

Replacing Cesspools with Improved Sewage Treatment in Puakō & Waialea Bay

A solution to safeguard Hawai'i's shoreline communities and coral reefs

"I want to swim in clean water. I want my grandkids to swim in clean water."

- George Fry, Puakō Homeowner



CORAL REEF ALLIANCE

Clean
Water
for **REEFS**

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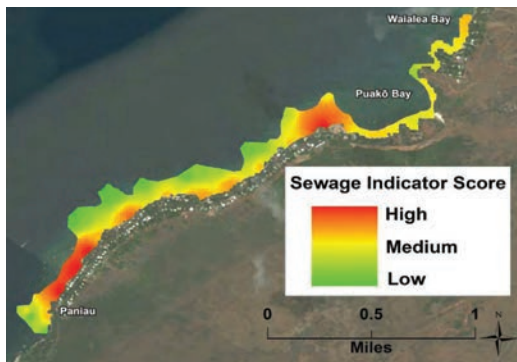
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Problem

Coastal waters across the State of Hawai'i are polluted with 90,000 cesspools releasing 55,000 gallons of raw sewage into our groundwater every day, allowing high levels of nutrients and pathogens to enter the marine environment. This sewage poses risks to human health, damages coral reefs and threatens the tourism industry.

The communities of Puakō and Waialea Bay, in South Kohala, Hawai'i Island showcase this problem and provide us with an ideal case study site to pilot a replicable and scalable solution. Experts from The Nature Conservancy (TNC) and University of Hawai'i Hilo (UHH) have studied these coastal waters intensively and have demonstrated that leaky residential cesspools and septic tanks release high quantities of raw sewage along the shoreline. Seventy-six percent of all sites sampled between 2013 and 2016 exceeded the Hawai'i Department of Health (DOH) standard for fecal indicator bacteria with 91 percent having medium to high pollution scores.



91% had medium to high pollution scores

76% exceeded Hawai'i DOH standard for bacteria found in sewage

66% had high nutrient levels

A strategic solution is needed to safeguard Hawai'i's communities and coral reefs and enable Hawai'i to achieve its goal to replace all cesspools across the state with superior technology by 2050.

Strategic Solutions

Clean Water for Reefs Puakō

To resolve the sewage problem in Puakō and Waialea Bay, the Coral Reef Alliance (CORAL) established Clean Water for Reefs Puakō—a collaborative, community driven project whose goal is to identify and implement an alternative to outdated cesspools and septic tanks. CORAL has worked in these communities since 2014 to identify a solution that maximizes environmental and human health benefits while remaining cost effective for homeowners. The proposed solution has four components.

Component 1: Onsite Wastewater Treatment Facility

In 2014, CORAL contracted AQUA Engineering (AQUA) to conduct the Puakō, Hawai'i Community Feasibility Study & Preliminary Engineering Report¹. AQUA identified and analyzed three alternatives to cesspools and concluded that the solution that best met the project goals would be an onsite wastewater treatment facility with a low-pressure collection system. The proposed facility is more affordable than the gravity-fed systems that are commonly used in Hawai'i because it employs a collection system that is easier to install and maintain.

¹ Please refer to Supplemental Documents

Component 2: Chapter 32 Financing Mechanism

Financing the facility through the *Hawai'i County Code Chapter 32: Special Improvement Financing by Community Facilities Districts (CFD)*² process represents a novel solution to ensure long term financial sustainability of the system by creating a predictable revenue stream in the form of a special tax with two components:

1. **Operation and Maintenance (O&M):** Every homeowner will pay the same fee of \$1,200 per year to cover operation and maintenance costs. Owners of undeveloped lots will not pay this fee.
2. **Facility Rate:** Every homeowner will pay a fee which is calculated based on the square footage of each home. This will cover the debt service on a loan or municipal bond issuance, funds for capital replacement costs, reserve fund and administrative costs.

To initiate a CFD process, 25 percent of landowners (by acreage) must sign a petition to support the improvement. During the public comment period the CFD process can be stopped if more than 55 percent of land owners (by acreage or Tax Member Key [TMK] number) submit written protest. If all steps are completed and supported, the CFD is established and the special tax is levied and payable annually by lot owners.

Component 3: Public-private Partnership

Implementing improvements to wastewater infrastructure in Hawai'i is challenged by lack of funding and capacity, as well as local demands which limit the county's ability to take on new projects. Building and operating the onsite wastewater treatment facility through a public-private partnership maximizes environmental and human health benefits and increases the financial feasibility of the facility for homeowners by expanding the user base, increasing the total amount of sewage treated, and decreasing cost per gallon treated.

Component 4: Securing Additional Funds

Community survey results from 30 respondents indicate that a mean annual rate of \$1,500 (including O&M and facility rate) would place costs of the facility within financial reach. CORAL contracted Webb Associates, experts in civil engineering and planning services, to explore scenarios in which additional funds (\$3, \$5, \$7 and \$9 million) for capital development costs are raised, in order to reduce the cost for homeowners to the acceptable annual rate of \$1,500.

The analysis indicates that implementing an onsite wastewater treatment facility in partnership with the Puakō Marine Lab and Hapuna State Parks and raising a further \$7 million can make the proposed facility financially feasible to homeowners.

² Please refer to Supplemental Documents

Financial Feasibility Analyses

The recommended onsite treatment facility could be designed to serve the Puakō and Waialea communities alone, or designed to also serve other local entities such as the proposed Puakō Marine Lab and the Hapuna State Park system. Three potential user options were investigated to spread the cost more equitably across a larger user base. In Option A, the full facility rate is spread across the Puakō and Waialea communities. As elaborated below, this option is financially unfeasible for homeowners. In Options B and C, which involve public-private partnerships, costs are more broadly distributed and the percentage of the facility rate paid for by each user group is proportional to the gallons of sewage they are estimated to produce. Exempt lots are not included within the CFD financing mechanism and would require capital costs based on usage to be settled by other means. The analyses illustrates the special tax payable by homeowners for the three options and how this tax can be reduced if an additional \$3, \$5, \$7 or \$9 million can be raised to support capital development costs.

The analyses are based on the following assumptions and considerations:

- The facility will require a 40-year loan at a 3.5 percent interest rate
- Capital and development costs include 30 percent contingency
- The operation and maintenance rate will increase 3 percent annually due to inflation

Note that under Act 120 “a temporary income tax credit for the cost of upgrading or converting a qualified cesspool to a septic tank system or an aerobic treatment unit system, or connecting to a sewer system are eligible for the \$10,000 tax credit.” Currently, 53 TMK lots are eligible for this tax credit, which would result in further reducing the special tax burden for qualifying homeowners by approximately \$500 per year. This additional cost reduction is not included in the analyses below.

Estimates on number of gallons of wastewater treated for each user group are from the following sources³:

- *Puakō, Hawai'i Community Feasibility Study & Preliminary Engineering Report (PER)*
- *Final Environmental Assessment Puakō Marine Education and Research Center Puakō, Island of Hawai'i, Hawai'i*
- *Final Environmental Impact Statement Hapuna Beach State Recreation Area Expansion Lalalimo, South Kohala, Hawai'i*

³ Please refer to Supplemental Documents

Option A

Users: Puakō and Waialea Bay communities

Full capital cost of facility: \$14.5 million

Usage: 60,300 gallons per day

Properties connected: 268 TMKs / 89 acres

Option A would require Puakō and Waialea Bay homeowners to take on the full cost of constructing the facility. Table 1 represents community support for the onsite treatment facility under this financing scenario. Although results from community surveys and engagement show significant community support for implementing an onsite treatment facility (43 percent by TMK and 41 percent by acreage), the financial burden is cost prohibitive for many homeowners—even with the scenario in which an additional \$9 million is raised (see Table 3). Only 23 percent of TMK landowners support the facility at full cost. Table 2 is important to demonstrate the wide income disparity in Puakō and Waialea Bay communities. Although the mean household income of \$140,770 exceeds what most wastewater infrastructure grants will approve, the table shows that there are many homeowners who would not be able to afford the costs.

Table 1: Community support for the onsite treatment facility

Puakō & Waialea Bay Engagement & Support	# of TMKs	% TMKs	Acreage	% Acreage
Total TMK Lots	268	100%	89	100%
In Community with	232	87%	76	86%
Not in Community with	36	13%	12	14%
Total Support	110	41%	38	43%
Total Do Not Support	75	28%	22	25%
Cost Concern Data	# of TMKs	% TMKs	Acreage	% Acreage
Total TMK Concern Over Annual Cost	94	35%	27	31%
TMKs that have No Concern Over Annual Cost	61	23%	18	20%

Statistics are current as of 8/31/17 and change on a daily basis.

Option A (continued)

Table 2: Community demographics for Puakō and Waialea Bay

Income and Benefits (2015 Inflation-Adjusted Dollars)	Estimate	Margin of Error	Percent	Margin of Error (%)
Total Households	343	+/-62	100.00%	(X)
Less than \$10,000	19	+/-11	5.50%	+/-3.2
\$10,000 to \$14,999	8	+/-8	2.30%	+/-2.4
\$15,000 to \$24,999	24	+/-23	7.00%	+/-6.3
\$25,000 to \$34,999	6	+/-9	1.70%	+/-2.6
\$35,000 to \$49,999	28	+/-15	8.20%	+/-4.6
\$50,000 to \$74,999	89	+/-39	25.90%	+/-9.1
\$75,000 to \$99,999	26	+/-15	7.60%	+/-3.9
\$100,000 to \$149,000	40	+/-23	11.70%	+/-6.2
\$150,000 to \$199,999	28	+/-17	8.20%	+/-4.7
\$200,000 or more	75	+/-24	21.90%	+/-6.9
Median Household Income (Dollars)	73,750	+/-23,643	(X)	(X)
Mean Household Income (Dollars)	140,770	+/-27,741	(X)	(X)

Source: U.S. Census Bureau, 2011-2015 American community Survey 5-year Estimates

Table 3: Cost and rate analysis for Option A

User Group	Usage (GPD)	Percent Total Usage by User Group	Proportionate Capital Cost Based on Usage (Full Cost)	\$3M Reduction	\$5M Reduction	\$7M Reduction	\$9M Reduction		
Puakō & Waialea	60,300	100%	\$14,452,399	\$11,452,399	\$9,452,399	\$7,452,399	\$5,452,399		
Facilities Tax Class	TMK Square Footage Ranges		Facilities Rate					O&M Rate	# of Units
D1	Less than 1,000		\$1,600	\$1,285	\$985	\$685	\$440	\$1,200	82
D2	1,001 to 2,250		\$2,600	\$2,085	\$1,735	\$1,385	\$1,040	\$1,200	78
D3	2,251 to 3,500		\$3,600	\$2,885	\$2,485	\$2,085	\$1,640	\$1,200	47
D4	3,501 to 4,750		\$4,600	\$3,685	\$3,235	\$2,785	\$2,240	\$1,200	18
D5	4,751 to 6,000		\$5,600	\$4,485	\$3,985	\$3,485	\$2,840	\$1,200	4
D6	6,000 and greater		\$6,600	\$5,285	\$4,735	\$4,185	\$3,440	\$1,200	2
UND	Undeveloped Property		\$4,600	\$6,379	\$5,324	\$4,269	\$3,214	\$0	37
Average Total % Cost Savings to TMK Lot Owners			0%	15%	23%	32%	41%		268

Option B

Users: Puakō and Waialea Bay communities and Puakō Marine Lab

Full capital cost of facility: \$14.5 million

Usage: 67,710 gallons per day

Properties connected: 269 TMKs / 94 acres

Option B would spread the cost between the Puakō and Waialea Bay homeowners and the Puakō Marine Lab. The current facility design as outlined in the PER is sufficient to meet the needs of the communities and the lab. The University of Hawai'i (UH) Foundation plans to build the Puakō Marine Lab on state land in between Puakō and the Waialea community, for which it already has a lease. The wastewater treatment facility can be sited on this land, thus reducing the cost of the project by \$500,000, which is not demonstrated in the above analysis. With this option, the financial burden continues to be cost prohibitive for homeowners. Even if an additional \$9 million is raised the annual cost to homeowners is greater than the annual target of \$1,500 (see Table 4).

Table 4: Cost / rate analysis for Option B

User Group	Usage (GPD)	Percent Total Usage by User Group	Proportionate Capital Cost Based on Usage (Full Cost)	\$3M Reduction	\$5M Reduction	\$7M Reduction	\$9M Reduction		
Puakō & Waialea	60,300	89%	\$12,870,767	\$9,870,767	\$7,870,767	\$5,870,767	\$3,870,767		
Puakō Marine Lab	7,410	11%	\$1,581,632	\$—	\$—	\$—	\$—		
Total	67,710	100%	\$14,452,399	\$9,870,767	\$7,870,767	\$7,452,399	\$3,870,767		
Facilities Tax Class	TMK Square Footage Ranges	Facilities Rate						O&M Rate	# of Units
D1	Less than 1,000	\$1,440	\$1,010	\$760	\$510	\$320	\$1,200	82	
D2	1,001 to 2,250	\$2,340	\$1,810	\$1,460	\$1,110	\$770	\$1,200	78	
D3	2,251 to 3,500	\$3,240	\$2,610	\$2,160	\$1,710	\$1,220	\$1,200	47	
D4	3,501 to 4,750	\$4,140	\$3,410	\$2,860	\$2,310	\$1,670	\$1,200	18	
D5	4,751 to 6,000	\$5,040	\$4,210	\$3,560	\$2,910	\$2,120	\$1,200	4	
D6	6,000 and greater	\$5,840	\$5,010	\$4,260	\$3,510	\$2,570	\$1,200	2	
UND	Undeveloped Property	\$7,127	\$5,545	\$4,490	\$3,435	\$2,380	\$0	37	
Average Total % Cost Savings to TMK Lot Owners		7%	21%	30%	39%	49%		268	

Option C

Users: Puakō and Waialea Bay communities, Puakō Marine Lab and Hapuna State Parks

Full capital cost of facility: \$18.1 million

Usage: 136,870 gallons per day

Properties connected: 269 including all Hapuna Beach System TMKs / 940 acres*

**Assumes all 846 acres of Hapuna property will be serviced by the facility*

Option C would spread the cost between Puakō and Waialea Bay homeowners, the Puakō Marine Lab and Hapuna State Parks. The facility design would need to be altered to absorb the extra capacity and the project cost will increase to \$18.9 million. Despite the capital cost increase, the annual cost to homeowners is lowered because project costs are distributed across more users and the facility becomes financially feasible for 82 TMKs with only an additional \$7 million raised (see Table 5).

Table 5: Cost / rate analysis for Option C*

User Group	Usage (GPD)	Percent Total Usage by User Group	Proportionate Capital Cost Based on Usage (Full Cost)	\$3M Reduction	\$5M Reduction	\$7M Reduction	\$9M Reduction		
Puakō & Waialea	60,300	44%	\$8,303,572	\$5,303,572	\$3,303,572	\$1,303,572	\$—		
Puakō Marine Lab	7,410	5%	\$1,020,389	\$—	\$—	\$—	\$—		
Hapuna Park	69,160	51%	\$9,523,632	\$—	\$—	\$—	\$—		
Total	136,870	100%	\$18,847,593	\$5,303,572	\$3,303,572	\$1,303,572	\$—		
Facilities Tax Class	TMK Square Footage Ranges		Facilities Rate					O&M Rate	# of Units
D1	Less than 1,000		\$730	\$435	\$225	\$105	\$—	\$1,200	82
D2	1,001 to 2,250		\$1,530	\$1,010	\$675	\$330	\$—	\$1,200	78
D3	2,251 to 3,500		\$2,330	\$1,585	\$1,125	\$555	\$—	\$1,200	47
D4	3,501 to 4,750		\$3,130	\$2,160	\$1,575	\$780	\$—	\$1,200	18
D5	4,751 to 6,000		\$3,930	\$2,735	\$2,025	\$1,005	\$—	\$1,200	4
D6	6,000 and greater		\$4,730	\$3,310	\$2,475	\$1,230	\$—	\$1,200	2
UND	Undeveloped Property		\$4,718	\$3,136	\$2,081	\$1,025	\$—	\$0	37
Average Total % Cost Savings to TMK Lot Owners			27%	42%	51%	63%	74%		268

**Cost allocation is based on usage on weekends at buildout.*

Conclusion

Option C – building and operating this facility through a public-private partnership with the Puakō and Waialea Bay Community, Puakō Marine Lab and Hapuna State Parks – creates the greatest environmental and human health benefits, while achieving financial feasibility for homeowners. Raising an additional \$7 million will enable us to reach our target of reducing the annual cost to \$1,500 per year for 82 homeowners in Puakō and Waialea Bay.

Direct benefits resulting from implementing this plan include:

- Approximately 50 million gallons of wastewater will be prevented from entering the marine environment each year, which will improve coral reef health and reduce risks to human health.
- Cost efficiency associated with building and operating the onsite wastewater treatment facility will be maximized by expanding the user base, increasing the total amount of sewage treated and decreasing the cost per gallon treated.
- Homeowners will benefit from a 63 percent reduction in annual rates, resulting in a rate that is financially feasible for class D1 homeowners.

Beyond the direct benefits that can be generated along the Puakō shoreline, establishing a successful model in Puakō could lay the groundwork for adoption of this model across Hawai'i. This would not only support Hawai'i's 2050 goal to replace all cesspools across the state with superior technology, but could provide a long-term solution to safeguard the health of both people and coral reefs for future generations.

Next Steps

- Secure a public-private partnership for owning, operating and maintaining the wastewater treatment facility
- Establish a partnership with the University of Hawai'i (UH) Foundation to support capital development, potentially provide land on which the facility could be built, and connect the proposed UH Foundation-owned Puakō Marine Lab to the wastewater treatment facility
- Establish a partnership with Hapuna State Parks to support capital development, and connect state park restrooms to the wastewater treatment facility
- Raise an additional \$7 million to ensure that the annual cost to homeowners in the Puakō and Waialea Bay communities is financially feasible
- Continue to engage the Puakō and Waialea Bay communities and keep them apprised of updates and setbacks

Clean Water for Reefs Project Information

The Clean Water for Reefs Puakō project is guided by an advisory committee, which comprises experts and representatives from, academia, the Puakō and Waialea communities, as well as representatives from the construction, civil engineering and nonprofit sectors. In addition to this committee, a suite of experts have consulted on the engineering, planning and financing aspects of this project.

Advisory Committee



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HILO



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Consulting Experts

