LU Committee

From: Leslie Freimuth <lesliefreimuth1@gmail.com>
Sent: Tuesday, May 30, 2017 1:16 PM
To: LU Committee
Subject: testimony

This letter is from my neighbor in Launiupoko. I have also lived in LP since 2004 and have endured 3 fires and traffic that will stop our tourists from coming to visit the island.
I am very opposed to this development.
Thank you for hearing us,

Leslie Freimuth
40 Kumu Niu Place
Lahaina, Hi 96761

Aloha, I live in Launiupoko, and was the first resident to live there moving in almost 15 years ago. 10 years ago during our drought years, we had the devastating fire that burned for 4 days originating in Olowalu. It jumped over the mountain and came down through my property and did $50,000 worth of damage. i was told at the time that our wells were down to 10% of capacity. They were using water from local swimming pools to fight the fires from the helicopters. My main concern is that if we find ourselves in another drought, which is probable, and since the population as probably doubled in the last 10 years, what will we do when our wells dry up? I understand that both West Maui Land and Brown development are looking for ways to increase the home density by a few hundred homes. How can we tax our wells with this added usage? It does not add up.

Sunday, in the Maui News, the front page article headline read "Solutions for pali traffic woes elusive". It went on to describe the unbearable waits the traffic load is imposing on our residents and tourists. How long before our tourists stop coming due to inadequate infrastructure in our roads? The reasons for the growing traffic were cited in the article as increased flow from tourists, more construction,and development in West Maui. It was stated that there will be substantial growth in the population of Maui and the west side, but our island is not getting any bigger, and our roads, at least for now, are not keeping up with the population growth. By building more housing on the west side, we are putting the cart before the horse. We can only accommodate more housing, affordable and otherwise, if we can make room for them in an intelligent manner by fixing the infrastructure first.

I understand the need for affordable housing and I applaud your attention and devotion to finding a solution to that issue, The developers are promising an attractive quick fix for this problem, but in my opinion, they are creating an even bigger problem by doing so.

Sincerely

With Aloha
Betsy Talon

<testimony.docx>

LU Committee

From: nearymail@yahoo.com
Sent: Tuesday, May 30, 2017 1:23 PM
To: LU Committee
Subject: Proposed Makila Kai Project

Attn: Committee Members

We are writing to express our complete opposition to the above referenced Makila Kai development.

There are many reasons, which are thoroughly explained in the May 17, 2017 letters from attorney Doug Wright and homeowner Steve Strombeck. We totally concur with their reasons for opposition to this proposal.

In a nutshell for us, as residents of Mahanalua Nui, two words: TRAFFIC and WATER. We would invite anyone who is doubtful that there is already a significant problem, to attempt to drive inbound or outbound of Lahaina almost any day of the week or any time of day. It doesn't seem to matter anymore; it is horrific MOST of the time! Just trying to turn onto the highway from Kai Hele Ku can take several minutes. That intersection is already a disaster; adding more vehicles would make it impossible.

Until proper infrastructure is COMPLETED, we are opposed to any houses being built on the land in question, let alone the number of houses being proposed.

Respectfully we ask that you vote NO on this proposed project.

Thank you.

Dave & Jo Neary
34 Awaiku St.
Lahaina, HI 96761

Sent from Mail for Windows 10

LU Committee

From: Dana Reed <dreed@hawaii.edu>
Sent: Tuesday, May 30, 2017 2:18 PM
To: LU Committee
Subject: Makili Project Testimony

Aloha all,

I want to go on record as being in opposition of granting any permits for this project at this time. I am opposed to allowing the developer to break the land into smaller parcels in order to avoid the public scrutiny that comes with an approval process for larger projects. I also have many concerns about this project that are addressed below, and think it is not advisable at this point for project approval.

1. We have an infrastructure problem in west Maui which should prohibit further development until Highway 30 is relocated mauka of it's current position. The relocation of this road should be a top priority of the county and state governments to prevent a catastrophic scenario where a portion of the road is washed away during a storm and/or very high tide and swell events. The highway in it's current position is breached by the ocean on an increasingly frequent basis. There are areas along the road where the ocean has already began to undercut the foundation of the roadway and it is only a matter of time before the roadway collapses. Areas along some of the recently built seawalls routinely see large waves coming over which causes panic in unsuspecting drivers and makes the road increasingly hazardous to maneuver. Tourists are especially vulnerable as they are not expecting waves to crash down upon their cars as they drive. When we lose a portion of this road, west Maui will be cut off from emergency services to the hospital, routine food and goods delivery, and access to the airport - creating a very critical problem! NO NEW DEVELOPMENT ON WEST SIDE UNTIL THIS CRITICAL INFRASTRUCTURE IS ADDRESSED.
2. The land area which will be developed has no access to county waste water treatment, and like the Launiupoko development project will be relying on On Site Sewage Disposal Systems (OSDS) for each dwelling or group of dwellings. While cesspools are no longer allowed to be constructed for new dwellings, the basic septic system which is still allowed provides only a small improvement over the cesspool system. Additionally, septic systems need frequent maintenance which falls to the individual homeowners. This type of maintenance can be expensive, and particularly for owners of the affordable housing units that are being proposed. There is no requirement for monitoring that this maintenance is performed. Guidelines suggest that use of such systems should only be used when a property has at least 2 acres per home site. These new developments will be much closer to the ocean than the existing Launiupoko homes and stand a good chance of impacting the marine environment.
3. Water quality monitoring by the state DOH and the volunteer water quality monitoring group (Hui O Ka Wai Ola) show that current nitrogen and phosphorous levels at Launiupoko are within the state guidelines of acceptable levels. There are occasional high bacteria counts most often associated with storm water runoff from streams. Additional building in this area, particularly adding a much higher density of OSDS that are much closer to the shoreline is quite likely to raise these levels which will have a detrimental effect upon the near shore reef. Turbidity (water clarity) levels are above state standards already and new construction and preparation has likely already affected this water quality parameter.

Thank you for allowing me to provide my opinion on this project. Please feel free to contact me if you have any additional questions.

Respectfully,

Dana Reed
West Maui Regional Coordinator - Hui O Ka Wai Ola program
dreed@hawaii.edu
808-669-4015

LU Committee

From: K Zimmerman <katieislands@yahoo.com>
Sent: Tuesday, May 30, 2017 2:35 PM
To: LU Committee
Subject: LU-2 support

Aloha,

I am in support LU-2, the affordable housing project for Makila Kai. Please vote in favor to move the project along to completion to provide necessary homes for working families.

Respectfully,
Katie Zimmerman

Katie Zimmerman REALTOR® (S) e-PRO
RS- 75832
Whalers Associates - KW Island Living
2435 Kaanapali Pkwy Suite A3
Lahaina, Maui Hawaii 96761
cell: (808) 280-8986
office: (808) 661-8777
toll free: (800) 367-5632

Melissa Bonnin

145 West Kane Street ▪ Kahului, HI 96732
808-250-1965 ▪ mmbonnin@gmail.com

May 30, 2017

Council Vice-Chair Robert Carroll,
Chair – Land Use Committee
Maui County Council
Kalana O Maui Building, Eighth Floor
200 South High Street
Wailuku, Hawaii 96793

SUBJECT: Affordable Housing Project (Chapter 201H, Hawaii Revised Statutes) (Independent Development of Makila Kai; Lahaina) (LU-2(1))

Dear Councilmembers,

I am sending this letter in support of the proposed Makila Kai project for the following reasons:

- Affordable homes. Makila Kai will provide a rare opportunity for Maui residents to purchase an affordable first home on a large lot which is usually attainable only by buyers who can afford to purchase a home at market rates. I commend the developer for providing the opportunity for working families to purchase a workforce home in this desirable area of West Maui.
- As a single mother working a fulltime professional job, I cannot afford homes on Maui. This is one of the few opportunities to purchase a home and financial stability for my family. I came from a low-income background, paid for college and graduate school myself, and have no one to turn to for financial support. Without developments such as Makila Kai, even those who have professional jobs cannot purchase a home due to the housing market being driven by the endless supply of non-residents with higher incomes.
- The fact that Makila Kai plans to offer a financial gift to each workforce home buyer further emphasizes the developer's commitment to the idea of truly "affordable" housing.
- Location. I support the creation of housing on Maui which is located near community facilities and important services. Makila Kai residents would be able to drive to Lahaina Town in five minutes or could eventually take the bus, since the project is located along the future Lahaina Bypass Highway.
- Community design. Makila Kai is located in an area designated for rural growth by the Maui Island plan. Given this designation and the existing agricultural (large) lots outside the Rural Growth Boundary, Makila Kai's design (mauka agricultural lots, makai rural lots) provides a thoughtful compromise between what exists and what is allowed by the Maui Island Plan.
- In addition, I support this project because about 50% (41 acres) of Makila Kai will be open space, and buildings will be limited to a single story to protect views. Most of the open space will be taken up by a neighborhood park, pedestrian trails, and a large greenbelt along the future bypass. These features will directly benefit the neighborhood in terms of well-being and visual impacts.

I ask and strongly encourage the Maui County Council to support Makila Kai.

Sincerely,

Melissa Bonnin

LU Committee

From: Mary Britton <mary@mauipineappletour.com>
Sent: Tuesday, May 30, 2017 3:06 PM
To: LU Committee
Subject: AFFORDABLE HOUSING PROJECTS (CHAPTER 201H, HAWAII REVISED STATUTES) (INDEPENDENT DEVELOPMENT OF MAKILA KAI; LAHAINA) (LU-2(1))

Dear Councilmembers,

I am writing this email in support of the proposed Makila Kai project. I would like you to know that I support Makila Kai for the following reasons.

Location. I support the creation of housing on Maui which is located near community facilities and important services. Makila Kai residents would be able to drive to Lahaina Town in five minutes or could eventually take the bus, since the project is located along the future Lahaina Bypass Highway.

Community design. Makila Kai is located in an area designated for rural growth by the Maui Island plan. Given this designation and the existing agricultural (large) lots outside the Rural Growth Boundary, Makila Kai's design (mauka agricultural lots, makai rural lots) provides a thoughtful compromise between what exists and what is allowed by the Maui Island Plan.

In addition, I support this project because about 50% (41 acres) of Makila Kai will be open space, and buildings will be limited to a single story to protect views. Most of the open space will be taken up by a neighborhood park, pedestrian trails, and a large greenbelt along the future bypass. These features will directly benefit the neighborhood in terms of well-being and visual impacts.

Affordable homes. Makila Kai will provide a rare opportunity for Maui residents to purchase an affordable first home on a large lot which is usually attainable only by buyers who can afford to purchase a home at market rates. I commend the developer for providing the opportunity for working families to purchase a workforce home in this desirable area of West Maui.

The fact that Makila Kai plans to offer a financial gift to each workforce home buyer further emphasizes the developer's commitment to the idea of truly "affordable" housing.

I ask and strongly encourage the Maui County Council to support Makila Kai. Sincerely,

Mary Britton, Director
Maui Pineapple Tours, LLC
PO Box 542
Lahaina, HI 96761
m: 808.280.5745
w: mauipineappletour.com

LU Committee

From: Richard Finch <circlecitybluejay@yahoo.com>
Sent: Tuesday, May 30, 2017 3:06 PM
To: LU Committee
Subject: Brown development in Launiupoko

Aloha Council Members,

I realize that you are getting a lot of pressure from your constituents about affordable housing. But I ask that you not rush into a decision just because a carrot is being dangled in front of you. That carrot has 2 catches to it.

First, when a resident buys one of these affordable houses it can flip to market value 10 years later. I gotta ask....how does that help keep the prices affordable in the long run? What houses are my grandkids going to be able to afford in the years to come? These 25 affordable houses will skyrocket in value, with their ½ acre ocean views.

The other catch it that this development also has 25 multi-million dollar homes. Talk about driving the housing prices up! And the developer doesn't even live on Maui. He lives on 80 acres on the Big Island, because he's told folks that it's too crowded here. He flies in by private plane every couple of days to check on his projects. Let's not kid ourselves, this guy has only one motive...to make money off of Launiupoko.

Council Members....we need housing that will stay affordable for our working class. Not these short lived affordable projects that just makes a developer rich.

You were elected is to make carefully thought out decisions. Fast tracking a subdivision is not a wise decision.

Please vote NO for this development.

Mahalo,

Richard Finch

Kihei

LU Committee

From: vera sreda <verasreda@gmail.com>
Sent: Tuesday, May 30, 2017 3:43 PM
To: LU Committee
Subject: Makila Kai Opposition letter LU-2

Dear council, I am writing in opposition to Makila Kai.

You will notice that Launiupoko residents and west side residents strongly oppose this development, it is interesting and unethical that Makila Kai team was using lottery for units that were not even approved by you. It is giving false hope to desperate people looking for affordable housing, just to later disappoint them. By providing only 8 true low income units, Makila Kai team is gathering public support for their project, even though most of these people would have low probability of getting these units, but developer gets a loud voice to push this through. I would suggest that such immoral tatctics should be prohibited and that only approved developments should start the lottery process.

These projects are not even affordable as there is a high $400/mo association fee just to be able to use the private roads we use (as these 2 roads are only access roads proposed by developer-and association that manages those roads charges $400/mo in association fees), non subsidized solid waste pick up, septic tank maintenance, private water....

If this gets passed people who win the lottery would just do vacation rentals-as they could make so much more money renting it out to tourists than what they would pay for rent elswhere, or if they really tried to live here the expenses would be too high and they would be forced to foreclose or sell. In either scenario they would be again renters and we would still be in a same predicament on affordable housing. Affordable housing needs to be tryly affordable, with convenient school, medical access, walkable, with public subsidized utilities, no association fees/affordable...

I see you already approved 2 large affordable developments in West Maui, one in Lahaina 68 units-all affordable and another one in Kaanapali-with 400+ affordable units and plans for new school. These are perfect locations to minimize traffic on the west side, Launiupoko location would just aggravate it.

List of objections is too long. Please don't be fooled by allegedly affordable homes, which are just a token to create enourmous profits for developers at the expense of entire added traffic to the pali, Launiupoko current residents, environment, sacred agricultural land, limited Ag water resources, safety of current and new residents....

Please vote against it, in order not to set precedents for future developments to irresponsibly take away Ag lands and disrespect all the rules set in place to ensure our safety, environment and scarce resources are protected for generations to come.

Thank you
Launiupoko Resident
Vera Sredanovic

LU Committee

From: Linda Taylor <linda-lte@hawaii.rr.com>
Sent: Tuesday, May 30, 2017 4:13 PM
To: LU Committee
Cc: Greg Brown
Subject: Makila Kai-Land Use Committee meeting, testimony
Attachments: LTE_Maila Kai-ltr to Council_2017-05-30.pdf

Aloha,

Please find my testimony for the subject project public meeting, May 3, 2017 @ 1:30 pm.

Mahalo,
Linda

Linda V. Taylor, P.E.

Linda Taylor Engineering, Inc.
(808) 572-2688

Linda Taylor Engineering, Inc.

May 30, 2017

Council of the County of Maui
Land Use Committee
200 South High Street
Wailuku, Maui, Hawai'i

Attention: Land Use Chair, Mr. Robert Carol

Subject: Individual Wastewater System for:
Makila Kai, Affordable House Projects
Lahaina, Maui, Hawaii

I would like to introduce myself to the Council as I will be the engineer designing the Individual Wastewater Systems (IWS) for the subject project. I am an Environmental/Civil Engineer with over 34 years of experience in the industry. I have been designing IWS in the State of Hawaii since they were required by the State of Hawaii, Department of Health, Wastewater Branch (SDOH) starting around 1992.

All of the IWS that I have designed are submitted to the SDOH for review and approval to construct. The IWS must be in compliance with SDOH Hawaii Administrative Rules, Chapter 11-62 in order to be approved for construction. The Wastewater Branch's mission is to protect public health and the environment. Their specific guide lines must be met in order to protect the environment.

All of the IWS's that Brown Development LLC has installed in the Launiupoko area were designed by an engineer licensed in the State of Hawai'i and were reviewed and approved by the SDOH for construction. The IWS is comprised of a septic or aerobic tank which retains the solids in the wastewater and allows them to settle out so that only the effluent is discharged into the disposal area, or soil absorption bed. Effluent that enters the soil absorption bed percolates into the soil and is filtered through soil strata (to help recharge the aquafer or is used for subsurface irrigation).

We are in support of this affordable housing project which will serve those in our community who meet the requirements.

If you have any questions regarding this matter, please contact me at 572-2688.

Very Truly Yours,

Linda V. Taylor,
P.E. 6507

P.O. Box 779, Makawao, Maui, Hawai'i 96768 • Phone: (808) 572-2688 • Fax: (808) 573-0636

LU Committee

From: Jeff and Sue Anderson <smander@pacbell.net>
Sent: Tuesday, May 30, 2017 4:22 PM
To: LU Committee
Cc: Linda Jenkins; Irene McPhee
Subject: LU-2 Makila Kai 201H

May 30, 2017

Maui County Council Land Use Committee

Re: Makila Kai Development

Dear Committee Members:

There are many factors to consider as you review the Makila Kai 201H application. This letter focuses on just one health and safety issue; evacuation and emergency responder access.

We have a serious access problem in Launiupoko that would likely leave residents trapped and emergency responders blocked if Kai Hale Ku was obstructed in an emergency. This problem should be fully and perpetually resolved before allowing any new development in Launiupoko.

Here are the details. Launiupoko is served by one road from the highway, Kai Hale Ku. If that road were blocked in an emergency (major fire for example) the primary emergency exit (and fire truck access) is via a dirt road that starts on the northwest corner of Makila Plantation and heads downhill through the proposed Polaniu Gardens development, eventually connecting via a settlement basin access road to Hokiokio which connects to the highway. There are other potential evacuation routes, for example the bike paths, but this dirt road is the primary way all of Launiupoko would exit (and fire trucks would enter) if Kai Hale Ku were blocked. This dirt road is also apparently legally required for Hawaiian land access to land located north and Mauka of Makila Ridge. All exit routes are marked with Evacuation Route signage.

In my experience, the dirt road has never been in good shape. It is currently so rutted after the recent big rains it is impassable except with a 4WD truck. There is strong concern within both Launiupoko homeowners associations about evacuation, which makes sense as there is a lot of combustible fuel in the neighborhood and we've had fires in the past. In our recent Firewise Community certification process, substandard evacuation routes were identified as a serious concern to be mitigated. West Maui Land (who owns the land through a related company) declined homeowners' request to scrape the route to make it passable.

In talking with West Maui Land about evacuation, Mariah Gill and Glenn Tremble stated the WML plan is to replace the existing northern dirt evacuation route (and Hawaiian access road) with a route that proceeds down the new Punakea Street, turns right on Waianukole Place to the end of the road where a short dirt segment goes to the settlement basin access road which takes you to Hokiokio. Most of this route is paved while the dirt segment appears easily passable. I'm told this new route will be available in emergencies once the bypass is complete and the underpass is in place. Note that some change in the evacuation route is necessary as the existing route will be cut off by the Bypass. The WML planned evacuation route is good, far better than what we have today. It would serve existing residents and any new homes makai of Haniu Street.

But, Glenn stated "there is no formal requirement to deem this as such, we have voluntarily stated to the residents that it may be used as such". I had previously guessed the requirement for an evacuation route existed as a condition to West Maui Land developing Launiupoko in the early 2000s and that condition would still exist. If not, it begs the question what is to stop WML (or future owner) from someday rescinding the right to use the route for evacuation and somehow blocking access?

Before considering any new Launiupoko development please ensure there is a viable, perpetual evacuation plan serving all Launiupoko with evacuation routes that could actually be used in an emergency.

Jeff Anderson
President, Makila Plantation Homeowners Association

LU Committee

From: Gabriel P Castano. <gauchogabe@aol.com>
Sent: Tuesday, May 30, 2017 4:57 PM
To: LU Committee
Subject: Makila Kai proyect...

Incredible BAD PROYECT...It's almost unbelievable that given the current horrible conditions of traffic in the West Side and particularly the lack of proper access this proyect its even a consideration.
This speaks volumes of the power of money and the influence that developers have over planners, politicians and elected officials.
Ignoring all the voices and the reality of what this will bring its nothing more than criminal behavior.
Gabriel P Castano
Launiopoko

Sent from my iPad
Gabriel

LU Committee

From: Janice Goodnight <janice@goodnightmaui.com>
Sent: Tuesday, May 30, 2017 5:39 PM
To: LU Committee
Subject: Makila Kai opposition
Attachments: Makila Kai letter J.pdf; Makila Kai Wright.pdf; Makila Kai strombeck.pdf

Please deliver the attached items to the Council members for the hearing tomorrow regarding Makila Kai.
Thank you,
Janice Goodnight

View Our Collection of Listings

Janice Goodnight REALTOR(S)
Island Sotheby's International Realty
5095 Napilihau Street, Suite 113A
Lahaina, Maui, Hawaii 96761
Cell: (808)298-9768
Email: Janice@GoodnightMaui.com
New Maui listings updated daily at www.GoodnightMaui.com!

The finest compliment I could receive is the referral of your friends, family, and business associates.
Thank you for your trust!

May 30, 2017

Via e-mail: Lu.committee@mauicounty.us

Dear Committee Members:

My name is Janice Goodnight and I am a Launiupoko resident that will be impacted by the proposed Makila Kai development ("Makila Kai").

I write to voice my opposition to Makila Kai based on, among other things, the items raised in the letter dated May 17, 2017 from Doug Wright, attorney for the Makila Plantation Homeowner's Association and the letter dated May 17, 2017 from Mr. Steve Strombeck.

The Makila Kai project should not be approved.

Thank you,

Janice Goodnight

WRIGHT & KIRSCHBRAUN

A Limited Liability Law Company
1885 Main Street, Suite 108
Wailuku, HI 96793
Telephone: (808)244-6644
Facsimile: (808)244-1013
E-Mail: firm@wkmaui.com

Deborah K. Wright (Email: Deborah@wkmaui.com)
Keith D. Kirschbraun (Email: Keith@wkmaui.com)
Douglas R. Wright (Email: Doug@wkmaui.com)

May 17, 2017

Sent via e-mail to: lu.committee@mauicounty.us
Maui County Council
Attn: Land Use Committee

Re: Makila Kai proposed project

Dear Committee Members:

I have been asked by the Makila Plantation Homeowners Association Inc. ("HOA") to submit written comments expressing some of the concerns identified following an expedited review of the Makila Kai application.

How much affordable housing will this project actually provide and how does that stack up against the risks and damage it is likely to bring? Doesn't this warrant more time to take a good look at the impacts?

The applicant seeks to fast-track a repurposing of land under the auspice of "affordable housing." This is to provide 25 lots on approximately 14.6 acres which may be offered for sale to a pool of eligible people having annual earnings between 81% and 140% of the Median Income as published by the County. But from these 25 lots, only 8 will be offered to those earning less than 100% of the median income.

The applicant has bundled its affordable housing with requests for significant exemptions to build and sell 24 market priced homes as well. The project before you asks for your permission to convert 80 acres of agricultural land to something having a greater density that will allow the applicant to make a lot of money. In exchange, the County gets only 8 homes on the market for those who earn less than 100% of the median income.

The County should not be asked to partner with a developer if the request seeks to maximize a private entity's profits by pitting significant priorities of sustainable living and affordable housing against each other. The applicant earns a hefty profit, gets permission to evade certain laws, gloss over environmental concerns and mute the public. The County doesn't even get a drop in the bucket toward housing.

A hurried decision is being forced upon you to accommodate the applicant's motives. It is still a *decision* that must factor in the significant cost and risk that comes this project. The decision should not be made in haste, and it's important to remember that "NO" is a good option under the circumstances, recognizing that there are significant concerns which merit a meaningful due diligence process. After all, the proposal substantially fractures the existing, functional agricultural community (each neighboring agricultural lot with a home is required to submit and adhere to a County-approved farm plan) and will permanently expand non-ag urban sprawl It places at risk the environment, the precious public right to water, as well as public safety due to the increased traffic burden.

The neighboring HOA only recently became aware of the detailed plans (the applicant refused to voluntarily provide the HOA with a copy of the application), but have quickly identified at least the following concerns:

1. **Ill-conceived location and abuse of County project goals.**

Makila Kai permanently prioritizes urban sprawl over existing agricultural communities. Urban sprawl vastly benefits the private developer far more than Maui residents/community. Compare/contrast with Kahoma Residential which went from Ag to Urban: the big issue was the commitment to affordable housing, the character of the surrounding community and the existing level of urban services adjacent thereto. Urban opportunities for designated land infill development on the West Side remain available. **Makila Kai is proposed for the benefit of the applicant, not the community.**

2. **Water.**

We must be responsible with our scarcest resource, especially knowing that the existing community currently confronts supply problems. An island community that has goals of working toward being self-sufficient should responsibly manage its scarcest resources: agricultural land and water. Perhaps the developer should fund an independent study of water supply (i.e. long-term potable and non-potable water systems capacity, reliability and expandability). The Department of Water has pointed out that the correct water usage figures are 181,000 gallons per day ("gpd") for 49 residences on 60.5 acres, not including ag use. The applicant's response only gave lip-service to the Department's work. **The application itself contradicts the findings prepared and presented by the County's Department of Water Supply.** This difference alone is serious enough to take the time for a thorough analysis!

3. **Environment.**

The socioeconomic and environmental impacts are real and important. To name a few, this project *changes* the community experienced by residents and those traveling to Lahaina; *impacts* the shoreline; *removes* good ag land; *affects* wildlife; and *increases* pollution (light, traffic, hard road surfaces, density, fire concerns). **Hawai'i law addressing environmental impact statements mandates the preparation of an environmental assessment. *See* HRS §343-5(6). This is a KEY step in reducing the risk of irreparable damage.**

4. Segmentation.

Makila Kai is just one section (about 1/3 total acreage) of the previously submitted Makila Rural project. That was withdrawn from the state LUC April 2016 but has now returned "segmented" or split into three smaller scale (but contiguous) projects. Once the HOA became aware of this developer's plan, a letter dated Feb. 14, 2017 was prepared and sent raising the issue with the Maui County Planning Department.

Unfortunately, and unbeknownst to the HOA, the HOA's letter was sent one week after the County already submitted its review of Makila Kai, and the issue of segmentation is absent from its review. Since the HOA's concerns about segmentation do not appear to be otherwise considered, a copy of that letter is enclosed and incorporated herein.

We would also direct this Committee to the responses of the State LUC and Office of Planning who clearly recognized this segmentation issue and the motives behind it in trying to avoid a full EIS and DBA application.

5. Jurisdiction.

Is this a 14.6 acre project or a 79.5 acre project? The applicant seeks exemptions for the entire project and has tied exemptions related to the so-called affordable housing aspect to the market rate side. The applicant though urges you to make a decision for a boundary adjustment claiming the project is only 14.6 acres. Which is it? Is the review limited to the 14.6 acres and it will comply with the agriculturally zoned laws for the balance of the acreage or is the applicant seeking a change for the entire parcel. It matters because the County does not have jurisdiction to entertain a district boundary amendment over the entire project – that is a matter that rests with the State's Land Use Commission. The applicant is deceiving you by arguing the project is really only 14.6 acres, the applicant is asking you to deceive the community by repeating his false claim, and the applicant is inviting litigation for a determination as to the appropriate jurisdiction for its request. By letter dated January 26, 2017, the State's Land Use Commission agrees. **This project needs to be presented to the State Land Use Committee.**

6. Community Outreach

This is a substantial departure from the character of a functioning community having roughly 1,000 people. Rushing the process, providing only one limited chance to consider the plan hardly qualifies as "community outreach". Most community members still have not adequately considered the reach of the project and what questions they may have or identify opportunities for improvement. It is apparent, though, that careful planning should be a priority.

7. Pending litigation (Civil No. 17-1-0036). Access to this large development is through a private road.

Access to the project is through a private road managed by Makila Plantation HOA. The HOA charges each of its members equally for the shared maintenance cost for this road and everything associated with it. Without the approval or knowledge of the HOA, Makila Land Co., another developer, unilaterally changed the cost-sharing mechanism requiring the existing HOA members to subsidize the applicant's access to the entire project (affordable and market-rate

lots). A Complaint has been filed and the matter is pending. **Until appropriate access has been resolved, this project should not proceed.**

8. Better-suited proposals.
There is a recent boost in meaningful proposals for affordable housing projects in our community, many of which bolster the supply of housing far greater than this project, and in areas appropriate for dense development. **Makila Kai should not be considered in isolation.**

9. Subsidies.
The public bears the heavy cost (exemption for fees, less/no emphasis on subdivision safety, environmental concerns, neighbor impacts, etc.) to facilitate the applicant's ability to sell multi-million dollar homes (as represented by the applicant to the neighbors) with the absolute removal of agriculture from the land (see proposed water restrictions).

10. Character of the Community.
More than 1000 people own homes here now because they were expressly told that the adjoining areas would be subdivided as ag lots (requiring approved ag farm plans). The proposal may benefit a few, will certainly enrich the developer but comes at the cost of permanently changing the community.

11. Highway Traffic.
Principal public access is through a burdened highway. The traffic study was prepared by SSFM International. Interestingly, it found that the existing intersection at Kai Hele Ku and Honoapiilani Highway operate at an appropriate level of service. This would likely come as a surprise to most drivers. In a recent Maui News article concerning traffic on the West Side, State Department of Transportation Director Ford Fuchigami was quoted as saying that "smart land-use decisions can minimize the impacts future growth will have on the existing highway system." Tanji, Melissa. "Solution for pali traffic woes elusive." *The Maui News*, May 14, 2017. **This new development will increase pressure on a road system which is currently not even coping with today's density of population.**

A decision has been forced upon the County due to the developer's desire to fast-track and obtain valuable benefits of fast-tracking. However, it is still a decision that needs to be made and a recognition that these benefits come at a significant cost. The decision can, and should be, made not to fast-track this project. There are lots of concerns which merit a meaningful due diligence process. This is a substantial fracture of an existing, functioning agricultural community (each home has a County approved farm plan) and has the potential of permanently severing and expanding non-ag urban sprawl. The potential risk to the environment, the precious public resource of water, and the safety of the community warrants taking the time to make the right decision.

The overwhelming crush of unanswered questions, realignment of priorities, extraordinarily low public benefit, public subsidies in the form of fee and land use exemptions, and the significant risk of the wasteful use of long-term resources highly weighs in favor of denying this project.

After all, the standard bearer requires the exercise of reasonable judgment that the proposed project is primarily for the benefit of lower income housing. HRS §201H-41. The applicant has failed to demonstrate or otherwise justify that this project is reasonable under the circumstances or that it's primarily for the benefit of lower income housing.

On behalf of the HOA, please **DENY** the application. This application is just not justified in proceeding on an expedited basis. There is too much at stake and there is a much better way of approaching the use of this land. After all, the applicant purchased the land knowing its restrictions; it is not the County's job to spend the public's capital to maximize the applicant's profits. There is nothing preventing the applicant from building affordable homes in conformance with the agricultural zoning – in fact, the County should consider the fact that those who might benefit the most from affordable housing are farmers.

Respectfully submitted,

Douglas R. Wright
Enc.
cc: Makila Plantation HOA

WRIGHT & KIRSCHBRAUN
A Limited Liability Law Company
1885 Main Street, Suite 108
Wailuku, HI 96793
Telephone: (808)244-6644
Facsimile: (808)244-1013
E-Mail: firm@wkmaui.com

Deborah K. Wright (Email: Deborah@wkmaui.com)
Keith D. Kirschbraun (Email: Keith@wkmaui.com)
Douglas R. Wright (Email: Doug@wkmaui.com)

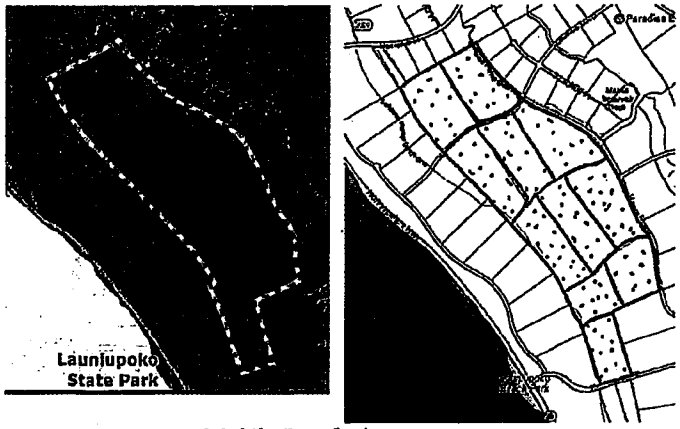
February 14, 2017

Danny Dias, Planner
Current Planning Division
Department of Planning, County of Maui
2200 Main Street, Suite 619
Wailuku, Maui, Hawaii 96793

Re: Segmentation of development for the withdrawn Makila Rural project
TMK Nos.: (2)4-7-013:001 and 002 (Polanui Gardens)
(2)4-7-013:003, 004 and 005 (Makila Kai)
(2)4-7-013:006, 007 and 008 (Makila Rural East)
(2) (name not yet known)

Dear Mr. Dias:

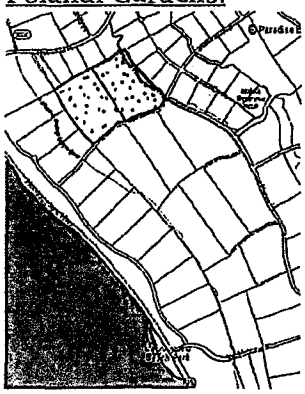
It is my understanding that you are the planner assigned to review the Polanui Gardens development project, which includes a mix of urban affordable housing development, as well as market rate lots dubbed "agricultural." This project is being proposed as one of several in the area formerly known as Makila Rural for mixed-use development seeking the expedited review and exemptions afforded HRS Chapter 201H-38 affordable housing projects. Since pictures say a thousand words, here are a few pictures to put things into perspective:



Makila Rural +/- 270 acres
(as depicted on Maui Island Plan Directed Growth Map & Tax Map - project withdrawn)

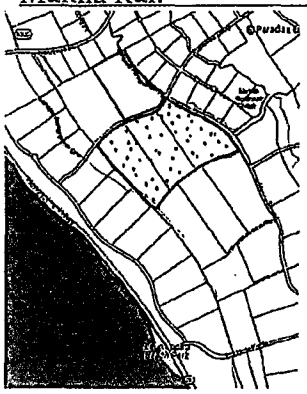
Following are pictures of the tax maps showing the land presently being drafted and presented for new development, under the guise of different owners and different projects, in the works:

Polanui Gardens:



+/-54.507 acres

Makila Kai:



+/- 79.512 acres

Makila Rural East:

+/-80.103 (est.)

As you may know, the now-defunct Makila Rural project would have required a change in zoning and land use designation. As part of any application for change to the land use designation from agriculture to a denser development, the applicant would have been required to prepare and present an Environmental Assessment and, in all likelihood, a full environmental impact statement to fully explore the significant impacts arising out of the proposed use upon the natural environment and its community. As you can see from the above pictures, the projects being proposed occupy and represent the dense development for the previously withdrawn project. The applicant has broken its massive project into chunks and seeks to fast-track the review of its pieces by linking arms with the County and using affordable housing as the tool to avoid a meaningful review.

This is not a new tactic and Hawaii Administrative Rules ("HAR") have a particular rule in response:

> § 11-200-7. Multiple or Phased Applicant or Agency Actions.
> A group of actions proposed by an agency or an applicant shall be treated as a single action when:
>
> (1) The component actions are phases or increments of a larger total undertaking;
> (2) An individual project is a necessary precedent for a larger project;
> (3) An individual project represents a commitment to a larger project; or
> (4) The actions in question are essentially identical and a single statement will adequately address the impacts of each individual action and those of the group of actions as a whole.

Although each of the above projects are linked with affordable housing, and seek the benefits of a fast-track review and its significant statutory exemptions (HRS §201H-38), the process does not disregard or otherwise omit environmental considerations. The exemption from certain environmental scrutiny for affordable housing projects states:

> § 11-200-8. Exempt Classes of Action.

> (a) Chapter 343, HRS, states that a list of classes of actions shall be drawn up which, because they will probably have minimal or no significant effect on the environment, may be declared exempt by the proposing agency or approving agency from the preparation of an environmental assessment provided that agencies declaring an action exempt under this section shall obtain the advice of other outside agencies or individuals having jurisdiction or expertise as to the propriety of the exemption. Actions declared exempt from the preparation of an environmental assessment under this section are not exempt from complying with any other applicable statute or rule. The following list represents exempt classes of action:
>
> ...
>
> (11) Acquisition of land and existing structures, including single or multi-unit dwelling units, for the provision of affordable housing, involving no material change of use beyond that previously existing, and for which the legislature has appropriated or otherwise authorized funding.

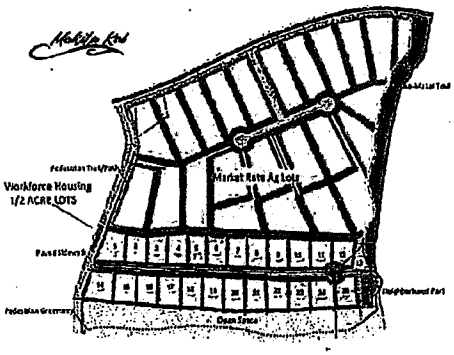
The above exemption would not apply to the projects proposed due to the fact that they represent a radical change of use to the land as it presently exists. However, as if to use a highlighter to point out that segmentation of projects shall not be allowed to avoid environmental scrutiny, the very next section in the HAR, states:

> (b) All exemptions under the classes in this section are inapplicable when the cumulative impact of planned successive actions in the same place, over time, is significant, or when an action that is normally insignificant in its impact on the environment may be significant in a particularly sensitive environment.

These projects seek to plant dense development in the middle of agricultural land. The two projects which have shared information so far appear to *intentionally mislead* about the true nature of the remaining developments. Polanui Gardens and Makila Kai each refer to the remaining lots as "Ag" or "Agricultural" lots:

Polanui Gardens

Makila Kai



The plans for the development of these lots, though, state that there will be NO non-potable (agricultural) water. The only water supply will be potable water, a cherished resource which deserves protection, respected and used efficiently. The details and impacts are not known and not adequately investigated, but that is exactly why these

projects should be viewed cumulatively and not in isolation. The parceled review of shared and important resources is also why the Hawaii Administrative Rules guard against segmentation of projects. In this same regard, enclosed is a letter prepared by and on behalf of the neighboring Makila Plantation Homeowners Association, Inc., which has asked me to provide it to the Department.

The review of these projects in isolation should not be rushed, and certainly not outside the scrutiny of environmental law. Although affordable housing projects enjoy the benefit of a fast-track review process and exemption from certain laws, the development in Makila clearly anticipates successive dense developments having a cumulative impact in the same place, over time, and being quite significant in scope, a burden on resources and permanent impact upon the land and community.

Sincerely,

WRIGHT & KIRSCHBRAUN
A Limited Liability Law Company

DOUGLAS R. WRIGHT
Enc.
cc: William Spence, Planning Director
Jeffrey Ueoka, Deputy Corporation Counsel
Makila Plantation Homeowners' Association, Inc.

To: **Department of Planning, Maui County**

From: **Board of Directors, Makila Plantation Homeowners Association, Inc.**

Dated: **February 10, 2017**

Memorandum of Objections to the fast-tracking of Three Launiupoko development projects

Residents of Launiupoko are aware that developers have plans to 'fast-track' three project covering substantially the same acreage as the withdrawn Makila Rural project. 'Fast-tracking' of three apparently independent projects is a transparent ploy by developers to get the County to sign on as partners/co-sponsors hence avoiding the level of environmental scrutiny facing the larger single Makila Rural project.

The leading edge of these three phased developments is by Brown Development branded as Makila Kai currently working its 201H-38 project through the planning Dept. Residents want to raise these concerns now in advance of the normal timing of public input since there is a widespread perception that the fast-track process is not a level playing field and is tilted heavily in developers favor against resident opposition.

It is our understanding that developers work with County planning over a period of months to produce a plan where the County partners with the developer as a condition of 201H-38 status. This status exempts the developer from most of the normal development costs and regulation and significantly allows approval at County level and avoids EIS environmental scrutiny that would normally take place at State level as a DBA application.
Fast-track allows only a very compressed 45 day period for analysis assessment and comment by the public after developer and County have worked together on the project. We are advised that it is very rare that significant changes to a 201H-38 are achieved once the County has signed on as a sponsor of a developer's plan.

There is widespread perception by the community that 'affordable housing' being offered up to gain 201H-38 status, which developers claim they will build at a loss, is an avenue to buy favors and exceptions from County Code

ordinances, thereby financially benefitting a developer at the cost of far greater density of market price housing than current zoning allows, radically changing communities and forever altering the landscape

These suspicions result from Makila Land putting forward the Makila Rural project for a large single integrated development of the fields makai of Haniu Street and then withdrawing it after submission to the State LUC. Substantial local opposition was voiced plus a formal Intention to Intervene by a neighboring HOA. On April 14th 2016 at the time of withdrawal of the project from the LUC it was stated by Heidi Bigelow *"Makila Land has decided to terminate their pursuit of a rural community and will instead market the eleven existing agricultural lots"*
This has not happened.

What has become crystal clear is that substantially the same project covering most of the acreage of the original Makila Rural has been segmented in to three projects each attempting to claim it is a small-scale project. Nobody in Launiupoko is fooled.

The open house presented by Greg Brown of Brown Development September 23rd last year and site plans produced made it clear that the 25 affordable housing units currently in front of Planning was not a stand-alone project. Rather it was an integrated plan to allow the developer to market and develop 24 market price lots on the remainder of the three large agricultural lots. The developer was totally open that this was the only way he could develop affordable housing.

Furthermore at that same meeting Peter Martin appeared and announced that on the lots he still owned (not in fact sold off as announced in April 2016) contiguous and south of the Brown development it was his intention to follow up Brown with dense, urban development of 10,000 to 12,000 square foot lots.

So residents feel it is reasonable to expect that any public official involved in the approval process on these projects will see clearly that:

i) Makila Rural has been segmented into three (or more) to make the whole thing easier to get through the County and avoid a State require EA or EIS.

ii) affordable housing and the 201H-38 process is being used/abused to facilitate massive market price development on agricultural land.

iii) the Brown Development project of 25 affordable housing lots has been misleadingly marketed on the Makila Kai web site and portrayed in a PR piece in the Lahaina News February 1st ....*"MKL proposes to develop Makila Kai a workforce housing community in the Launiupoko area....the project would be located on three large parcels totaling 79.5 acres"*. No. The workforce housing would be on just under 15 acres (hence not triggering a State DBA) with the remainder a legally-required buffer from the proposed by-pass and the remaining majority of the acreage developed as 24 market priced lots. This is not a subtle difference and makes clear the true purpose of this segmentation.

Brown Development is well known in the community and we would expect that the extensive vetting laid out on the County web site for developer 201H-38 eligibility is fully pursued before Maui County becomes a partner/sponsor. In particular:

i) *a resume of housing development experience*...Brown is a developer of high end luxury homes, the BD web site stresses this exclusivity. There does not seem to be evidence of previous experience or interest in an integrated housing low cost development.

ii) *proof of applicant's ties to the community and support from local community groups*....Brown Development has a reputation in Launiupoko which officials should investigate

iii) *legal action taken or pending*.... We would reasonably expect the developer's record of legal actions be thoroughly checked by the County's Corporation Counsel and Planning, so that decision-making may be as well-informed as possible about the relationship being entered into. For example, the developer been prohibited building elsewhere or had his license in jeopardy?

In summary, it is the perception of the surrounding ag community that Brown and Makila Land (and its successor corporations, Makila Ranches, Kipa Centennial et al) seeks to segment the previously withdrawn large Makila Rural project, with the express objective of easier approval.

We are asking all involved branches of the County to recognize this transparent reality during your process before signing on to partnering on 201H-38 projects.

Board of Directors
Makila Plantation Howeowners Association, Inc.

TO: Land Use Committee of the Council of the County of Maui

FROM : STEVE STROMBECK

Re: *OPPOSITION* to Affordable Housing Development of Makila Kai; Lahaina (LU-2(1))

Date: May 17, 2017

My name is Steve Strombeck and I live at 24 South Lahoe Place (right across the street from the proposed project). By trade I am a developer in California. The purpose of my letter is to ***oppose*** the new subdivision in Makila Kai that is being proposed by Greg Brown. I have been through this process many times in the past and I understand what it takes to subdivide land. Let me list my concerns about the current proposed project.

1. The facts are that 4 years ago when I bought the property nothing was ever disclosed to me about the possibility of a subdivision going in. The only thing I was told about was that a Bypass would be going in over the next few years. Disclosure is important and was never done! Greg Brown made promises to me and my neighbors that haven't been kept, similar promises to those he is making to the County for this project.

2. The facts are that traffic will become a huge issue if this subdivision goes in. You can't put that many more cars in to the mix and not expect big problems. Yes, you can hire an engineering company that can produce a traffic study that satisfies whoever is paying to have it produced. Traffic will be the biggest problem! Emergency vehicles will have trouble getting in and out as well. In addition to the issue of fire evacuation, currently the lights at the bottom of Kai Hele Ku Street are a bottleneck with only one road in and out of our development from the highway. Even if a second road goes in, with a tripling of the population this is unlikely to solve the resulting congestion problem. This traffic issue is my biggest concern and I will have a traffic study done at my own expense if need be.

3. The facts are that water is a big deal and I have been told over and over that I need to conserve. Again consultants can be hired to report anything but water just can't be make out of thin air. I have animals to water and crops to water. I have a farm plan as required and I need a lot of water. Any new project will have the same needs and the information provided to the County by the Developer has not shown that adequate water is available.

4. Almost every day I see Nene geese flying around my house. I think they nest next door an on the property that is being proposed. I think that these Nene geese are federally recognized as endangered species and I don't think that you want their habitat disturbed.

5. I'm concerned that this is not really an affordable project at all. I met with the developer (Greg Brown) and he acknowledged that he is going to profit well from the market-priced homes. If this is going to get approved as an affordable project, it should by more than

51% affordable. As a responsible developer he should provide more public benefit instead of only lining his own pockets.

6. Almost 80 acres is being turned into 25 affordable homes. That seems like an incredible waste of acreage. The fast-track process should be used to create higher-density development as those are the types of projects that will have a real impact on affordable housing shortage. 25 affordable units will not be any help at all to the Maui market, but it will certainly make a big impact to the developer's own pocket. This just doesn't seem right.

7. The developer is saying that there will be agricultural farms on the market-rate homes, yet the lot sizes are only 1.5-2 acres. After the house, driveway, wastewater systems, setbacks, etc., there will be little land left to actually farm.

8. Many people in my neighborhood do no support the project and we are prepared to challenge this process through the legal system.

9. Even the State Land Use Commission and State Office of Planning do not believe that the project should be able to avoid review by the State. This just isn't the type of project that should receive the benefits of the fast-track process.

In summary I have many concerns about this proposed subdivision. I just don't believe that this can work as proposed. Maybe if there was a much smaller subdivision planned and all of our studies proved out, then the proposed project may work but that would have to be looked at very carefully. I've attached some additional specific notes from the developer's application that should make the County take a long look at whether this is the type of project that should benefit from being identified as "affordable".

As I said before, I am a developer in California and I have some experience in how this gets approved. Even if this got approved there is a very good chance that the courts will get involved as there are a number of problems with the project. I would like to see this property remain as AG as it is zoned now. Our farm does very well and the AG land needs to be preserved in Hawaii. This land once grew sugar cane and produced a great harvest. The ground is very fertile so why not continue to use it for AG purposes? Let's not get into a war over this project, it's going to cost all of us a lot of time and money. If anyone would like to call me in regards to my concerns, my number is (707)527-2204. Thanks for your time.

Sincerely,

Steve Strombeck

Specific Notes re Concerns About the Makila Kai Project

(from Steve Strombeck, concerned neighbor)

1. 201 Expedited Review is Not Warranted. The entire project is not appropriate for expedited review under 201H as only 51% of the units are affordable units. Developer is abusing the process to "fast-track" the market segment of his project.

2. The Project is NOT "Primarily" Affordable. 201H requires that the projects be "primarily" for affordable housing. The developer here is taking the term "primarily" very literally and only providing 51% of the units as affordable. Other 201H projects approved in Maui have been predominantly 100% affordable and here the developer is only providing barely more than half of the units as affordable.

3. The Project is an Inefficient use of Land. The reclassification of 80 acres to only create 25 affordable units is not efficient. Prior 201H projects created many more units on much smaller lots:

    a. 30-acre project on Lanai created 372 affordable units (2010)

    b. 4-acre project (Hale Mahaolu Ewalu) created 60 affordable units (2014)

    c. 48-acre parcel (Kula Ridge) to provide 116 homes (only 36% of the units will be market-compared to 49% at Makila Kai).

    d. 9.3 acre project (Kaiwahine Village) to provide 120 units (100% affordable)

4. The State Land Use Commission (LUC) Must Review the Project. The entire 80 acre project should be reviewed by the State Land Use Commission.

    a. The LUC has taken a clear position in its comment letter to the Project dated January 26, 2017 that the Project should **not** be exempt from review under HRS 205.

    b. Developer is trying to break the project into two pieces so it can specifically avoid review by the LUC by taking advantage of special rules that allow the Counties to reclassify property less than 15 acres in size. The Developer has conveniently squeezed all of the affordable units onto a 14.6 acre parcel.

    c. This "segmentation" of the project to avoid appropriate levels of review should not be permitted as it will result in creating a precedent for "spot zoning" by the Counties which was not the intent when the State delegated authority to the Counties for parcels under 15 acres.

    d. The Hawaii State Office of Planning has also taken the position that the LUC needs to review this Project given its size and the proposed reclassification under the state land use laws.

5. The 1.5 to 2 acre lot size proposed for "Agricultural" use are a sham.

    a. Given the size of the lots, no realistic agricultural use will occur on the market lots.

    b. The market-rate lots will become "gentlemen farms" where the wealthy will point to vegetable gardens or fruit trees to substantiate their "agriculture" on the property.

    c. Other AG Lots (like in Kula Ridge) were 4 acres in size which provides owners with the area required to conduct meaningful agricultural activities.

    d. There is no non-potable water to sustain agricultural uses on the 24-market rate lots. Water is in short supply and potable resources should not be used for farming. The Developer's failure to find a non-potable resource suggests he does not intend these lots to ever be used for farming.

    e. The County Department of Planning in its letter providing comments on this Project has expressed specific concerns about the size of the lots and the potential use as "gentlemen estates" and recommended that the Developer reclassify the affordable units from the State Agricultural District to the State Rural District to better "reflect the actual use of the property."

6. It is Unclear if There is Water Adequate to Service the Project.

    a. In its response to specific questions from the Department of Water Supply, the developer has taken the position of assuring the county that it will be figured out later as part of the building permit process. This is not responsible development.

    b. Developer is seeking approval for a project where the estimated water consumption and availability (potable and non-potable) have not been defined. The County should not approve projects where the availability of water is unknown. The Developer needs to clearly show that there is adequate water (potable and non-potable) to serve the project.

    c. The County estimates that 181,500 gallons per day will be required whereas the Developer suggested that only 98,000gpd was required. The County's estimate also does NOT include water usage for agricultural purposes (which, if the market rate units are in fact used for agriculture) will cause this number to increase significantly.

    d. According to the 2002 Water System Standards, the State estimates that 5,000 gallons per day, per acre is the anticipated utilization for agricultural use on Maui. That is likely to generate an additional 90,000 gallons (or more) of consumption per day of POTABLE water (as Developer has not identified a non-potable water source).

    e. According to the 2013 Rainfall Atlas of Hawaii published by the UH Manoa Department of Geography, the Laniupoko region on Maui is described as "mostly

desert, dry and sunny virtually all the time". The rainfall totals in the region are in the lowest range (i.e., only 10.3 to 30 inches of rainfall per year). This climate will likely require significant irrigation which will further strain the potable water system.

7. To Suggest that this Project is an "affordable" Project is Disingenuous. The project is not truly an "affordable" project based on the unit breakdown. 17 of the 25 homes (i.e., 68% of the units) will be sold to families with moderate to above moderate incomes. Only 8 of the 49 units will be sold to families with below moderate incomes.

8. The rules of the HHFDC say that an EA is required, but one has not been prepared.

    a. In the "Threshold Requirements for Applications to HHFDC", the Hawaii Housing Finance and Development Corporation who administers the 201H program specifically provides that developers submit an approved EA if the project: (i) is greater than 15 acres; (ii) will rely on non-public sewer or water systems; and (iii) is a subdivision and requests subdivision exemptions. Here, the Project satisfies all of these triggers, yet no EA has been prepared.

    b. With 49 new private septic systems being installed, there could be significant impacts to groundwater resources as the Laniupoko region does have an underground aquifer.

LU Committee

From: Cambria <cambria.reiter@gmail.com>
Sent: Tuesday, May 30, 2017 9:06 PM
To: LU Committee
Subject: AFFORDABLE HOUSING PROJECTS (CHAPTER 201H, HAWAII REVISED STATUTES) (INDEPENDENT DEVELOPMENT OF MAKILA KAI; LAHAINA) (LU-2(1))

Aloha council members,
I'm writing this email to show my support for the Makila Kai project.
It's so important that the working families in our community have a home that can be purchased within our working wages.
My husband and I meet here 15 years ago and now have two children. We both work in tourism and are finally in a financial position to buy a family home after renting our adult lives. However we can not afford the average home of $700,000-$800,000. We have lived and worked on the west side for the whole 15 years and want to stay here. Our current rental is going through transitions and we need to look for another place to live. There are no affordable rentals on the west side. We would prefer not to move to the other side and commute adding to traffic or worse, move off island.
The proposed Makila Kai project is perfect for our community. It's conscience of the land and resources and allows the homeowners to live a more self-sustainable lifestyle.
Please allow the project to pass. My 6 year old son is already planning what we are going to grow in our garden!
Mahalo,
The Russell's
Cambria, Norman, Rio and Asia

LU Committee

From: Amber Gifford <amberonislands@gmail.com>
Sent: Wednesday, May 31, 2017 1:23 AM
To: LU Committee
Subject: LU-2 Makila kai development
Attachments: MakilaKai_Gifford_LetterToCouncilmembers.pdf

Looking forward to speaking at the council hearing in favor of the Makila kai foundation and its green belt development in the currently vacant Launiupoko area, offering workforce housing to local families is much needed. I support Makila kai and hope you can too!

-Amber
(808)283-9193

Council Vice-Chair Robert Carroll,
Chair – Land Use Committee
Maui County Council
Kalana O Maui Building, Eight Floor
200 South High Street
Wailuku, Hawaii 96793

SUBJECT: Affordable Housing Project (Chapter 201H, Hawaii Revised Statutes) (Independent Development of Makila Kai; Lahaina) (LU-2(1))

Dear Councilmembers,

I am sending this letter in support of the proposed Makila Kai project. I would like you to know that I support Makila Kai for the following reasons.

Location. I support the creation of housing on Maui which is located near community facilities and important services. Makila Kai residents would be able to drive to Lahaina Town in five minutes or could eventually take the bus, since the project is located along the future Lahaina Bypass Highway.

Community design. Makila Kai is located in an area designated for rural growth by the Maui Island plan. Given this designation and the existing agricultural (large) lots outside the Rural Growth Boundary, Makila Kai's design (mauka agricultural lots, makai rural lots) provides a thoughtful compromise between what exists and what is allowed by the Maui Island Plan.

In addition, I support this project because about 50% (41 acres) of Makila Kai will be open space, and buildings will be limited to a single story to protect views. Most of the open space will be taken up by a neighborhood park, pedestrian trails, and a large greenbelt along the future bypass. These features will directly benefit the neighborhood in terms of well-being and visual impacts.

Affordable homes. Makila Kai will provide a rare opportunity for Maui residents to purchase an affordable first home on a large lot which is usually attainable only by buyers who can afford to purchase a home at market rates. I commend the developer for providing the opportunity for working families to purchase a workforce home in this desirable area of West Maui.

The fact that Makila Kai plans to offer a financial gift to each workforce home buyer further emphasizes the developer's commitment to the idea of truly "affordable" housing.

I ask and strongly encourage the Maui County Council to support Makila Kai.

Sincerely,

Amber Gifford

LU Committee

From: Shauna Norris <ilovemaui22@gmail.com>
Sent: Wednesday, May 31, 2017 7:07 AM
To: LU Committee
Subject: Affordable Housing Project (Chapter 201H, Hawaii Revised Statutes) (Independent Development of Makila Kai; Lahaina) (LU-2(1))

Council Vice-Chair Robert Carroll,
Chair – Land Use Committee
Maui County Council
Kalana O Maui Building, Eight Floor
200 South High Street
Wailuku, Hawaii 96793

Dear Councilmembers,

I am sending this letter again in support of the proposed Makila Kai project.

Unfortunately, I cannot make it in person today since I had work scheduled on this day before knowing of this meeting. I wish I could be there today, but I hope this letter finds the council members in time for my support of this workforce housing development.

I would like you to know that I strongly support Makila Kai for the following reasons.

Affordable Housing. This should be the #1 reason that this development should take place. Through this workforce housing it is possible to have the opportunity to own an affordable home on a 1/2 acre lot for a single family that is born/raised on Maui. Most houses are above market prices that makes it much harder to own a home when it seems like you are working to just live here especially being a single mom and working so much to be able to reach that goal of being comfortable enough to pay these high mortgage costs. A lot of people I know including myself need to live with family members well in their 30's because of the priced out single-family homes going for over $700,000. And this area already has million dollar housing developments that most likely do not house your average local family so I'm unsure why anyone

would oppose this project. There's also a shortage of homes priced for workforce buyers.

Sustainability. Many families including myself need to live with family members or pay ridiculous rents to cover high mortgage costs. So in turn people need to settle for small, cramped homes in an apartment, condo or small home with barely a yard. Makila Kai will provide half acre lots which will make plenty of room for growing families to have yards to play in & teach kids about gardening & growing their own fruits & vegetables to be self-sustainable.

Local Support. Many desired location homes on Maui are built for second homes by people who do not live here. Having a community of local families will not only support local housing, but local businesses as well.

Community design. Makila Kai is located in an area designated for rural growth by the Maui Island plan. Given this designation and the existing agricultural (large) lots outside the Rural Growth Boundary, Makila Kai's design (maukaagricultural lots, makai rural lots) provides a thoughtful compromise between what exists and what is allowed by the Maui Island Plan.

In addition, I support this project because about 50% (41 acres) of Makila Kai will be open space, and buildings will be limited to a single story to protect views. Most of the open space will be taken up by a neighborhood park, pedestrian trails, and a large greenbelt along the future bypass. These features will directly benefit the neighborhood in terms of well-being and visual impacts.

The fact that Makila Kai plans to offer a financial gift to each workforce home buyer further emphasizes the developer's commitment to the idea of truly "affordable" housing.

I ask and strongly encourage the Maui County Council to support Makila Kai.

Mahalo for your time,
Shauna Norris

Sent from my iPhone

LU Committee

From: Cy Gabourie <cy@hawaiistastingtours.com>
Sent: Wednesday, May 31, 2017 7:41 AM
To: LU Committee
Cc: gigi.gaea@gmail.com; 'Cy Gabourie'
Subject: AFFORDABLE HOUSING PROJECTS (CHAPTER 201H, HAWAII REVISED STATUTES) (INDEPENDENT DEVELOPMENT OF MAKILA KAI; LAHAINA) (LU-2(1))
Attachments: Cy Gabourie 05.31.2017.pdf

Aloha,

Please see the attached letter and approve the Makila Kai Project!

Mahalo,

Cy

Council Vice-Chair Robert Carroll,
Chair – Land Use Committee
Maui County Council
Kalana O Maui Building, Eight Floor
200 South High Street
Wailuku, Hawaii 96793

SUBJECT: Affordable Housing Project (Chapter 201H, Hawaii Revised Statutes) (Independent Development of Makila Kai; Lahaina) (LU-2(1))

Dear Councilmembers,

I am sending this letter in support of the proposed Makila Kai project. I would like you to know that I support Makila Kai for the following reasons.

Location. I support the creation of housing on Maui which is located near community facilities and important services. Makila Kai residents would be able to drive to Lahaina Town in five minutes or could eventually take the bus, since the project is located along the future Lahaina Bypass Highway.

Community design. Makila Kai is located in an area designated for rural growth by the Maui Island plan. Given this designation and the existing agricultural (large) lots outside the Rural Growth Boundary, Makila Kai's design (mauka agricultural lots, makai rural lots) provides a thoughtful compromise between what exists and what is allowed by the Maui Island Plan.

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Affordable homes. Makila Kai will provide a rare opportunity for Maui residents to purchase an affordable first home on a large lot which is usually attainable only by buyers who can afford to purchase a home at market rates. I commend the developer for providing the opportunity for working families to purchase a workforce home in this desirable area of West Maui.

The fact that Makila Kai plans to offer a financial gift to each workforce home buyer further emphasizes the developer's commitment to the idea of truly "affordable" housing.

I ask and strongly encourage the Maui County Council to support Makila Kai.

Sincerely,

LU Committee

From: Gigi Gaea <gigi.gaea@gmail.com>
Sent: Wednesday, May 31, 2017 7:42 AM
To: LU Committee
Subject: AFFORDABLE HOUSING PROJECTS (CHAPTER 201H, HAWAII REVISED STATUTES) (INDEPENDENT DEVELOPMENT OF MAKILA KAI; LAHAINA) (LU-2(1))
Attachments: img203.pdf

Aloha,

Please approve the Makila Kai Project.

Mahalo,

Gigi Gaea

Council Vice-Chair Robert Carroll,
Chair – Land Use Committee
Maui County Council
Kalana O Maui Building, Eight Floor
200 South High Street
Wailuku, Hawaii 96793

SUBJECT: Affordable Housing Project (Chapter 201H, Hawaii Revised Statutes) (Independent Development of Makila Kai; Lahaina) (LU-2(1))

Dear Councilmembers,

I am sending this letter in support of the proposed Makila Kai project. I would like you to know that I support Makila Kai for the following reasons.

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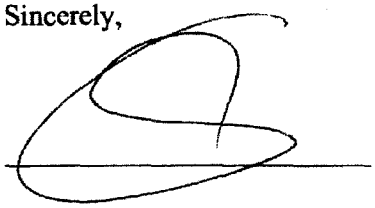
The fact that Makila Kai plans to offer a financial gift to each workforce home buyer further emphasizes the developer's commitment to the idea of truly "affordable" housing.

I ask and strongly encourage the Maui County Council to support Makila Kai.

Sincerely,



LU Committee

From: Gigi Gaea <gigi@hawaiistastingtours.com>
Sent: Wednesday, May 31, 2017 7:53 AM
To: LU Committee
Subject: AFFORDABLE HOUSING PROJECTS (CHAPTER 201H, HAWAII REVISED STATUTES) (INDEPENDENT DEVELOPMENT OF MAKILA KAI; LAHAINA) (LU-2(1))

Council Vice-Chair Robert Carroll,

Chair – Land Use Committee

Maui County Council

Kalana O Maui Building, Eight Floor

200 South High Street

Wailuku, Hawaii 96793

SUBJECT: Affordable Housing Project (Chapter 201H, Hawaii Revised Statutes) (Independent Development of Makila Kai; Lahaina) (LU-2(1))

Aloha kakou Council members:

I am sending this letter in support of the proposed Makila Kai project. As a small business owner of Hawaii Tasting Tours and a strong advocate for our tourism industry, I would like you to know that I support Makila Kai for the following reasons.

Firstly, there are certain group of people who recently moved to Launiupoko from California and feel that their wealth and status make them immune to our philosophy of sharing in Hawaii. Some have even made it a mission to destroy any possibilities of affordable housing in Launiupoko and have taken extreme measures including clouding issues to lying on or in www.change.org <http://www.change.org> petitions, tricking real farmers to rally with them claiming to be farmers although producing no fruit/vegetables, facebook and other social media forums.

Note, these are detailed notes from the last hearing. I will be unable to attend today and am hopeful someone can read on my behalf.

The elephant in the room: the word affordable. Most of the wealthier persons in Launiupoko think it's unfair that they have to 'throw a bone' to our teachers, firefighters and other applicants. They feel it's unfair that their housing value may go down. The resounding message from the opposition, Build Anywhere but Launiupoko. That doesn't really sound like people who care about the environment or Maui, just themselves and its very unHawaiian. Most of these people here are mainlanders who arrived 1-7 years ago and only live here part time. The most vocal express that they are well above Hawaiians due to their status of wealth and education and that the city has to hit their demands as elites of our society. Again, not really people who sound concerned with the environment, rather themselves. (note, you will find these quotes from "NextDoor" and facebook.

Fire rules. Some speakers didn't make sense in regards to this but Stephen, David and several other speakers are terrified of the mortality rates that will occur if 25 homes are built in Makila as there is no evacuation route. The bypass would be right there so there would be no impact on those living in the heart of Launiupoko. James Whitehead said he has lived in Lahainaluna for years, and generations before them with only 1 access route in and out, and there has never been a problem. However, others against the project claim that we will now need a new fire station to cover the additional 25 homes that the Makila Kai project will bring. One attorney, Doug Wright, held up a photo claiming that the green belt is just old grass. He makes a great point as the grass is so dry, it is a fire waiting to happen, where if it was irrigated as a green belt, fires would be a much less likely issue. This is a moot point that the bypass will handle.

Stephen Brown also brought up traffic. Even though plenty of information was shared about the Lahaina Bypass by the group in Launiupoko opposing this project, they don't seem to understand how the bypass will literally do just that, bypass their traffic. I have included bypass info for your perusal. Doris Lang who is fiercely and actively opposed to this project claims that we don't need affordable housing, we need the city to handle the traffic. This is a moot point that the bypass will handle.

Water: I've attached information about Aquifers. We actually don't' have one in Launiupoko. We share from Lahaina and Olowalu. First, nobody should monopolize water and secondly, please let Charlie, the last speaker know that Launiupokians actually go out of their way to 'WASTE' water because the more you use here, the less you pay. I've seen people run water for no reason at all for hours at a time just to get a cheaper bill and at what cost? To our real farmers like Charlie, ruined kalo fields, all for the greed of the wealthy who are trying to save money. Perhaps the city should not charge less for more water usage and then there would be enough for everyone. 25 houses will have zero impact to Launiupokians so this is also a moot point.

Vacation Rentals/Illegal tenants: this was brought up by people opposing the project because they feel that there are more illegal units and everyone should be forced to have tenants or short terms legally. Some claim that becauxse of this, there will be very limited road use if you add 25 houses .

Farms: Ms. Lang and Mr. Firestein worked very hard on 'NextDoor' app to find farms and only about 2.5-5% of the people living here actually farm. (in Launiupoko) Ms. Lang and Mr. Firestein even joke they can't farm however, they are claiming that the 25 homes with Makila Kai will ruin the farm land here that everyone jokes is great for growing rocks. One contractor who has lived here 20 yrs said .5 acres would allow him to grow his own food and that there should be a balance between nature and housing. Opposing that, David, who has lived in Launiupoko for 3 years claims no one can grow anything on .5 acres, just enough for yourself. He feels if you grow, it should be to supply the masses, not self-sustain. Note that David is not a farmer. In fact, the city should check how many people actually farm so this is a moot point.

3 housing projects: everyone opposing the project keeps referring to Peter Martin's previous and highly detailed and extensive projects. Those projects have been scrapped due to cost. Please do not let that influence your decision today.

The view: some opposing like Kimberly, feel that Makila Kai will force them to see rooftops and that those living at Makila kai will not be able to afford the transportation into Lahaina due to the distance from Makila to Lahaina. imberly.

Just because we can't afford multi-million dollar homes, doesn't mean we can't afford to drive and thinking so is ignorant and should be a moot point.

Environment: Vera, a Maui transplant for2 years, claims she is terrified about the environment. Although she kept referring to Peter Martin's projects, she feels any septic tanks will leech into the ocean and endanger tourism. She feels affordable housing can be put anywhere else but not near Launiupoko. She believes the beach is already too busy and that by adding 25 homes, you will kill tourism, coral, and Nene. Nene live predominantly on Maui and Big Island and I have attached their living patterns which is mostly Hana although, as birds, they are free to fly anywhere and not forced to live in Lauiniupoko. She also believes that those buying into affordable homes can't afford association fees and will need cars so we clearly can't afford a home in Launiupoko which is insulting and a moot point.

Bill 201H: Kari Lawrence brought up a powerful point that affordable housing homes, bill 201H, makes it that anyone can buy a home, regardless of whether they live in Maui or on the mainland. That should defiantely be addressed.

Council members, you hold a decision that is very powerful. Please do not let the wealthier people take away the rights of the working class. Its discrimination in any way you look at it. These points brought up in the last meeting are desperate pleas to stop affordable housing which is completely necessary. Makila Kai has responded earnestly to the previous complaints brought up by Mr. Peter Martin's project which has nothing to do with this current one. It comes down to the word affordable. Traffic and fire rules are solved once the bypass goes in however, there are an enormous number of illegal rentals that go tax free as well as water misuse that should be looked at. Bill 201H also needs to be amended to be applicable to those who live in Hawaii and preferably to those who have resided here for a number of years. Please vote yes to Makila Kai!

Gigi Gaea

Attached: Maui Aquifers, Letter to Approve

Until then....Noho Pōloli! (Stay Hungry!)

Mahalo nui loa,

Gigi Gaea

GastroPreneur

Hawaii Tasting Tours
"feed your 5 senses™"
c. (808) 359.8159 <tel:%28808%29%20359.8159> e gigi@hawaiistastingtours.com
<mailto:%20gigi@hawaiistastingtours.com>
www.hawaiistastingtours.com <http://www.hawaiistastingtours.com/>

<https://twitter.com/@HlTastingTours> <http://www.tripadvisor.com/Attraction_Review-g60634-d3370426-Reviews-Hawaii_Tasting_Tours-Lahaina_Maui_Hawaii.html> <https://www.facebook.com/pages/Hawaii-Tasting-Tours/499448403403958?fref=ts> <https://www.youtube.com/watch?v=IvPalrk4PRQ>

LU Committee

From: County Clerk
Sent: Wednesday, May 31, 2017 9:16 AM
To: LU Committee
Subject: Fw: Makila Kai 201H

From: George Vierra <gkvierra@gmail.com>
Sent: Wednesday, May 31, 2017 7:26 AM
To: Elle Cochran; Alika A. Atay; Kelly King; Mike White; County Clerk; Donald S. Guzman; Robert Carroll; Yukilei Sugimura; Stacy S. Crivello; Riki Hokama
Subject: Makila Kai 201H

Aloha Maui County Councilmembers,
I am writing in regards to the proposed Makila Kai 201H project. I know that we desperately need affordable housing for local people. We also are in need of low income housing and both low income and affordable rentals. All of these desperate needs are creating desperate people and desperate situations. When we as a people are desperate we tend to make desperate decisions taking anything that is offered. This project Makila Kai is exploiting our desperation and exploiting the 201H process. Please understand that without this designation only three lots would be allowed to be developed. Knowing this it makes sense for the developer to offer 25 so called affordable units (the bare minimum required for 201H) so that 24 market value homes can be developed and sold.

Although it looks like a great deal large amount of land $250,000 for a one bedroom house is not affordable for local families especially when you factor in an estimated $311 for water/sewer/trash and HOA fees, this does not include electricity and other household expenses and there is no way for the county to hold this private development to the estimated $311 amount-significantly more every few years when the septic systems need to be pumped.

There are so many things to consider on this development. I helped the 'Ohana Palakiko open lo'i kalo in Kaua'ula valley until Peter Martin unilaterally reduced the amount of water going into the stream that fed our lo'i kalo and all of our hard work rotted. If there is enough water for all this development then there should be enough water for the lo'i which by Hawaii State law takes precedence through appurtenant rights.

Traffic is also a huge issue. Everyone that commutes will tell you that the traffic to and from West Maui cannot handle any increase. This project is outside of the community plan boundaries for this type of development, it is adding sprawl on top of sprawl as it is not close to schools, jobs, emergency services and shopping increasing the traffic burden. If anything the bypass infrastructure and community plan update should be in place before development is allowed in this location. Kaua'ula winds are a real and documented phenomenon, life/property threatening fires have already occurred at Launiupoko. I pray the two do not occur at the same time at rush hour traffic or the whole valley will burn down.

This project is linked to the Makila Rural plan which was not given approvals and did require an EIS per Tom Schnell of PBR, this particular land has been sold to developer Greg Brown by Peter Martin. Peter Martin holds the rest of the Makila Rural lands and is waiting to see if Greg Brown can ram this through the 201 H process, if he can then the rest of Makila Rural will be developed just as Makila Kai will which amounts to segmentation and hiding of the true and final impact of this project that will have no EIS.

In March of this year Launiupoko beach park tested for enterococcus and people were advised to stay out of the water. It is unknown what caused this but common sense shows there are all septic above Launiupoko and this project proposes adding even more septic with no EIS!

The 201H lottery system does nothing to guarantee that these "affordable houses" will go to local people or people who live and or work in West Maui. The income gap is so narrow that struggling families will not even qualify to apply and if they do how will they meet the burdens of providing for their family while paying the mortgage and the fees? We have seen many projects like this including the Front St apartments not last as affordable. At this location guaranteed as soon as the time is up if not sooner these will be multimillion dollar mansions/ fake farms/ air bnb rentals and it will be the local people screwed over once again.

This is the wrong location for this project. We need to limit development on the transportation corridor. Launiupoko development was a huge mistake, do not create more mistakes. If this project is to be accepted it needs a much more thorough review than can be done in 45 days. Limit the lots built here to 3 do not allow the negative impact to our entire West Maui community.

George Vierra
808-250-3604

LU Committee

From: thomas landrigan <toroland12@icloud.com>
Sent: Wednesday, May 31, 2017 10:03 AM
To: LU Committee
Subject: Makila Kai & linked projects

Dear Land Use Committee,

By now you have heard a great deal of issues from both sides.

Please don't allow this project to go forward. There are enough developments in the works and they should be studied & evaluated.

Greg Brown will enrich himself under the guise of helping others. He is a Luxury Home Builder. Brown knew what he was purchasing; land that could only sustain six total homes (one Main House & one Ohana/Cottage) on each of the three parcels.

Call for a moratorium on this type of density. It is absolutely the wrong development in the wrong place at exactly the wrong moment in Maui County History. A pause will reflect well on the wisdom of our elected officials.

We sincerely thank you for your consideration,

Thomas & Rona Landrigan
590 Punakea Loop
Lahaina

LU Committee

From: Ulrich 'Uli' Okura Kirkegaard <uli@mauitechguru.com>
Sent: Wednesday, May 31, 2017 10:26 AM
To: LU Committee
Subject: RE: AFFORDABLE HOUSING PROJECTS (CHAPTER 201H, HAWAII REVISED STATUTES) (INDEPENDENT DEVELOPMENT OF MAKILA KAI; LAHAINA) (LU-2(1))

Importance: High

Dear Councilmembers,

I'm writing again to voice my support for the Makila Kai affordable house project. At last committee meeting we heard pros from people for and cons from people against. My family is for Makila Kai – we are pre-approved and in the lottery. We are excited for this opportunity. We humbly request that the honorably committee will approve the Makila Kai workforce housing project today.

People pro and for this project are like us in need of proper housing in Lahaina. We are overwhelmed by ever increasing rents and lack of inventory pushing sales prices up .. and up ... a house on Lahainaluna Rd is now ~$750,000 because it offers rental income though likely not even permitted. it's impossible for a working family to buy these old plantation houses. For us Makila Kai will be the best ever workforce housing project.

People against already own houses in the Launiopoko area and would like to keep status quo – not to develop anymore. I don't blame them but they too have to realize that before them the whole area was undeveloped and it needed to be developed for them to buy a house. It will continue to change as Maui resident base grows. No one should have the right to block others from owning a house too. Still there is plenty room for more houses; Makila Kai won't spoil their views or create a huge traffic issue.

Traffic was a concern; but 1) 25-50 more house aren't going to make a huge change to traffic; considering there are thousands of cars going through daily. The new bypass section promises to resolve part of the traffic issue; so traffic planning is a different discussion; traffic shapes around community needs – the community shouldn't shape around the traffic conditions.

I recommend that the committee approves Makila Kai workforce housing project today – to allow these affordable houses for local workforce.

Please Please Please,

Your truly,

Ulrich 'Uli' Okura Kirkegaard
Lahaina Resident.

From: Ulrich 'Uli' Okura Kirkegaard
Sent: Wednesday, May 17, 2017 9:43 AM
To: 'lu.committee@mauicounty.us' <lu.committee@mauicounty.us>
Subject: AFFORDABLE HOUSING PROJECTS (CHAPTER 201H, HAWAII REVISED STATUTES) (INDEPENDENT DEVELOPMENT

OF MAKILA KAI; LAHAINA) (LU-2(1))
Importance: High

Aloha Councilmembers,

I'm writing in support of proposed Makila Kai workforce housing development. I would like you to know that I support Makila Kai for many reasons;

Lahaina needs more housing – but the current market leaves many of us incapable of owning a home on the West side we call home.

High housing prices causes people to live elsewhere which means more commuters – and more traffic which is getting pretty bad. Makila Kai residents can easily get to Lahaina by car, bus or even bicycle.

Makila Kai is designed with ample green areas and will be a contribution to the West side.

The homes built will be affordable - Makila Kai is a rare opportunity – and very much needed. I excited for the opportunity it presents. Also Makila Kai developer plans to offer a financial gift to each workforce home buyer further emphasizes the developer's commitment to the idea of truly "affordable" housing.

I ask and strongly encourage the Maui County Council to support Makila Kai.

Thank you so much for helping run Maui County. Both my dad and brother were both council members in the county we grew up in so I know how much time and dedication it takes. Thanks again.

Mahalo for your kokua,

Have an awesome time ☺

Yours Truly Online,

Ulrich 'Uli' Okura Kirkegaard
Principal Guru, MCP - Maui Tech Gurus
Biz Tech Partners & Small Biz Specialist
'Helping businesses tie IT all together'
Ph. (808) 661-1000 or Cell (808) 281-1169
E-mail uli@mauitechgurus.com
Visit http://www.mauitechgurus.com/

MAUI TECH GURUS
Business Technology Partners

Microsoft
Small Business
Specialist

Rotary Club of Lahaina Sunrise
Past President (2012-13)
http://www.lahainasunriserotary.org/

LU Committee

From: County Clerk
Sent: Wednesday, May 31, 2017 10:53 AM
To: LU Committee
Cc: Danny A. Mateo
Subject: Fw: Please Request a full EIS for the Makila Kai Proposed Development
Attachments: Makila Kai Testimony 31 May 2017 Deakos.pdf; NOAA_final report_March 2017.pdf; PCA_handout_5_2017_CSC-ab3_FINAL.pdf

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From: deakos@hawaii.edu <deakos@hawaii.edu>
Sent: Wednesday, May 31, 2017 10:44 AM
To: Mike White; Elle Cochran; Riki Hokama; Robert Carroll; Stacy S. Crivello; Donald S. Guzman; Kelly King; Alika A. Atay; Yukilei Sugimura
Cc: County Clerk
Subject: Please Request a full EIS for the Makila Kai Proposed Development

Dear Honorable Councilmembers:

My name is Dr. Mark Deakos and I'm the Executive Director and marine biologist with the Hawaii Association for Marine Education and Research (HAMER). I have a lot to share so I will try to be concise with 3 points:

1. We love our tourist money but we have to recognize tourists aren't coming to Maui for our hotels and shopping malls, they are coming for our beaches and coral reefs. Coral reefs by the way, create our beaches, and surf and responsible for a $360M year ocean recreation industry. However, Maui has the worst water quality in the state and West Maui has some of the worst brownwater issues, both of which contribute to our coral reef decline. We have lost nearly 50% of our coral reefs in the past 30 years and we are on track to lose all our reefs by 2050 if we don't change our ways. So we really need to rethink how our land practices are impacting our most valued resources.

2. On March 7, 2017 KHON 2 News reported (http://khon2.com/2017/03/07/waters-off-two-maui-beaches-show-high-bacteria-count/) that the public be advised to stay out of the waters off Launiupoko Beach Park because swimmers can get sick from pathogens. This is not good for business. The proposal before you is for 49 dwellings at Launiupoko, all on septic systems. Here are scientific publications describing why septic systems should never be used in Hawaii because our reefs and our people are impacted by leaching effluent. Hawaii has very porous volcanic rock with very steep slopes so the effluent sinks quickly into the water table and quickly out to our oceans. How quickly? Dr. Colbert from U.H. Hilo tracked green dye flushed down 10 toilets in Puako on the Big Island (4 cesspools, 4 ATUs and 2 septic systems). All the die reached the shoreline within 10 days, some within 5 hours. Even the best septic systems with an anaerobic component require constant, expensive maintenance that is unmonitored so we can be sure this will be a low priority for "low-income" home owners and likely a low priority for all homeowners. So adding 49 lots on septic in addition to the cumulative effect of the additional 300-400 dwellings planned for this area, will only contribute to our water quality and declining reef problems.

Waters off two Maui beaches show high bacteria count - KHON2

khon2.com

KHON2 is Hawaii's leading source of local news, sports, weather, breaking news, and traffic for all counties including Honolulu, Maui, Kauai and Hawaii.

3. Given West Maui is struggling with some of the worst water quality in the State, wastewater, brownwater discharge and water rights issues, rapidly declining resources including beach and coral reef loss, and the unacceptable traffic situation, it would seem to me that addressing all of these issues should be a priority before worsening the situation with this project. Just the other day I watched waves crashing over the Ukumehame seawall into car windows as they drove past. I truly hope it doesn't take someone dying on the Honoapiilani Highway to realize that should be of highest priority before discussing if we should add more people and cars to West Maui?

Let me conclude with "septic systems do not belong in Hawaii and we need to address the serious problems facing West Maui before we start fast tracking more development.

Thank you,

Mark Deakos

****
****

Mark H. Deakos, Ph.D.
Executive Director, Chief Scientist
HAMER
Hawaii Association for Marine Education and Research, Inc.
PMB#175
5095 Napilihau St. 109B
Lahaina, HI 96761
808-280-6448 (cell)
866-594-1896 (fax)
www.hamerinhawaii.org

The Hawaii Association for Marine Education and Research, Inc.

PMB#175
5095 Napilihau St. 109B
Lahaina, HI, 96761
USA
Phone: 808-280-6448
Fax: 866-594-1896
Email: mdeakos@hamerinhawaii.org
www.hamerinhawaii.org

May 31, 2017

Maui County Council

RE: Testimony requesting Makila Kai Development be required to do a full EIS.

Dear Honorable Councilmembers:

My name is Dr. Mark Deakos and I'm the Executive Director and marine biologist with the Hawaii Association for Marine Education and Research (HAMER). I have a lot to share so I will try to be concise with 3 points:

1. We love our tourist money but we have to recognize tourists aren't coming to Maui for our hotels and shopping malls, they are coming for our beaches and coral reefs. Coral reefs by the way, create our beaches, and surf and responsible for a $360M year ocean recreation industry. However, Maui has the worst water quality in the state and West Maui has some of the worst brownwater issues, both of which contribute to our coral reef decline. We have lost nearly 50% of our coral reefs in the past 30 years and we are on track to lose all our reefs by 2050 if we don't change our ways. So we really need to rethink how our land practices are impacting our most valued resources.

2. On March 7, 2017 KHON 2 News reported (http://khon2.com/2017/03/07/waters-off-two-maui-beaches-show-high-bacteria-count/) that the public be advised to stay out of the waters off Launiupoko Beach Park because swimmers can get sick from pathogens. This

is not good for business. The proposal before you is for 49 dwellings at Launiupoko, all on septic systems. Here are scientific publications describing why septic systems should never be used in Hawaii because our reefs and our people are impacted by leaching effluent. Hawaii has very porous volcanic rock with very steep slopes so the effluent sinks quickly into the water table and quickly out to our oceans. How quickly? Dr. Colbert from U.H. Hilo tracked green dye flushed down 10 toilets in Puako on the Big Island (4 cesspools, 4 ATUs and 2 septic systems). All the die reached the shoreline within 10 days, some within 5 hours. Even the best septic systems with an anaerobic component require constant, expensive maintenance that is unmonitored so we can be sure this will be a low priority for "low-income" home owners and likely a low priority for all homeowners. So adding 49 lots on septic in addition to the cumulative effect of the additional 300-400 dwellings planned for this area, will only contribute to our water quality and declining reef problems.

3. Given West Maui is struggling with some of the worst water quality in the State, wastewater, brownwater discharge and water rights issues, rapidly declining resources including beach and coral reef loss, and the unacceptable traffic situation, it would seem to me that addressing all of these issues should be a priority before worsening the situation with this project. Just the other day I watched waves crashing over the Ukumehame seawall into car windows as they drove past. I truly hope it doesn't take someone dying on the Honoapiilani Highway to realize that should be of highest priority before discussing if we should add more people and cars to West Maui?

Let me conclude with "septic systems do not belong in Hawaii and we need to address the serious problems facing West Maui before we start fast tracking more development.

A hui hou,

Mark Deakos
President

NOAA Coral Reef Conservation Program
Final Project Report

I. Recipient: Marine Science Department, University of Hawai'i at Hilo

II. Project Title: Spatial distribution and effects of sewage on Puakō's (Hawai'i) coral reefs

III. Award Number: NA14NOS4820087

IV. Award Period: July 1, 2014 - December 31, 2016 (approved 1-year no cost extension)

V. Period Covered by this Report: July 1, 2014 – March 31, 2017

VI. Report

A. *Introduction.* Hawai'i's coral reefs contribute ~$800 million dollars annually to the state's economy. Unfortunately, these coral reefs are declining as a result of multiple stressors. Sewage from cesspools is one of most devastating stressors in rural areas where reefs are still relatively healthy. Cesspools are used more widely in Hawai'i than any other state in the U.S., and their discharge of pathogens, nutrients, cleaning chemicals, and hydrocarbons pose a threat to coral reef and human health. Hence, Hawai'i State's Coral Reef Strategy, Objective 1, is to reduce key anthropogenic threats to near-shore reefs. Puakō, a coastal community on Hawai'i Island, is located within one of the two priority sites in the state identified for site-based actions.

While Puakō's coral reefs are some of the richest in Hawai'i State, there has been increasing concern about sewage pollution since the 1960s. Hawai'i's Division of Aquatic Resources (HDAR) found Puakō's reefs to be in 'dire straits', with coral cover decreasing 35% and turf and macroalgae cover increasing 38% over the last 30 years. The Puakō Community Association (PCA) contacted the University of Hawai'i at Hilo (UH Hilo) and requested a study to determine whether sewage was entering their coastal waters and impacting their reef. To do this, dye tracer tests, $\delta^{15}N$ macroalgal and fecal indicator bacteria (FIB) measurements, as well as water quality and benthic sampling, surface and benthic water quality mapping, and coral pathogen testing were conducted. With data from UH Hilo's study, PCA will have scientifically-defensible results that will demonstrate to Hawai'i County and State the urgency to remove cesspools from their community and to replace them with an improved sewage treatment system. Options under consideration include: 1) building an on-site sewage treatment plant, 2) connecting homes within their community to an existing sewage treatment plant at the Mauna Lani Resort through construction of a sewer line, or 3) replacing their cesspools with aerobic treatment units (ATU). Removal of cesspools will improve water quality at Puakō and help mitigate coral disease, future coral cover loss, and reduce human health hazards.

B. *Purpose.* In November 2013, PCA contacted UH Hilo's Marine Science Department and requested that they conduct a study to determine whether sewage was entering their coastal waters and impacting their reefs. They wanted to document the presence of sewage in their near-shore waters to convince Hawai'i County and State of the urgency to improve sewage collection and treatment in their community. Data collected by UH Hilo, as part of this study, is providing PCA with baseline data to compare to following any sewage collection and treatment upgrade efforts, and allowing them to evaluate whether those upgrades were effective. PCA would like to be a model community for Hawai'i Island and State with regards to a community-based initiative to improve near-shore water quality and coral reef health. Hawai'i State needs examples like Puakō to help convince the public that a cesspool ban is necessary to improve coastal water quality and decrease the health risks to recreational water users. In 2015, Hawai'i's Department of Health (HDOH) revised its proposed 2014 cesspool ban and it was signed into legislation. It bans construction of new cesspools and provides a tax credit to homeowners near waterbodies who voluntarily remove their cesspools and replace them with septic tanks, ATU, or connect to an existing sewer line.

In collaboration with PCA, goals and objectives to address their sewage pollution issue were derived. The **Project's Goals were to**: (1) use chemical and biological approaches to determine if sewage pollution was entering near-shore waters with coral reefs, (2) determine whether the sewage pollution was impacting water

quality, and (3) assess whether the sewage pollution was eliciting a community-level response on the reef. The **Project's Objectives were to:** (1) determine the connectivity between domestic onsite sewage disposal systems (OSDS) and adjacent coastal waters through dye tracer tests, (2) evaluate the presence of sewage in near-shore waters through $\delta^{15}N$ measurements in macroalgal tissues and FIB, (3) determine if state water quality standards were exceeded in Puakō waters through FIB measurements, and (4) assess whether there was coral reef community response to sewage through measurements of benthic cover.

D. ***Accomplishments and Results.*** The UH Hilo Marine Science research team has successfully accomplished all tasks outlined in the proposal (Table 1). Additionally, findings have been presented at meetings and conferences, 1-page project summaries for the general public have been generated and circulated, community outreach events have been attended, undergraduate and graduate students have been trained, and a conference session was organized. Below, accomplishments and results for each objective are described

Table 1. Completed and remaining tasks for UH Hilo's NOAA Coral Reef Conservation Program project. Checks (√) indicate completed tasks; x's indicate remaining tasks. Project started July 2014. A no cost extension was awarded until December 2016. This table covers tasks completed from July 2014 to March 2017.

	Year													
	2014 -2015												2016 - 2017	
Task	J - J	F	M	A	M	J	J	A	S	O	N	D	J-J	A-M
1. Community/outreach events/advisory board	√		√					√				√	√	√
2. Planning/preparation														
-Hire personnel	√						√							
-Order equipment/supplies	√	√		√		√	√	√	√	√	√	√	√	
-Draft work plan/schedule	√				√									
-Permit applications					√									
-GIS site maps	√	√			√		√							
-Database preparation	√													
3. Personnel training														
-Equipment use	√						√							
-Water sampling	√						√							
$-\delta^{15}N$ macroalgal assay	√						√							
4. Initial sampling														
-Water sampling/mapping	√													
-Macroalgal sampling	√													
$-\delta^{15}N$ macroalgal assay		√	√		√	√								
-Final site selection	√				√									
5. Project Sampling														
-Dye trace studies	√									√				
-Water sampling/mapping	√		√				√							
$-\delta^{15}N$ macroalgal assay							√							
-Benthic community structure							√							
6. Data Analyses														
-Sample processing	√		√				√	√	√	√	√	√	√	
-Statistical analysis			√						√	√	√	√	√	√
7. Reporting														
-Progress reports	√												√	√
-Presentations	√	√	√		√			√	√				√	
-Final report														√

Objective 1: In order to determine the connectivity of OSDS with near-shore coastal waters at Puakō, groundwater seeps that may be transporting sewage were identified during low tide when groundwater influence is greatest and easiest to detect through measurements of surface water salinity. These data were then used to make a near-shore surface salinity map. This map was used to identify ideal locations for dye tracer tests and sampling stations for Objectives 2 - 4 (Fig. 1). Based on the location of the groundwater seeps, as well as cooperating homeowners, dye tracer tests were completed at four oceanfront homes' OSDS, three were cesspools in the southern portion of Puakō, and one was a fractured ATU (not in use) in the central portion of the community (Fig. 2, black squares). Five stations along the shoreline in front of each home were sampled

before and after the dye was added to the OSDS. Samples were analyzed for salinity and fluorescein (a non-toxic fluorescent dye). Fluorescein concentration vs. time data were used to calculate dye travel time, flow rate, and dilution before entering the near-shore waters. Dye was visually observed at the shoreline in front of all four homes. For each test, there was only one spring with dye, which was located on the beach in front of the home, suggesting that the groundwater flow between the OSDS was restricted to specific fractures in the aquifer. At three homes, dye was only observed during low tide and was highly diluted (max. observed dye concentration = 0.02% initial concentration). At the third home, while the same amount of dye was added to the OSDS, the discharge was much less diluted, and dye was visible during low and high tides for several days, as it was trapped in an area with little water circulation (Fig. 3, inset). The dye from these springs dispersed over an area between 0.25 to 4 m^2. Initial detection of fluorescein at the shoreline ranged from 0.4 to 9.3 days after release, and it continued to flow out during low tide over the next several days (Fig. 3). Three homes had comparable flow rates between 4 to 14 m/day; the OSDS at one home had a remarkably faster flow rate, where dye in the groundwater traveled 76 m/day. Based on dilution of the dye, the maximum fraction of sewage in the freshwater at the shoreline varied from <0.02 to 0.14%, depending on how much mixing occurred before shoreline discharge.

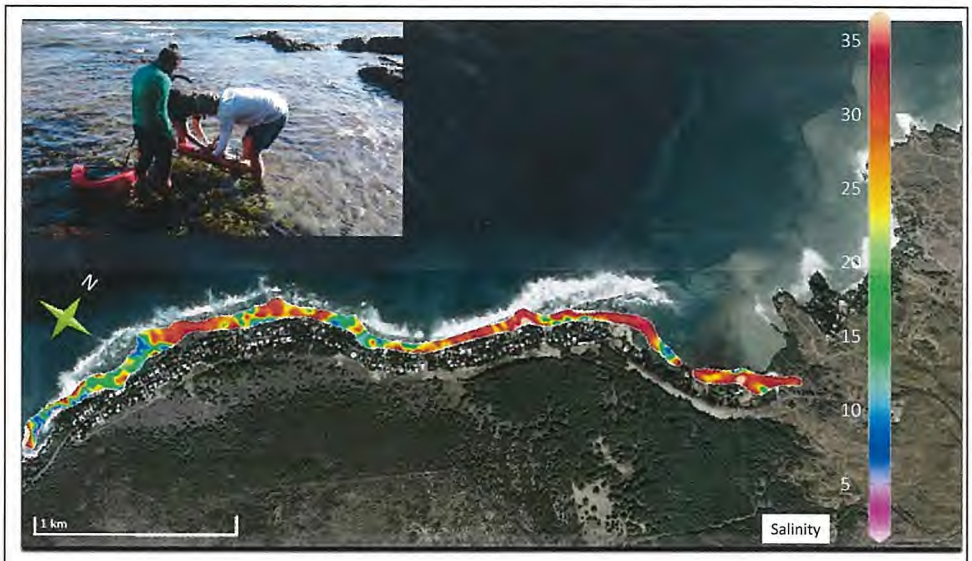


Figure 1. Map of surface salinity along the Puakō shoreline (June 2014). The map was created using a YSI 6600 sondes and GPS. Shown in the picture is Dr. Steve Colbert with two of the three summer interns (NSF REU program at UH-Hilo) at the beginning of the surface salinity mapping effort.

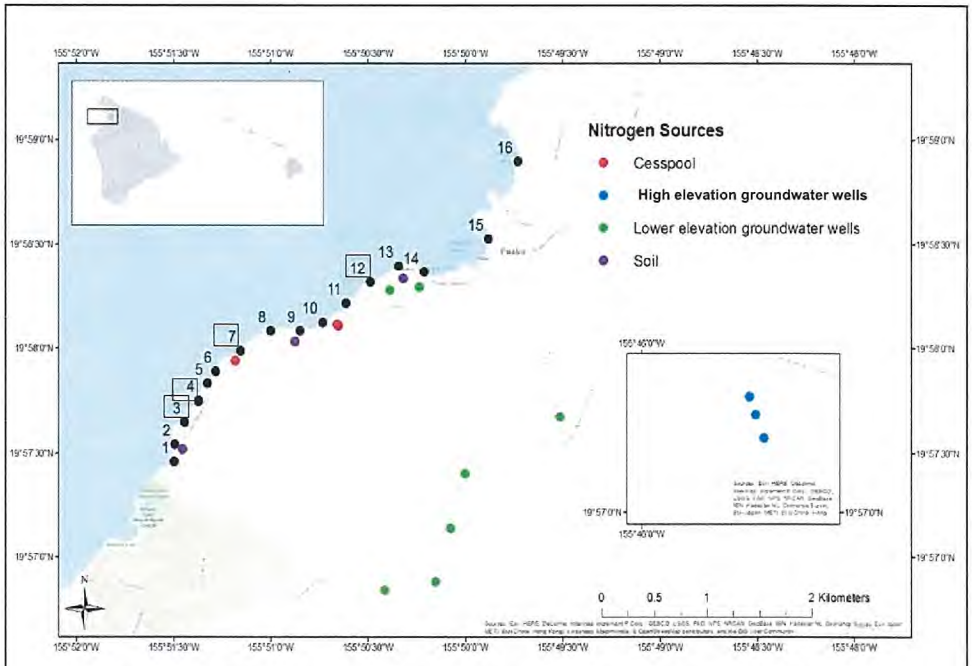


Figure 2. Locations of dye tracer tests (open squares), nitrate source sampling (red, blue, green, and purple circles), and shoreline water and algae collections (black circles) along the Puakō coastline, Hawai'i, USA.

Objective 2: Three different approaches were used to evaluate the presence of sewage in near-shore surface and benthic waters. First, groundwater and shoreline waters were sampled and analyzed for nutrient concentrations and $\delta\,^{15}N\text{-}NO_3^-$ (*Upland well measurements* section). Second, macroalgal tissues and nearshore waters were collected along the shoreline for $\delta\,^{15}N$ and FIB analyses, respectively (*Shoreline measurements* section); FIB data are discussed in Objective 3's results. Finally, macroalgal tissues were deployed in surface

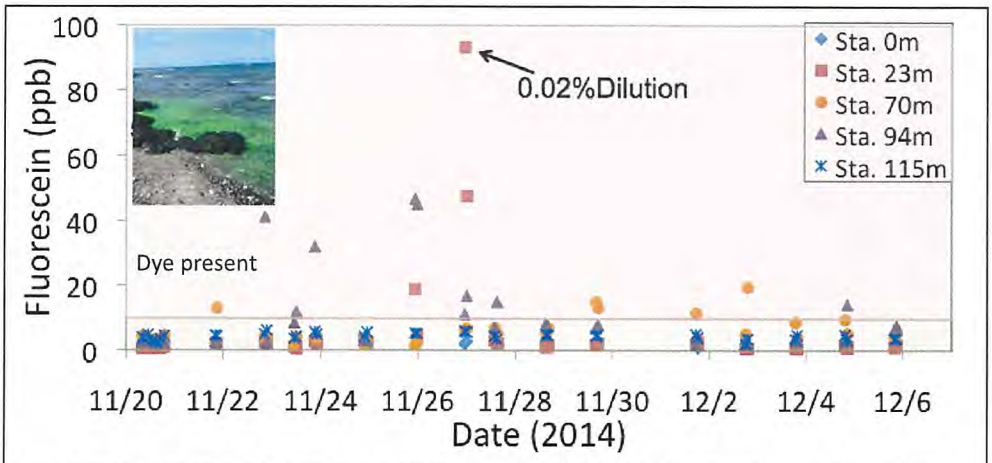


Figure 3. Time series of fluorescein dye concentration in near-shore waters of Puakō following dye injection into a cesspool (20 Nov 2014). Background fluorescence levels are indicated by the gray-shaded area. The concentration of the dye injected was 500 ppm. Dye was detected within three days of the initial release and continued to be detected for five more days (pink-shaded area). The dye was only detected at two sampling locations in front of the home and only observed during low tides. Inset picture is from dye tracer study conducted in November 2015. Here, the dye reached the shoreline in nine hours and persisted in nearshore waters for several days, unlike what was observed during the other three dye tracer tests.

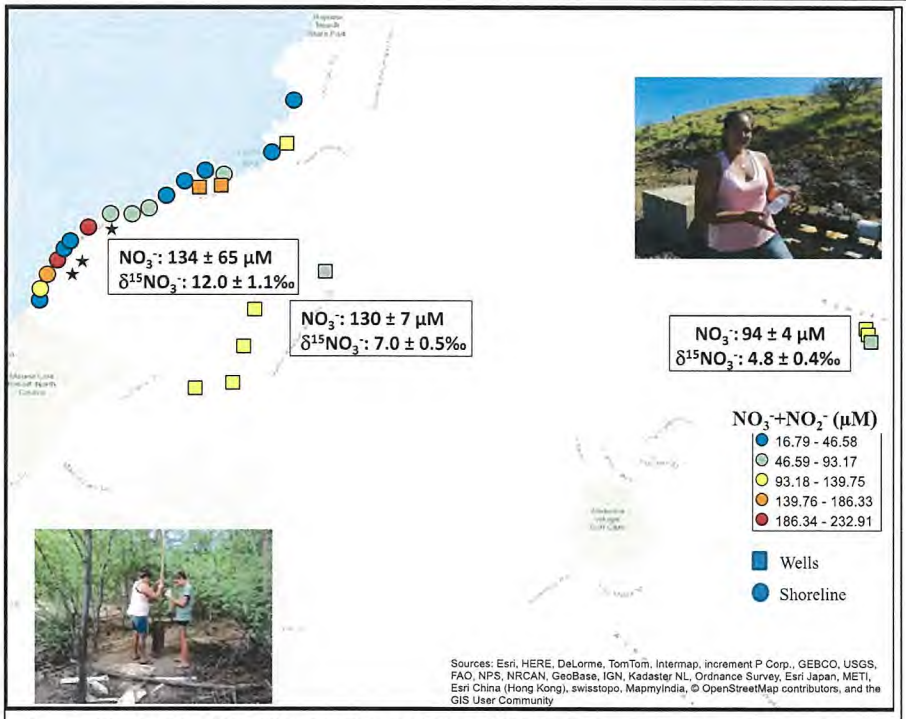


Figure 4. Nitrate + nitrite ($NO_3^-+NO_2^-$) concentrations (µM) and $\delta^{15}N$-NO_3^- (‰) in up-mountain groundwater and shoreline coastal waters. Shoreline waters at some locations have concentrations ~70- 120 µM higher than up-mountain groundwater.

and benthic cages and analyzed for $\delta^{15}N$, with concurrent nutrient and FIB water measurements at cage stations (*Cage deployment* section).

Upland well measurements—During January 2015, upland groundwater samples were collected from drinking (high elevation, n = 3) and irrigation (low elevation, n = 7) wells within the Puakō watershed (Fig. 2, blue and green circles). Samples were analyzed for nutrient concentrations and $\delta^{15}N$-NO_3^-. These samples were taken as part of the N source $\delta^{15}N$-NO_3^- determination effort (*see Shoreline measurements* below). Water samples were also collected at 16 shoreline stations for nutrient analyses as part of the *Shoreline measurements* described below. $\delta^{15}N$-NO_3^- was quantified only once at three shoreline stations (3, 4, and 7), as they were suspected of being contaminated with sewage pollution.

$NO_3^- + NO_2^-$ concentrations were ~ 40 µM lower in high elevation wells compared to the low elevation wells (Fig. 4). In contrast, PO_4^{3-} and NH_4^+ concentrations were similar between high and low elevation wells (Table 2). $NO_3^- + NO_2^-$ concentrations increased ~70 to 120 µM from the high elevation groundwater wells to the shoreline stations. Comparable increases in PO_4^{3-} and NH_4^+ concentrations were not observed.

Table 2. Average ± SE of $\delta^{15}N$ - NO_3^- (‰) and $NO_3^- + NO_2^-$, PO_4^{3-}, and NH_4^+ concentrations (µM) of N sources collected in the Puakō watershed. (n = sample size)

N Source	n	$\delta^{15}N$ in NO_3^-	$NO_3^- + NO_2^-$	NH_4^+	PO_4^{3-}
Cesspools	3	10.45 ± 0.58	20.76 ± 10.50	6370.00 ± 806.16	378.58 ± 16.59
Soil	3	2.13 ± 2.37	6366.67 ± 3682.45	594.52 ± 93.24	193.56 ± 141.56
Ocean	2	3.02 ± 0.79	1.43 ± 0.07	2.53 ± 0.55	0.11 ± 0.05
High elevation groundwater wells	3	4.76 ± 0.43	93.87 ± 4.35	4.84 ± 1.43	2.48 ± 0.19
Low elevation groundwater wells	7	7.03 ± 0.50	130.09 ± 6.69	4.82 ± 1.19	2.47 ± 0.54
Shoreline	3	11.95 ± 1.13	133.93 ± 64.68	n/a	n/a

$\delta^{15}N\text{-}NO_3^-$ became increasing enriched downslope from the high elevation groundwater wells to the shoreline stations (Table 2). Additionally, nutrient concentrations ($NO_3^- + NO_2^-$, TDN, PO_4^{3-}, TDP, and H_4SiO_4) significantly differed among shoreline stations ($p < 0.001$; Table 3). NH_4^+ concentrations were similar across all shoreline stations.

Table 3. Average ± SE and [range] of $NO_3^- + NO_2^-$, NH_4^+, TDN, PO_4^{3-}, TDP, H_4SiO_4 concentrations (μM), and salinity for shoreline stations at Puakō. Superscript letters indicate significant groupings from One-way ANOVA and post-hoc Tukey's test. $\alpha = 0.05$; $n = 4$.

Station	$NO_3^- + NO_2^-$	NH_4^+	TDN	PO_4^{3-}	TDP	H_4SiO_4	Salinity
1	27.87 ± 4.09^{b-e} [18.10-36.79]	20.83 ± 0.15 [0.78-1.23]	41.4 ± 6.8^{c-f} [24.6-57.5]	0.44 ± 0.04^{fg} [0.33-0.51]	0.70 ± 0.12^{fg} [0.51-1.04]	132.61 ± 22.80^{a-c} [86.85-195.35]	27.58 ± 1.44^{a-c} [23.63-30.37]
2	149.94 ± 12.79^{ab} [129.62-187.09]	0.49 ± 0.11 [0.18-0.72]	158.7 ± 12.8^{ab} [139.2-194.6]	2.24 ± 0.24^{a-d} [1.62-2.73]	2.86 ± 0.26^{a-e} [2.21-3.45]	580.91 ± 154.78^{ab} [187.35-875.96]	7.12 ± 0.61^{e} [5.77-8.70]
3	137.12 ± 35.39^{a-c} [36.22-190.37]	1.95 ± 0.30 [1.04-2.29]	153.6 ± 39.4^{a-c} [41.2-217.1]	3.81 ± 0.92^{ab} [1.34-5.37]	4.28 ± 0.72^{ab} [2.42-5.09]	376.56 ± 124.15^{a-c} [112.21-646.18]	16.26 ± 3.96^{b-e} [9.50-25.73]
4	196.05 ± 28.14^{a} [125.66-263.07]	1.34 ± 0.05 [1.24-1.47]	221.3 ± 26.0^{a} [153.2-267.1]	7.42 ± 1.11^{a} [4.12-9.0]	8.25 ± 1.36^{a} [4.45-10.84]	501.07 ± 113.17^{ab} [172.26-683.13]	15.25 ± 2.30^{c-e} [9.10-20.20]
5	46.92 ± 8.73^{a-e} [23.44-65.52]	1.32 ± 0.16 [0.86-1.57]	70.2 ± 11.8^{a-f} [41.5-86.7]	1.34 ± 0.17^{b-f} [0.90-1.71]	1.74 ± 0.28^{b-f} [0.90-2.13]	179.13 ± 40.75^{a-c} [85.38-278.15]	24.98 ± 2.35^{a-d} [19.70-31.07]
6	26.78 ± 11.48^{de} [2.50-54.16]	1.22 ± 0.10 [1.03-1.46]	43.7 ± 15.9^{d-f} [22.5-86.4]	0.66 ± 0.21^{e-g} [0.25-1.17]	0.85 ± 0.22^{fg} [0.25-1.26]	95.35 ± 42.89^{c} [21.60-219.16]	30.77 ± 2.31^{a} [24.53-35.53]
7	134.56 ± 54.94^{a-d} [42.27-285.74]	1.69 ± 0.65 [0.46-2.90]	130.5 ± 42.7^{a-d} [52.5-240.8]	3.08 ± 0.44^{a-c} [2.12-3.83]	3.41 ± 0.50^{a-c} [2.19-4.51]	446.70 ± 132.37^{ab} [164.00-803.60]	21.98 ± 0.97^{a-d} [19.87-24.03]
8	39.15 ± 14.53^{c-e} [0.99-67.10]	2.40 ± 0.97 [0.53-5.07]	59.0 ± 18.5^{b-f} [12.3-98.5]	0.70 ± 0.23^{e-g} [0.52-1.07]	1.01 ± 0.21^{e-g} [0.56-1.55]	252.83 ± 83.24^{a-c} [31.05-416.30]	20.60 ± 4.90^{a-d} [14.10-35.17]
9	69.74 ± 9.06^{a-e} [47.81-91.92]	1.00 ± 0.33 [0.89-1.77]	85.2 ± 7.3^{a-e} [73.6-105.4]	1.37 ± 0.13^{b-f} [1.15-1.73]	1.80 ± 0.17^{b-f} [1.48-2.30]	341.87 ± 89.74^{a-c} [219.17-608.54]	15.28 ± 2.31^{cd} [8.53-18.53]
10	56.72 ± 17.48^{a-e} [11.59-94.94]	0.95 ± 0.27 [0.47-1.51]	73.1 ± 19.0^{b-f} [19.7-106.1]	1.14 ± 0.31^{e-g} [0.34-1.84]	1.48 ± 0.16^{b-f} [1.18-1.84]	354.04 ± 75.56^{a-c} [129.10-444.74]	15.03 ± 3.60^{de} [4.90-21.90]
11	16.52 ± 1.21^{de} [14.08-18.73]	0.96 ± 0.30 [0.18-1.45]	29 ± 3.9^{ef} [23.2-40.5]	0.49 ± 0.04^{e-g} [0.40-0.58]	0.76 ± 0.22^{fg} [0.25-1.33]	108.26 ± 26.71^{bc} [52.94-172.90]	28.30 ± 0.93^{ab} [26.07-30.60]
12	35.80 ± 4.37^{a-e} [25.62-46.59]	1.34 ± 0.25 [0.78-1.88]	46.4 ± 4.7^{b-f} [34.2-55.6]	0.99 ± 0.11^{c-g} [0.40-1.31]	1.26 ± 0.29^{c-g} [0.91-2.11]	259.66 ± 104.79^{a-c} [111.52-567.91]	24.50 ± 0.96^{a-d} [22.57-27.13]
13	34.89 ± 4.73^{a-e} [22.54-44.18]	1.21 ± 0.19 [0.73-1.56]	48.5 ± 6.7^{b-f} [34.5-66.9]	1.64 ± 0.28^{b-e} [0.91-2.29]	1.89 ± 0.17^{b-f} [1.66-2.38]	207.44 ± 23.43^{a-c} [166.70-267.48]	23.96 ± 2.00^{a-d} [19.90-28.27]
14	89.08 ± 5.48^{a-d} [75.93-101.22]	1.15 ± 0.29 [0.64-1.54]	100.9 ± 6.9^{a-d} [83.7-117.1]	2.61 ± 0.17^{a-c} [2.22-2.98]	2.91 ± 0.27^{a-d} [2.35-3.61]	651.66 ± 173.89^{a} [358.62-1017.63]	6.43 ± 0.63^{e} [5.33-8.07]
15	13.37 ± 2.80^{e} [5.73-19.24]	1.07 ± 0.17 [0.75-1.44]	21.6 ± 2.6^{f} [14.8-27.4]	0.39 ± 0.09^{g} [0.16-0.55]	0.57 ± 0.21^{g} [0.25-1.12]	120.33 ± 24.28^{a-c} [52.40-157.86]	29.94 ± 0.70^{a} [28.67-31.27]
16	38.53 ± 7.17^{a-e} [17.35-47.44]	0.63 ± 0.31 [0.18-1.51]	45.8 ± 4.1^{c-f} [33.8-51.7]	0.81 ± 0.13^{d-g} [0.45-1.09]	1.14 ± 0.30^{d-g} [0.60-1.99]	322.79 ± 86.47^{a-c} [141.63-552.47]	17.13 ± 3.44^{b-e} [7.94-24.53]

Comparison of $NO_3^-+NO_2^-$ concentration data from high and low elevation groundwater wells with nearshore coastal waters indicate that there is some source between these two locations adding $NO_3^-+NO_2^-$ to the water (Fig. 4). The observation that $NO_3^-+NO_2^-$ concentrations increased from low elevation wells (Mauna Lani Resort just above Puakō and Puakō on the mountain-side of the street) to the nearshore waters suggests that leakage from OSDS is a likely source. Enrichment of $\delta^{15}N\text{-}NO_3^-$ from the low elevation groundwater wells to the shoreline further suggest OSDS leakage is the source, as shoreline values were within range reported for sewage (Table 2). Results from our dye tracer tests confirm that OSDS are the source, as dye was detected at in front of the homes with the highest $NO_3^-+NO_2^-$ concentrations and most enriched $\delta^{15}N\text{-}NO_3^-$ values.

Additionally, the change in the $\delta^{15}N\text{-}NO_3^-$ from the high to low elevation groundwater wells suggests a change in NO_3^- source from forest soil to sewage (Table 2). It is possible that sewage is contaminating the low elevation groundwater as an upslope development (Waikoloa Village) has over 4,800 people whose homes have OSDS (U.S. Census Bureau 2000). Additionally, NO_3^- concentrations increased ~40 μM from the high to low elevation groundwater wells (Table 2).

Shoreline measurements –$\delta^{15}N$ measurements in near-shore macroalgal tissues were used to identify locations with sewage pollution along the Puakō coastline. Sixteen stations were identified as sampling locations based on the surface salinity map (Figs. 1 and 2, black circles). At each station, the macroalgal community was characterized, and the most predominant species were collected and analyzed for $\delta^{15}N$ (species included: *Ulva fasciata*, *Cladophora* spp., and *Gelidiella acerosa*). For this study, a pilot collection at six

stations occurred during July 2014, four full sampling efforts occurred in November 2014, and March, June, and July 2015, and sampling at five stations (algal cage deployment shoreline stations) continued monthly from September 2015 through February 2016. In September 2015, several new stations south and north of Puakō were sampled to address concerns of residents that resorts in these areas might be contributing to their local pollution problem.

In January, February, and June 2015, potential N sources (sewage, fertilizers, up-mountain groundwater, soil under Kiawe trees, ocean water) were sampled and analyzed for $\delta^{15}N\text{-}NO_3^-$ (Fig. 2, blue, green, red, purple circles). $\delta^{15}N$ fertilizer values from another study on Hawai'i Island were used in our study (Wiegner et al.

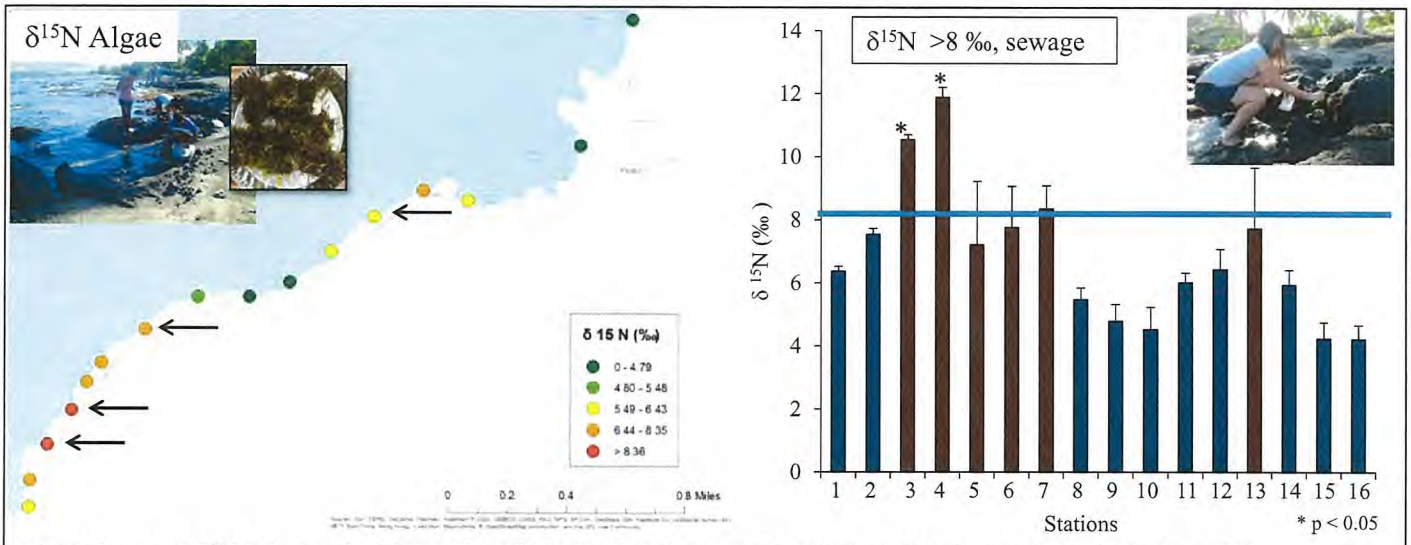


Figure 5. Average δ^{15} N of macroalgal tissues along the Puakō shoreline (November 2014, and March, June, July 2015). Values >8 ‰ are indicative of sewage pollution (light blue line). Arrows indicate location of dye tracer tests.

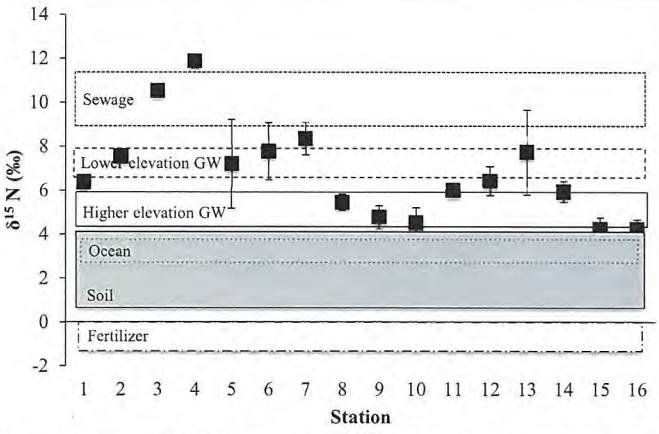


Figure 6. Average ± SE δ^{15} N (‰) of macroalgae found at 16 stations in Puakō. Background areas represent (average ± SE) δ^{15} NO_3^- of the N sources (fertilizer, soil, ocean, high elevation groundwater wells, low elevation groundwater wells, and sewage; Table) measured as part of this study. Fertilizer values are from previous sewage study on Hawai'i Island (Wiegner et al. 2016).

2016). Additionally, in September 2015, shoreline water samples were collected and analyzed at three of the 16 stations (stations 3, 4, and 7) where sewage was thought to be most concentrated for $\delta^{15}N\text{-}NO_3^-$ analyses. N source values were compared to those in the macroalgal tissues and at water at the three shoreline stations to help identify sources of N pollution at Puakō.

The δ^{15}N macroalgal tissue values ranged from 4.23 to 11.88‰ across all 16 shoreline stations and significantly differed among them ($p<0.0001$), with stations 3 and 4 being the most enriched (Fig. 5). Overall, six of the 16 stations fell within the sewage $\delta^{15}N\text{-}NO_3^-$ range, including stations 3 and 4, as well as 5, 6, 7, and 13 (Fig. 6, encompassing SE of source averages). The remaining stations fell within the high and low elevation groundwater ranges (Fig. 6). These results suggest that Stations 3 and 4 are two sewage pollution hotspots. However, past studies have found that macroalgae assimilate N more rapidly under low NO_3^- concentrations (Fujita 1985), and that δ^{15}N in macroalgal tissue can be underestimated by up to 6‰ in waters with high NO_3^- concentrations (>10 µM) (Swart et al. 2014). All of the stations had $NO_3^- + NO_2^-$ concentrations exceeding 10 µM, suggesting that the δ^{15}N macroalgal values may be underestimated. If this is the case, then all 16 stations fall within the sewage range. From these measurements, sewage pollution appears to be widespread along the Puakō shoreline with some areas having more concentrated pollution (Fig. 5).

Similar patterns were not observed in front of the resorts; $\delta^{15}N$ macroalgal ranged from $\delta^{15}N$ -1.0 to +0.1‰, the range reported for fertilizers (shown on Fig. 6).

Cage deployments— To determine the spatial extent of sewage pollution offshore, as well as possible inputs from benthic seeps that could directly impact the coral reefs, water was sampled for FIB and nutrients. Additionally, the native green macroalga, *Ulva fasciata,* was deployed during bioassays for $\delta^{15}N$ analysis at five stations (Fig. 7). These stations encompassed three zones (shoreline, bench, and slope) and two depths (surface and benthic) (Fig. 7). Benthic zones were chosen based on physiography features. The bench zone was ~7 m deep, and ~196 m from the shoreline. The slope one was

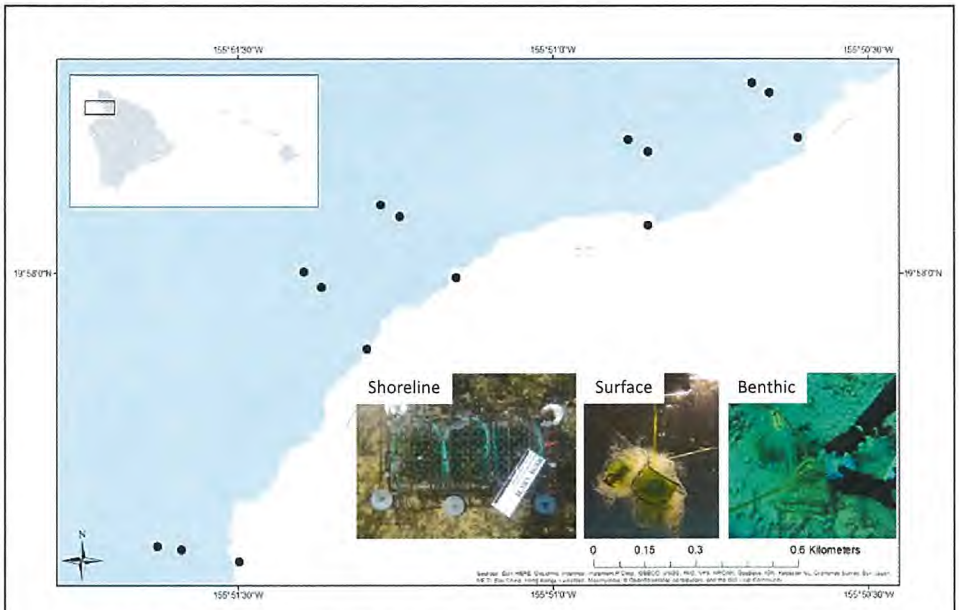


Figure 7. Location of water sample collection (for FIB and nutrients) and algal cage deployments (for $\delta^{15}N$ in *U. fasciata*). Water and macroalgal samples were taken at three zones (shoreline, bench, deep) in Puakō to determine the spatial extent of sewage pollution in surface and benthic waters offshore. Pictures of algal cage deployment design are shown in lower right corner of figure.

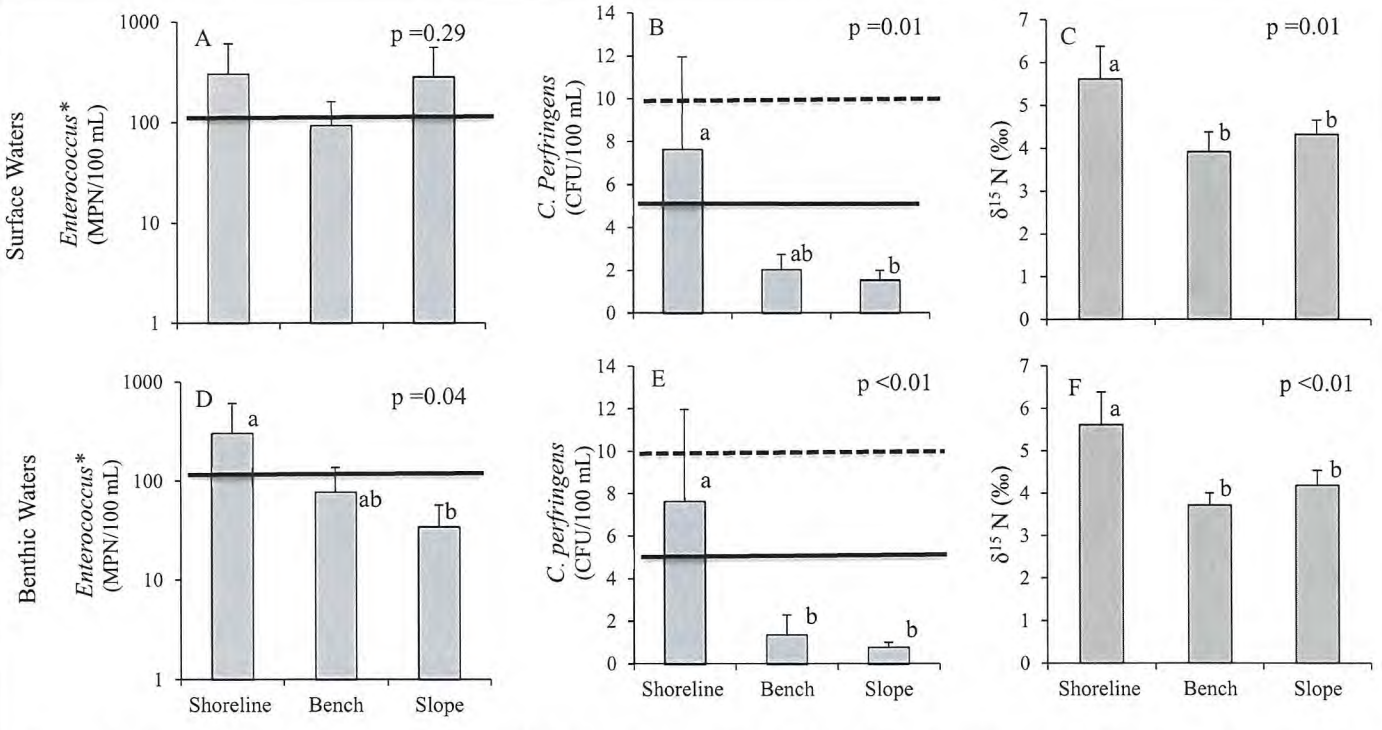


Figure 8. Average ± SE of sewage parameters (A, D) *Enterococcus* (*log scale), (B, E) *C. perfringens, and* (C, F) $\delta^{15}N$ in *U. fasciata* collected within three zones (shoreline, bench, slope) in both surface and benthic waters in Puakō. Black lines represent the HDOH single sample maximum for *Enterococcus* (104 CFU/100 mL) and Fujioka's recommendation (1997) for *C. perfringens* in marine recreational waters (5 CFU/100mL). Dashed lines represent non-point source sewage contamination level of 10 CFU/100 mL for *C. perfringens* (Fung et al. 2007) Results from GLM and Tukey's test are shown, with different letters indicating significant differences (α =0.05). FIB n =10. Sample size varied for $\delta^{15}N$ in *U. fasciata* in both surface waters (shoreline, n =9; bench, n =6; slope, n =10) and benthic waters (shoreline, n =9; bench, n =8; slope, n =10).

~15 m in depth, and ~267 m from the shoreline. The bench and slope zones were ~65 m apart. Collection of water samples and algal cage deployments were conducted in June and July 2015. There was one sample collection and cage deployment per month. Additionally, wild algae from the benthos were also collected for $\delta^{15}N$ analyses at all algal cage deployment stations. Public flyers describing the experiment with pictures of the buoys demarcating the deployment locations were placed around Puakō during the cage deployments (*see* Appendix A).

Enterococcus counts were similar among surface water zones, but significantly differed among benthic zones ($p = 0.04$; Fig. 8A,D). The greatest differences in the benthos were detected between shoreline and slope zones, which were almost an order of magnitude different. In contrast, *C. perfringens* significantly differed among surface ($p = 0.01$) and benthic ($p < 0.01$) zones (Fig. 8 B,E). In surface waters, the largest differences were detected between shoreline and slope zones (Fig. 8B). Shoreline *C. perfringens* counts were also significantly higher compared to benthic bench and slope waters (Fig. 8E). Nutrient concentrations ($NO_3^- + NO_2^-$, NH_4^+, TDN, PO_4^{3-}, TDP, and H_4SiO_4) were highest on the shoreline in both surface ($p < 0.02$) and benthic ($p < 0.01$) waters (Table 4). Nutrient concentrations among zones in surface and benthic waters were similar between bench and slope zones. Salinity also varied among zones in both surface ($p<0.01$) and benthic waters ($p<0.01$), with the shoreline having the freshest (lowest) values (Table 4). $\delta^{15}N$ in *U. fasciata* significantly varied in surface ($p = 0.01$) and benthic zones ($p<0.01$) (Fig. 8C,F). Shoreline values were the highest, followed by slope, and bench. Both $\delta^{15}N$ for surface and benthic *U. fasciata* samples fell within the $\delta^{15}N$ - NO_3^- range for soil, seawater, and low elevation groundwater at all zones (Fig. 9).

Averages of sewage indicators: *Enterococcus*, *C. perfringens*, nutrient concentrations ($NO_3^- + NO_2^-$, NH_4^+, TDN, PO_4^{3-}, and TDP), and $\delta^{15}N$ in *U. fasciata* were similar among water depths. H_4SiO_4 concentrations did vary, with the greatest differences detected between surface waters at the bench and benthic waters at the slope ($p < 0.01$). Salinity was similar between surface and benthic waters.

Table 4. Average ± SE and [range] of nutrient concentrations (μM) and salinity for surface and benthic water samples among zones (shoreline, bench, slope) in Puakō. A GLM was used and superscript letters indicate grouping from post hoc Tukey's test. $\alpha = 0.05$; $n = 10$.

Zone	$NO_3^- + NO_2^-$	NH_4^+	TDN	PO_4^{3-}	TDP	H_4SiO_4	Salinity
Shoreline	66.87 ± 11.47[a]	1.52 ± 0.16[a]	72.9 ± 11.4[a]	1.67 ± 0.22[a]	1.98 ± 0.22[a]	439.18 ± 74.06[a]	18.52 ± 3.08[a]
	[11.59 – 139.72]	[0.18 – 3.05]	[21.1 – 120.6]	[0.47 – 2.56]	[0.70 – 3.25]	[153.57 – 616.73]	[3.78 – 29.63]
Surface							
Bench	1.43 ± 0.26[b]	0.57 ± 0.14[b]	9.8 ± 0.5[b]	0.14 ± 0.03[b]	0.64 ± 0.13[b]	7.34 ± 3.07[b]	33.26 ± 1.11[b]
	[0.83 – 1.84]	[0.18 – 1.56]	[7.9 – 11.7]	[0.02 – 0.27]	[0.25 – 1.23]	[1.31 – 20.92]	[29.95 – 34.47]
Slope	1.23 ± 0.18[b]	0.38 ± 0.11[b]	9.4 ± 0.6[b]	0.12 ± 0.02[b]	0.59 ± 0.11[b]	5.00 ± 1.42[b]	34.24 ± 0.41[b]
	[0.40 – 2.14]	[0.18 – 1.06]	[6.5 – 13.0]	[0.02 – 0.24]	[0.25 – 0.96]	[1.21 – 11.10]	[33.75 – 34.62]
Benthic							
Bench	1.10 ± 0.13[b]	0.50 ± 0.12[b]	9.5 ± 0.6[b]	0.18 ± 0.05[b]	0.58 ± 0.11[b]	2.16 ± 0.78[b]	33.55 ± 0.95[b]
	[0.53 – 2.06]	[0.18 – 1.23]	[7.2 – 12.9]	[0.02 – 0.49]	[0.25 – 0.94]	[0.83 – 5.49]	[31.03 – 35.0]
Slope	1.57 ± 0.51[b]	1.10 ± 0.53[ab]	8.8 ± 0.7[b]	0.24 ± 0.11[b]	0.94 ± 0.29[b]	0.65 ± 0.11[b]	34.46 ± 0.30[b]
	[1.10 – 6.09]	[0.18 – 5.58]	[7.0 – 13.3]	[0.02 – 1.13]	[0.25 – 3.25]	[0.55 – 0.99]	[34.22 – 34. 85]

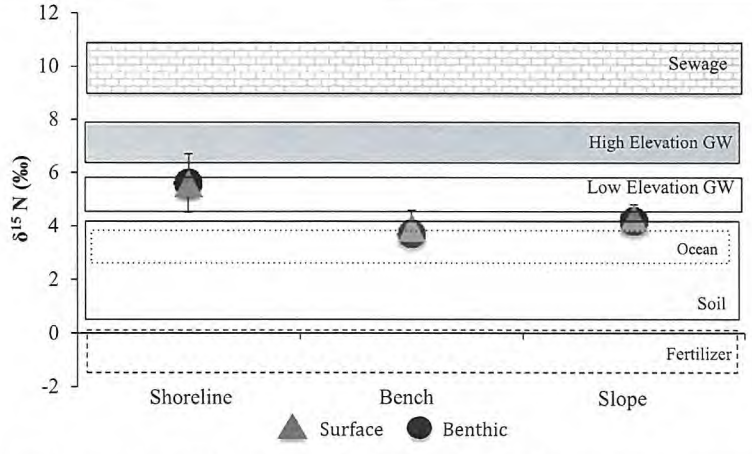


Figure 9. Average ± SE δ^{15} N (‰) of *U. fasciata* deployed within three benthic zones (shoreline, bench, slope) in Puakō. Background areas represent average ± SE of δ^{15} N – NO_3^- of the N sources and fertilizer from another study on Hawai'i Island (Wiegner et al. 2016). Surface samples are represented by grey triangles and benthic samples by black circles.

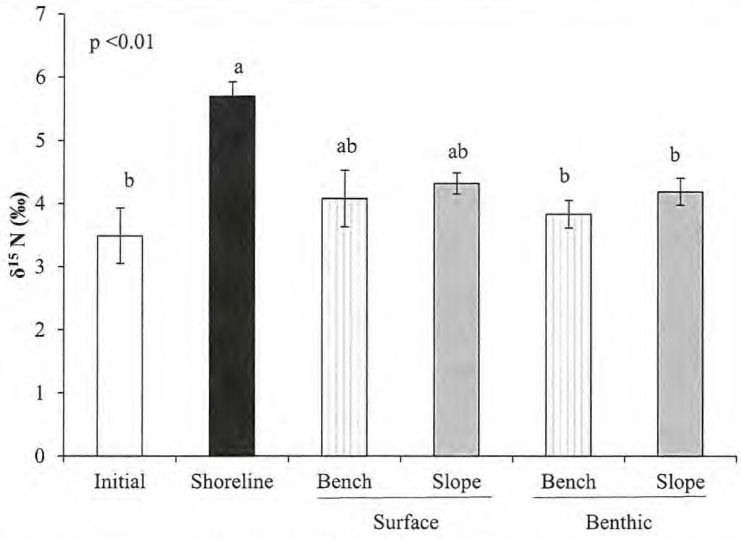


Figure 10. Average ± SE δ^{15} N (‰) of *U. fasciata* pre-(initial) and post-deployments within three benthic zones (shoreline, bench, slope) and two depths (surface and benthic) in Puakō. GLM was used and shared lettering indicates no significant differences in Tukey's post hoc test. Sample size varied (initial, n =11; shoreline, n =5; surface bench, n =4; surface slope, n =5; benthic bench, n =5; benthic slope, n =5). α =0.05.

Pre- and post-deployment δ^{15}N *U. fasciata* values differed ($p < 0.01$), with the greatest differences occurring at the shoreline (Fig. 10). Within the slope zone, surface and benthic waters showed smaller differences in pre- and post-deployment δ^{15}N, followed by the bench zone in surface and benthic waters.

δ^{15}N in benthic wild macroalgae and deployed cages were similar to one another, but differed from both wild and caged at the shoreline. Bench zone δ^{15}N in wild algae ranged from -0.57 to +4.02‰ (average ±SE; +2.90‰ ± 1.96), whereas caged bench zone *U. fasciata* ranged from +3.23 to +4.27‰, (+3.83‰ ± 0.49). In the slope zone, δ^{15}N in wild algae ranged from +3.48 to +8.92‰ (+6.09‰ ± 2.31) and deployed *U. fasciata* ranged from +3.50 to +4.78‰ (+4.19‰ ± 0.48). Wild shoreline algae ranged from +5.07 to +10.18‰

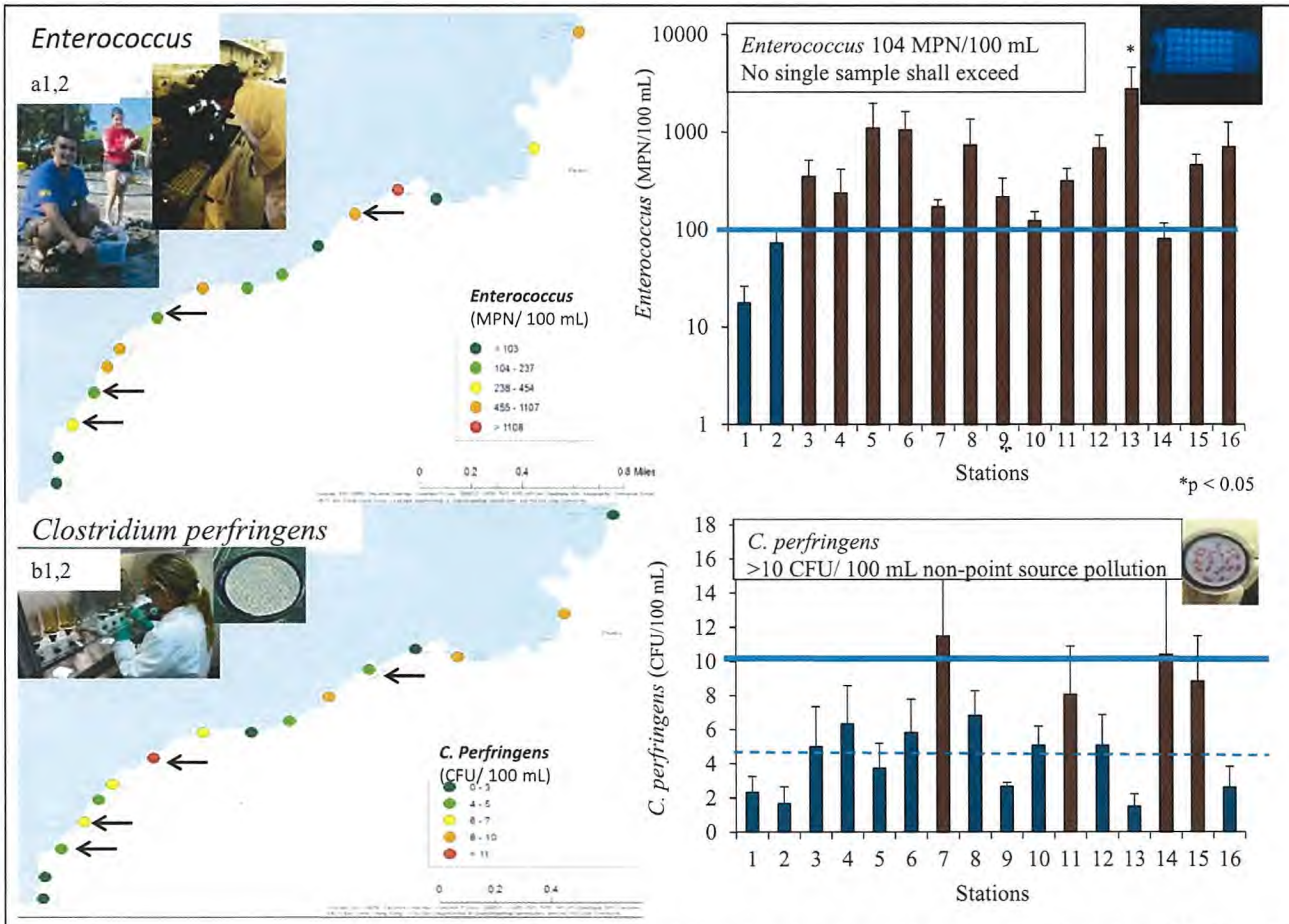


Figure 11. Average (±SE) *Enterococcus* (a1,2) and *Clostridium perfringens* (b1,2) values along the Puakō shoreline from November 2014 to July 2015 (n= 4). Red bars indicate values that are above established or recommended standards to HDOH (light blue lines). For *Enterococcus*, no single sample shall exceed 104 MPN/100 mL. For *C. perfringens*, the recommended standard for recreational water is 5 CFU/100 mL (solid line; Fujioka et al. 1997) and 10-100 CFU/100 mL is considered to be indicative of non-point sewage pollution (dashed line; Fung et al. 2007). Arrows are indicative of dye tracer tests.

(+7.75‰ ± 1.25) and caged *U. fasciata* ranged from +3.37 to +7.27‰ (+5.61‰ ± 1.08). The highest shoreline $\delta^{15}N$ values in both wild and caged macroalgae were observed at station 2.

Sewage indicators (FIB, $\delta^{15}N$ macroalgae, nutrients) were highest along the shoreline compared to values offshore in surface and benthic waters in both the bench and slope zones. These results suggest that sewage pollution is concentrated along the shoreline, and that low offshore values reflect smaller direct sewage inputs through benthic seeps or dilution of nearshore inputs.

Objective 3: To determine if state water quality standards are exceeded in Puakō's near-shore environment for FIB (*Enterococcus* and *C. perfringens*), water samples were collected at 16 shoreline stations (Fig. 2, black circles). Values for these parameters were compared to state water quality standards to determine if state benchmarks were exceeded. Pilot sampling occurred at six stations during July 2014, four full shoreline samplings occurred November 2014, March, June, and July 2015, and five stations from September 2015 to February 2016. During November 2014, July 2015, and July 2016 samples were also collected for *Bacteroides* analysis. *Bacteriodes* are the most numerous bacteria in the human gut and there are molecular probes to

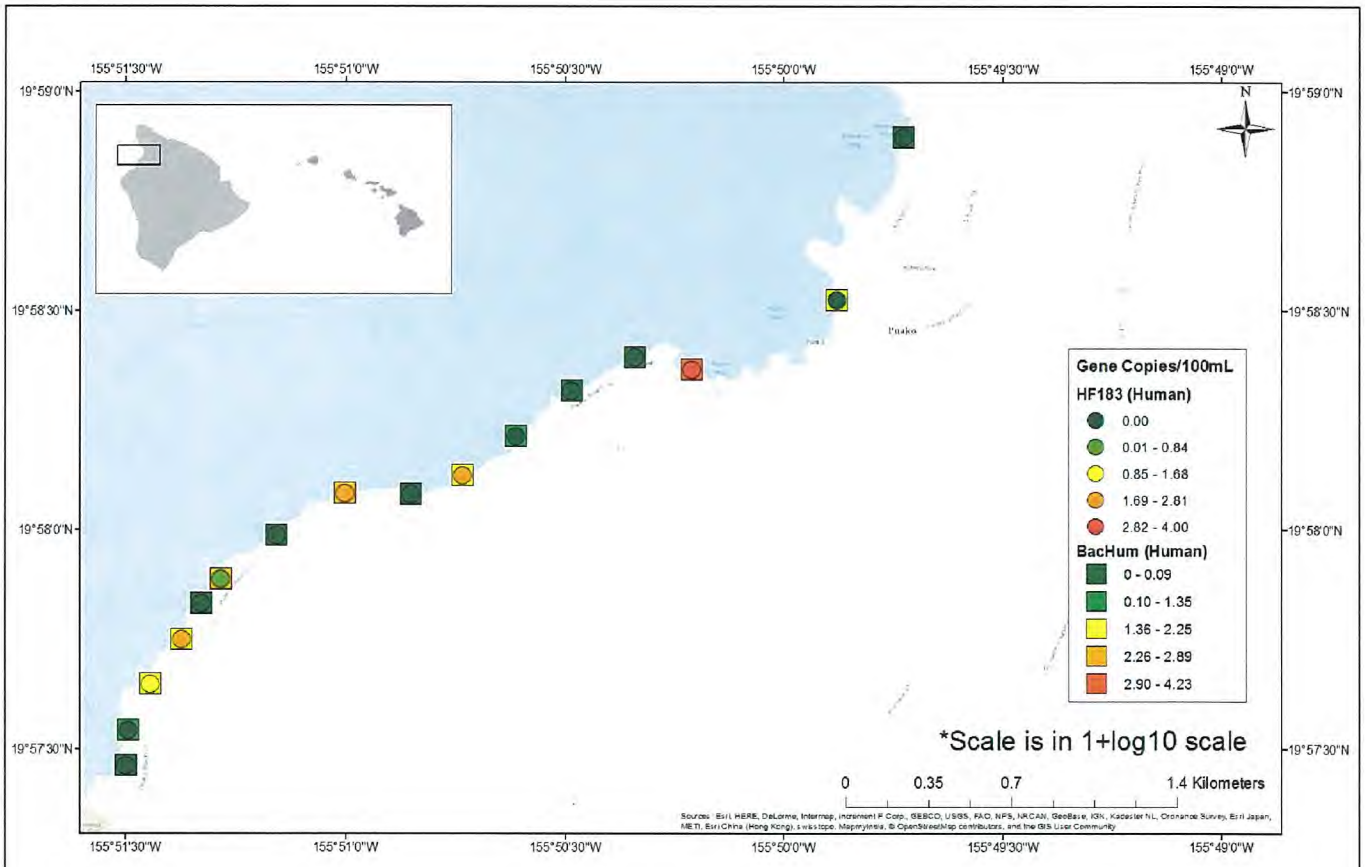


Figure 12. Human-associated *Bacteroides* in nearshore waters along the Puakō coastline (November 2014, July 2015, and July 2016). Two molecular markers were used to detect these bacteria (HF183 and BacHum). Data were log transformed (log 10 (x +1)).

identify those specifically from humans. Dr. Craig Nelson from UH Mānoa, Center for Microbial Oceanography (C-MORE), School of Ocean and Environmental Sciences and Technology (SOEST) analyzed these samples using the BacHum-UCD and HF183 markers.

Our results indicate that FIB levels are quite variable and often higher than the HDOH standards at several stations (Fig. 11). For *Enterococcus*, 14 of the 16 stations had average values that were higher than the HDOH single sample maximum recreational water quality standard (no single sample shall exceed 104 MPN/100 mL; Fig. 11a). Eleven of the 16 stations also had *C. perfringens* values higher than the recommended standard to HDOH of 5 CFU/100 mL (Fig. 11b; Fujioka et al. 1997). Four of the stations also had values of 10 CFU/100 mL or higher which is indicative of non-point source sewage pollution (Fung et al. 2007). Overall, 11

of the 16 stations had *Enterococcus* and *C. perfringens* values that were both higher than established or recommended HDOH standards (Fig. 11). Lastly, one of the stations with high *C. perfringens* values was also one of the locations where a dye tracer test was conducted (Station 7); these results confirm that the high bacteria levels were from sewage pollution (Figs. 2 and 11). Eight stations (3, 4, 6, 8, 10, 11, 14, and 15) had positive hits for human *Bacteriodes* markers, two of which were dye tracer test locations (Fig. 12).

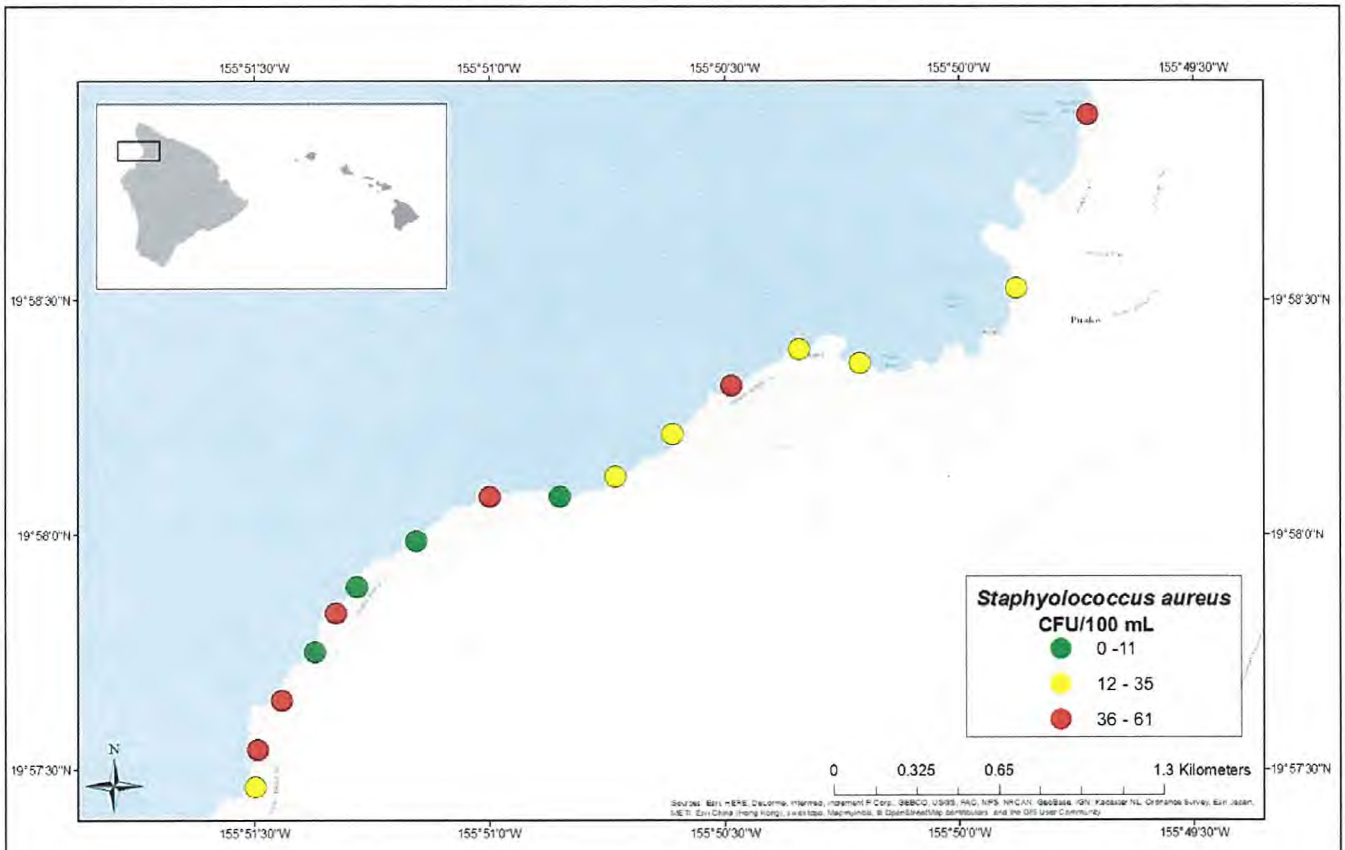


Figure 13. *Staphylococcus aureus* counts in nearshore waters along the Puakō coastline (June 2015). There are no HDOH standards for *S. aureus* in recreational waters; however, it has been recommended that counts be lower than 100 CFU/ 100 mL in recreational waters (Shenawy 2005).

In June 2015, shoreline water samples were also collected for *Staphylococcus aureus* analysis at the 16 stations (Fig. 13); sampling at five of these stations continued from September 2015 to February 2016. *S. aureus* is a human pathogen that can be found in sewage. It often causes skin infections that are thought to be acquired during recreational water use. Two stations had values greater than 100 CFU/ 100 mL, which has been recommended as a standard for recreational waters (Shenawy 2005). Presently, there are no HDOH *S. aureus* water quality standards.

Objective 4: To assess the benthic community responses to sewage inputs at Puakō, shoreline stations and the two

Table 5. Summary of benthic cover at 16 shoreline stations along the Puakō shoreline. Values are presented as (%) cover. Eight major categories were summarized: basalt, coral, crustose coralline algae (CCA), turf, macroalgae, limestone, sand, and invertebrates.

Station	Basalt	Coral	CCA	Turf	Macroalgae	Limestone	Sand	Invertebrates
1	51.5%	0.0%	0.0%	39.5%	0.0%	0.0%	9.0%	0.0%
2	10.7%	26.8%	2.8%	52.2%	0.0%	2.0%	5.0%	0.5%
3	87.5%	0.0%	0.0%	7.0%	0.0%	4.0%	1.5%	0.0%
4	38.0%	0.0%	0.0%	52.5%	0.0%	0.0%	9.5%	0.0%
5	11.0%	0.0%	0.0%	72.0%	0.0%	1.5%	15.5%	0.0%
6	12.7%	7.8%	11.0%	64.8%	0.0%	1.0%	2.7%	0.0%
7	18.2%	23.3%	10.5%	40.8%	0.0%	0.5%	6.5%	0.2%
8	27.0%	0.0%	0.0%	41.0%	0.0%	11.0%	21.0%	0.0%
9	8.3%	19.7%	8.3%	61.5%	0.0%	2.2%	0.0%	0.0%
10	23.5%	0.0%	0.0%	70.5%	0.0%	6.0%	0.0%	0.0%
11	4.8%	16.3%	18.7%	59.5%	0.0%	0.5%	0.0%	0.2%
12	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%
13	23.0%	0.0%	0.0%	77.0%	0.0%	0.0%	0.0%	0.0%
14	16.5%	0.0%	0.0%	79.0%	0.0%	0.0%	4.5%	0.0%
15	26.5%	0.0%	0.0%	73.5%	0.0%	0.0%	0.0%	0.0%
16	21.0%	0.0%	0.0%	78.0%	0.0%	0.0%	1.0%	0.0%

primary coastal benthic environments (basalt bench and coral-dominated fore-reef slope) were surveyed using standardized techniques during the two algal cage deployments in June and July 2015. Data from these surveys have been summarized (Tables 5 and 6). The majority of the shoreline stations were dominated by turf and basalt (Table 5). Benthic cover at the bench and slope stations consisted of turf, coral, and crustose coralline algae, with turf comprising the greatest percentage at the bench and coral at the slope (Table 6).

Table 6. Summary of benthic cover at deployments stations onshore at the two primary coastal benthic environments (bench and slope) in Puakō. Values are presented as (%) cover. Eight major categories were summarized: basalt, coral, crustose coralline algae (CCA), turf, macroalgae, limestone, sand, and invertebrates.

Station	Basalt	Coral	CCA	Turf	Macroalgae	Limestone	Sand	Invertebrates
2								
Shoreline	32.0%	0.0%	0.0%	61.5%	0.0%	6.0%	0.5%	0.0%
Bench	0.0%	35.5%	0.0%	63.0%	0.0%	0.0%	0.0%	1.5%
Slope	0.0%	45.0%	8.5%	32.0%	0.0%	0.0%	14.5%	0.0%
6								
Shoreline	38.0%	0.0%	0.0%	54.0%	0.0%	3.0%	5.0%	0.0%
Bench	0.0%	1.0%	20.0%	79.0%	0.0%	0.0%	0.0%	0.0%
Slope	0.0%	22.5%	13.0%	61.5%	0.0%	0.0%	3.0%	0.0%
7								
Shoreline	54.5%	0.0%	0.0%	44.5%	0.0%	0.5%	0.5%	0.0%
Bench	0.0%	26.0%	16.5%	37.5%	0.0%	1.0%	19.0%	0.0%
Slope	0.0%	44.0%	15.0%	40.5%	0.0%	0.0%	0.0%	0.5%
9								
Shoreline	25.0%	0.0%	0.0%	75.0%	0.0%	0.0%	0.0%	0.0%
Bench	0.0%	16.0%	13.0%	64.5%	0.0%	6.5%	0.0%	0.0%
Slope	0.0%	43.0%	12.0%	45.0%	0.0%	0.0%	0.0%	0.0%
11								
Shoreline	14.5%	0.0%	6.5%	77.5%	0.0%	1.5%	0.0%	0.0%
Bench	0.0%	12.0%	20.0%	67.5%	0.0%	0.0%	0.0%	0.5%
Slope	0.0%	37.0%	29.5%	33.5%	0.0%	0.0%	0.0%	0.0%

Sampling for coral pathogens (*Serratia marcescens* and *Vibrio* spp.) occurred from September 2015 to February 2016 at five shoreline locations, and coincided with $\delta^{15}N$ macroalgal tissue, FIB, and nutrient sample collection. Both pathogens were detected in the nearshore waters of Puakō.

Development of a novel "Sewage Pollution Score": As this study and others have shown, sewage indicators can provide conflicting information on the intensity and location of sewage pollution. In this study, for example, *Enterococcus* concentrations were highly variable among shoreline stations, with some exceeding HDOH standards, and station 13 having the highest concentrations (Fig. 11a). In contrast, *C. perfringens* concentrations were similar among shoreline stations, but averages for stations 7, 11, 14, and 15 were in the non-point source sewage pollution range (Fig. 11b; Fung et al. 2007). Additionally, $\delta^{15}N$ in macroalgal tissue were found to be highly variable along the shoreline, with six stations (3, 4, 5, 6, and 13) falling within the range of our sewage source value (Figs. 5 and 6, Table 2). Previous studies have confronted similar issues with their sewage indicator data (Shibata et al. 2004; Yoshioka et al. 2016). Hence, we developed a sewage pollution score using sewage indicators to more holistically assess sewage pollution in coastal waters. This score was developed in collaboration with The Nature Conservancy (TNC). Water quality scores and indices have been used successfully in the past to assess water quality conditions for both humans and ecosystems (Zambrano et al. 2009; Wang et al 2015).

Our scoring system used sewage indicators (FIB, $\delta^{15}N$ macroalgae, and nutrients) and was applied to shoreline and offshore surface and benthic waters at Puakō. The scoring system had three levels for each indicator: level 1 = low, level 2 = medium, and level 3 = high. Levels for each indicator were based on established standards or literature information (Table 7). Specifically, the scoring system used HDOH's single sample maximum for *Enterococcus* concentrations in marine waters (HDOH 2014), the Fung/Fujioka *C. perfringens* scale for sewage pollution (Fung et al. 2007), $\delta^{15}N$ values in macroalgal tissue for different N sources (*reviewed in* Wiegner et al.

Table 7. Parameters (FIB = CFU/100 mL, $\delta^{15}N$ = ‰, and nutrients = μM) used to evaluate water quality along the Puakō coastline, as well as offshore surface and benthic waters. Sewage parameters were ranked (low = 1, medium = 2, high = 3), multiplied by a weight factor, and summed for a final sewage pollution score. * "Medium" nutrient concentration ranks exceed HDOH standards for open coastal waters wet criteria.

Sewage Parameter	Weight Factor	Low (1)	Medium (2)*	High (3)	Reference
C. perfringens	3	0 – 10	11 - 100	101 – 505+	Fung et al. 2007
$\delta^{15}N$ in macroalgae	3	+2 - +7	-5 - +1.9	+7 - +20	Wiegner et al. 2016
Enterococcus	2	0 - 35	36 - 104	105+	HDOH 2014
$NO_3^- + NO_2^-$	1	0 – 0.4	0.5 – 1	1.1 – 1.8+	HDOH 2014
NH_4^+	1	0 – 0.25	0.26 – 0.61	0.61 – 1.07+	HDOH 2014
TDP	1	0 – 0.7	0.8 – 1.3	1.4 – 1.9+	HDOH 2014

2016), and HDOH's water quality standards for nutrient concentrations in open coastal waters ($NO_3^- + NO_2^-$, NH_4^+, TDP) (HDOH 2014) (Table 7). Nutrient concentration standards for the wet criteria were used because the freshwater inputs along the Puakō shoreline ranged from 2083-2730 L m^{-1} h^{-1} (Paytan et al. 2006), an order of magnitude larger than the baseline for the wet criteria (>294 L m^{-1} h^{-1}). Two dissolved inorganic forms of N were chosen for the score system rather than TDN because the latter contains DON and there are no well-established patterns with this constituent for sewage pollution. TDP was used as the phosphorous water quality parameter since HDOH has no PO_4^{3-} water quality standard for open coastal waters (HDOH 2014). It should also be noted that a 'medium' score in nutrient concentrations exceeds HDOH standards for open coastal waters wet criteria.

Once each indicator was assigned a level (1-3) based on its measured value and our scoring system (Table 7), its level was multiplied by a weight factor (1-3), with the most reliable sewage indicators having the greatest weight. The greatest weight (weight = 3) was given to *C. perfringens* and $\delta^{15}N$ in macroalgal tissue, because these indicators are more specific to sewage pollution, more integrative measurements of environmental conditions, and do not fluctuate as much as *Enterococcus* and nutrient concentrations (Fung et al 2007; Dailer et al. 2010; Viau et al. 2011; Yoshioka et al. 2016). *Enterococcus* received a medium weight (weight =2) as HDOH uses this FIB to assess marine recreational water safety specifically for sewage pollution, but not the highest weight because concentrations fluctuate over short time scales (min to h) and have other sources, like soils, in tropical areas (Hardina & Fujioka 1991; Byappanahalli & Fujioka 1998; Byappanahalli & Fujioka 2004). Nutrient concentrations received the lowest weight (weight = 1) since sewage pollution is known to increase nutrient concentrations, but nutrients can also come from other sources within the watershed and concentrations can vary over short time scales (Lapointe et al. 1990; David et al. 2013; Nelson et al. 2015). The equation for deriving the overall sewage pollution score for each station was: (*C. perfringens* level x 3) + ($\delta^{15}N$ macroalgae level x 3) + (*Enterococcus* level x 2) + (NO_3^-+NO_2^- level x 1) + (NH_4^+ level x 1) + (TDP level x 1). Sewage pollution score categories were: 'low' = 11-15, 'medium' = 16-20, and 'high' = 21-30.

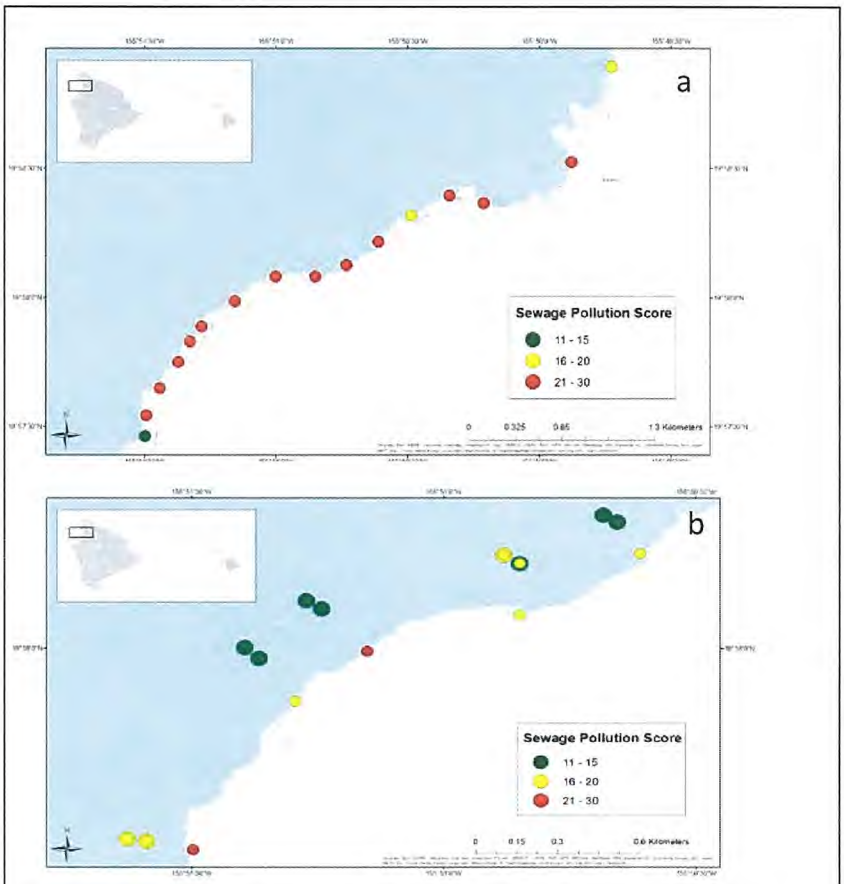


Figure 14. Sewage pollution scores for the (a) shoreline and (b) algal cage deployment studies at Puakō. The score is based on standards and literature values for sewage indicators (FIB, δ^{15} N in macroalgae, and nutrients). Sewage pollution score represents the following catergories: Low = 11 - 15; Medium = 16 - 20; High = 21 - 30.

The shoreline stations with highest pollution sewage scores were station 7 (score =30) and 4 (30) (Fig. 14a). Note, that based on dye tracer tests, these two stations are known locations of OSDS leakage. Station 3 (score = 27), another location of known OSDS leakage, had the third highest pollution score. Overall, 13 stations fell in the high category, two were medium, and one was low (Fig. 14a). These results confirm of the effectiveness of our score in identifying sewage pollution hotspots.

During the algal cage deployments, shoreline stations had the overall highest scores (medium and high), with stations 2 and 7 being the highest (Fig. 14b). As noted above, station 7 was a dye tracer test location (Fig.

2). Offshore transport or direct sewage discharge onto the reef through benthic seeps was localized, as stations 2 and 9 offshore surface and benthic waters only had medium sewage pollution scores (Fig. 14b). Most offshore stations fell in the low sewage pollution score category (Fig. 14b).

The sewage pollution score is an integrated approach that accurately identified sewage hotspots along the Puakō coastline. At these locations, it is critical for homes to remove their cesspools and employ better sewage treatment technology. These maps also provide information to the community on areas where community members may want to limit water exposure during recreational activities until sewage treatment is improved.

E. *Outreach.* The UH Hilo Marine Science research team was involved in 25 outreach and advisory board events from July 2014 to January 2017 (Table 8). They met with PCA 10 times. In June 2014, UH Hilo met PCA to inform them of the funding of the proposal, review the objectives of the project, and introduce the research team. In August 2014, the team met with them during a NOAA CRCP site visit. UH Hilo also attended seven community association meetings: November 2014, January, April, August 2015, and January, April, and October 2016. At the November 2014 meeting, Dr. Wiegner gave a presentation and handed out a 1-page informational sheet on this project and its results to date (Fig. 15). In January 2015, UH Hilo attended PCA's meeting to answer any questions regarding this project, and how its results support the 'Puakō Sewage Disposal Upgrade Project' led by the Coral Reef Alliance. An updated 1-page information sheet was circulated at this meeting (*see* Appendix B). In April 2015, Drs. Wiegner and Beets attended a community meeting where the engineering firm (Aqua Engineering) contracted by Coral Reef Alliance for a sewage treatment upgrade feasibility study was introduced to the community. In August 2015, Dr. Wiegner attended a community meeting where Aqua Engineering presented results and recommendations from their preliminary feasibility study. In January 2016, Dr. Colbert gave a presentation at the annual PCA meeting summarizing results from UH Hilo's and TNC's efforts at Puakō; this presentation, as well as a 1-page handout that was distributed (*see* Appendix C), were a joint effort between the two research groups. In April 2016, Dr. Wiegner attended a PCA meeting with NOAA officials to discuss research in NOAA's Habitat Blue Print area (which includes Puakō). In October 2016, Dr. Wiegner attended a PCA meeting with the new director of HDAR to discuss ways in which HDAR could support the 'Puakō Sewage Disposal Upgrade Project' led by the Coral Reef Alliance. Additionally, Drs. Wiegner, Colbert, and Beets are members of the Coral Reef Alliance's Advisory Board for the 'Puakō Sewage Disposal Upgrade Project'; they met with the

Table 8. Outreach during UH Hilo's NOAA Coral Reef Conservation Program project from July 2014 to January 2017.

Organization	Number of events (year)
Puakō Community Association	10 (2014 = 3; 2015 = 3; 2016 = 3; 2017 =1)
Coral Reef Alliance's 'Puakō Sewage Disposal Upgrade Project' Advisory Board	7 (2014 = 1; 2015 =2 ;
South Kohala Conservation Action Plan Advisory Board	4 (2016 = 4)
Hawai'i Theatre for Youth "The Story of Water and Hawai'i" performance – Water Hero appearance	1 (2016)
NOAA BWET water quality lectures	2 (2015 = 1; 2016 = 1)
"Flushing Our Future" workshop panelist – ASLO 2017 Conference	1 (2017)

Figure 15. Meeting with the Puakō Community Association (PCA) in November 2014. From left to right, (front row): Sierra Tobiason (UH Sea Grant), Tracy Wiegner (UH-Hilo), Erica Perez (Coral Reef Alliance), Kaile'a Carlson (UH-Hilo), Leilani Abaya (UH-Hilo), Wes Crile (Coral Reef Alliance), (back row) Steve Colbert (UH-Hilo), and Jim Beets (UH-Hilo). Photo is from the Coral Reef Alliance letter included in the PCA January 2015 newsletter.

board in October 2014, August and December 2015, November 2016, and January 2017. Dr. Wiegner also attended a two-day workshop in August 2016 held by the Coral Reef Alliance to develop a 10-year monitoring plan for Puakō. Drs. Wiegner and Colbert also served as panelist at a recent forum held by the Coral Reef Alliance to address PCA's questions regarding options for cesspool removal (Fig. 16). At this meeting, a 1-page handout summarizing results from UH Hilo and TNC was distributed (*see* Appendix D). Data from UH Hilo's CRCP project were also submitted in written testimony to the HDOH in support of their proposed cesspool ban in September 2014 and included in a letter to Hawai'i's Governor encouraging him to sign the ban on new cesspool construction in the state (March 11, 2016) (*see* Appendix E).

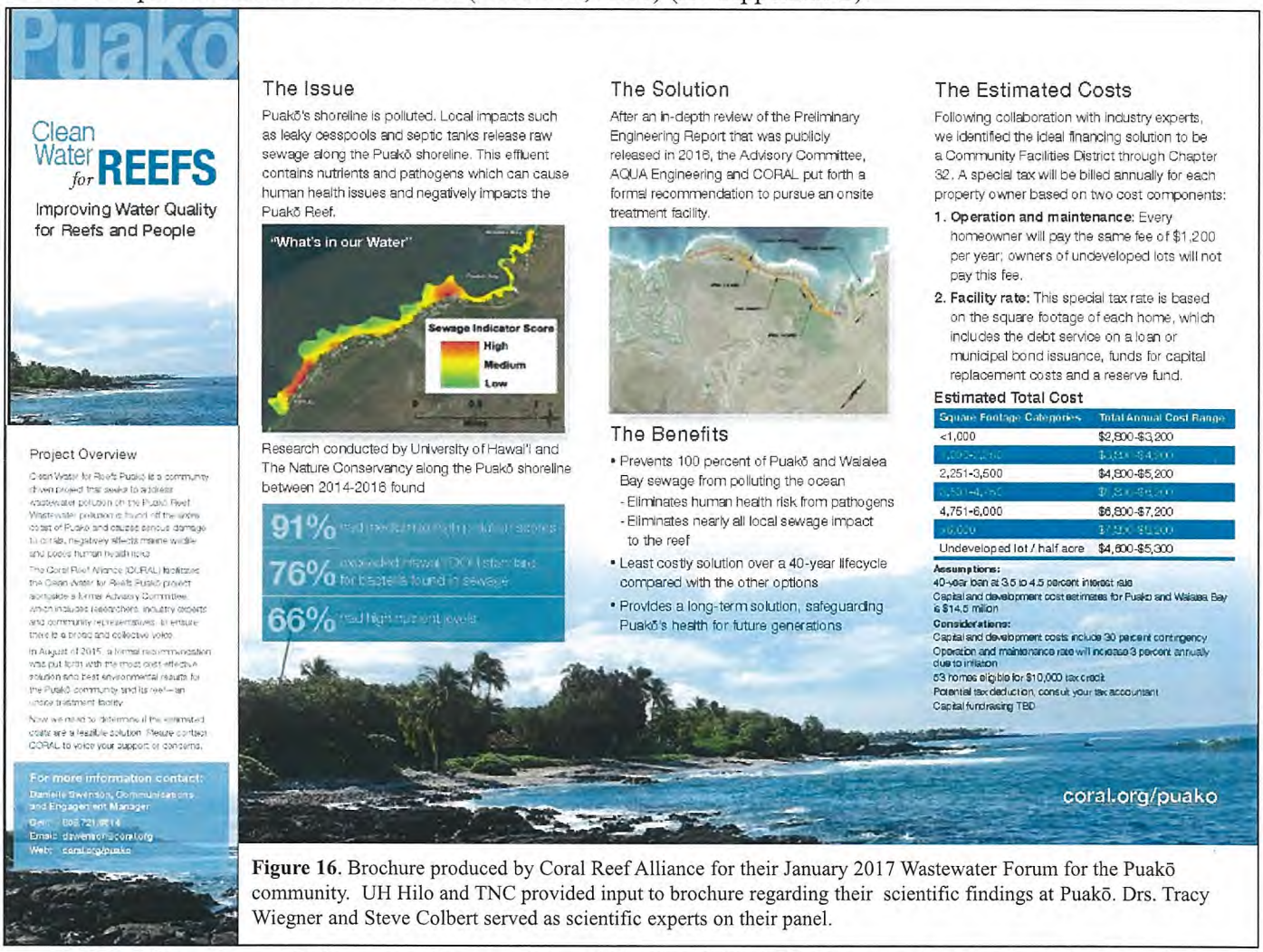


Figure 16. Brochure produced by Coral Reef Alliance for their January 2017 Wastewater Forum for the Puakō community. UH Hilo and TNC provided input to brochure regarding their scientific findings at Puakō. Drs. Tracy Wiegner and Steve Colbert served as scientific experts on their panel.

Drs. Wiegner and Colbert are also members of the South Kohala Conservation Action Plan Marine Advisory Board, and attended four meetings in 2016 (March, June, August, and December). In October 2016, Dr. Wiegner was also a "Water Hero" in the Hawai'i Theatre for Youth's performance of "The Story of Water and Hawai'i" at the UH Hilo Performing Arts Center where she spoke about sewage pollution on Hawai'i Island to local K-12 students (Fig. 17). Dr. Wiegner has also given two online lectures (January and November 2016) to Hawai'i State public school teachers (6-12 grade) regarding water pollution in Hawai'i State as part of the NOAA BWET "OPIHI" project at UH Mānoa led by Dr. Kanesa Seraphin Duncan, Education Director for University of Hawai'i Sea Grant College. In February 2017, Dr. Wiegner was a panelist for a town hall event entitled "Flushing Our Future" at the Association for the Sciences of Limnology and Oceanography (ASLO) Conference in Honolulu, HI. This event was organized by Dr. Craig Nelson from UH Mānoa's C-MORE program and Dr. Daniele Spirandelli from UH Mānoa's Department of Urban and Regional Planning.

HTY Embarks on Statewide Tour with H20: THE STORY OF WATER AND HAWAII

by BWW News Desk Sep. 20, 2016

Honolulu Theatre for Youth will tour its 2015-16 season finale *H20, THE STORY OF WATER AND HAWAII* to Maui County, Kauai and the Big Island in October and November. This sweeping musical by the HTY company will immerse both school and public audiences in a celebration of our islands' most precious resource. Show dates, times and locations are:

The extraordinary musical floods the senses as HTY's cast of "Water Warriors" (alternately scientists, activists and rock stars) explores the cultural, historical, environmental and physical properties of water through song, humor and interactive story telling. **At the close of each performance, different "Water Heroes" from the surrounding community will take the stage and share their knowledge on an aspect of water in the islands.**

Big Island - Hilo
UH Hilo Performing Arts Center
Public Performance Friday, October 21, 7 p.m.
Tickets $10 all seats all ages, available via www.htyweb.org, (808) 839-9885 ext. 720, or at the door.
(School performances Oct. 19, 20, 21)

Figure 17. October 2016, Hawai'i Theatre for Youth performed at the UH Hilo Performing Arts Center and Dr. Tracy Wiegner was their **"Water Hero"** during one of their Hawai'i Island school group performances. She talked about sewage pollution on Hawai'i Island.

F. *Student Training.* This project has trained 12 undergraduates and one graduate student to date with a variety of funding sources (Figs. 18 and 20, Table 9, *see* Appendix F). Between summer 2014 and 2016, eight interns (2014: Evelyn Braun, Maile Aiwohi, Ricky Tabandera; 2015: Bryan Tonga, Devon Aguiar, Jazmine Panelo; 2016 Saria Sultan and Christopher Thompson) from the UH Hilo Pacific Internship Program for Exploring Science (PIPES, funded by the National Science Foundation [NSF]) worked with Drs. Wiegner and Colbert. Both years, the students conducted field and laboratory work, wrote final reports, and presented their findings at a student symposium. In 2014, their results served as pilot data for this project. They helped identify groundwater seep locations (Fig. 1), work out the logistics for macroalgal and water quality sampling, processing, and analyses, as well as conduct the first dye tracer test. In 2015, the interns' projects were designed to collect data for portions of the larger project. During the 2014-2015 academic year, two undergraduates (Cherie Kauahi and Devon Aguiar), supported by UH Mānoa's C-MORE program (NSF funded), assisted Dr. Colbert on his dye tracer tests and Dr. Wiegner on her *Enterococcus* sampling. Another undergraduate (Carrie Soo Hoo) completed her senior thesis with Dr. Wiegner examining the $\delta^{15}N$ distribution in coastline macroalgae. She received funding for her project from UH Hilo's Science, Technology, Engineering, and Math (STEM) Honor's program (NSF funded) and Sigma Xi. Another undergraduate (Serina Kiili) received a U.S. Environmental Protection Agency (USEPA) Greater Research Opportunities (GRO) fellowship to examine sewage pathogens affecting coral health. During the 2015-2016 academic year, two undergraduates (Devon Aguiar and Jazmine Panelo), supported by UH Mānoa's C-MORE program, assisted Dr. Wiegner on her *Enterococcus* and *S. aureus* sampling. Ms. Panelo's and Kiili's senior thesis projects focused on *S. aureus* and coral pathogens, respectively. Fall 2016, Carey Demapan joined the research

Table 9. Organizations that have provided student (undergraduate and graduate) support during UH Hilo's NOAA Coral Reef Conservation Program project from July 2014 to January 2017.

Organization	Number of students supported
Puakō Community Association	1 graduate student
UH Hilo PIPES (NSF REU)	8 undergraduate summer interns
UH Mānoa C-MORE (NSF)	3 undergraduate trainees
USEPA GRO	1 undergraduate fellow
UH Hilo STEM Honors Program (NSF)	1 undergraduate senior
Sigma Xi	1 undergraduate
'Ike Wai (NSF EPSCoR)	1 undergraduate
ASLO Minority Program (ASLOMP)	3 student travel grants (2 graduate, 1 undergraduate)
UH Hilo Marine Science Department	3 undergraduate senior theses; 12 undergraduate interns
Ecological Society of America (ESA)	1 undergraduate travel grant

Figure 18. UH-Hilo PIPES 2014 summer interns. From left to right: Ricky Tabandera (UH-Hilo), Maile Aiwohi (UH-Hilo), and Evelyn Braun (UH-Mānoa).

team as an 'Ike Wai scholar supported through the UH system NSF EPSCoR grant. Lastly, Leilani Abaya, a graduate student enrolled in the Tropical Conservation Biology and Environmental Science (TCBES) Master's program at UH Hilo, defended her research proposal in February 2015 and thesis in April 2016. Her thesis was submitted to UH Hilo Library August 2016 (*see* Appendix G).

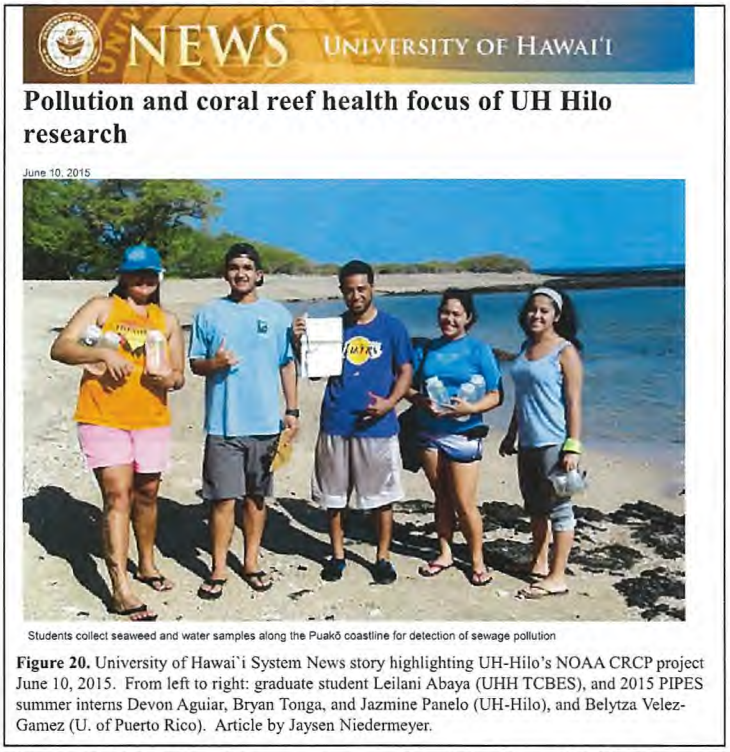
G. Products. **Sixty products** have resulted from this project (*see* Appendices A–J). These include: reports, manuscripts (*see* Appendix G), student theses (*see* Appendix G), presentations (*see* Appendix F), posters (*see* Appendix B), 1-page information sheets (*see* Appendix F), newspaper/ magazine/ online articles (*see* Appendix D), videos, testimony (*see* Appendix E), and a conference session (Table 10). Reports have been submitted to NOAA's CRCP (biannual) and HDAR (algal cage deployment permit report). Dr. Wiegner has given eight presentations on this project to date – The Hawai'i Ecosystem Meeting (July 2014, Hilo, HI), HDOH, Clean Drinking Water Branch, Inter-government Water Conference (INVITED, August 2014, Kona, HI), PCA meeting (November 2014), NOAA CRCP/HDAR meeting (April 2015, Honolulu, HI), NOAA Mokupāpapa Discovery Center (INVITED, May 2015, Hilo, HI), UH Hilo (Public lecture, September 2015, jointly with Dr. Colbert; Fig. 19), International Coral Reef Symposium (ICRS, June 2016, Honolulu, HI), and at the 2017 ASLO Conference (Honolulu, HI). Dr. Colbert has presented twice on this project – a poster at the Hawai'i Conservation Conference (HCC, Hilo, HI, August 2015) and a presentation at the annual PCA meeting (January 2016). Rebecca Most from TNC also presented results from this project in a joint talk at the ICRS. Dr. Courtney Couch from TNC and UH Mānoa's Hawai'i Institute of Marine Biology (HIMB) will be presenting results from this project in a joint talk at HCC in July 2017. Fifteen undergraduate student presentations have been given at the UH Hilo PIPES Summer Internship Symposium, the UH Hilo Marine Science Department Senior Thesis Symposium, and the UH Hilo STEM Honors Program Symposium. Three undergraduate posters and one oral presentation were given at the annual C-MORE symposium (2 posters May 2015, one poster and one presentation May 2016). August 2016, Ms. Panelo presented findings from her undergraduate senior thesis at the Ecological Society of America (ESA) Annual Meeting (Fort Lauderdale, FL). Ms. Panelo received a travel grant through this society. She and Ms. Sultan will also be presenting their results at the 2017 ASLO Conference

Table 10. Products from UH Hilo's NOAA Coral Reef Conservation Program project from July 2014 to January 2017.

Product	Number produced
Reports	6 (NOAA, biannual = 5 [2015-2017]; HDAR = 1 [2016])
Manuscript (submitted/in prep)	2 (Marine Pollution Bulletin)
M.S. thesis	1 (UH Hilo, TCBES, August 2016)
B.S. senior theses	3 (UH Hilo, Marine Science Department, 2015 = 1; 2016 = 2)
Presentations	32 (12 PI, 5 graduate student, 15 undergraduate student)
Posters	5 (1 PI, 1 graduate student, 3 undergraduate student)
Community handouts	4 (PCA, 1 per year from 2014 -2017)
Newspaper/magazine/newsletter articles	3 (UH System News [2015, Fig. 20], Hawai'i Tribune Herald [2016, Fig. 21], Hawai'i Business [2017, http://www.hawaiibusiness.com/water-warning/])
Videos	1 (Coral Reef Alliance [2017, http://coral.org/puako/])
Testimony regarding Hawai'i state cesspool ban	2 (1 [2015], 1 [2016])
HCC Land-based pollution conference session	1 (2015)

Figure 19. Flyer for public lecture on sewage pollution given by Drs. Wiegner and Colbert (September 2015).

(Honolulu, HI). Ms. Sultan received a travel grant through this society's minority students' program. Additionally, five graduate student presentations and one poster were given –ASLO in Granada, Spain (February 2015), UH Hilo TCBES Symposium (April 2015), HCC (August 2015), Ocean Sciences Meeting (OSM) in New Orleans (February 2016), M.S. Thesis defense (April 2016), and Hawai'i Ecosystems Meeting in Hilo (July 2016). Leilani Abaya won best student presentation at the ASLO conference and was also awarded a travel grant through this society's program for minority students. Ms. Abaya also received a travel grant to OSM through their minority students' program. The UH Hilo Marine Science research team organized a session for the HCC (August 2015) on land-based pollution effects on coral reefs and near-shore waters. This project was also highlighted in the UH system-wide news



NEWS UNIVERSITY OF HAWAI'I

Pollution and coral reef health focus of UH Hilo research

June 10, 2015

Students collect seaweed and water samples along the Puakō coastline for detection of sewage pollution

Figure 20. University of Hawai'i System News story highlighting UH-Hilo's NOAA CRCP project June 10, 2015. From left to right: graduate student Leilani Abaya (UHH TCBES), and 2015 PIPES summer interns Devon Aguiar, Bryan Tonga, and Jazmine Panelo (UH-Hilo), and Belytza Velez-Gamez (U. of Puerto Rico). Article by Jaysen Niedermeyer.

(June 2015; Fig. 20; *see* Appendix H), Hawai'i Tribune Herald (March 2016; Fig. 21; *see* Appendix I) and in the Hawaii Business magazine (*see* Appendix J).

Big Island lawmakers lobbied against cesspool ban

Published March 15, 2016 - 1:30am

By COLIN M. STEWART Hawaii Tribune-Herald
The state has taken an important step toward addressing water pollution, according to some isle scientists.

A statewide ban on new cesspool construction approved Friday by Gov. David Ige came despite protests from seven Hawaii Island legislators, who claimed the ban would place undue financial burdens on local homeowners who might not be able to afford more expensive sewage systems.

The new rules also implement a 2015 law providing a tax credit of up to $10,000 for cesspools upgraded to sewer or septic system during the next five years, limited to $5 million or about 500 cesspool upgrades a year. Under the law, owners of cesspools located within 200 feet of the ocean, streams or marsh areas, or near drinking water sources, can qualify for the credit.

In announcing the ban, Ige said Hawaii had been the only state in the union that allowed the construction of cesspools.

"Today's action banning new cesspools statewide would stop the addition of pollution from approximately 800 new cesspools per year," he said.

Cesspools, which are effectively "just holes in the ground," according to University of Hawaii at Hilo marine scientist Tracy Wiegner, inject about 55 million gallons of raw, untreated sewage into Hawaii's groundwater every day, potentially spreading diseases and harming the quality of drinking water supplies and recreational waters.

Wiegner applauded the ban on Monday, calling it "a good first step towards reducing sewage pollution in our near-shore waters."

Figure 21. Hawaii Tribune Herald article highlighting results from UH-Hilo's NOAA CRCP project March 15, 2016. Picture taken by Steven Colbert.

H. Related UH Hilo Funded Projects.

1. NFWF. 2017. Local Engagement for Conservation Solutions: Measuring the Impact of Management Action in South Kohala, Hawai'i Island. Tracy Wiegner (PI), Jim Beets, Steve Colbert, and Courtney Couch. $ 25,020. Contracted through the Coral Reef Alliance.

2. NOAA/HDAR Coral Reef Working Group. 2016. Sewage pollution source tracking on Puakō's coral reefs. Tracy Wiegner (PI), Steve Colbert, Jim Beets, Courtney Couch, and Craig Nelson. $83,918. Recommended for funding. (2018-2019).

3, NOAA. West Hawaii Habitat Focus Area. 2016. Water quality and coral reef health. Stuart Goldberg (PI), Lani Watson, Jamie Gove, Jonathan Martinez, Tracy Wiegner, Steve Colbert, Eric Conklin, Courtney Couch, Chad Wiggins, Kim Falinski. Rebecca Most, and Julia Rose. $99,955. (2016-2017).

4. NOAA/HDAR Coral Reef Working Group. 2016. Sewage pollution source tracking at Puakō and comparison of onsite waste disposal systems for management actions. Tracy Wiegner (PI), Steve Colbert, and Jim Beets. $80,555. (2016-2017)

I. Collaborators

Table 11. Collaborators on UH Hilo's NOAA Coral Reef Conservation Program project from July 2014 to January 2017.

Organization	Collaborators
UH Mānoa, Hawai'i Institute of Marine Biology (HIMB)	Courtney Couch
The Nature Conservancy (TNC)	Chad Wiggins, Rebecca Most, Amy Bruno, Eric Conklin, Kim Falinski
UH Mānoa, School of Oceanography and Environmental Science and Technology (SOEST), Center for Microbial Oceanography Research and Education (C-MORE)	Craig Nelson, Kristina Remple, Barbara Bruno
Puakō Community Association (PCA)	Peter Hackstedde, George Fry, Robby Robertson, Mike O'Toole
Coral Reef Alliance	Erica Perez, Jos Hill, Cherrie Kauahi, Danielle Swanson, Wes Crile, Michael Webster
South Kohala Conservation Partnerships (SKCP)	Julia Rose, Sierra Tobiason
UH Hilo PIPES	Sharon Ziegler-Chong, Noe Puniwai, Rebecca Ostertag, Ulu Ching, Erika Perry, Rita Miller, Linnea Heu
NOAA Habitat Blue Print	Lani Watson, Stuart Goldberg
Aqua Engineering	Justin Logan
Cornell University	C. Drew Harvell, Charles Greene
NOAA Coral Reef Conservation Program	Paulo Maurin
Seattle Aquarium	Shawn Larson, Amy Green

J. Cited Literature.

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K. APPENDICES.

A. UH Hilo handout for Puakō Community and recreational ocean users during deployments in 2015.

B. UH Hilo handout for Puakō Community Association meeting in November 2014 and January 2015

C. UH Hilo and TNC joint handout for the Puakō Community Association annual meeting. January 2016.

D. Joint UH Hilo and TNC handout for Coral Reef Alliance's Wastewater Forum for the Puakō community. January 2017

E. Testimony regarding Hawai'i state cesspool ban

F. List of conferences, years, presenters, and title presentations given over the duration of the study.

G. Manuscripts' and M.S. thesis abstracts

H. University of Hawai'i System News story highlighting Puakō project June 2015.

I. Hawai'i Tribune Herald article highlighting results in March 15, 2016.

J. Hawai'i Business article highlighting efforts in January 2017.

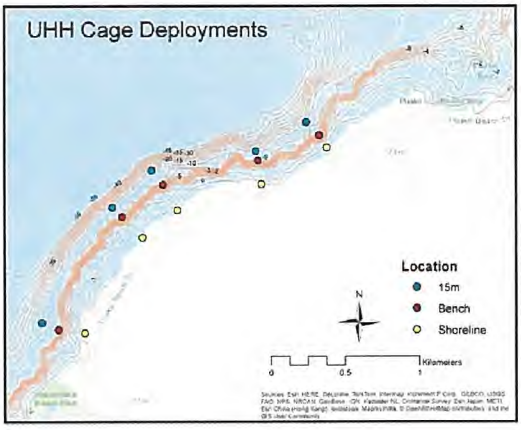
APPENDIX A

UH Hilo handout for Puakō Community and recreational ocean users during cage deployments in 2015.

Attention:
Puakō Boaters & Ocean Users

(Swimmers, Snorkelers, Surfers)

University of Hawai'i at Hilo will be conducting a marine research experiment in the area



Please be aware: A short term surface array will be installed at the shoreline and 100 m – 200 m offshore of Puakō. The purpose of the array is to assess water quality in these areas using native algae in cages (pictured right). The arrays extend from the surface to the ocean floor. They will have white buoys at the surface with reflective tape to be visible to boaters at night and can be identified with University of Hawai'i signs.

Deployed from June 12 – 19, 2015.

Please do not moor to, hang on to, or disturb.

THANK YOU!

This project is in collaboration with the Puakō Community Association

For more information please contact Jim Beets (808) 932-7600

APPENDIX B

UH Hilo handout for Puakō Community Association meeting in November 2014 and January 2015.

Spatial Distribution and Effects of Sewage on Puakō's Coral Reefs

Goals

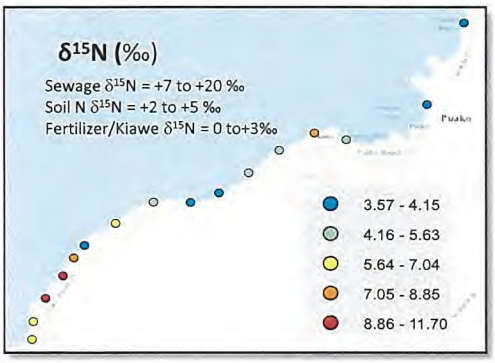
- Use chemical and biological tools to determine if sewage is entering coastal waters
- Determine if sewage is impacting water quality
- Assess coral reef community-level response to sewage

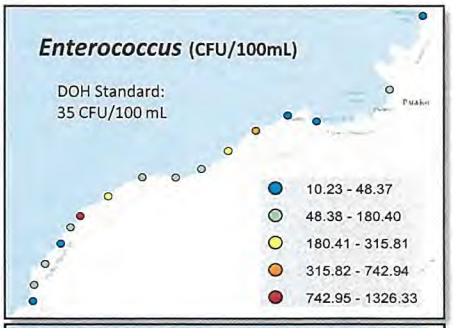
Objectives

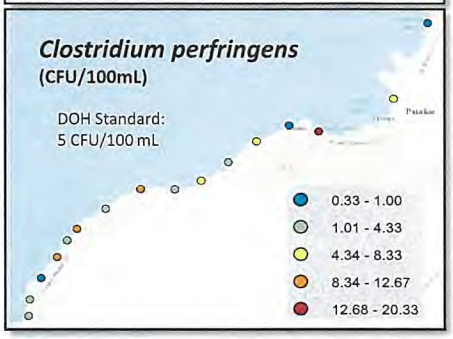
1. Dye Tracer Studies: Use dye to document connection between cesspools and ocean
2. $\delta^{15}N$ Seaweed Measurements: Evaluate presence and spatial extent of sewage near- and offshore
3. Fecal Indicator Bacteria & Nutrient Measurements: Determine if DOH water quality standards are exceeded
4. Benthic Community Responses: Assess responses of corals, fishes, and macroinvertebrates to wastewater

Findings

Dye travel time was 3 days from cesspool to ocean, only observed at low tide and localized







Fecal indicator bacteria (*Enterococcus & C. perfringens*) and $\delta^{15}N$ seaweed values indicate sewage presence at multiple locations

Remaining Work

- Two more dye tracer experiments
- Nutrient, bacteria, and $\delta^{15}N$ seaweed measurements including offshore seaweed cage experiments
- Coral and fish sampling

Seaweed cage experiments

UHH Faculty
Dr. Tracy Wiegner (PI, water quality) wiegner@hawaii.edu
Dr. Jim Beets (Coral & fish) beets@hawaii.edu
Dr. Steve Colbert (Dye studies) colberts@hawaii.edu
Dr. Jason Adolf jadolf@hawaii.edu

Technician:
Kaile'a Carlson kaileac@hawaii.edu

Graduate Student (supported by PCA):
Leilani Abaya labaya@hawaii.edu

Undergraduates:
Carrie Soo Hoo, Cherie Kauahi, Serina Ki'ili, Ricky Tabandera, Maile Aiwohi, Evelyn Braun

University of Hawai'i Hilo
200 West Kawili St
Hilo, HI 96720

Funded by NOAA Coral Reef Conservation Program and Puakō Community Association

APPENDIX C

UH Hilo and TNC joint handout for the Puakō Community Association annual meeting. January 2016.

PUAKŌ hawai'i

WHAT'S IN OUR WATER?

Meandering underground streams flowing beneath Puakō and entering the ocean through springs and seeps once nourished an abundant fishery and vibrant coral reefs. So, when residents began noticing declines in fish and corals, they enlisted partners to help them understand why these changes were occurring.

Today, Cornell University, the University of Hawai'i at Hilo Marine Science Department (UH Hilo), The Nature Conservancy (TNC), and the Hawai'i Institute of Marine Biology (HIMB) are working with the Puakō Community Association to identify causes of the declines and solutions for restoring coral reef health at Puakō.

Domestic wastewater (sewage) was suspected as one of the threats to the reef. Research found outdated cesspools leaching untreated sewage through permeable rock to beaches, tide pools, and the reef, impacting nearshore water quality.

How far offshore does the sewage travel from the nearshore seeps? How quickly does sewage from cesspools enter nearshore waters? What are the impacts of sewage to the reef ecosystem? These are the questions currently being addressed by research groups.

KEY FINDINGS

Indicators of domestic wastewater have been found in coastal and marine areas where they are likely impacting people, coral reefs, and other marine life:

- Dye tracer studies found that sewage from cesspools reached seeps along the Puakō coast within six hours to three days.
- At some shoreline locations, often corresponding to those of the dye tracer studies:
  - Levels of two bacteria associated with sewage often exceeded Hawai'i Department of Health standards.
  - Nitrate levels were two times higher than those in mauka groundwater from Waikoloa and Mauna Lani.
  - Nitrogen isotope measurements in seaweed were indicative of sewage pollution.
- Coral growth anomalies–tumor-like growths on coral skeletons–were highest on reefs with evidence of groundwater input and elevated nutrients.
- Studies conducted across the region show Puakō's reefs have especially high levels of red filamentous algae, which overgrow and can kill corals.

IMPACTS ON PEOPLE AND OCEAN LIFE

Exposure to sewage can cause skin, urinary, blood, and abdominal infections like gastroenteritis, Hepatitis A, conjunctivitis, salmonellosis, and cholera. Children and the elderly are particularly susceptible to these infections.

Sewage also increases disease risk in reef animals and can shift the balance in favor of fast-growing invasive algae, which smother corals and reduce oxygen levels necessary for other animals to survive.

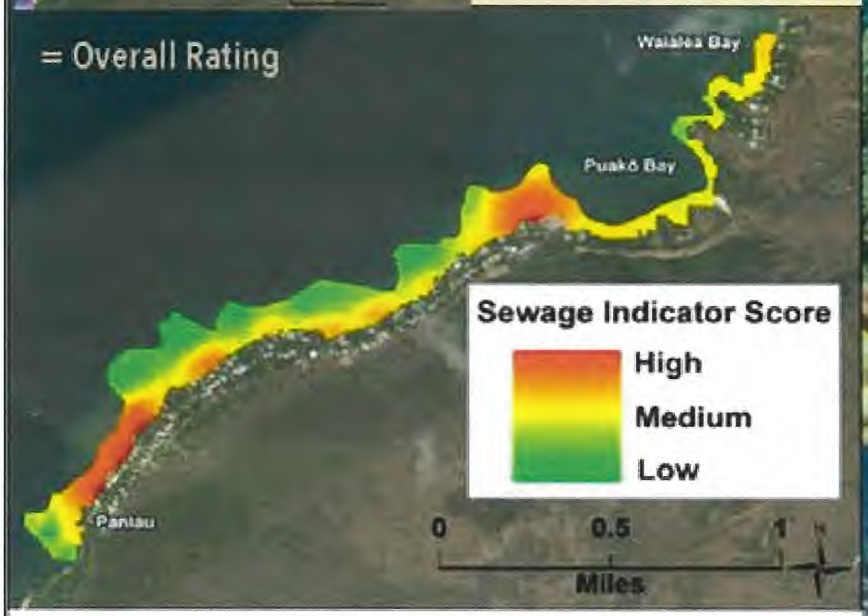
CONCLUSIONS

The continued use of domestic wastewater systems that do not treat sewage, like cesspools, expose recreational water users, coral reefs, and other marine life to significant health risks. Minimizing the flow of untreated sewage into Puakō's waters is critical to reducing these risks, and making corals more resilient to ocean warming and acidification. Investing in clean, long-term sewage treatment alternatives will not only benefit the coral reef, but all of us who use and care for the ocean.

FOR ADDITIONAL INFORMATION

Contact Julie Rose, South Kohala Marine Coordinator, at julie.rose@tnc.org

The sewage indicator score was created by combining multiple water quality metrics to show where the highest sewage inputs are occurring along the Puakō coastline. The water quality metrics used included stable isotope values (Nitrogen 15), bacteria abundance (Clostridium and Enterococcus), and nutrient concentration (nitrate, phosphate, and ammonia).



Sewage carries pathogens (bacteria, protozoa, and viruses), pharmaceuticals, nutrients (nitrates and phosphates), cleaning chemicals, and other pollutants into groundwater, onto beaches, and into the ocean. These pollutants have been found in Puakō in areas where people swim, surf, dive, and fish.

January 2016

APPENDIX D

Joint UH Hilo and TNC handout for Coral Reef Alliance's Wastewater Forum for the Puakō community. January 2017.

PUAKŌ hawai'i

WHAT'S IN OUR WATER?

Meandering underground streams flowing beneath Puakō and entering the ocean through springs and seeps once nourished an abundant fishery and vibrant coral reefs. So, when residents began noticing declines in fish and corals, they enlisted partners to help them understand why these changes were occurring.

Today, scientists from The Nature Conservancy, University of Hawai'i at Hilo Marine Science Department, Hawai'i Institute of Marine Biology, University of Hawai'i at Mānoa, and Cornell University are working with the Puakō Community Association to identify causes of the declines and solutions for reviving coral reef health at Puakō.

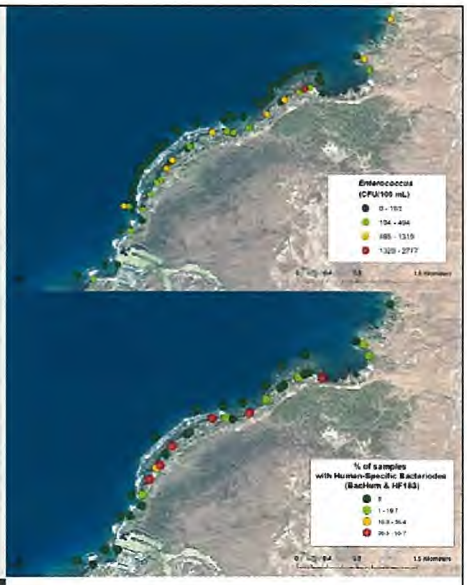
Using a combination of tools, including stable nitrogen isotopes and DNA-based tools which are able to identify the presence of human waste, the research confirms what has long been suspected: cesspools are leaching untreated sewage underground to Puakō's beaches, tide pools, and reef.

KEY FINDINGS

- Nutrients are elevated at coastal springs and seeps, as evidenced by high nitrates across 66% of the sites. Measurements were especially high in areas with high levels of submarine groundwater.
- Stable nitrogen isotope measurements in seaweed (> + 7 ‰) are indicative of sewage pollution at several locations, with the highest values observed at the southern and northern end of Puako's shoreline.
- Elevated levels of stable nitrogen isotopes at several reef stations are indicative of sewage reaching the reef.
- Stable nitrogen isotope measurements showed that groundwater became increasingly polluted with sewage moving downslope to the shoreline, with the highest values being measured within Puakō and lower values found at Waikaloa Village.

KEY FINDINGS (*continued*)

- Between 2014 and 2016, measurements at 76% of shoreline sites exceeded Hawai'i Department of Health standard (single sample maximum, 104 CFUs/100ml) for *Enterococcus* concentrations in coastal waters.
- Like the stable nitrogen isotope data, *Enterococcus* concentrations were lower over the reef compared to the shoreline but were relatively high (36-91 CFUs/100ml) at 20% of the reef stations, also suggesting that sewage pollution is reaching some locations along the reef.
- Using DNA-based tools, researchers found that 36-67% of the samples collected during 2015, contained bacteria only found in the human gut, suggesting frequent exposure to sewage pollution.
- Similar to the stable nitrogen isotope seaweed data, the highest values were found in the northern and southern portions of Puakō.



CONCLUSIONS

Ongoing research provides strong evidence of sewage pollution along Puakō's shoreline and reef. Minimizing the flow of untreated sewage into Puakō's waters by investing in clean, long-term sewage treatment alternatives will reduce risks to human health and to marine life. Our research constitutes a baseline against which reductions in pollution levels can be measured if wastewater treatment improves.

IMPACTS ON PEOPLE AND OCEAN LIFE

Exposure to sewage can cause skin, urinary, blood, and abdominal infections like gastroenteritis, Hepatitis A, conjunctivitis, salmonellosis, and cholera. Children and the elderly are particularly susceptible to these infections. At *Enterococcus* concentrations of 35 CFU/100ml, like those documented at Puakō, recreational water users have a 3.6% chance of contracting gastroenteritis. Sewage pollution also increases disease risk in reef marine animals and can shift the balance in favor of fast-growing invasive algae, which smother corals and reduce oxygen levels necessary for other animals to survive.

FOR ADDITIONAL INFORMATION

Contact Julia Rose, South Kohala Marine Coordinator, at julia.rose@tnc.org.

APPENDIX E

Testimony regarding Hawai'i State's proposed cesspool ban.

UNIVERSITY of HAWAI'I HILO

03/04/2016

Dear Governor Ige,

We are writing a letter of support for Hawai'i's Department of Health's (HDOH) proposed revisions to HAR 11-62 to prohibit installation of new cesspools. Several of us in the Marine Science Department at the University of Hawai'i at Hilo (UH-Hilo) have conducted research in Hawai'i Island's coastal waters relative to cesspool pollution. We have worked in Hilo Bay, Wai 'Opae (Vacation Lands, Kapoho), and Puakō- several of the places listed as concerns in the HDOH 'Rational for the Proposed Revisions' document (2015). Through our studies and others, it is clear that wastewater from cesspools leaks into streams and the coastal ocean. This untreated wastewater, which contains pathogens, pharmaceuticals, nutrients, cleaning chemicals, and petroleum products, is negatively impacting public health and coastal ecosystems.

Over half of 50,000 cesspools on the Hawai'i Island are located within the two-year time of travel to a river or the shoreline region (Whittier and El-Kadi 2014). Dye tracer study tests have been conducted both at Wai 'Opae and Puakō, and time of travel from homes to shoreline ranged from 20 min (HDOH 1984) to three days (Colbert et al. unpubl. data). Additionally, wastewater has been shown to be polluting private drinking water wells. In Hawaiian Paradise Park, Hawai'i Island, 50% of drinking water wells sampled, tested positive for fecal indicator bacteria. Pathogens associated with this indicator bacteria can live for months in groundwater. These results indicate that cesspools can be immediate human health hazard.

Cesspools do not remove harmful pathogens (bacteria, protozoa, and viruses). Human health effects from sewage inputs range from abdominal infections (gastroenteritis in swimmers), to skin, urinary, and blood ones (Pinto 1999). Some of these bacteria have a high salt tolerance and have developed resistance to antibiotics, making them potentially life threatening (Hancock and Gilmore 2000). To monitor whether recreational waters are safe to swim in, the HDOH monitors fecal indicator bacteria, including *Enterococcus* and *Clostridium perfringens*. According to USEPA (820-F-12-061, 12/2012), when *Enterococcus* levels are at the geometric mean of 35 CFU/100 mL, the estimated gastrointestinal illness rate is 3.6%. These *Enterococcus* levels are often exceeded in Hilo Bay, Wai 'Opae, and Puakō (range <10 to 2777 CFU 100 mL^{-1}; Wiegner et al. 2013; Economy et al. unpubl. data; Wiegner et al. unpubl. data). The presence of *Enterococcus* suggests that disease-causing microorganisms might also be present, especially if they are from human waste. This has been found to be the case on the island of Oahu, where *Enterococcus* levels were positively associated with several waterborne pathogens including: *Salmonella*, *Campylobacter*, and *Staphylococcus aureus* (Viau et al. 2011). In Hilo Bay, it has been confirmed that some of these bacteria are from human waste using microbial source tracking techniques (Evans et al. submitted); comparable measurements have not yet been made in Wai 'Opae and Puakō.

Since cesspools lack any wastewater treatment, the nutrients and pathogens in the sewage enter the groundwater and are transported to the coastal ocean. Ecological effects of sewage pollution include shifts in reef community structure (coral- to algal- dominated systems), eutrophication, declines in the abundance, mortality, and fecundity of corals and reef fish, as well as high occurrence of diseases and infections of reef biota (Hunter and Evens 1995). One of the environmental drivers of coral disease that has been identified is nutrient pollution, often from sewage (Harvell et al. 2007; Kaczmarsky and

Richardson 2010; Haapkylä et al. 2011; Vega Thurber et al. 2013). Because cesspools are aerobic, very little nitrogen in the wastewater is volatilized and most is in the form of nitrate, which is not retained by soil. Chronic nutrient exposure has been shown to lead to increases in disease prevalence and severity, as well as bleaching in scleractinian corals (Vega Thurber et al. 2013). Disease has played a major role in the decline of corals worldwide (Harvell et al. 2007; Ruiz-Mureno et al. 2012). While only a few diseases have been identified in Hawai'i, coral diseases are on the increase and a recent outbreak of white syndrome on Kaua'i Island is of particular concern (Work et al. 2012). Two of the sites where we have worked on Hawai'i Island show signs of coral and reef health deterioration – Puakō and Wai 'Opae- with high prevalence of growth abnormalities, discoloration, and algal overgrowth (Burns et al. 2011; Couch et al. 2014). The reefs at Puakō are reported to be in 'dire straights' due to decreases in fish abundances, coral and crustose coralline algae cover, as well as increases in macroalgal cover (HDAR 2013). In part, these observations are thought to be linked to sewage pollution from cesspools.

It is therefore imperative that Hawai'i State adopts these changes to HAR 11-62 and ban the installation of new cesspools. Hawai'i is the only state in the U.S. that still allows for new cesspools to be permitted; Rhode Island, the state with the second largest number of cesspools, banned construction of new ones in 1968, 46 years ago. Even in Florida, a warm state like Hawai'i where the ground does not freeze, has banned cesspools. Symptoms of sewage pollution are becoming more apparent on the outer Main Hawaiian Islands in rural areas, such as Hawai'i Island – as documented in many of UH-Hilo's studies described above. In these areas, coral reefs are still relatively healthy, underscoring the urgency for improved sewage disposal management. Hawai'i State needs to lead the nation in protecting its coastal waters. The economy and Hawaiian culture depend on the quality and health of coastal waters. For example, Hawai'i's coral reefs contribute ~$800 million dollars annually to the state's economy, and services related to tourism account for 17% (HDLIR 2010). If new cesspool construction continues, human health risks and associated health care costs will increase, and revenue generated by Hawai'i's coral reefs will decrease, impacting the state's economy. Therefore, we strongly support HDOH's proposed rules to ban new cesspool construction.

Tracy Wiegner, Ph.D., Professor of Marine Science, UHH
Steve Colbert, Ph.D., Assistant Professor of Marine Science, UHH
Jim Beets, Ph.D., Professor of Marine Science, UHH

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APPENDIX F

List of conferences, years, presenters, and title presentations given over the duration of the study. Presentations were given to a variety of different symposiums and conferences including: the Pacific Internship for Exploring Sciences (PIPES) symposium, Center for Microbial Oceanography: Research Education (CMORE) symposium, Science, Technology, Engineering, and Mathematics (STEM) symposium, Sigm Xi symposium, United States Environmental Protection Agency Greater Research Opportunities (USEPA GRO) symposium, the Association for the Sciences of Limnology and Oceanography (ASLO) conference, the Tropical Conservation, Biology, and Environmental Studies (TCBES) symposium, the Hawai'i Conservation Conference (HCC), the Ocean Science Meeting (OSM), the Hawai'i Ecosystem Meeting (HEM), the Ecological Society of America (ESA) conference, the Coral Reef Symposium (CRS), and the NOAA Mokupapapa Discovery Center weekly talks.

PIPES		
Year	Name	Title
2014	Evelyn Braun	Cesspools discharge pathogens, nutrients, cleaning chemicals, and hydrocarbons that pose a threat to coral reef and human health.
2014	Maile Aiwohi	Sewage pollution effects in a groundwater-fed coral reef area.
2015	Bryan Tonga	Is there a significant correlation between the pH and the amount of $\delta^{15}N$ in sewage pollution along Puakō's coast?
2015	Devon Aguiar	Using *Enterococcus* to identify sewage pollution along the Puakō coastline.
2015	Jazmine Panelo	Quantification of *Staphylococcus aureus* in Puakō, Hawai'i in association with sewage indicators.
2016	Saria Sultan	Identifying locations of sewage pollution in the Puakō watershed.
2016	Christopher Thompson	Characterizing groundwater flow in fractured rock from coastal septic systems.
CMORE		
Year	Name	Title
2015-2016	Jazmine Panelo	Quantification of *Staphylococcus aureus* in Puakō, Hawai'i in association with sewage indicators
2015-2016	Devon Aguiar	*Enterococcus* trends along the Puakō coastline.
2014-2015	Cherie Kauahi	Cesspool, groundwater and coastal ocean connectivity at Puakō, Hawai'i.
2014-2015	Devon Aguiar	Highly variable *Enterococcus* concentrations along the Puakō coast.
STEM/SIGMA XI		
Year	Name	Title
2014-2015	Carrie Soo Hoo	$\delta^{15}N$ in macroalgae as a proxy for nutrient enrichment from sewage.

USEPA GRO		
Year	Name	Title
2016	Serina Kiili	Abundance of *Serratia marcescens* and *Vibrio* spp. at Puakō, Hawai'i and their association with sewage indicators
ASLO		
Year	Name	Title
2017	Tracy Wiegner	Spatial distribution of sewage pollution on a Hawaiian coral reef .
2017	Saria Sultan	Identifying locations of sewage pollution in a leeward Hawaiian watershed.
2017	Jazmine Panelo	Association between *Staphylococcus aureus* and other sewage indicators in coastal waters of Puakō, Hawai'i.
2016	Leilani Abaya	Spatial distribution and effects of sewage in coastal Hawaiian waters (Puakō, Hawai'i).
2015	Leilani Abaya	Spatial distribution and effects of sewage in coastal Hawaiian waters (Puakō, Hawai'i).
TCBES Symposium		
Year	Name	Title
2015	Leilani Abaya	Spatial distribution and effects of sewage on Puakō's (Hawai'i) coral reefs.
HCC		
Year	Name	Title
2015	Leilani Abaya	Spatial distribution and effects of sewage on Puakō's (Hawai'i) coral reefs.
2015	Steven Colbert	Linking sewage pollution to near-shore coastal waters through dye tracer, water quality, and fecal indicator bacteria measurements at Puakō, Hawai'i
OSM		
Year	Name	Title
2016	Leilani Abaya	Spatial distribution and effects of sewage in coastal Hawaiian waters (Puakō, Hawai'i).

HEM		
Year	Name	Title
2014	Tracy Wiegner	Spatial distribution and effects of sewage on Puakō's coral reefs.
2016	Leilani Abaya	A multi-indicator approach for identifying hotspots of shoreline sewage pollution adjacent to coral reefs.
ESA		
Year	Name	Title
2016	Jazmine Panelo	Association between *Staphylococcus aureus* and other sewage indicators in coastal waters of Puakō, Hawai'i.
CRS		
Year	Name	Title
2016	Tracy Wiegner	A multi-tracer approach for identifying sewage pollution hotspots on a Hawaiian coral reef.
NOAA Mokupapapa Discovery Center		
Year	Name	Title
2015	Tracy Wiegner	Spatial distribution and effects of sewage on Puakō's (Hawai'i) coral reefs

APPENDIX G

G1. Abstract submitted to Marine Pollution Bulletin for publication (in prep).

A multi-indicator approach for identifying hotspots of shoreline sewage pollution adjacent to coral reefs

Sewage pollution is contributing to the global decline of coral reefs, making identifying sources of sewage pollution a key management priority. We used dye tracer tests, measurements of sewage indicators (fecal indicator bacteria (FIB), $\delta^{15}N$ in macroalgae, nutrient concentrations), and a scoring tool to identify shoreline sewage pollution hotspots in Puakō, Hawai'i. FIB abundance was high and variable, and $\delta^{15}N$ macroalgal values were within sewage range. Shoreline nutrient concentrations were two times higher than those in upland groundwater. Sewage from homes reached shoreline waters within 9 hours to 3 days. A sewage pollution score was created using sewage indicators to identify pollution hotspots. Our study documented sewage entering Puakō's shoreline waters, and highlights the need for a multi-indicator approach and scoring tool to identify sewage pollution hotspots for appropriate management actions. Our approach provides a useful framework for identifying the extent and severity of sewage pollution in other coastal regions.

G2. Abstract submitted to Marine Pollution Bulletin for publication (in prep).

Spatial distribution of sewage pollution on a Hawaiian coral reef

Sewage pollution has been shown to affect both human health and nearshore ecosystems, and is especially a concern in tropical regions with coral reefs. Puakō, located on Hawai'i Island, is one area of concern because sewage pollution has been detected along on its shoreline; however, the spatial distribution of sewage pollution offshore in surface and benthic waters is unknown. This study examined the spatial extent of sewage pollution using algal bioassays and a combination of sewage indicators (fecal indicator bacteria (FIB), stable nitrogen isotopes ($\delta^{15}N$) in macroalgal tissue, nutrients). FIB counts and nutrients were spatially variable in both surface and benthic waters, with shoreline concentrations exceeding water quality standards. $\delta^{15}N$ in macroalgal tissue, along the shoreline were the most enriched and within the range for sewage. However, sewage indicators were not always in agreement on the location and intensity of pollution. To assess water quality with regards to these indicators, a sewage pollution score was created, allowing for locations of sewage pollution hotspots to be identified. This approach for identifying sewage pollution hotspots is valuable for other coastal communities

with documented sewage pollution so that appropriate management actions can be taken to improve water quality, and reduce human and ecosystem health hazards.

G3. Abstract submitted to University of Hawai'i at Hilo library in fulfillment of a M.S. degree.

Identifying hotspots of sewage pollution in coastal areas with coral reefs

Sewage pollution threatens human and coral reef health. Study goals were to identify sewage pollution hotspots through dye tracer tests, measurements of sewage indicators, and development of a sewage pollution score, along Puakō's (Hawai'i) reef. Sewage was localized within 10 m of the shoreline and reached it within 9 hours to 3 days. Shoreline nutrient concentrations were two times higher than upland groundwater. Sewage indicators were higher and more variable along the shoreline than on the reef, and often greater than water quality standards. Shoreline $\delta^{15}N$ macroalgal values were indicative of sewage, while offshore values were indicative of soil or groundwater nitrate. A sewage pollution score was created using several indicators that accurately identified sewage pollution hotspots, as three dye tracer locations had the highest scores. Results highlight the need for a multi-indicator approach and scoring system for identifying sewage pollution hotspots to improve water quality.

APPENDIX H

University of Hawai`i System News story highlighting Puakō project June 2015.

Pollution and coral reef health focus of UH Hilo research

hawaii.edu/news/2015/06/10/pollution-and-coral-reef-health-focus-of-uh-hilo-research

UH News 6/10/2015

Students collect seaweed and water samples along the Puakō coastline for detection of sewage pollution

For conservation efforts to be effective and long lasting, partnerships between local communities and researchers are necessary, says **Tracy Wiegner**, professor of marine science at the University of Hawai'i at Hilo who is part of a research team studying ocean water quality in South Kohala on Hawai'i Island. In particular, she says, local communities must see a need for conservation activities and desire for them to occur. It is crucial that they participate in developing these projects to meet their community's desired outcomes, and are committed to the efforts required for long-term success.

For a long time, these types of partnerships were overlooked by university and state and federal agencies, but they are now recognized as essential for any conservation project to be successful.

Wiegner is working on this new type of community-researcher partnership in collaboration with **Steve Colbert**, assistant professor of marine science, and **Jim Beets**, professor of marine science. The research team is investigating sewage pollution in nearshore waters off Puakō, an ocean-side community in South Kohala.

Wiegner, her collaborators, and students are documenting the presence of sewage through bacterial, seaweed and water quality measurements.

"The first step of the project was to document that there was a sewage pollution problem," Wiegner explains. Documentation is essential to establish that a problem exists, she says, and it allows the community to decide, first, if they want to do something about it, and second, to investigate potential solutions.

1/2

Household waste present in nearshore waters

To date, results from the project demonstrate that waste from homes in Puakō is present in the nearshore waters. The most telling piece of the research is results from the dye tracer studies where dye was washed down sinks or added to cesspools. Colbert detected the dye in 72 hours in seeps along the shoreline in front of the houses. Wiegner says these results "really demonstrate the connection between the homes and the nearshore waters. You couldn't ask for more concrete evidence than that."

Other results have shown that the groundwater upslope of Puakō has much lower nutrient concentrations than the groundwater that enters the ocean. This suggests that there is some source of nutrients at Puakō, possibly sewage.

Coincidently, nearshore seaweed at Puakō has nitrogen values similar to those of sewage. Together, these data suggest that indeed these extra nutrients are from human waste.

Research this summer will further examine how far offshore the sewage can be detected and whether it is coming up through the reef and directly impacting coral.

For the full story, visit the UH Hilo Stories website.

APPENDIX I

Hawaii Tribune Herald article highlighting results in March 15, 2016.

Big Island lawmakers lobbied against cesspool ban

Published March 15, 2016 - 1:30am

By COLIN M. STEWART Hawaii Tribune-Herald
The state has taken an important step toward addressing water pollution, according to some isle scientists.

A statewide ban on new cesspool construction approved Friday by Gov. David Ige came despite protests from seven Hawaii Island legislators, who claimed the ban would place undue financial burdens on local homeowners who might not be able to afford more expensive sewage systems.

The new rules also implement a 2015 law providing a tax credit of up to $10,000 for cesspools upgraded to sewer or septic system during the next five years, limited to $5 million or about 500 cesspool upgrades a year. Under the law, owners of cesspools located within 200 feet of the ocean, streams or marsh areas, or near drinking water sources, can qualify for the credit.

In announcing the ban, Ige said Hawaii had been the only state in the union that allowed the construction of cesspools.

"Today's action banning new cesspools statewide would stop the addition of pollution from approximately 800 new cesspools per year," he said.

Cesspools, which are effectively "just holes in the ground," according to University of Hawaii at Hilo marine scientist Tracy Wiegner, inject about 55 million gallons of raw, untreated sewage into Hawaii's groundwater every day, potentially spreading diseases and harming the quality of drinking water supplies and recreational waters.

Wiegner applauded the ban on Monday, calling it "a good first step towards reducing sewage pollution in our near-shore waters."

However, a large contingent of Big Island delegates to the state Legislature had opposed the rule changes. In a Feb. 1 letter, state Reps. Mark Nakashima, Richard Creagan, Richard Onishi, Clift Tsuji and Cindy Evans, as well as state Sens. Russell Ruderman and Lorraine Inouye, asked Ige to refrain from signing the new rules, citing the high costs associated with installing alternative septic systems. Their letter claimed that arguments for not allowing cesspools anywhere in the state were "weak and unsubstantiated," while discriminating against Hawaii's poorest residents.

"The cost of a septic system in Hawaii is in the range of $20,000 to $30,000," the letter reads. "The cost of a cesspool is in the range of $2,000-$3,000. There should thus be a substantial benefit to justify this great difference in cost."

According to the letter, there are more than 50,000 cesspools on Hawaii Island, and the total cost to homeowners could eventually be as high as $1.5 billion to replace them all with septic systems. Meanwhile, the legislators say, the cesspools work well, and it would be a hardship to ask people in areas not near the coastline to install more expensive options.

"In many areas of our Hawaii and Maui counties there is no county water system. Water catchment provides water to over 17,000 homes in Hawaii County alone," the letter reads.

"The use of water in the home and the eventual flows into the cesspools are therefore minimal. These areas should be absolutely excluded from any such ban."

Wiegner and her colleagues, however, said last week that they thought they had substantial data documenting sewage pollution on Hawaii Island, which they hoped Ige would consider as he weighed the proposed rule changes.

UH marine scientists Wiegner, Steven Colbert and Jim Beets wrote in a March 4 letter to the governor that their research showed more than half of the island's cesspools are located within two years of travel to a river or the shoreline for sewage that has seeped out of cesspools.

"Dye tracer study tests have been conducted both at Wai'opae and Puako, and time of travel from homes to shoreline ranged from 20 minutes to three days," the scientists wrote.

"Additionally, wastewater has been shown to be polluting drinking water wells. In Hawaiian Paradise Park ... 50 percent of drinking water wells sampled tested positive for fecal indicator bacteria. Pathogens associated with this indicator bacteria can live for months in groundwater. These results indicate that cesspools can be immediate human health hazards."

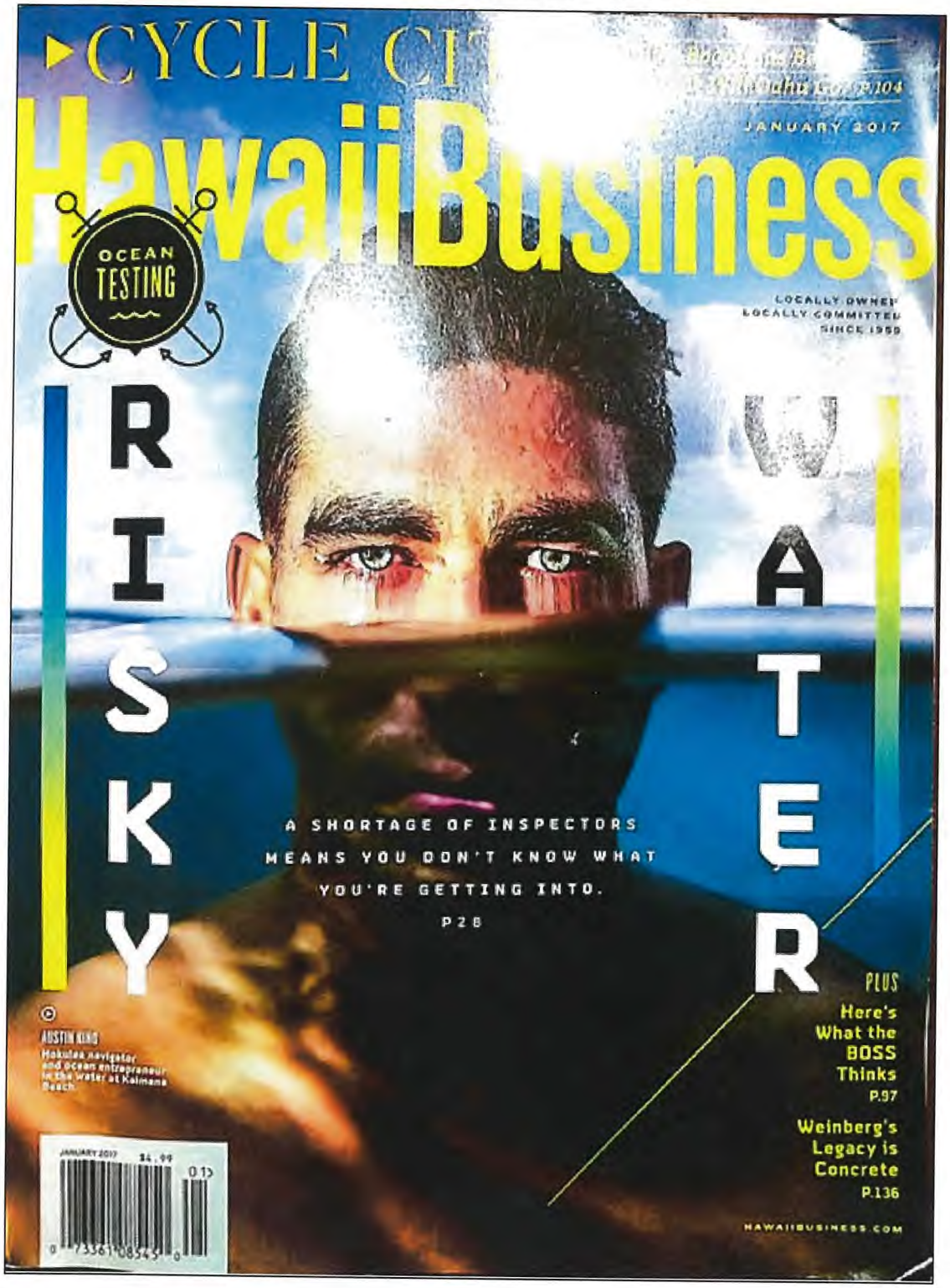
The presence of Enterococcus bacteria in areas such as Hilo Bay suggest that disease-causing bacteria might also be present, especially if they are from human waste, the scientists said.

"In Hilo Bay, it has been confirmed that some of these bacteria are from human waste using microbial source tracking techniques," the letter reads. "Comparable measurements have not yet been made in Wai'opae and Puako."

The new administrative rules for the Wastewater Division of the Department of Health will go into effect 10 days after filing with the lieutenant governor's office.

APPENDIX J

Hawaii Business article highlighting efforts in January 2017.




WARNING
BACTERIA IN THE OCEAN CAN MAKE YOU SICK. THIS ARTICLE EXPLAINS HOW AND WHERE THE STATE TESTS NEARSHORE WATER. READING THIS WON'T MAKE YOU ILL, BUT IT MAY LEAVE YOU QUEASY.
MOST PEOPLE ARE SMART ENOUGH TO

"You would think that the high counts [illegible] be at the boat ramp and the restroom bec[illegible] pool, but, actually, the water's coming out [illegible] from higher elevations. And it was feedin[illegible] it's very challenging to understand bacte[illegible] waters because it's not very simple," he sa[illegible] why you really need to understand the ve[illegible] the contributing factors, and other testing [illegible] later on in Kahana, which showed the hig[illegible] were not from humans."

MONITORING THE WATER

The Clean W[illegible]er Branch [illegible] two indicato[illegible]cteria to de[illegible] mine if a bea[illegible]s contamin[illegible] with fecal m[illegible]m enteroco[illegible] and clostridi[illegible] perfringens. The two are [illegible]nd together, though a high [illegible]vel of one is a low level of [illegible]o other does indicate human fecal contam[illegible] tion, Okubo says. It's when b[illegible] counts are high that a beach may be contaminated, and th[illegible] when the branch would do a initial survey and resample the next day. The inspector[illegible] Okubo often have to make a judgment call while awaiti[illegible] test results: Put up warning signs immediately or wait[illegible] the lab results. Because the branch receives funding fr[illegible] the EPA's Beach Act grant, it has to notify the public wh[illegible] recreational waters are not meeting or are not expected [illegible] meet applicable quality standards.

Sample sites that exceed water-quality standards hal[illegible] more of the time could get permanent warning signs. At [illegible] press time, Okubo said new caution signs created by the [illegible] Clean Water Branch and Surfrider Foundation's Oahu C[illegible] ter were being reviewed by stakeholders.

The two kinds of bacteria aren't foolproof clues of f[illegible] waste. They can both be found in animals, and entero[illegible] the Environmental Protection Agency-approved indi[illegible] can be found in soils, sediment and decaying matter; [illegible] cally, bacteria from human waste is the most dangero[illegible] humans.

Hawai'i has 303 miles of recreational shoreline, acc[illegible] to the 2014 state Water Quality Monitoring and Assess[illegible] Report, and the Clean Water Branch focuses on monit[illegible] the nearshore waters between the shore and 300 meter[illegible] out. The mouths of streams are also monitored.

Samples are collected in knee-deep water, with 300-m[illegible] filter containers submerged about elbow depth. Meters [illegible] ments for the physical characteristics of the water, such [illegible] temperature, salinity, pH and turbidity, are also taken.

Okubo says the major costs of sampling water are [illegible] equipment and manpower. Testing for enterococci can b[illegible] done with a kit; however, it's much more complicated fo[illegible] clostridium. The water sample has to be filtered, placed [illegible] in a petri dish with a gel that helps to isolate and identify [illegible] clostridium in the water sample, and put in an anaerobic [illegible] incubator, which will require a full lab to count the colon[illegible] of bacteria.

The state water-quality standa[illegible] standards say enter[illegible]

I WAS BORN IN HAWAII. THE WATER WAS GOOD TO ME AND MY FAMILY. MY GRANDFATHER WAS A FISHERMAN, MY FATHER WAS A DIVER FISHERMAN, I SUPPLEMENTED MY INCOME BY FISHING IN MY YOUNGER DAYS. MADE GOOD MONEY AND SO I HAVE AN ALOHA FOR THE OCEAN. I DON'T WANT TO SCREW IT UP. I WANT TO DO AS MUCH AS I CAN.

ric mean of 35 colony-forming units per 100 milliliters over any 30-day period, or a beach action value of 130 colony-forming units per 100 milliliters. For clostridium perfringens, the alert level is 50 colony-forming units per 100 milliliters.

The Clean Water Branch has 446 identified sites to test around the state, but has only six people to do the job. With no labs on Lanai and Molokai to immediately test samples, that leaves one person to test 104 sites on Hawaii Island, one to test 81 sites on Maui and one to test 75 sites on Kauai. The remaining three people test 145 sites on Oahu. EPA funding – $300,000 to $330,000 a year – can't cover all six positions, Okubo says, so most are funded by the state.

With so many sites to test, the Clean Water Branch categorizes beaches based on how likely they are to be contaminated by human fecal matter. Some beaches are tested once a week; others once a year.

High human use, a breakwater, a nearby stream and a nearby storm drain make for a tier-one, high-risk beach. "The more humans go, the higher the bacteria's going to be in the water," Okubo says. "There may be unknown sewage spills and the monitoring will pick that up."

Picture Ala Moana Beach Park during a three-day weekend. Thousands of people will be there, making for an adverse situation, Okubo says. "We know a lot of people don't look at it that way, but, from the health perspective, the more people recreating in one location, the health risk goes up because we're looking at human fecal contamination. ... If you don't have to be at risk, then you go someplace not too many people go."

In addition, degree of dilution plays a role. Generally speaking, if there's no water movement and a lot of people are in the water, there's a bigger risk of exposure to sewage from bathers, especially if there are no bathrooms nearby, according to a 1999 World Health Organization report on health-based monitoring of recreational waters.

A JUMP IN BACTERIA LEVELS

In 2004, the state found high bacteria levels in Kahaluu Lagoon and the channel leading into Kaneohe Bay. There are an estimated 600 cesspools in the area, so leakage and runoff were suspected as the causes. The state is partnering with UH scientists to study the interaction between the groundwater and surface water to help identify where the contamination is coming from and where it's going.

An earlier study looked at the connection between cesspools and nearshore pollution. Working with the Coral Reef Alliance, UH Hilo marine science researchers Tracy Wiegner and Steven Colbert studied Pualoa on Hawaii Island, a community of about 160 homes that heavily relies on cesspools and septic tanks to dispose of sewage. Dye tracer studies found that sewage from cesspools could reach the seeps along the coast in as little as nine hours, or up to three or four days, meaning there's little time for any pathogens to be lost or nutrients to be removed from the wastewater.

"The shorter the travel time, the more similar it is to swimming in raw sewage," Colbert says. The travel time depends on how far the cesspool is from the shore and how big the cracks in the rocks are that allow water to flow, he adds. The cesspools in Pualoa were about 300 feet from the shore.

Wiegner says sewage in Pualoa ocean waters seem to be concentrated within 100 to 200 feet of the shore; however, there also seems to be evidence that wastewater will also discharge through seeps on the seafloor – which is where the team will now be concentrating further efforts to figure out how much sewage is coming up.

Currently, the Coral Reef Alliance and the Pualoa Community Association are looking at getting a private onsite treatment plant built, the best option according to a feasibility study.

A LACK OF TREATMENT

The problem with cesspools is they do not treat wastewater, they're unlined holding areas underground that allow untreated wastewater to percolate into the surrounding soil. Until March, Hawaii was the only

state that still allowed new construction of small cesspools, meaning cesspools that serve less than 20 people. New small cesspools are now banned. Large-capacity cesspools were banned in 2000 (existing ones had to be upgraded or closed by April 2005). However, there are still 88,000 cesspools in the state, with almost half located on Hawaii Island. Of those, 6,900 are within 750 feet of a shoreline and have a greater potential to introduce harmful pollutants to the ocean than those farther inland, according to Hawaii's Nonpoint Source Management Plan for 2015-2020.

"Our populations are growing, so stopping that input of raw sewage to our shorelines is a very important step, but there's more that can be done," Colbert says.

While connecting residences using cesspools and other on-site disposal systems to wastewater treatment systems seems like a simple solution, Okubo says, there's not enough room to put a sewer line in every community. Sina Pruder, chief of the state's Wastewater Branch, says cost is also a challenge. It would take millions of dollars to install sewer infrastructures in the state's many rural areas, and sewer fees collected in these areas would not be enough to pay for construction and maintenance.

At the beginning of 2016, the Wastewater Branch started its tax-credit program for replacing cesspools located within 200 feet of a shoreline, perennial stream or wetland, or when the sewage takes less than two years to reach a public source of drinking water. However, Pruder says few people have used the credit of up to $10,000 for each qualified cesspool. This money covers a portion of the cost to upgrade to a septic tank or aerobic treatment unit. Pruder says the price will vary based on site conditions, but she estimates a septic tank would cost $8,000 to $20,000 and an aerobic treatment unit $20,000 to $30,000.

When upgrading to a new wastewater disposal system, a home's location is a factor in determining which system to pick. Those near the shore or a stream usually have high groundwater, Pruder says, so, if a homeowner were to put in a leach or drainage field, the Department of Health requires there be three feet separating the bottom of the field and the groundwater. The soil usually provides a natural treatment for the wastewater, so, if homeowners don't have that separation, they have to install an aerobic treatment unit that disinfects the wastewater, she says.

LEAKS AND SPILLS

Bacteria can also get into nearshore waters th and spills from the sewer system. In 2015, the Cl Branch reported 19 sewage spills around the sta affecting coastal waters, but the spills didn't a the nearby beaches. Okubo says this is because sp before reaching beaches.

Marvin Heskett, water-quality expe with Surf Foundation's Oahu chapter and senior entist at Environmental LLC, says nonpoint so e pollu concern. Nonpoint source means the p llution from more than one location. During a storm, picks up pollutants as it makes its way down to He cites the area around Waikiki's Kapahulu example: "That's usually especially bad after long ods, and then you get your first initial storm and flushing streets and neighborhoods clean, and all rial comes rushing down out of stor drain pipe

The Clean Water Branch also wa tes stream no matter which stream is tested, e rococci going to be high, Okubo says, becau of sedimen In addition, counts jump each time it rains, so Ok issuing brown-water advisories after he became of the branch's monitoring section in December

"I developed the brown-water advisory becau flowing cesspools, unknown chemicals, pestici cides, dead animals being washed into the ocea "So, if the water's brown, stay out. Because you leptospirosis issues coming up. People think, 'Oh, in the salt water you don't have to worry about rosis.' It's not true, because it survives long enough coastal water where all the salinity is depressed."

In the 24 hours it takes to get bacteria test res beaches may or may not have warning signs bas judgment of Okubo and his team. That's why W Colbert are seeking funding for a pilot project th inform people whether the beach water is safe Their model would be based on salinity and turbi which appear to be related to bacterial counts, be recorded by a buoy in Hilo Bay.

"If we have that established relationship betw two parameters, we could make calls for bacte at least predicted bacteria counts based on turb salinity being measured in the water, based on Wieguer says.

HOW A BROWN WATER ADVISORY WORKS

A [illegible]

[illegible]

[illegible]

In addition to testing for enterococci, the Oahu Surfrider chapter is also concerned with other pollutants. It has a separate water quality monitoring program that will track four sites around the island for enterococci and clostridium and over 100 pollutants, says Matt Moore, chapter treasurer and water-quality specialist.

The program is funded by a [illegible] grant. The money arises out of a settlement after millions of gallons of storm water leaked from the Waimanalo Gulch Sanitary Landfill into nearshore waters in 2011, Moore says. The program started over the summer and is expected to last two to three years. The test sites will include Nanakuli, Fort DeRussy, Sunset Beach and Canoes in Kailua, and the frequency of testing will be based on brown-water events: the group wants to know the levels before, during and after storms.

"We're just trying to inform the public of what's in the water and bring to light some of the issues that have been around for a while without a lot of people knowing," Moore says.

Nevertheless, Hawaii's water quality is a lot better than places on the mainland, Okubo says, citing our location in the middle of the ocean, where currents and winds eventually clear everything away. But, we have to keep addressing the issues that arise.

"I was born in Hawaii, the water was good to me and my family," he says. "My grandfather was a fisherman, my father was a diver fisherman. I supplemented my income by fishing in my younger days, made good money. And so I have an aloha for the ocean. I don't want to screw it up. I want to do as much as I can. All these big issues that are coming up, hopefully I can put down the template for how we are going to do it, do the framework, so I can retire." ■

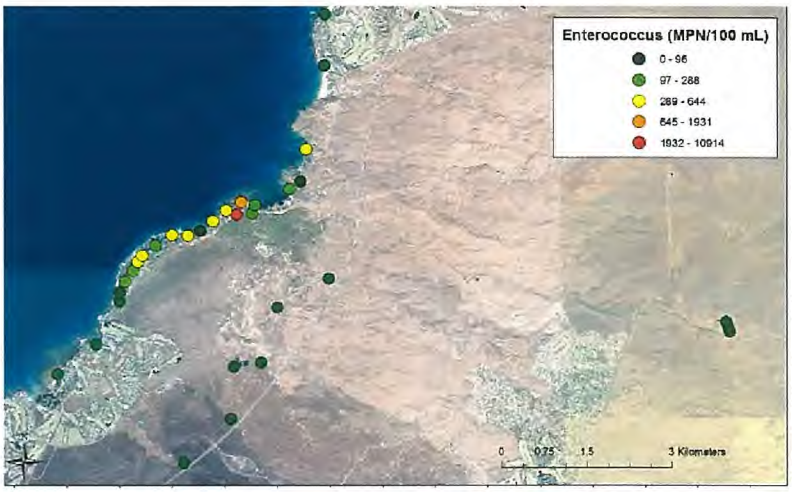
End of Report

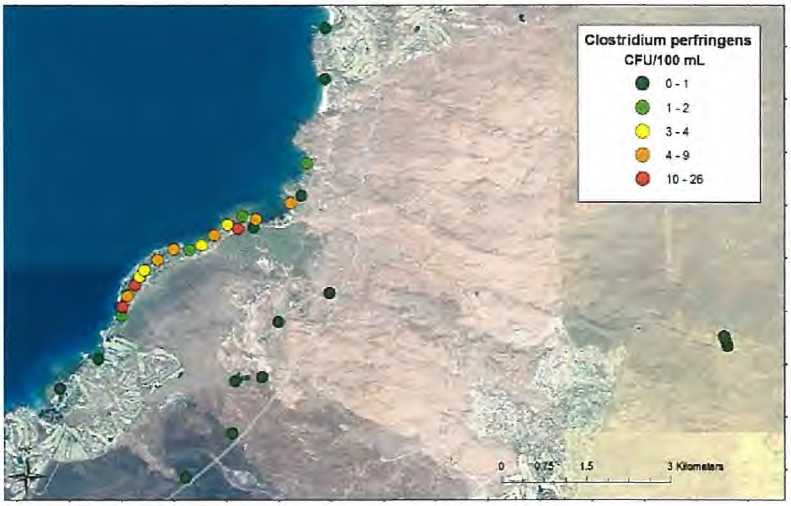
WHERE IS THE SEWAGE COMING FROM?

Since 2013, University of Hawai'i at Hilo, The Nature Conservancy, and Cornell University have been working to document the presence of sewage along Puakō's shoreline and reef. Through measurements of sewage indicators (fecal indicator bacteria, stable nitrogen isotopes, and nutrients) and dye tracer studies, we've shown that sewage is present, is traveling from houses to the shoreline within hours to days, and may be influencing reef health.

But, could sewage also originate from upslope communities or adjacent resorts?

Our most recent study sought to answer this question. We sampled waters—from groundwater wells at Waikoloa Village and Mauna Lani and from resorts' shorelines at Mauna Kea, Hapuna Prince, Fairmont Orchid, and Mauna Lani—analyzing them for sewage indicators.





KEY FINDINGS

Sewage indicator values were highest along Puakō's shoreline compared to adjacent resorts and upland wells.

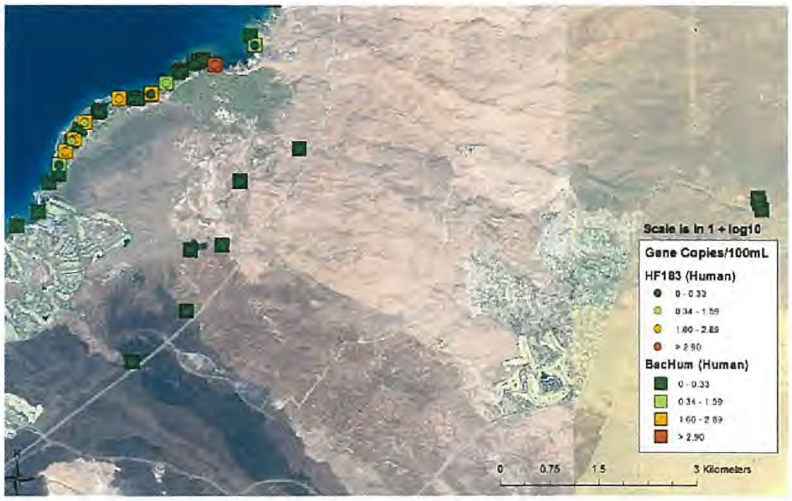
***Enterococcus* concentrations often exceeded Hawai'i's Department of Health's (HDOH) single sample maximum** of 104 CFU/100 mL. Upslope wells and resorts' shoreline waters had low concentrations that were all below HDOH's standard.

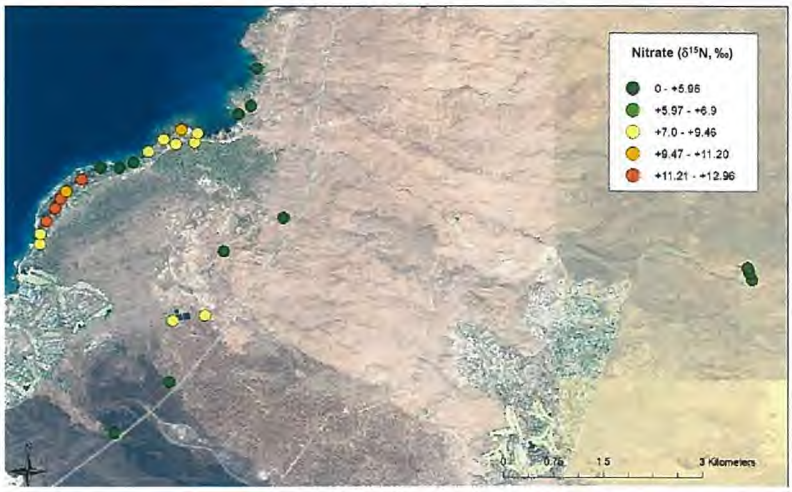
***Clostridium perfringens* concentrations exceeded the recommended HDOH standard for marine recreational waters** (5 CFU/100 mL), with several Puakō stations having values indicative of non-point source sewage pollution (10 -100 CFU/100 mL).

KEY FINDINGS (*continued*)

Positive hits for human *Bacteroides*, the most common bacteria in the human gut, only occurred at Puakō.

Stable nitrogen isotopes were indicative of sewage pollution at Puakō, while values upslope and at adjacent resorts were indicative of soil and fertilizers.





These findings confirm that sewage is largely entering the water table at Puakō as evidenced by the high levels of sewage indicators measured along its shoreline.

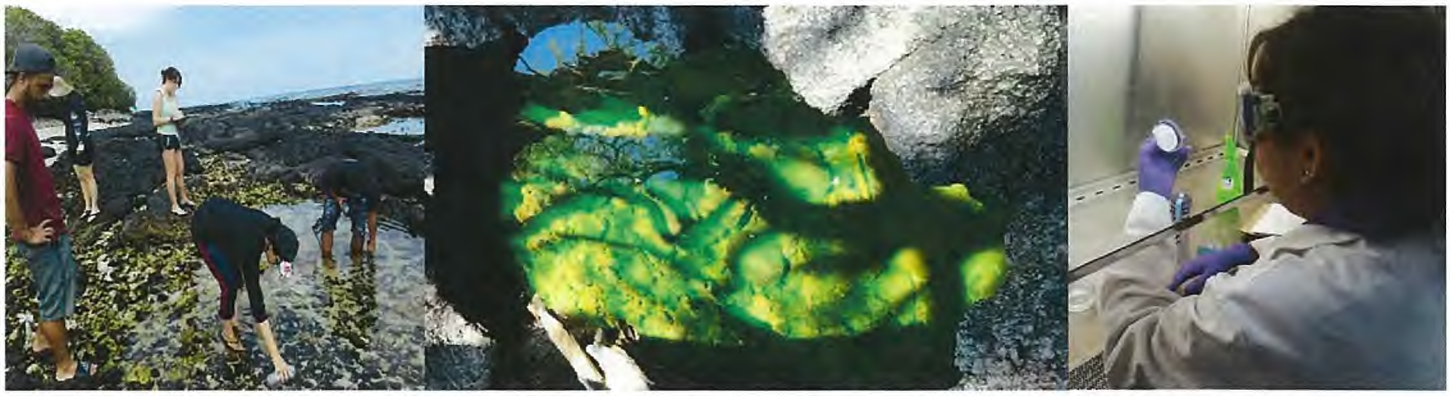
Does sewage from septic tanks and aerobic treatment units (ATU) reach the shoreline?

We conducted dye tracer studies at 4 cesspools, 2 septic tanks, and 2 ATUs. Dye was detected in front of all sites, focused at 1 or 2 shoreline springs, and reached the shoreline within 5 hours to 10 days. All sewage systems had examples of sewage reaching the shoreline in less than 1 day.

These findings confirm that sewage from all onsite sewage disposal systems flows to the ocean, and seeps out onto the beach at shoreline springs.

For additional information, contact South Kohala Marine Coordinator Julia Rose at julia.rose@tnc.org.

Mahalo nui loa *to the National Oceanic and Atmospheric Administration, National Science Foundation, Hawai'i Division of Aquatic Resources, Hawai'i Sea Grant, and the University of Hawai'i at Hilo for helping to make this work possible*



Shoreline water collection, green dye in shoreline pool following dye release from test site, and lab analysis.

UNIVERSITY of HAWAI'I HILO

C-MORE

HAWAII INSTITUTE OF MARINE BIOLOGY · COCONUT ISLAND, OAHU ·

The Nature Conservancy

May 2017

LU Committee

From: Don Johnson <don@topgunmaui.com>
Sent: Wednesday, May 31, 2017 11:39 AM
To: LU Committee
Subject: Proposed Developments at Launiupoko

Dear Maui County Council,

I would like to go on record in opposition to the proposed Makila Kai development at Launiupoko for the following reasons.
- Save our county of Maui agricultural zoned land.
"Once it's gone it's gone forever "
- Require a full environmental impact statement.
"No fast track "
"No segmentation "
- Demand an independent traffic impact study.
" No shortcuts "
" No bottlenecks "
- Don't close the lower Beach road .
" save what we have "
- Look at the (3) proposed developments as one .
"No high density "

Mahalo,

Don Johnson
Makila Plantation Resident