Ministry *of* Marine Resources

GOVERNMENT OF THE COOK ISLANDS

Rarotonga Annual Water Quality Report 2013

Introduction

Rarotonga's lagoon is of central importance to all of our lives – be it through providing food, attracting tourism, or protection from severe ocean conditions. In some way, we all rely on the lagoon. For that reason it is of critical importance that we monitor and protect our precious resource. Many of our actions on land can have unintended consequences with regards to water quality and lagoon health. Excrement from poorly located farms can introduce bacteria to streams; fertilisers washed off crops by rain can promote algae growth; and cutting down trees allows sediment from hillsides to wash into the water. The Ministry of Marine Resources (MMR) works in collaboration with the National Environment Services, the Ministry of Infrastructure and Planning, the Ministry of Health, and the Meteorological Service with funding from NZaid, AUSaid, the European Union and Telecom to provide reliable and accurate scientific data on the water quality not only in the marine environment around Rarotonga, but also all waters which feed into the lagoon.

Water Quality Parameters Explained

Bacteria: *Enterococci* occur naturally at very low levels in all waters, however if found in high concentrations are a strong indicator of human or animal faecal contamination and can pose a serious risk to human health. The higher the number of *Enterococci* bacteria present in a sample, the greater the amount of faecal contamination in the water. Very low *Enterococci* counts are A Excellent, whereas high *Enterococci* counts signal F Extremely Poor water quality

Water Clarity (TSS & Chlorophyll-a): Total Suspended Solids (TSS) are silt, mud and organic matter found in suspension in the water; Chlorophyll-a (Chl-a) is the green pigment which gives algae (plants) its colour. Together these are the components which determine the colour and clarity of the water. The presence of large amounts of particles and/or algae is responsible for creating the murky appearance of dirty water and can quickly kill coral reefs. Low TSS/Chl-a concentrations are A Excellent whereas high TSS/Chl-a* concentrations signal F Extremely Poor water quality and can affect coral reef health.

*Because phytoplankton is only relevant to reef health, Chl-a is not measured in stream samples.

Nutrients: Nitrogen and Phosphorous are elements commonly found in fertilizers and washing detergents. They are normally present in water in small amounts and are needed for the growth of plants and algae. However, if their concentration becomes high an excessive amount of algae will grow which is harmful to corals and may pose a public health concern. Low nutrient concentrations are A Excellent, whereas high nutrient concentrations signal F Extremely Poor water quality.

Dissolved Oxygen (DO): DO is the amount of oxygen dissolved in the water. DO is introduced to water by absorption from the air and production by plants and algae through photosynthesis. DO is removed by respiration of animal s and microbes and through the decomposition of organic matter. High DO concentrations are A Excellent whereas low DO concentrations signal F Extremely Poor water quality.

* Because of the large amounts of seawater input to the lagoon, DO levels are very consistent and as such only reported for streams

Key Findings for Rarotonga Lagoon (2012)

- The nutrient levels were generally bad at all sites resulting in poor to extremely poor water quality.
- Water clarity levels were below those recommended by Bell (1992) for the protection of coral reef health at all sites except at Paringaru, Tikioki Packing Shed, Kent Hall, East Airport Drain, Sails and Ta'akoka where the levels were poor.
- All sites had low indicator bacteria levels showing that the water quality was generally good.

Key Findings for Rarotonga Streams (2012)

- The DO levels varied at all sites resulting in very good to extremely poor water quality.
- DO levels were below those recommended by ANZECC (2000) and NIWA (2011) for subtropical and tropical streams except at Avana, Rutaki, North Airport Drain and Aroko 1 where the levels were good and at Totokoitu where the level was very good.
- The nutrient levels varied at all sites resulting in good to very poor water quality.
- Nutrient levels were below those recommended by ANZECC (2000) and NIWA (2011) for subtropical and tropical streams except at Are Mango 2 and Aroko 2 where the levels were good.
- Water Clarity varied at all sites resulting in excellent to very poor water quality.
- All sites had high indicator bacteria levels showing that the water quality was very poor to extremely poor except at the North Airport Drain and at Drain 2 where the levels were good.
- January-June 2013 Report

Key Findings for Rarotonga Lagoon (2013)

- Bacteria levels were excellent at most sites except at Totokoitu Station where the level was poor.
- Water clarity levels were below those recommended by Bell (1992) for the protection of coral reef health except at Club Raro, Paringaru, Tikioki Packing Shed, Kent Hall, Arorangi School and Ta'akoka where the levels were poor to very poor.
- None of the nutrients results were available at the time this report was released.

Key Findings for Rarotonga Streams (2013)

- Bacteria levels were mostly poor to extremely poor at most sites except at North Airport Drain where the level was excellent.
- Water clarity levels varied at all sites resulting in excellent to poor water quality.
- DO levels varied at all sites resulting in good to extremely poor water quality.
- DO levels were below those recommended by ANZECC (2000) and NIWA (2011) for subtropical and tropical streams except at Avana and Aroko 1 where the level was good.
- Rutaki and Aremango 2 were the only two sites that resulted in ND.
- None of the nutrients results were available at the time this report was released.

Results for 2013: January to June

A	Excellent	D	Poor
B	Very Good	E	Very Poor
C	Good	F	Extremely Poor
		-	No Data

Lagoon

	Avatiu Harbour	East Airport	Social Centre	Public Works	Arorangi School	Kaena	Papua	Totokoitu Station	Kent Hall	Tikioki Packing Shed	Paringaru	Taakoka	Sails	Nukupure Park	Avana Mudflat	Pou'ara Ra'ui	Club Raro	TJ's
Bacteria	A	A	A	A	A	A	A	D	A	A	A	A	A	A	A	A	A	A
Water Clarity	C	C	C	C	D	C	B	C	D	D	E	D	C	B	C	C	D	B

Streams

	Avatiu	North Airport	Betela	Rutaki	Totokoitu	Akapuao	Paringaru	Aremango 2	Aremango 3	Aroko 2	Aroko 1	Aroko 3	Drain 2	Drain 1	Avana
Bacteria	F	A	F	-	F	F	D	-	F	F	F	F	F	D	F
Water Clarity	E	D	A	-	B	C	A	-	D	D	D	C	C	B	C
DO	E	D	E	-	D	F	D	-	D	F	C	D	E	E	C

Rarotonga Streams: 2012 data analysed

Betela: Dissolved oxygen and nutrient levels were poor, water clarity level was very good and bacterial level was extremely poor.

North Airport Drain: Dissolved oxygen and bacterial levels were good and nutrient and clarity levels were poor.

Avatiu: Dissolved oxygen level was poor, nutrient level was very poor, water clarity level was good and bacterial level was extremely poor.

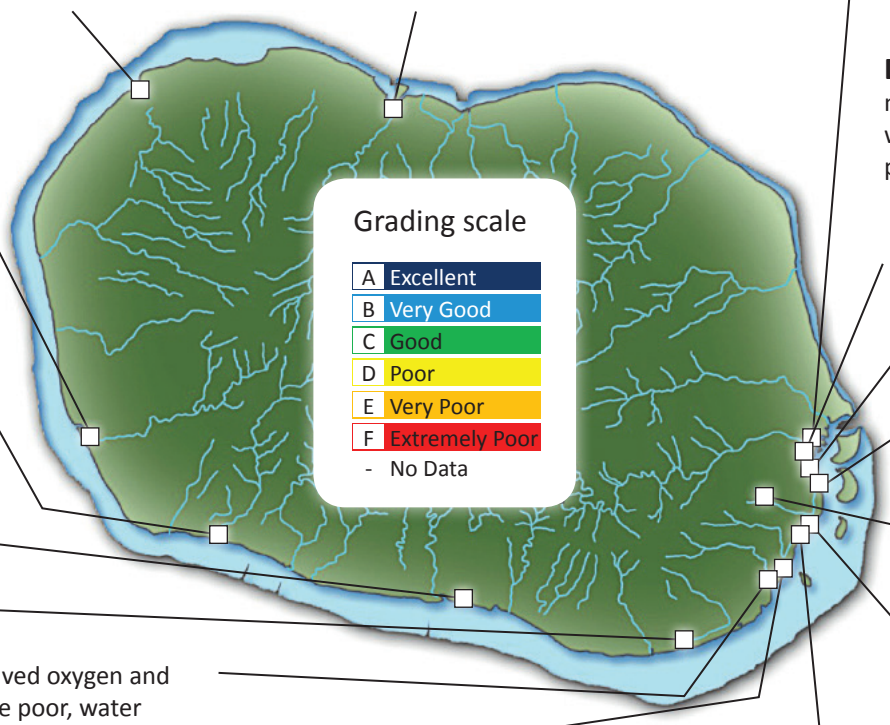
Avana: Dissolved oxygen level was good, nutrient level was poor, water clarity level was excellent and bacterial level was extremely poor.

Rutaki: Dissolved oxygen level was good, nutrient level was poor, water clarity level was excellent and bacterial level was extremely poor.

Drain 1: Dissolved oxygen level was poor, nutrient level was very poor, water clarity level was good and bacterial level was extremely poor.

Drain 2: Dissolved oxygen level was poor, nutrient level was very poor, water clarity level was very good and bacterial level was good.

Totokoitu: Dissolved oxygen level was very good, nutrient level was very poor, water clarity level was excellent and bacterial level was extremely poor.



Aroko 3: Dissolved oxygen level was poor, nutrient level was very poor, water clarity level was good and bacterial level was extremely poor.

Akapuao: Dissolved oxygen level was very poor, nutrient level was poor, water clarity level was good and bacterial level was extremely poor.

Aroko 1: Dissolved oxygen and water clarity levels were good, nutrient level was poor and bacterial level was extremely poor.

Paringaru: Dissolved oxygen and nutrient levels were poor, water clarity level was good and bacterial level was extremely poor.

Aremango 2: Dissolved oxygen level was extremely poor, nutrient and clarity levels were good and bacterial level was very poor.

Aremango 3: Dissolved oxygen and nutrient levels very poor, water clarity level was good and bacterial level was extremely poor.

Aroko 2: Dissolved oxygen and bacterial levels were extremely poor, nutrient level was good and bacterial level was poor.

	Avatiu	North Airport	Betela	Rutaki	Totokoitu	Akapuao	Paringaru	Aremango 2	Aremango 3	Aroko 2	Aroko 1	Aroko 3	Drain 2	Drain 1	Avana
Nutrients	E	D	D	D	E	D	D	C	E	C	D	E	E	E	D
Water Clarity	C	D	B	A	A	C	A	C	C	D	C	C	B	C	A
Bacteria	F	C	F	F	F	F	F	E	F	F	F	F	C	F	F
Oxygen	D	C	D	C	B	E	D	F	E	F	C	D	D	D	C

Rarotonga Lagoon: 2012 data analysed

East Airport Drain: Nutrients and clarity levels were poor and bacterial level was excellent.

Avatiu Harbour: Nutrients level was very poor, clarity level was good and bacterial level was excellent

TJ's: Nutrients level was poor, clarity level was very good and bacterial level was excellent.

Club Raro: Nutrients level was poor, clarity levels was good and bacterial level was excellent.

Social Centre: Nutrients level was poor, clarity level was good and bacterial level was excellent.

Pou'ara Ra'ui: Nutrients level was very poor, clarity level was good and bacterial level was excellent.

Public Works: Nutrients level was extremely poor, clarity was good and bacterial level was excellent.

Avana Mudflat: Nutrients level was very poor, clarity level was good and bacterial level was excellent.

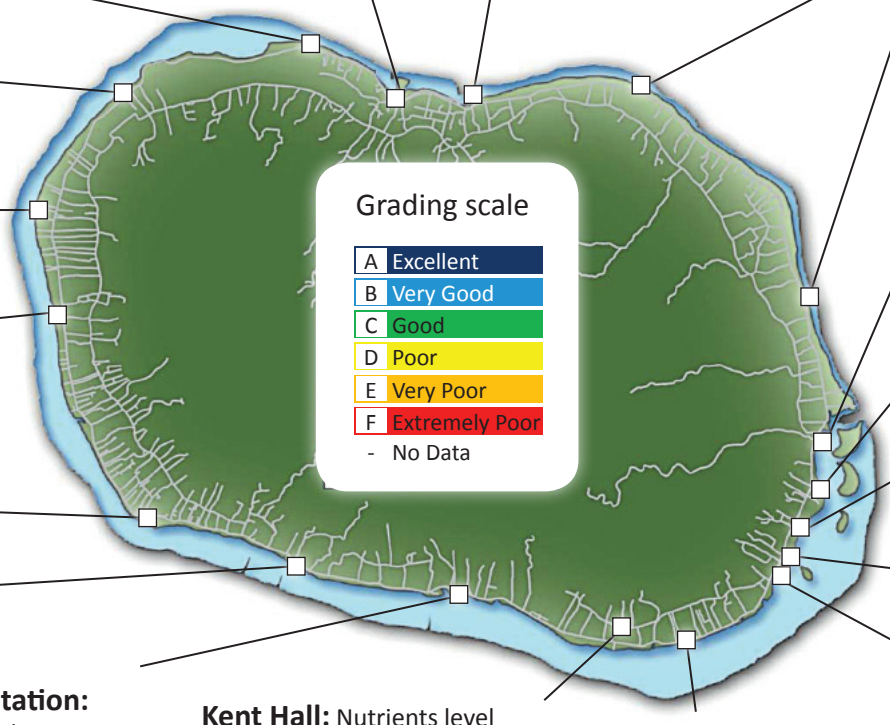
Arorangi School: Nutrients level was very poor, clarity level was good and bacterial level was excellent.

Nukupure Park: Nutrients level was poor, clarity levels were very good and bacterial level was excellent.

Kaena Restaurant: Nutrients level was very poor, clarity was very good and bacterial level was excellent.

Sails: Nutrients and clarity levels were poor and bacterial level was excellent.

Papua: Nutrients level was very poor, clarity was very good and bacterial level was excellent.



Taakoka: Nutrients level was very poor, clarity level was poor and bacterial level was excellent.

Totokoitu Research Station: Nutrients level was very poor, clarity level was good and bacterial level was very good.

Kent Hall: Nutrients level was very poor, clarity level was poor and bacterial level was excellent.

Tikioki Packing Shed: Nutrients level was very poor, clarity level was poor and bacterial level was excellent.

Paringaru: Nutrients level was very poor, clarity level was poor and bacterial level was excellent.

	Avatiu Harbour	East Airport	Social Centre	Public Works	Arorangi School	Kaena	Papua	Totokoitu Station	Kent Hall	Tikioki Packing Shed	Paringaru	Taakoka	Sails	Nukupure Park	Avana Mudflat	Pou'ara Ra'ui	Club Raro	TJ's
Nutrients	E	D	D	F	E	E	E	E	E	E	E	E	D	D	E	E	D	D
Water Clarity	C	D	C	C	C	B	B	C	D	D	D	D	D	B	C	C	C	B
Bacteria	A	A	A	A	A	A	A	B	A	A	A	A	A	A	A	A	A	A