
MEI TE VAI
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Choosing how to dispose of our waste safely and sustainably
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What are our options?

We have been working with your community to develop options for a new wastewater system that's sustainable, and supports a healthy and prosperous future for the people of Rarotonga.

Now we are ready to talk to you about two possible options for disposing of *treated* wastewater – either using land for the final treatment stage, or discharging through an outfall beyond the reef into the ocean. One of these options will be chosen by the Cook Islands Government to progress to detailed design for Muri. This option may also be used elsewhere around the island.

As well as working on an enduring solution for Rarotonga, we are also progressing possible short-term measures to help improve Muri Lagoon's water quality and reduce seaweed growth there. Muri is our first priority because there is pressure from population density and tourism and the lagoon environment is sensitive.

Working with the community to develop options.

Project timeline

MID 2017

- Environmental investigations
- Assess 'early measures' to help improve Muri
- Develop design options

LATE 2017

- Environmental investigations
- Assessment and permits to remove sediment from Aremango stream mouth

EARLY-MID 2018

- Environmental investigations
- Remove sediment and do riparian planting
- Detailed design

LATE 2018

- Remove sediment and do riparian planting
- Begin construction

UPCOMING MILESTONES

November 2017 – January 2018:

- Seek Aronga Mana and wider community feedback on disposal options

February 2018:

- Publish interim results of environmental investigations
- Submit options report to the Cook Islands Government for consideration
- Submit a wastewater masterplan to the Cook Islands Government

Meet our key science and environment experts

DR MURRAY WALLIS
Environmental Lead
GHD

ANTHONY KIRK
Hydrogeologist and Environmental Scientist
GHD

ZOE PATTISON
Hydrogeologist
GHD

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DR DIRK ERLER
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School of Environment, Science and Engineering
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DR SUSAN WILLIAMS
Marine Ecologist,
University of California, Davis (for Ministry of Marine Resources)

What's happening at Muri?

Investigating the cause of the issues at Muri

To help us find out what's causing the problems at Muri Lagoon, we're testing groundwater, streams, lagoon sediment and lagoon water for nitrogen and phosphorus (nutrients). Increased levels of nutrients in the lagoon enable the seaweed to grow and flourish. The location and level of these nutrients will help us assess how agricultural activities, on-site septic systems and other activities contribute to Muri Lagoon's water quality.

Thank you to all land and property owners who have consented to investigations on their land. We appreciate your support as we work together to protect the lagoon for future generations.

Seeking consent to remove sediment

One of the factors contributing to seaweed growth is the presence of sediment from the land that has washed into the lagoon through streams. Together with the community, we have identified an opportunity to remove some of these sediments, which also block the flow of water within the lagoon.

Following consultation with affected businesses and landowners, we're preparing an Environmental Impact Assessment (EIA) for the Aremango stream sediment removal (near Pacific Resort). We are planning to do this work in the tourism low-season, mid-January to February 2018.

Thank you to land and property owners for their approval and support of this work.

Planting to help protect the lagoon

Planting around streams with suitable indigenous plants will reduce the sediment and nutrients entering the lagoon. The Ministry of Agriculture and Ridge to Reef team have helped us identify suitable plants, and we will be seeking community volunteers to help with planting. This work can be done once we have National Environment Service approval for the EIA.

With land owner permission we aim to begin planting in about February 2017 around the Aremango stream after the proposed sediment removal is completed.

The water at Muri

Thinking about our future wastewater system

How should we return the waste that we create back into our environment safely, to protect our natural environment for future generations?

The options we considered

Our team of engineers and scientists considered a wide range of potential options for wastewater disposal. Not all options are suitable in the context of the Cook Islands, and not all options are equal. The summary table (right) gives the background to options that have been ruled out as part of the short listing process.

When we looked at each option, we considered technical, environmental and economic factors.

All options we recommend for detailed design will:

1. **meet international environmental and public health standards**
2. **be robust and reliable to operate**
3. **be affordable and manageable for Rarotonga to operate and maintain**
4. **have the capacity to cope with Rarotonga's future growth.**

Now we're ready to talk to you about two possible ways to dispose of *treated* wastewater – either onto land, or into the ocean.

While a 'secondary' treatment level is not essential to successful operation of an ocean outfall, we have listened to feedback from your community and will be recommending secondary treatment for ocean disposal. For land disposal, a secondary treatment level is needed so the wastewater can be irrigated.

This means you can consider both disposal options on the basis that the treatment level is the same.

We are preparing a report that looks at both disposal options, to present to the Cook Islands Government. This report, alongside community feedback and a separate social and cultural impact assessment, will help the Government choose one option to progress to detailed design.

What are the options for consideration?

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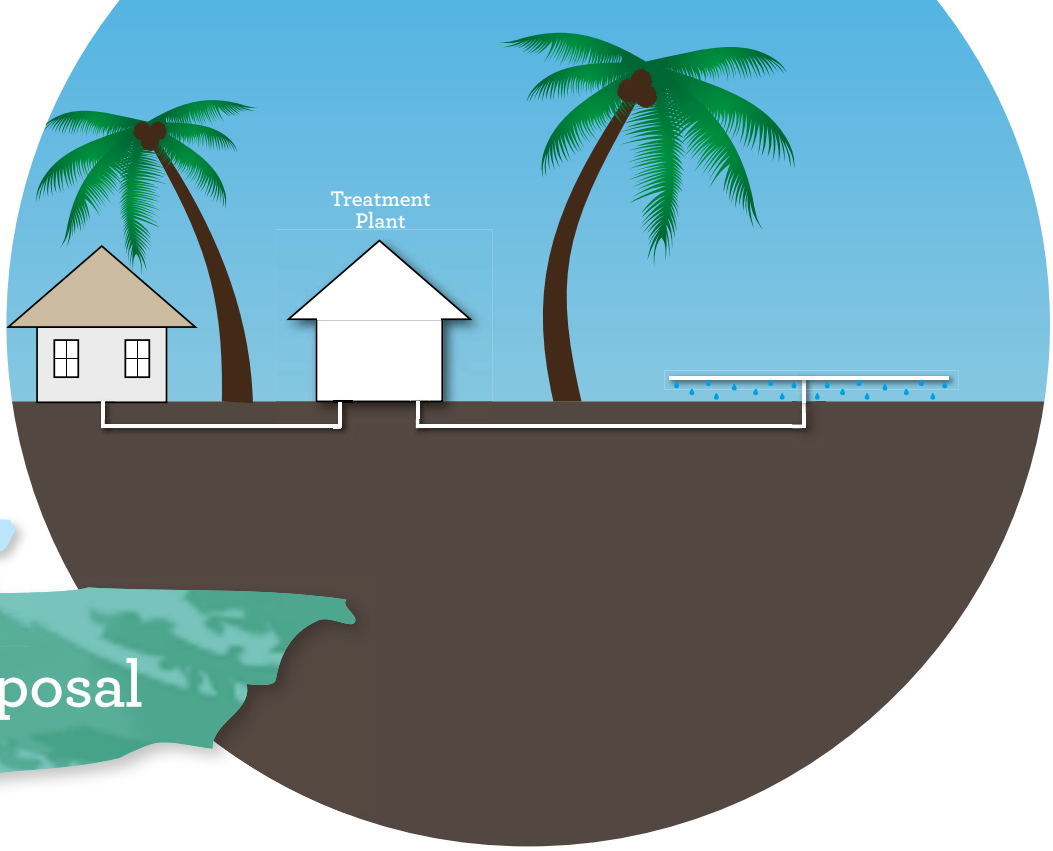
We reviewed and decided not to progress the following options:

Technology	Why we don't recommend it for Rarotonga
On-site septic tanks (current system)	Use of this system would make it very likely Muri Lagoon issues will continue or worsen. Land has a limit to its capacity to absorb and treat nutrients. In the Muri area houses and resorts are closer together so the land isn't able to absorb and treat all the waste. We expect that septic tanks can continue to be used in other areas of Rarotonga (and possibly parts of Muri) where it's not so built-up.
'Biogas' (waste water treatment plant energy production)	This system only treats solid waste, so you still need to dispose of liquid waste on land or into the ocean. This technology is only economical for large volumes of waste. It's also complex, high maintenance and costs a lot to operate. Although it does generate electricity, it is typically less than the treatment system consumes. It's unlikely that this system would be economic for Rarotonga.
Composting toilets (includes waterless toilets in general)	Composting toilets need plenty of air circulation to function and avoid odour. They are not suitable for built-up areas, especially in hot climates. They also need to be regularly maintained by owners, and international experience has shown that most people are reluctant to do this job.
Septic tank bacterial additive (pourable probiotics)	These additives are not necessary for septic tanks to function properly, and many affect tank performance.
Collection and disposal from holding tanks	This generates heavy traffic and is not cost-effective, due to the cost of transportation, collection and construction of suitable storage and treatment facilities.
Greywater Recycling	This system is complex as it requires additional piping, plumbing and distribution of the grey water, and puts additional responsibility on house owners. Most nutrients are in the "black water" so grey water recycling does not eliminate the need to deal with the wastewater.
Sea discharge of sludge wastes	This only treats solids, so you still need to dispose of liquid waste on land or into the ocean. It's also not cost-effective, due to the cost of transportation, collection and construction of suitable storage.
Reed beds/wetlands	There are no suitable existing reed beds or wetlands in Rarotonga. Constructed beds and wetlands require pre-treatment and a large land area.
In-lagoon discharge	This requires an uneconomic (very high) level of treatment required. Unlikely to be socially or culturally acceptable regardless of treatment level. It's unnecessary to discharge into the lagoon when ocean discharge to deeper water can be used.
Groundwater disposal/ deep well injection	There is a high cost to prove the long term technical performance of this system, and to operate and maintain it. Leaching and/or blockage problems could occur in the long-term that are difficult to predict.



OPTION 1

Land disposal

About this option

Disposal to land enables reuse of nutrients by plants, and the soil has a natural ability to filter out pathogens. A well designed system allows pathogens to decay within the ground, so surface water can be protected.

For this option, wastewater must be treated to 'secondary' level to ensure successful operation of the disposal system. Treated wastewater is either sprayed onto land using an irrigation system, or drip fed beneath the land surface through irrigation pipes. A wide range of plants can be grown on the land, and options for additional land use include golf courses, trees, and farming certain crops that absorb nutrients.

Land disposal is used successfully in places around the world. Relevant examples we are familiar with include:

- **Omaha, Auckland, New Zealand:** This system was installed in Omaha, a coastal community, in 1989, and upgraded in 2002. It distributes treated waste (tertiary treatment) over about 20 hectares of land – a combination of spray irrigation in a tree plantation and subsurface drip in the golf course.
- **Pauanui, Coromandel, New Zealand:** This system was installed in Pauanui, a coastal community, in 2009. It distributes treated waste (tertiary treatment) using a sub-surface drip system over a combination of parks, planted road median strips and a grassed air field.

Design of land disposal systems is limited by a number of things such as land availability, slope of land, distance from the collection system, soil type, rainfall, planting type, and availability of skilled operation and maintenance staff.

How might it affect our community?

- Land disposal needs a large area of flat to rolling land. Allowing for buffer zones and future growth in Muri, it would need up to 40 hectares to be dedicated to the irrigation system. Once this system is running, the land can't be used for other things unless another site is commissioned, because the wastewater flow can't be stopped.
- Public health risks vary depending on the irrigation technology used. For sprinklers, a buffer zone is needed around the disposal area to avoid nuisance smells and risks from fine droplets. This risk does not apply to subsurface drip systems, which are also suitable for growing food crops. In either option, public health risks can be managed.
- There is potential income from food crop farming (if adopted), balanced against the ongoing need for local workers to manage these crops.

How might it affect our environment?

- The main benefit is the re-use of the wastewater nutrients and the water needed to sustain plant growth, which can promote sustainable food production.
- If it's not operated and maintained regularly and properly, the system could fail. This could cause unplanned discharges or nuisance effects, like odour.

What are the potential economic impacts?

- Rarotonga may not be able to operate and maintain the system without support from overseas.
- It needs to be built on large sections of flat to rolling land, which would need to be acquired or leased. Steeper land adds engineering complexity because more pressure regulation is required. The soils on the steeper land of Rarotonga are also less suitable because they have poorer drainage.
- The land needed for wastewater disposal could be used for another purpose with equal or greater economic benefit.
- The productivity of the land can be enhanced, reducing the need for fertiliser imports.

OPTION 2

Ocean disposal

About this option

For this option, wastewater does not need to be treated to 'secondary' level to ensure successful operation of the disposal system. However based on community feedback, we will be recommending secondary treatment is used if Government chooses this option.

Treated waste is fed through a pipe and dispersed deep out into the ocean using a special 'diffuser' pipe. The ocean currents disperse and dilute the discharge, and the sea life consumes nutrients and organic matter through a natural process.

Ocean outfalls are common world-wide, including successfully run systems in other Pacific islands. They typically have minimal environmental impact because the capacity of the ocean to disperse treated waste is very high.

Relevant examples we're familiar with include:

- **Sogi, Samoa:** Installed in 2009, this system manages wastewater collected from Samoa's central business district area. It uses a wastewater treatment plant (tertiary treatment), and the plant's capacity is about the same as would be needed to service Muri. This treatment plant replaces septic tanks (which are still the main treatment system around the island) and was installed in response to poor quality of Vaiusu Bay.
- **ASPA Tutuila Island sewage treatment works, American Samoa:** The wastewater system for American Samoa was installed in the 1980's. Two separate treatment plants (primary treatment) treat the wastewater and then discharge it into the ocean. These treatment plants are an example of the regular and on-going testing required to ensure that the both the treatment plant and outfall are functioning correctly. By contrast, we understand existing commercial outfalls from canneries were seen to be causing problems in Pago Pago Harbour, and these were upgraded in 1992.

Design of these systems is limited by a number of things such as the depth of the outfall, wind, waves, ocean currents and distance from the collection system. Extensive monitoring and assessment is required to identify the most suitable location for an outfall.

How might it affect our community?

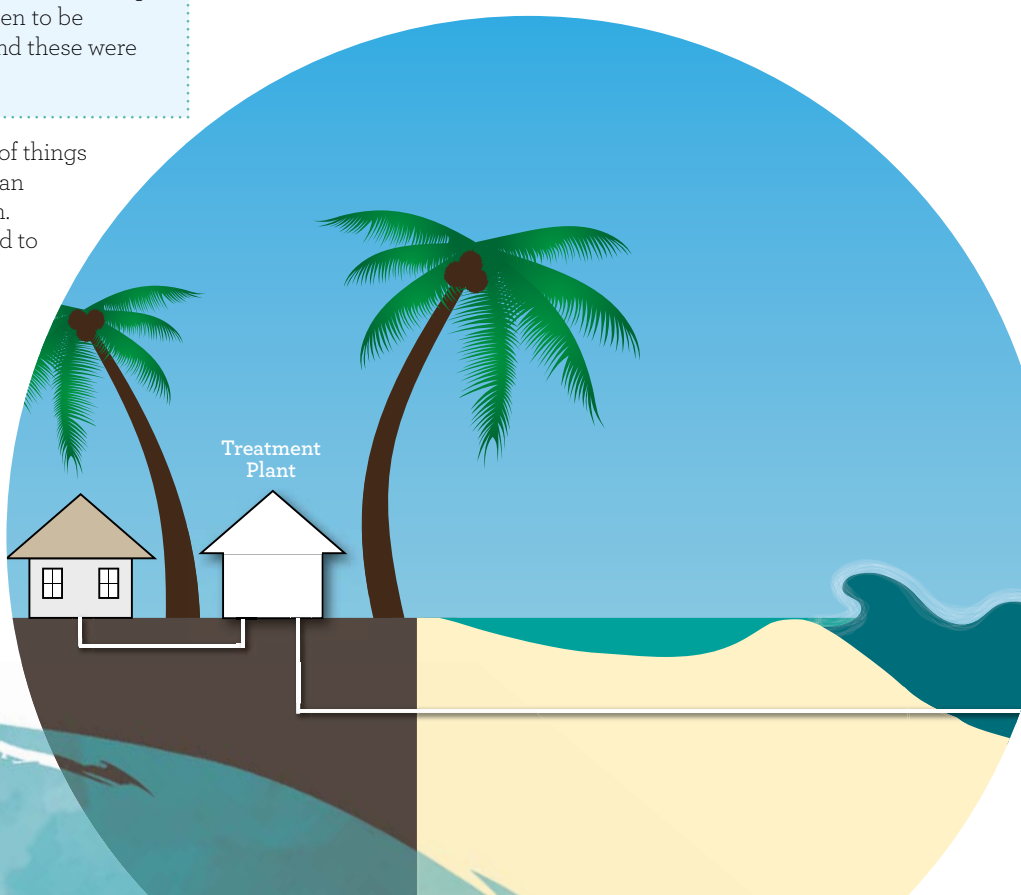
- Cultural concerns about health and consumption of fish and seafood.
- This option is safe, but the community might still worry about public health.
- This option is the most economically sustainable over the long term, as it is relatively easy and cheaper to operate and maintain, and would have capacity to cater for growth.

How might it affect our environment?

- Initial assessment for Rarotonga indicates that treated waste dispersed at about 30m deep will have minimal effect, and would meet international standards for ocean outfalls.
- Requires some land area for the treatment plant.
- Once in operation, regular and on-going testing of the treatment plant and water quality at the discharge site would be necessary.

What are the potential economic impacts?

- Likely to have significant capacity to cater for future growth.
- Technically difficult and expensive to build.
- Allowing for the same level of (secondary) treatment, the operation and maintenance cost is materially lower than for land-based systems.

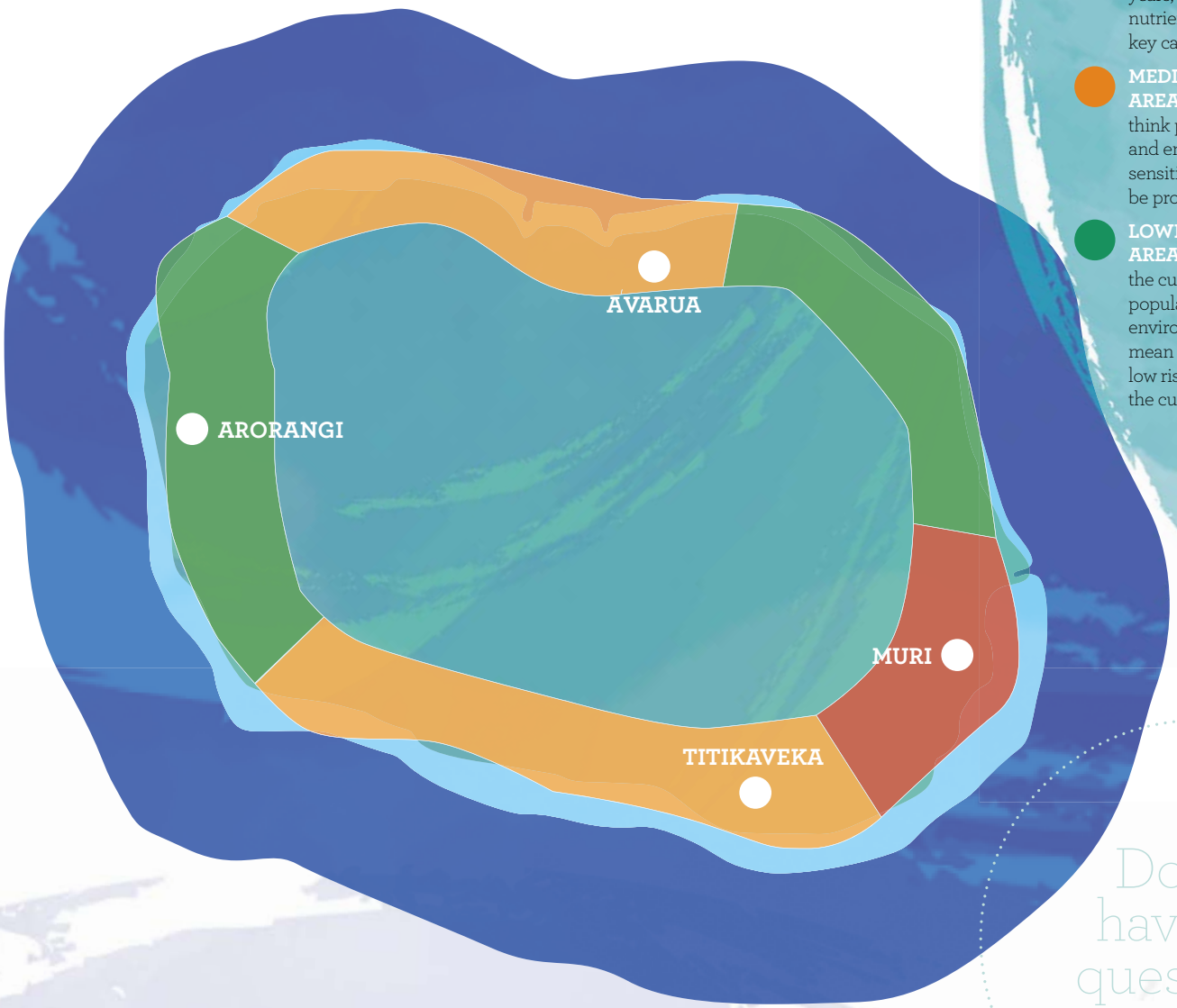


Why is this a Rarotonga-wide issue?

We expect the problems seen at Muri will not be limited to Muri. Similar problems will begin to show up in other places around Rarotonga - seaweed growth is already evident elsewhere.

The map below shows the areas we think are a priority for wastewater investment in the future. This is based on the intensity of land-use and environmental sensitivity.

We will update this map when we have completed our investigations at Muri, and as we learn from ongoing environmental monitoring at Muri and around the island.



Key:

- **PRIORITY AREA:** Areas where population density and environmental sensitivity mean we can expect problems. We know the seaweed in this area has grown in recent years, and we believe nutrient enrichment is a key cause.
- **MEDIUM PRIORITY AREA:** Areas where we think population density and environmental sensitivity mean there may be problems in future.
- **LOWER PRIORITY AREA:** Areas where the current levels of population density and environmental sensitivity mean there's a relatively low risk of problems under the current conditions.

Do you have any questions?

How you can have your say

We want to hear your views on the two wastewater disposal options presented here, and also welcome any questions you might have.

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