of our findings and recommendations for reducing nitrate and turbidity levels.



Mā'alaea to North Kīhei At-A-Glance

Partners in Action

- Maui Nui Marine Resource Council
- Central Maui Soil and Water Conservation District

Coastal Areas

Eight sites (see map at right) in the Pōhākea, Waikapū, Waiakoa, and Hāpapa watersheds.



Common Features

- All sites located within Mā'alaea Bay, downstream of former sugar cane and current farming operations
- Several private wastewater injection wells managed by condo associations in Mā'alaea area
- Downstream of potential surface sources of freshwater flow (e.g., gulch, runoff, storm drain) during storm events to all sites except Haycraft Park

Key Findings

- Brown water caused by coastal erosion and storm events is a concern, especially at Haycraft Park and Mai Poina Park.
- The area has some of the highest nitrate levels in leeward Maui, second only to Cove Park.
- Indicators of wastewater were highest near the harbor and boat ramp.
- Nitrate levels at Keālia Pond are consistently low.

DID YOU KNOW?

Steady erosion along this shoreline over the past couple of years has increased turbidity in the coastal zone and exposed dark red mud under the sand that gets churned up, especially during swell events.

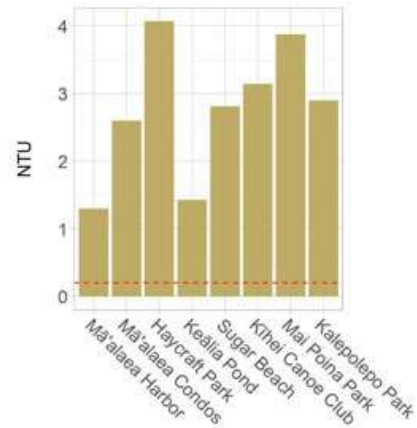
AND...

Areas makai of fire-prone landscapes or those eroded by large herds of axis deer, such as Kalepolepo and Mai Poina, experience higher turbidity during rainstorms.



AREAS OF CONCERN

- ✓ Haycraft Park
- ✓ Mai Poina Park



WHAT WE CAN DO

Install fire breaks and protect highly erosive areas above Mā'alaea and mauka of the highway in North Kīhei.

Support landowners' desires to reduce ungulate populations and restore vegetation on eroded landscapes.

To reduce coastal erosion, advocate for dune restoration projects where sand exists and other technical solutions where it does not.

High waves at Mai Poina exacerbate coastal erosion, which increases turbidity.

TREND OVER TIME

Addressing coastal erosion is complex and costly. Build partnerships with landowners to identify appropriate solutions and compel non-regulatory actions.

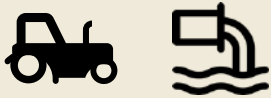


DID YOU KNOW?

Nitrate levels at sites makai of historic sugarcane farming are expected to decline. However, returning to pre-plantation era nitrate levels may take decades given the longevity of legacy agricultural fertilizers and the fact that groundwater can take anywhere from 10-100 years to reach coastal waters.

AND...

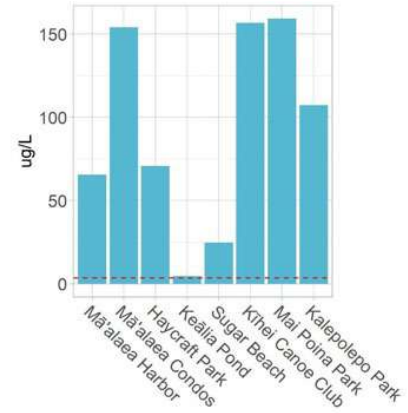
Outdated wastewater systems like injection wells, cesspools and septic tanks are also a source of nitrates.



This area has some of the highest nitrate levels in leeward Maui, second only to Cove Park.

AREAS OF CONCERN

- ✓ Kīhei Canoe Club
- ✓ Mai Poina Park
- ✓ Kalepolepo Park



WHAT WE CAN DO

Upgrade technology to reduce nitrate inputs from injection wells.

Investigate wastewater facilities (including possible cesspools, and septic systems) at Mā'alaea Harbor and boat ramp, where testing revealed indicators of wastewater.

Increase areas of natural retention (e.g., wetlands) that can absorb runoff and nitrates.

Continue monitoring to evaluate how land use change such as new agriculture or development impacts nitrate levels.



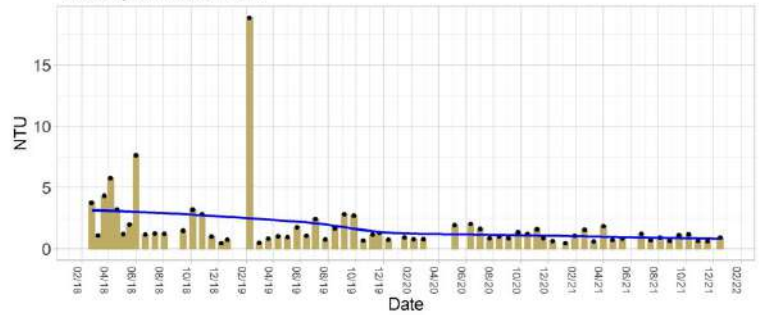
Only one site, Mai Poina (above), showed a statistical decrease over time.

DID YOU KNOW?

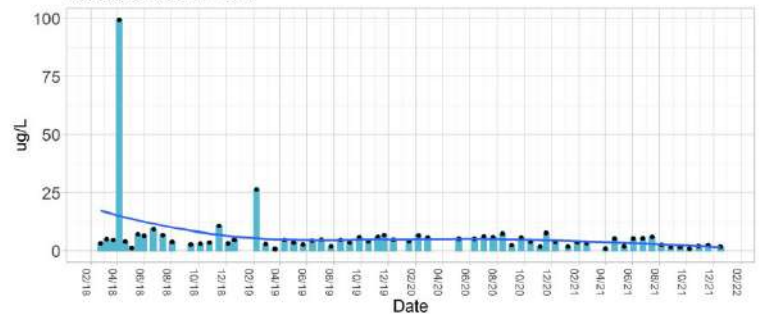
Restoration and maintenance of coastal habitats like wetlands and dunes – often called green infrastructure – are cost-effective solutions for coastal protection and for the reduction of turbidity and nitrates.

Functioning wetlands like Keālia Pond (below) protect coastal water quality by filtering and absorbing nitrates and sediment from freshwater flows, even in a place like South Maui where nitrates are abundant. Functioning wetlands also absorb storm surge and runoff.

Turbidity at Keālia Pond



Nitrate at Keālia Pond



Coastal waters at Keālia Pond have low levels of land-based pollutants, with rare unexplained exceptions (above).



Partners in Action

- Maui Nui Marine Resource Council
- South Maui Wetland Restoration Hui

Coastal Areas

Four sites (see map at right) in the Hāpapa watershed.

Common Features

- Significant coastal development
- Ranch lands mauka of highway
- Wetlands filled in for development, reducing the landscape’s ability to absorb water
- Large watershed with flashy streams that carry sediments to nearshore waters during heavy rains
- Channelization of waterways



Key Findings

- Turbidity levels at Waipu'ilani Park are twice that of other sites.
- Nitrate levels at Cove Park are the highest in leeward Maui – and more than twice as high as all other sites.

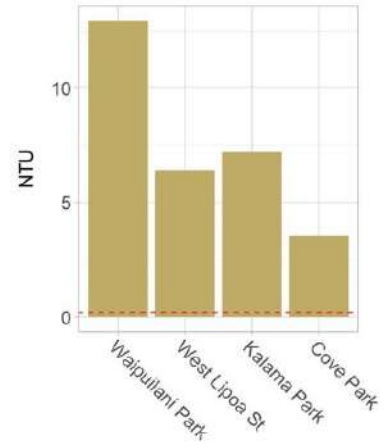
DID YOU KNOW?

Channels in Waipu'ilani gulch and an unnamed gulch flow through the central and northern portions of the beach park. Waipu'ilani gulch is prone to surface water flooding during heavy rainfall, whether rain is localized or mauka. Large amounts of sediment can be deposited into coastal waters after storm events and resuspend when there are waves.



AREA OF CONCERN

- ✓ Waipu'ilani Park



WHAT WE CAN DO

Remove herds of axis deer.

Stabilize erosion hotspots in grazing lands mauka of the highway.

Resuspension of sediment at Waipu'ilani Park from a rain event eleven days earlier (January 2017).

DID YOU KNOW?

Ungulate and erosion control work is costly, needs landowner commitment, and can require a water supply which is not readily available.



DID YOU KNOW?

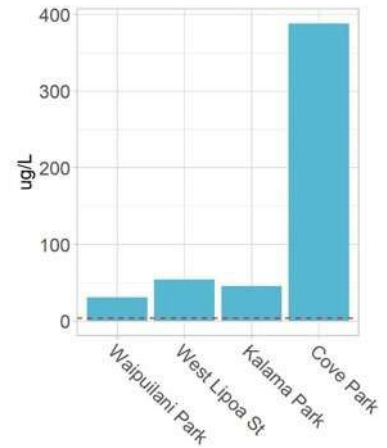
Studies show wastewater influence from the Kīhei Wastewater Reclamation Facility (WRF) – a likely driver of elevated nitrates – near Cove Park [Dailer 2010, Hunt 2007].

Nitrate levels at Cove Park have been consistent from 2017 to 2021, including during the COVID-19 pandemic.



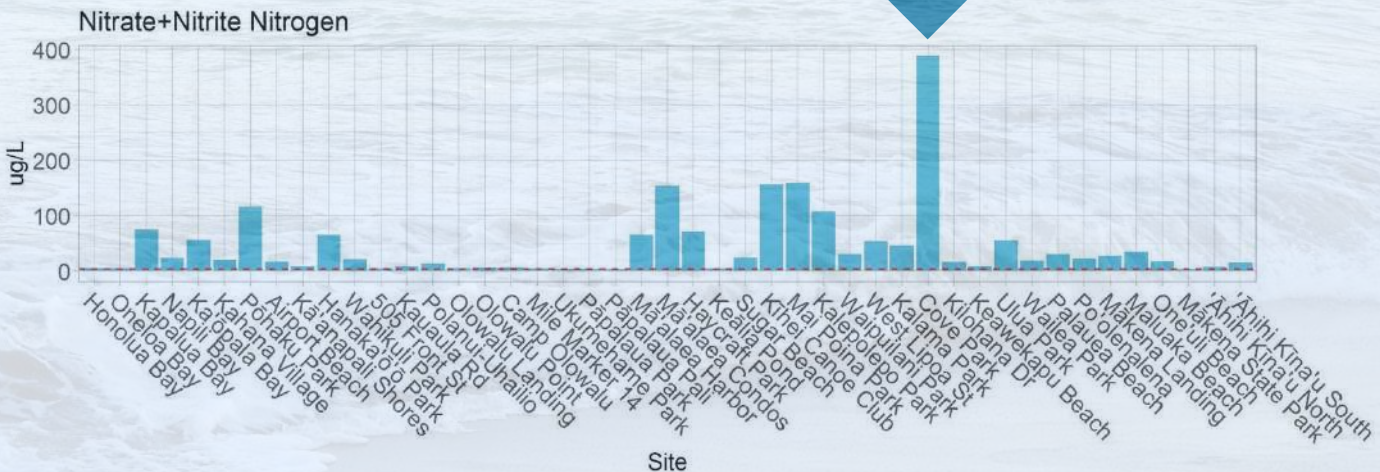
AREA OF CONCERN

- ✓ Cove Park – more than twice as high as all other sites



WHAT WE CAN DO

An HDR Engineering study conducted in 2018 recommended expanding reuse of and nitrate reduction treatment for R1 water, in line with previous efforts at the Lāhaina WRF. A pilot project to refine methods for alternate disposal is underway, and financial commitment must be secured for full implementation.



Wailea to 'Āhihi-Kīna'u

At-A-Glance

Partners in Action

- Maui Nui Marine Resource Council
- South Maui Wetland Restoration Hui

Coastal Areas

Fourteen sites (see map at right) in the Wailea, Mo'oloa, and 'Āhihi-Kīna'u Natural Area Reserve watersheds.

Common Features

- All west facing shores
- Similar land use in mauka areas
- Streams do not extend to the top of the mountain and only flow in heavy rain

Key Findings

- Relatively good water quality compared to all other regions of leeward Maui.
- Uluu Beach has much higher nitrate values than any other site in this area – and the 8th highest levels in South Maui.



DID YOU KNOW?

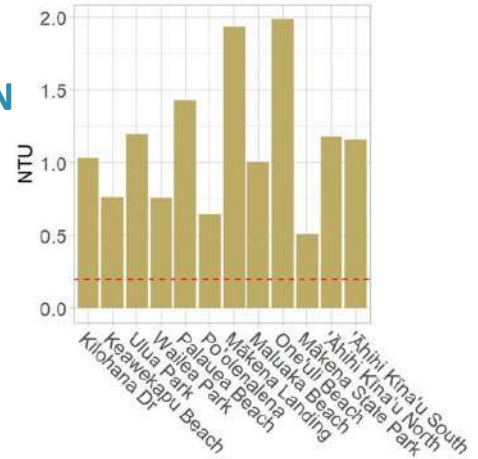
Recent studies revealed that the coral reef at Ulua Beach is currently among the most resilient in leeward Maui [Maynard et al., 2019].

Reducing overall pressures on the reef at this popular snorkel and fishing spot (e.g., trampling, harmful sunscreen, and overfishing of herbivores) can help maintain its resilience.

Turbidity levels in the area are so low on average that a snorkel partner 10 feet away will almost always be visible.

AREAS OF CONCERN

None for turbidity. Compared to the rest of leeward Maui, this area has good water clarity.



WHAT WE CAN DO

Monitor fishing effort and establish management rules to increase abundance of herbivores.

Reduce impacts of recreational activities on reefs through increased awareness, zoning, management rules, and enforcement.



DID YOU KNOW?

Contaminated groundwater is the likely source of nitrates at Ulua Beach, and nearby cesspools have not yet been upgraded.

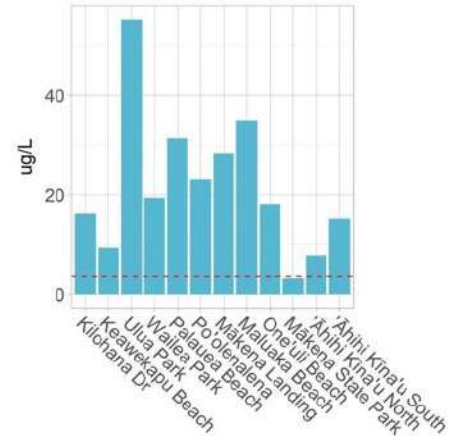
Despite the reef's resilience, it may continue to degrade due to these elevated nitrates, the lack of fisheries protections, recurring bleaching events, and chronic exposure to stressors (e.g., land-based pollutants).



Nitrate levels at 'Āhihi-Kīna'u North and South appear to be increasing, and there is evidence of pharmaceuticals at 'Āhihi-Kīna'u South, possibly from swimmers or from the large cesspool there.

AREA OF CONCERN

- ✓ Ulua Beach, with the highest nitrate level in this area and the 8th highest in south Maui



WHAT WE CAN DO

Consider upgrading cesspools in Maui Meadows to either sewer or advanced onsite treatment.

Explore improved stormwater practices in the suburban Wailea area.

Reduce impacts of recreational activities (see previous page).



How to Help



GET INVOLVED

Adopt a beach for water quality testing. Visit mauireefs.org/membership-and-giving/adopt-a-beach/ to learn more.

Volunteer with us. To find out how, contact huiokawaiola@gmail.com.

SUPPORT OUR RECOMMENDATIONS

Take action. This report includes a variety of actions we can take to reduce land-based pollutants and improve the quality of leeward Maui's coastal waters.

ADVOCATE FOR CHANGE

Share our findings, available at huiokawaiola.com/findings, with change-makers and decision-makers, and encourage supportive policies, actions, and funding to reduce the flow of land-based pollutants into coastal waters.

HELP US THRIVE

Donate to our efforts. Consider sharing your treasure to help cover Hui O Ka Wai Ola costs (e.g., equipment and supplies, lab processing, etc.). Visit huiokawaiola.com/join-us to make a donation.



TO OUR GENEROUS FUNDERS

Bayside Catering

County of Maui

Coastal Planners LLC

Da Hawaiian Store

Duke's Maui LLC

DWJ Smith Family Charitable Fund

Flatbread Company

Hawai'i Community Foundation

Hawaiian Paddle Sports

Hawai'i Tourism Authority

Host Hotels and Resorts

Jersey Mike's Subs

Ka'anapali Ocean Resort Charitable Trust

Lilly Pulitzer

Lush Fresh Handmade Cosmetics - Charity Pot

Honua Kai - West Maui Community Fund, Inc.

Marty Dread

Maui Sky Diving

Maui Brewing Company

Maui Classic Charters

Maui Ku'ia Estate Chocolate Inc.

Maui Marathon & Maui Half Marathon

Maui Ocean Center

Nāpili Bay and Beach Foundation

National Fish and Wildlife Foundation

North Beach - West Maui Benefit Fund Inc.

mediaThe foundation inc.

Pacific Whale Foundation

Plaza Home Mortgage

Pride of Maui

Robert F. Orr Foundation

The EACH Foundation

The GoodCoin Foundation/Target

The Makana Aloha Foundation

Vitalitea Hawai'i

Westin Ka'anapali Ocean Resort Villas

the participants in 100 Women Who Care - Maui
and many other private donors.

AND LAB PARTNERS

Hawaiian Island Humpback Whale National
Marine Sanctuary

Lāhainaluna High School

Pineapple Properties Maui LLC

TO OUR DEDICATED VOLUNTEERS

Alfred Wolf, Bill McLaughlin, Bob Sousa,

Charmaine Gallagher, CiCi Hehemann, Flo Bahr,

Harry Hecht, Jamie Kranberg, Jeep Dunning, Kathy Corcoran, Kit
Harris, Kristina McHugh, Kristy Gund, Lisa Berg, Lyn Hutchings, Maile

Sharpe, Mark Floyd, Scott Graves, Suzanne Bieser, Tabetha
Gonzalez, Ty Freiberg.

AND ALUMNI

Amber Coontz, Andrea Abromaitis, Ananda Stone,

Annalea Fink, Audrey Quinn, Ben Cone, Ben Karlsberg,

Bill Chase, Brenda Jarmakani, Deborah Rynak, Debra Caswell,

Donna Howard, Jim Maxwell, Jodi Kimmel, John Voorhis, Judy Jarvie,

Kathy Thunholm, Lauren Tyler, Layne Otomo, Lindsay Ranieri, Lori

Callnan, Lory Lowder, Lowell Reed, Margie Cyr, Marie & Terry

Schroeder, Michael Rybak, Michelle Griffoul, Nell Woods, Rene

Riley, Rich Bayly, Richard Noponen, Rick Cyr, Roxie Sylva, Scott

Splean, Seraph D'Alerta, Sheryl Cramer, Sheryl Fries, Steve Paselk,

Tara Miller, Tayler Saunders, Tiffany Morgan, Tina Wildberger.

SINCERELY,

THE HUI O KA WAI OLA 'OHANA

Steering Committee and Project Management Team

Alana Yurkanin, Amy Hodges, Bill Rathfon, Dana Reed,

Emily Fielding, George Burnette, Kim Falinski, Larry Stevens, Meredith

Beeson, Mike Fogarty, Mitch Brown, Nālei Sampson, Robin Newbold,

Tiara Stark, Tova Callender, Ylenia St-Louis.

Alumni

Bruce Banker, Cathy Maxwell, Grace Silver, James Strickland III, Megan

Edgar, Sofia de la Sota.

Partners



Amato, D. W., et al. (2016). Impact of Submarine Groundwater Discharge on Marine Water Quality and Reef Biota of Maui. *PLoS ONE* 11(11): e0165825.

<https://doi.org/10.1371/journal.pone.0165825>

Dailer, M. L., et al. (2010). Using delta N-15 values in algal tissue to map locations and potential sources of anthropogenic nutrient inputs on the island of Maui, Hawai'i, USA. *Marine Pollution Bulletin* 60(5): 655-671.

Hunt, C. D., Jr. (2007). Ground-Water Nutrient Flux to Coastal Waters and Numerical Simulation of Wastewater Injection at Kihei, Maui, Hawaii. *Scientific Investigations Report*.

Hunt, C. D., Jr. et al. (2009). A multitracer approach to detecting wastewater plumes from municipal injection wells in nearshore marine waters at Kihei and Lahaina, Maui, Hawaii: *U.S. Geological Survey Scientific Investigations Report 2009-5253*, 166 p.

HDR Engineering (2018). Kihei Wastewater Reclamation Facility Nitrogen Removal Alternatives Study. County of Maui, Department of Environmental Management, Wastewater Reclamation Division.

Laws, E., et al. (2004). Coastal water quality in the Kihei and Lahaina districts of the island of Maui, Hawaiian Islands. Impacts from physical habitat and groundwater seepage: implications for water quality standards. *International Journal of Environment and Pollution* 22(5): 531-546.

Maynard, J., et al. (2019). Assessing the Resilience of Leeward Maui Reefs to Help Design a Resilient Managed Area Network. NOAA Coral Reef Conservation Program. NOAA Technical Memorandum CRCP 33, 40 pp.

Stock, J. D., et al. (2021). Sediment budget for watersheds of West Maui, Hawaii: *U.S. Geological Survey Scientific Investigations Report 2020-5133*, 61 p., <https://doi.org/10.3133/sir20205133>

Thurber, R. L. V., et al. (2014). "Chronic nutrient enrichment increases prevalence and severity of coral disease and bleaching." *Global Change Biology* 20(2): 544-554.

‘Inā e lepo ke kumu wai, e hō‘ea ana ka lepo i kai

*If the source of water is dirty, the muddy water will travel on
Where there is evil at the source, the evil travels on*

(‘Ōlelo No‘eau 1238)

The mission of Hui O Ka Wai Ola
is to deepen the understanding of Maui’s coastal water quality through
science and advocacy to accelerate positive change.

Visit huiokawaiola.com to learn more about our water quality monitoring efforts.