

# Water and Wastewater Schemes Summary Report July to December 2020

PREPARED FOR Chatham Island Council | March 2021

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We design with community in mind



## Revision Schedule

Rev No.	Date	Description	Signature or Typed Name (documentation on file)			
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## Executive Summary

The Kaingaroa and Waitangi Water Schemes and the Waitangi Wastewater Scheme are owned by the Chatham Islands Council (Council) and are operated and maintained under contract by Fulton Hogan.

The purpose of this report is to summarise the operation of the three schemes for the period from 1 July 2020 to 31 December 2020 and recommend actions to protect public health and minimise adverse environmental effects.

Key findings, recommended actions, and progress for this reporting period are summarised below.

Scheme	Key findings	Recommended actions	Progress
Waitangi Water	<ul style="list-style-type: none"> <li>Non-complying with Drinking-water Standards for New Zealand, primarily due to inadequate treatment.</li> <li>Despite this, no E. coli detected in raw, treated or reticulated water.</li> </ul>	<ul style="list-style-type: none"> <li>Urgently replace existing, dysfunctional UV disinfection system.</li> </ul>	<ul style="list-style-type: none"> <li>Ministry of Health (MoH) funding for new UV secured, site visit carried out with supplier Nov 2020, design is in progress.</li> </ul>
Kaingaroa Water	<ul style="list-style-type: none"> <li>Non-complying with Drinking-water Standards for New Zealand, primarily due to poor water intake and inadequate treatment.</li> <li>Despite this, no E. coli was detected in treated or reticulated water.</li> </ul>	<ul style="list-style-type: none"> <li>Urgently extend water intake into deeper water and upgrade treatment process to include organics removal and chlorination.</li> </ul>	<ul style="list-style-type: none"> <li>MoH funding for intake and WTP upgrade secured, site visit carried out with contractor Nov 2020, design is in progress.</li> </ul>
Waitangi Wastewater	<ul style="list-style-type: none"> <li>Non-complying with resource consent, primarily due to elevated nitrogen and E. coli.</li> <li>Complying with solids and organics limits.</li> </ul>	<ul style="list-style-type: none"> <li>Urgently carry out various remedial works on wastewater scheme.</li> </ul>	<ul style="list-style-type: none"> <li>MoH funding for critical repairs secured, remedials carried out in Nov-Dec 2020.</li> <li>3 Waters Stimulus funding secured for improvement works (planning and construction), site visit carried out with contractor Nov 2020.</li> </ul>

Overall, the water and wastewater schemes urgently require remedial or upgrade works to address substantial limitations, meet current best practice, and achieve compliance. Central Government Funding to progress these works has been secured through a mixture of MoH and 3 Waters Stimulus Funding (Tranche 1) packages in late 2020, with work in progress and the majority due to be completed in 2021. Some design is being carried out under Tranche 1 in anticipation of additional funding being available via Tranche 2 of the 3 Waters Stimulus funding.

## Abbreviations

Acronym	Meaning
Ammonia N	Ammonia Nitrogen
cfu	Coliform Forming Unit
BOD	Biochemical Oxygen Demand
CCP	Critical Control Point
COD	Chemical Oxygen Demand
DWA	Drinking Water Assessor
DWSNZ	Drinking-water Standards for New Zealand 2005 (Revised 2018)
E. coli	<i>Escherichia coliform (E. coli)</i>
FAC	Free Available Chlorine
LTP	Long Term Plan
MPN	Most Probable Number
O&M	Operation and Maintenance
PHRMP	Public Health Risk Management Plan (now called a Water Safety Plan)
RBC	Rotating Biological Contactor
TSS	Total Suspended Solids
UV	Ultraviolet
WSP	Water Safety Plan
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

## 1.0 INTRODUCTION

The Waitangi community on the Chatham Islands is served by a reticulated sewerage system and treatment plant, installed in 2005, and a treated, reticulated water supply, upgraded in the same year. The Kaingaroa community is served by a treated, reticulated water supply, upgraded in 2014.

The water and wastewater schemes are owned by the Chatham Islands Council (the Council) and are operated and maintained under a combined water/wastewater and roading operations and maintenance contract (the O&M Contract). The O&M Contract was awarded to Fulton Hogan in late 2015 and commenced on 1 January 2016. It is a ten year contract.

The key objectives in the operation and maintenance of the water and wastewater schemes are to protect public health, minimise adverse environmental effects and ensure the efficient and effective operation of the schemes.

The purpose of this report is to provide a summary of information recorded for the water and wastewater schemes under the O&M Contract for the period from 1 July 2020 to 31 December 2020 (the reporting period) and recommend actions for the Council to consider to protect public health and ensure the efficient and effective operation of these schemes.

### 1.1 LEGISLATIVE CHANGES, REQUIRED UPGRADES AND FUNDING CHALLENGES

***The water and wastewater schemes all currently require significant upgrades to address substantial limitations. This is due to legislative changes as well as aging infrastructure. This section provides an overview.***

In December 2018, the Government published revised Drinking-water Standards for New Zealand 2005 (revised 2018) which supercede the Drinking-water Standards for New Zealand 2005 (revised 2008) and came into force on 1 March 2019. At that time, the Minister also noted “A comprehensive review of the Standards is also being carried out, led by an independent Drinking-Water Advisory Committee. I expect proposed changes from this review to be released for public consultation by mid-2019.” This review is progressing, with an exposure draft of the revised DWSNZ released in December 2020. Public submissions will be sought once the draft is complete; estimated to be in mid 2021.

The new DWSNZ 2005 (revised 2018) has, and further revisions are likely to have, significant implications for Waitangi and Kaingaroa water supplies. To date these have been largely foreseen by the Council, as they are generally consistent with the findings of the Government Inquiry into Havelock North Drinking Water (the Inquiry), particularly those in the Stage 2 Report released in December 2017<sup>1</sup>.

The Council considered the findings of the Inquiry as well as the current condition of critical assets when it developed its Combined Financial and Infrastructure Strategy (the Strategy) and its 2019/20 Long Term Plan (LTP) in early 2018. Accordingly, the Strategy and LTP included significant capital upgrades to address substantial limitations with the existing water and wastewater schemes. For the water supplies it also included upgrades to enable full compliance with the drinking water standards current at that time without relying on ‘secure’ bore water or the caveat of ‘all practicable steps’. For Waitangi water supply, the upgrade also included a new bore source as the current demand exceeds the sustainable yield of the existing aquifer during summer as well as extending the reticulation to Te One, the community where the main primary school for the Island and other facilities are located.

At the time the Strategy and LTP were prepared, the Council understood that Central Government funding would be made available to the Council for the upgrades in some form (eg fully-funded or funded from debt with assistance provided through annual Crown contributions). However, in May 2018 the Council was informed that its funding application to upgrade the water and wastewater schemes was declined.

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<sup>1</sup> Summary provided in Stantec’s 6-monthly report titled “Water and Wastewater – Operation and Maintenance Summary Report: July 2017 – December 2017”

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Following this, the Council sought Central Government funding for interim upgrades for the two water schemes to minimise public health risks until additional funding was secured to progress with the full upgrades. These interim upgrades are summarised in Stantec’s memo titled “Chatham Island Water Supplies – Interim Measures to Minimise Public Health Risks” dated 31 May 2018<sup>2</sup>. This attempt to obtain funding was also unsuccessful.

In early 2019 Stantec reviewed the forecast of infrastructure requirements in the 2019/20 LTP and identified priority works required for the water and wastewater infrastructure to remain ‘fit for purpose’ for the short to medium term (1 to 10 year horizon). Stantec findings are summarised in a memo titled “Chatham Island Water and Wastewater – Priority Infrastructure Needs” dated 11 April 2019<sup>3</sup>. The Council used this memo in support of obtaining alternative Central Government funding, but this was again unsuccessful.

In late 2019 the Council identified the possibility of reallocating funds totalling \$390k for urgent upgrades for the water and wastewater schemes. To support Council’s request to Central Government to approve reallocation of this funds, Stantec prepared a memo titled “Chatham Island Water and Wastewater – Priority Infrastructure Needs” dated 11 September 2019<sup>4</sup>. Funding was approved by MoH on the 28 August 2020 for the following works (see Appendix G):

- New UV unit at Waitangi WTP.
- Confirm feasibility of MPA bore for Waitangi.
- Extend Kaingaroa intake, at Lake Rangitai, into deeper water.
- Add organics and chlorate removal to Kaingaroa WTP treatment system.
- Repairs to Waitangi WWTP RBC shaft.
- WWTP inlet feed pump check valves replacement.

In May/June 2020 the Council prepared several “shovel ready” funding applications for water and wastewater projects<sup>5</sup>, however none of these were successful.

The Council signed the Memorandum of Understanding (MoU) for the three waters reform in August 2020, agreed with the Canterbury Councils to pro-rata the regional allocation of Tranche 1 Three Water Stimulus Funds in September and submitted its Delivery Plan (see Appendix G) and Funding Agreement on 30 September 2020. Funding was approved in October 2020 for the following projects:

- **Wastewater improvements** project to mitigate adverse public health and environmental impacts; hence, address consent non-compliance and improve resilience. This will involve extension of the land application system, design of new wastewater treatment plant, and investigation and remedial works to enable the existing system to continue to operate.
- **Water safety improvement** project to enable real-time monitoring and reporting of treated water from Council-owned reticulated water supplies. This will include critical alarms being able to be relayed in real-time. In two projects separate to this expenditure programme, cell phone coverage is being deployed to Chatham Islands and both water treatment plants are being upgraded. Completion of all three projects will substantially improve public safety of the water supply and address current drinking water non-compliances, including those due to weather-related delays in sample transport.
- **Water resilience** project to improve availability of water supply for communities, particularly during peak summer periods. This will involve replacement of aging assets to reduce network losses, provision of additional water storage tanks to reduce the need to tanker potable water from Waitangi, and provision of non-potable water storage to ensure sustainable, reliable supply of potable water for communities.

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<sup>2</sup> Reproduced in Appendix G of Stantec’s 6-monthly report titled “Water and Wastewater – Operation and Maintenance Summary Report: January 2018 – June 2018”

<sup>3</sup> Reproduced in Appendix G of Stantec’s annual report titled “Water and Wastewater – Operation and Maintenance Summary Report: July 2018 – June 2019”

<sup>4</sup> Reproduced in Appendix G of Stantec’s annual report titled “Water and Wastewater – Operation and Maintenance Summary Report: July 2019 – December 2019”

<sup>5</sup> See Appendix G of Stantec’s annual report titled “Water and Wastewater – Operation and Maintenance Summary Report: January 2020 – June 2020”

As required by signing the MoU, the Council is also collating information about the water and wastewater schemes in response to the Department of Internal Affairs (DIA)'s Request for Information for the Three Waters Reform programme. This work has, amongst other things, identified future requirements for water and wastewater services on the Chathams.

Going forward, Three Waters service delivery arrangement in New Zealand will change (see Section 1.2). The Government's intention is to reform local government's Three Waters services into a small number of multi-regional entities with a bottom line of public ownership. The exact size, shape, design, and funding model of these entities is still being worked through but will see significant change for the Chathams.

As the outcome of the Three Waters reform programme process is unknown, the Council has assumed a Business as Usual (BAU) approach when developing its 2021 LTP. For funding, this assumes continued assistance from Central Government for operational costs and obtaining additional external funding on a case-by-case basis for capital upgrades or increased level of service. Central Government assistance may not be available if services for the Chathams are provided by a new water entity. In addition, the Council currently sees economies of scale with having a combined roading and Three Waters contract for operations and maintenance (Fulton Hogan) as well as engineering services (Stantec) that may not be realised on the Chathams with a new water entity.

## **1.2 THREE WATERS REFORM**

***The Three Waters Reform will result in wide changes in the sector, including service delivery.***

The Department of Internal Affairs webpage for the Three Waters Reform provides the following summary:

*"In July 2020, the Government launched the Three Waters Reform Programme – a three-year programme to reform local government three waters service delivery arrangements.*

*This reform programme builds on the progress made through the Three Waters Review and establishment of Taumata Arowai.*

*Currently 67 different councils own and operate the majority of the drinking water, wastewater and stormwater services across New Zealand. Local government is facing urgent challenges in the provision of these services including: funding infrastructure deficits, complying with safety standards and environmental expectations, building resilience to natural hazards and climate change into three waters networks, and supporting growth.*

*Rather than piecemeal solutions, comprehensive, system-wide reform is needed to achieve lasting benefits for the local government sector, our communities, and the environment.*

*The Government's starting intention is to reform local government's three waters services into a small number of multi-regional entities with a bottom line of public ownership. The exact size, shape and design of these entities is still being worked through.*

*The reform programme is being progressed through a voluntary, partnership-based approach with the local government sector, alongside iwi/Māori as the Crown's Treaty Partner. A Joint Three Waters Steering Committee collaborative provides oversight of the reform programme that brings together central and local government expertise and experience."*

Whilst the Three Waters Reform may see funding in addition to the Tranche 1 allocation being made available to the Council for water and wastewater, it may not be sufficient to enable full compliance with the DWSNZ and current consents, that will be required by Taumata Arowai. In addition, a different entity (that Council may or may not be a joint owner of) may be responsible for service delivery and alternative funding mechanisms may be introduced which will impact residents.

## 2.0 WATER SUPPLY

### 2.1 WAITANGI WATER SUPPLY

#### 2.1.1 Process Overview

Raw water is drawn from the Tikitiki Bore<sup>6</sup> at Tikitiki Hill. The raw water enters the water treatment plant (WTP) and is pumped through a multimedia filter (sand and anthracite media) to remove particulate matter. The water is softened to reduce scaling in pipes from excessive hardness in the water. Disinfection is supposed to be provided via UV (for protozoa protection<sup>7</sup>) and sodium hypochlorite dosing (Critical Control Point, CCP, and providing residual disinfection in the reticulation). However, the UV disinfection system is no longer functional. The Tikitiki Reservoir provides more than 30 minutes contact time prior to treated water being pumped into the network. The four, interconnected Met Station Reservoirs are within the network for storage. Most properties have a header tank and some also have a booster pump.

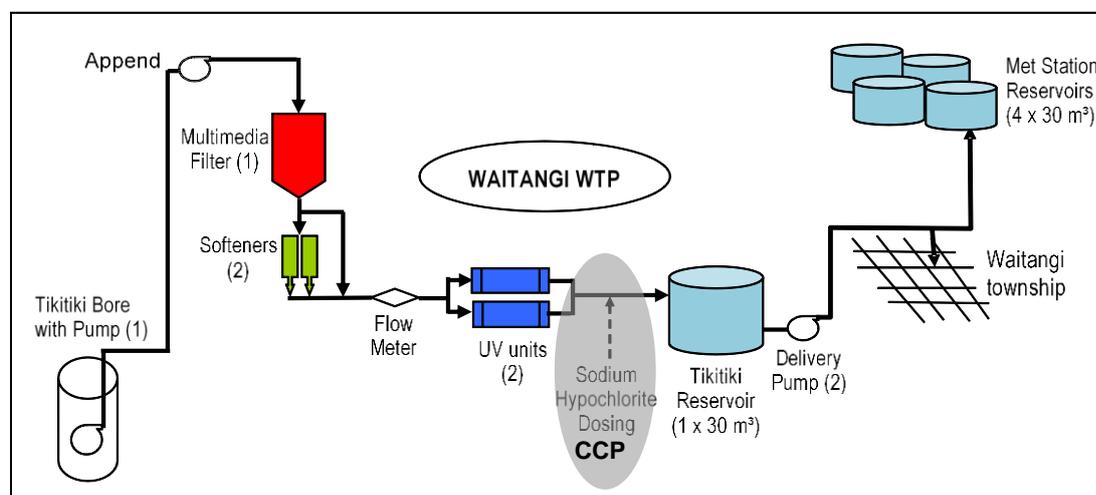


Figure 1: Waitangi Water Supply System Schematic

A proposed upgrade includes a new bore source as the current demand exceeds the sustainable yield of the existing aquifer during summer, a new treatment plant, as well as extending the reticulation to Te One. The Council secured funding from Ministry of Health on 28 August 2020 to replace the UV disinfection system at the existing WTP at Tikitiki Hill. Three Waters Stimulus funding was secured for improvement works (planning and construction) and a site visit was carried out with the contractor in November 2020.

#### 2.1.2 DWSNZ Requirements

**The Government has introduced a new regulatory framework for ensuring drinking water safety and improving environmental outcomes for wastewater and stormwater. The new system is to be overseen by the new dedicated water regulator (Taumata Arowai), with a new Water Services Bill and new DWSNZ. An exposure draft of the new DWSNZ was released in late 2020 with intention of being released for public consultation in mid-2021. This section reflects the current DWSNZ (2005, revised 2018). It will require updating when the new DWSNZ come into force.**

<sup>6</sup> The Tikitiki bore does not have secure status. Limited information is available on the bore's construction.

<sup>7</sup> The UV equipment is not validated and does not have any measurement of dose intensity and therefore the Waitangi unit is not considered compliant for protozoa protection under section 5.16 of the DWSNZ. In addition, one of the two parallel UV units has failed and is unable to be repaired.

### 2.1.2.1 Water Supply Classification

The Waitangi Water Supply is classified as a small supply (i.e., less than 500 people) under the Drinking-water Standards for New Zealand 2005 (Revised 2018) (DWSNZ).

The Council had elected to demonstrate compliance under section 10 of DWSNZ. However, during its assessment of the 2018/19 compliance period, the DWA considered that the supply is no longer eligible for compliance assessment under section 10 and so is required to comply with sections 4-9 of the DWSNZ. The reason for this is that the supply does not have appropriate protozoal treatment as per Table 10.1 in Section 10 of the DWSNZ (see discussion below).

### 2.1.2.2 Water Safety Plan (WSP) and Implementation

The Council is not required to have a Water Safety Plan (WSP) in place as the water supply serves less than 500 people, however it has elected to do so<sup>8</sup>.

A WSP for the scheme was approved by the DWA on 29 July 2016. It includes monitoring required to be undertaken for ongoing DWSNZ compliance and operation. This report is based on that monitoring regime.

The DWA carried out a WSP implementation audit in 2017/18 year, visiting the site on 6 December 2017 and providing a report on 8 March 2018<sup>9</sup>, and indicated subsequent on-site WSP implementation inspections are likely to be undertaken at 3 yearly intervals to determine implementation progress.

CIC has elected to not review its WSP (due for review in July 2021) due to uncertainty around the new drinking water framework and the new water delivery entities. However, the CCPs will be reviewed and documented as part of any WTP upgrades, with the most recent CCP documentation included in the 6-monthly report.

### 2.1.2.3 Groundwater Security Status (Tikitiki Bore) and Protozoal Treatment

Tikitiki bore was granted secure status by the DWA on 27 July 2016, which meant that no treatment was required to be in place for protozoal compliance under the DWSNZ. Ongoing monitoring of the raw bore water was required to retain secure status.

Tikitiki bore lost secure status on 27 June 2018 following the DWA's WSP implementation audit in December 2017. Fulton Hogan carried out remedial works to return the borehead to a similar condition as at the time of the initial borehead assessment in 2016 and the current DWSNZ only requiring a 5-yearly review of the borehead.

Without secure status, appropriate treatment is required to be in place for protozoal compliance under the DWSNZ. UV disinfection would provide protozoal treatment. The existing UV disinfection system is dysfunctional and does not meet the protozoal compliance requirements under the DWSNZ.

The Council has sought funding from Central Government to install a new UV disinfection system<sup>10</sup> to address existing public health risks and enable DWSNZ compliance. Funding was secured for this work from MoH on 28 August 2020.

Despite losing secure status, the Council has continued to monitor the raw bore water as per the WSP. E. coli have not been detected in the raw water for the past five years. Low levels of total coliforms have been detected on 10 occasions in the last five years, refer to Appendix B, Table B-1; this needs to be continually monitored.

### 2.1.2.4 Critical Control Points (CCPs)

The Council is required to have Critical Control Points (CCPs) in place for its supplies. A CCP is an active barrier that is essential for protecting consumers from water quality hazards. CCPs need to be monitored regularly, ideally continuously, to ensure the effectiveness of barriers. Properly operated CCPs help ensure safe drinking water.

<sup>8</sup> The Council understood they could demonstrate compliance under section 10 of DWSNZ, which requires a WSP. However, in late 2019, the DWA considered the supply was not currently eligible for compliance under Section 10.

<sup>9</sup> Summary and relevant documents provided in Stantec's 6-monthly report titled "Water and Wastewater – Operation and Maintenance Summary Report: January 2018 – June 2018" (see Section 2.2.2 and Appendix G)

<sup>10</sup> A new validated UV disinfection system and online monitoring is proposed as a step towards achieving protozoal compliance.

Stantec and Fulton Hogan discussed potential CCPs and associated documentation for Waitangi with the DWA during the 2017/18 WSP Implementation Audit and subsequently developed CCP documentation for chlorination as discussed. This documentation was reviewed in late 2019 based on the Ministry of Health’s revised water safety plan handbook<sup>11</sup>.

Council has now secured funding to provide treatment at Waitangi to replace the UV disinfection system. Once this upgrade is complete, the UV disinfection system will become a CCP.

The current version of the CCP documentation for chlorination is provided in Appendix H.

### 2.1.3 Monitoring Regime

Monitoring is undertaken within the water supply for DWSNZ compliance as well as for WTP operation as per the WSP. This monitoring is summarised in Table 1. It reflects the new DWSNZ requirement for total coliform monitoring from 1 March 2019, although it is noted the Council has been doing this voluntarily since 2008.

**Table 1: Waitangi Water Quality Monitoring Regime**

		Sampling Requirement		DWSNZ Compliance		Operational Requirement	
		Frequency	Location	Parameter	Limit	Parameter	Target
<b>Source Compliance</b>							
Protozoal	Monthly	Raw water	-	-	Turbidity	-	
					E. coli	<1 MPN/100mL	
					Total coliforms	<1 MPN/100mL	
<b>Treatment Compliance</b>							
Bacterial	Monthly	Treated water	E. coli	<1 MPN/100mL	Turbidity	<0.3 NTU	
			Total coliforms	no limit	Total coliforms	<1 MPN/100mL	
	Weekly		-	-	FAC <sup>12</sup>	0.2-0.6 mg/L <sup>13</sup>	
					pH	6-9 <sup>14</sup>	
<b>Distribution Compliance</b>							
Bacterial	Monthly	Reticulation	E. coli	<1 MPN/100mL			
			Total coliforms	no limit	Total coliforms	<1 MPN/100mL	

FAC<sup>15</sup> and pH of the treated water has been measured with a hand-held meter on-site since the 2005 WTP upgrade. Turbidity of the raw and treated water has been measured by laboratory analysis on the mainland since 26 July 2016.

Chlorination is a CCP, with documentation provided in Appendix H. It is not clear at this time if CCP monitoring will comprise part of DWSNZ compliance monitoring in the future.

<sup>11</sup> Ministry of Health, “Handbook for Preparing a Water Safety Plan”, May 2019.

<sup>12</sup> Free Available Chlorine (FAC)

<sup>13</sup> For FAC, DWSNZ has a Guideline Value (GV) of 0.6-1.0 mg/L for taste and odour, a Maximum Acceptable Value (MAV) of 5 mg/L and requirement of >0.2 mg/L in the network (section 4.2.2).

<sup>14</sup> For pH, DWSNZ has a guideline range of 7 – 8.5 for aesthetics and notes less than 8 is preferable for effective disinfection with chlorine. Note that no chemicals are dosed at the WTP to control pH.

<sup>15</sup> Fulton Hogan (Chatham Islands) are authorised by South Island Drinking Water Assessment Unit to perform measurement of FAC by a hand-held meter. The authorisation is based on an assessment of Fulton Hogan staff carried by the Drinking Water Assessment on 6 December 2017 and is valid until January 2021.

## 2.1.4 Monitoring Results

The monitoring results available since 2008 are provided in Appendix B, with the results from this reporting period shaded grey.

Table 2 summarises the monitoring results from the reporting period in the context of DWSNZ compliance and operational requirements as per the WSP.

**Table 2: Waitangi Water Quality Monitoring Results For Reporting Period**

DWSNZ Compliance		Operational Requirement
<b>Source Compliance</b>		
Bacterial	-	E. coli and total coliforms: All required raw water samples analysed. No E. coli detected. Low levels of total coliforms detected in one sample (December). Monitoring is ongoing.
<b>Treatment Compliance</b>		
Bacterial and protozoal	E. coli: All required treated water samples analysed and less than limit. Total coliforms: All required treated water samples analysed. No limit.  Non-compliant as UV not adequate. (Note: weekly sampling of treated water required under section 4; WSP requires monthly sampling)  Note: MoH funding secured to upgrade UV disinfection system	Total coliform: All required treated water samples analysed. No total coliforms detected.  pH and FAC: All required treated water samples analysed except for two-week period in July and October where pH was not recorded. pH: All results within expected bounds, stable trend observed. FAC: All results within target operational range. Turbidity: All required raw and treated water samples analysed. Elevated levels measured in one sample (20 October), possibly due to sample reaction on transport. Continue to monitor.
<b>Distribution Compliance</b>		
Bacterial	E.coli: All required reticulation samples analysed and less than limit. Total coliforms: All required reticulation samples analysed. No limit.  Compliant	Total coliform: All required reticulation samples analysed. No total coliforms detected.

## 2.1.5 Key Maintenance Works

Key maintenance and one-off works undertaken in the reporting period over and above routine works allowed for in the lump sum prices for the O&M Contract are summarised in Appendix A.

## 2.1.6 Water Conservation and Demand Management

The daily bore meter readings are shown in Figure 2. Key observations are as follows.

- The 30-day moving average for this reporting period has varied between 47 - 60 m<sup>3</sup>/day.
- The annual average usage at the end of this reporting period<sup>16</sup> is 54 m<sup>3</sup>/day. Based on a population of 170 people, this equates to an average usage of 318 L/person/day.

A decrease in demand was observed in 2019 following completion of the Wharf Project (ie water demand in July 2019 is similar to that seen in July 2015 before the start of the Wharf Project). However, this trend was reversed

<sup>16</sup> Based on the twelve month period from 1 July 2018 to 30 June 2019.

in late 2020 and can be attributed to Covid-19 – restrictions around international travel saw increased numbers of NZ domestic tourists visiting Chatham Islands.

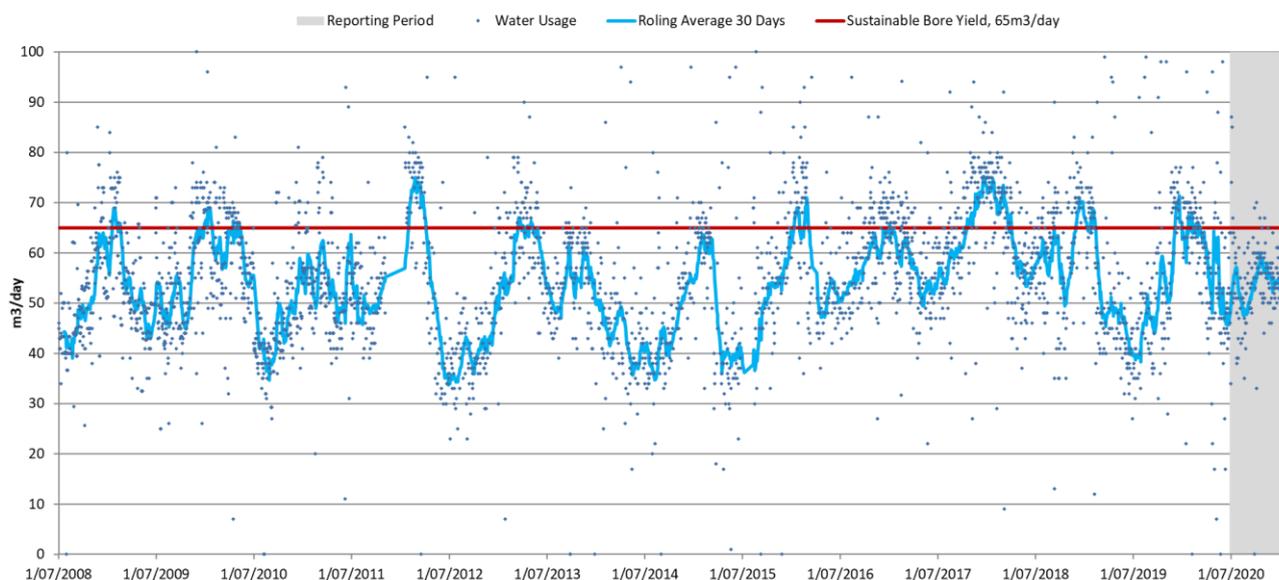


Figure 2: Daily Water Abstraction

Meter readings are taken on a quarterly basis. The last meter readings were taken at the end of December 2020 with the next readings programmed for April 2021. Figure 3 provides an overall summary of the average daily water use across the community in this reporting period. There are currently 62 active connections.

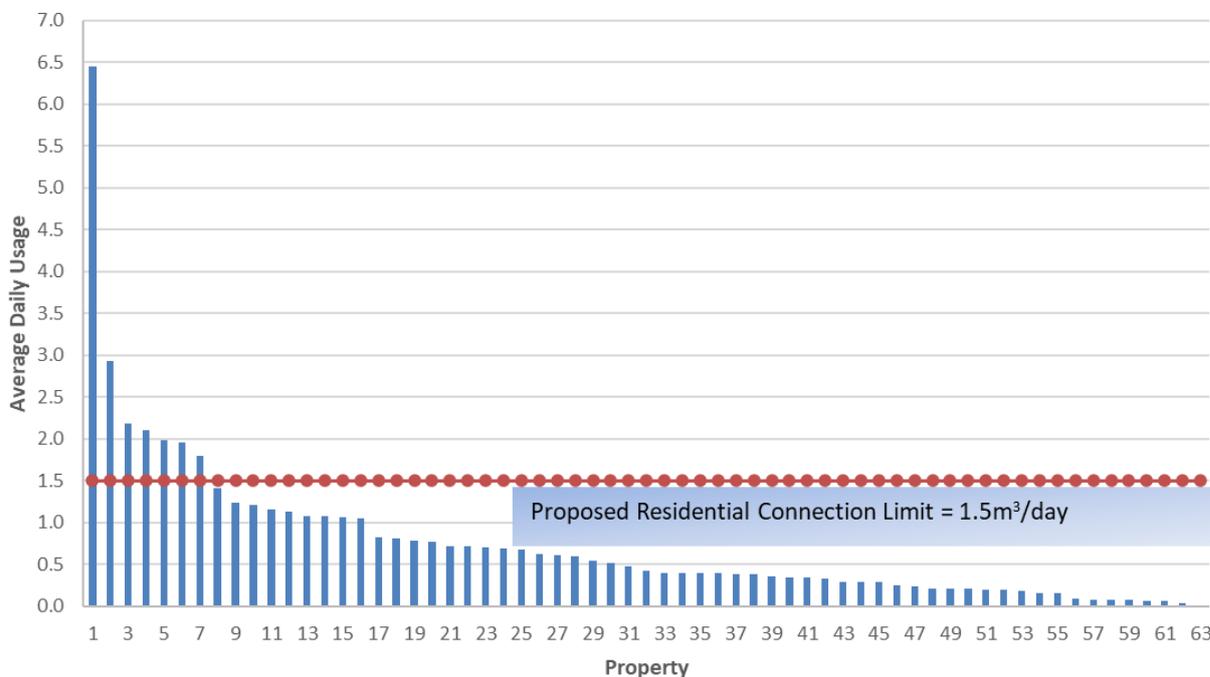


Figure 3: Ranked Average Daily Water Use in Waitangi

As shown in Figure 3, the majority of properties used significantly less than 1.5 m<sup>3</sup>/day (i.e., the proposed residential connection limit outlined in the Chatham Island Water Strategy, December 2010) in this reporting period. There were 7 exceptions, largely commercial connections: Hotel Chathams, Henry Damond, Joe & Rae Wills, Hotel Motels, Evelyn Tuanui, Fulton Hogan and Beach House.

## 2.2 KAINGAROA WATER SUPPLY

### 2.2.1 Process Overview

Raw water is drawn from Lake Rangitai via a screened inlet and pumped approximately 8km to the raw water reservoirs at the water treatment plant (WTP) located in Kaingaroa. There is also a rural supply connection off the raw water pumping main. The rural supply network is not actively operated or maintained by Council.

At the WTP, raw water is pumped through a multimedia filter (sand and anthracite media) to remove particulate matter and protect the downstream filter from blinding, and a macrolite filter (ceramic media) to further remove particulate matter and for protozoa protection<sup>17</sup> (CCP). The water is then softened to reduce scaling in pipes from excessive hardness in the water and then disinfected via UV (for further protozoa protection<sup>18</sup>). Chlorine is not dosed due to the risk of forming disinfection by-products from the dissolved organics present in the raw water.

The raw and treated water reservoirs provide storage at the WTP site. Most properties also have a header tank and some have a booster pump. There is also a valved, piped connection from the raw water main upstream of the reservoirs to a private bulk storage tank.

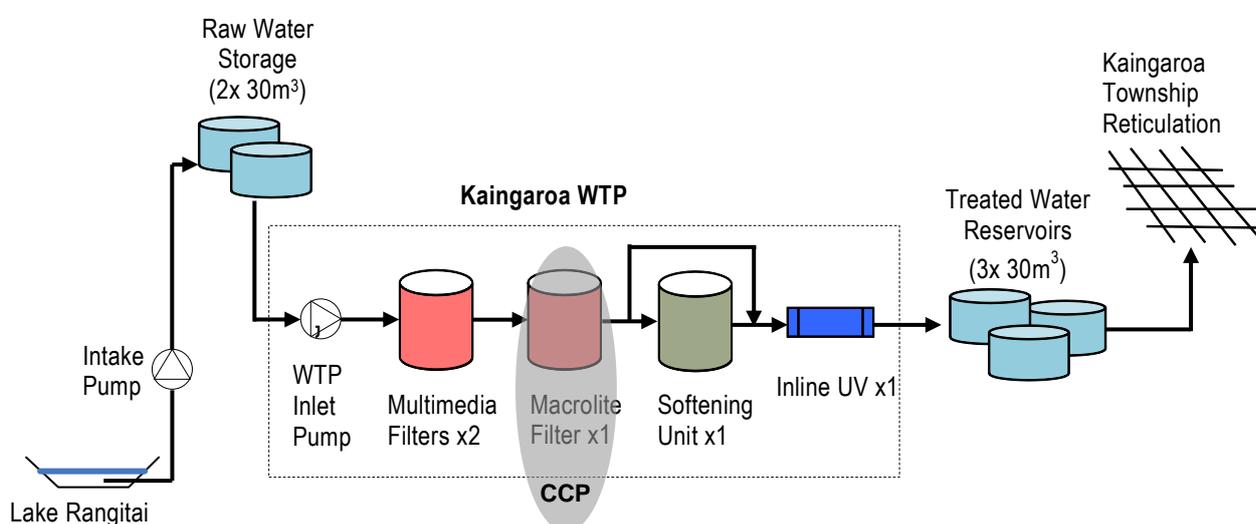


Figure 4: Kaingaroa Water Supply System Schematic

Council has approved funding to complete the proposed upgrade to extend the lake intake structure into deeper water, install a granular activated carbon (GAC) filter and provide chlorine disinfection.

### 2.2.2 DWSNZ Requirements

**The Government has introduced a new regulatory framework for ensuring drinking water safety and improving environmental outcomes for wastewater and stormwater. The new system is to be overseen by new dedicated water regulator (Taumata Arowai), with a new Water Services Bill and new DWSNZ. An exposure draft of the new DWSNZ was released in late 2020 with intention of being released for public consultation in mid-2021. This section reflects the current DWSNZ (2005, revised 2018). It will require updating when the new DWSNZ come into force.**

<sup>17</sup> The macrolite filter is not currently recognised as providing protozoal protection under Section 5 or 10 of the DWSNZ, however has been verified independently by Massey University as providing 3 log protozoal treatment

<sup>18</sup> The UV disinfection unit is not currently recognised as providing protozoal protection under Section 5 or 10 of the DWSNZ due to extended periods of poor water quality. The extent of protozoal removal is not readily quantifiable as the filtered UV transmittance (UVT) of the lake water can be low (eg 50-60%) for extended periods. To maximise UV dose delivery, the UV disinfection unit was selected to be significantly oversized hydraulically, being validated for 3 log protozoal credits under the USEPA at 75% UVT for flows up to 189 L/min but the flow to the unit at Kaingaroa is restricted to 37 L/min.

### 2.2.2.1 Water Supply Classification

The Kaingaroa Water Supply is classified as a neighbourhood supply (i.e., less than 100 people) under the DWSNZ.

The supply does not have appropriate protozoal treatment as per Table 10.1 in Section 10 of the DWSNZ. This means the supply is required to comply with Sections 4-9 of the DWSNZ.

### 2.2.2.2 Water Safety Plan (WSP) and Implementation

The Council is not required to have a Water Safety Plan (WSP) in place as the water supply serves less than 500 people, however it has elected to do so<sup>19</sup>.

A WSP for the scheme was approved by the Drinking Water Assessor on 5 August 2016. It includes the minimum monitoring required to be undertaken for ongoing WSP compliance and operation. This report is based on that monitoring regime.

The DWA carried out an WSP implementation audit in 2017/18 year, visiting the site on 6 December 2017 and providing a report on 8 March 2018<sup>20</sup>, and indicated subsequent on-site WSP implementation inspections are likely to be undertaken at 3 yearly intervals to determine implementation progress.

CIC has elected to not review its WSP (due for review in July 2021) due to uncertainty around the new drinking water framework and the potential for new water delivery entities. However, CCPs will be reviewed and documented as part of any WTP upgrades, with the most recent CCP documentation included in the 6 monthly report.

### 2.2.2.3 Protozoal Treatment

Appropriate treatment is required to be in place for protozoal compliance under the DWSNZ. UV disinfection would provide protozoal treatment, however the high level of dissolved organics often present in the lake water means the existing UV disinfection is not effective and also precludes chlorination due to the risk of forming disinfection by-products.

The Council has sought funding from Central Government to extend the lake intake structure into deeper water<sup>21</sup> as well as to install an activated carbon filter<sup>22</sup> and residual chlorination to address existing public health risks and enable DWSNZ compliance. Funding was secured for this work from MoH on 28 August 2020.

It is noted that whilst the current treatment process at Kaingaroa does not fully comply with the DWSNZ, prior to the upgrade it was agreed with the Ministry of Health that the current treatment process was the best practicable option to address the existing public health risks for Kaingaroa at that time.

### 2.2.2.4 Critical Control Points (CCPs)

The Council is required to have CCPs in place for its supplies. See Section 2.1.2.4 for additional information on CCPs.

Stantec and Fulton Hogan discussed potential CCPs and associated documentation for Kaingaroa with the DWA during the 2017/18 WSP Implementation Audit and subsequently developed CCP documentation for macrolite filtration as discussed. This documentation was reviewed in late 2019 based on the MOH revised water safety plan handbook<sup>23</sup>.

<sup>19</sup> The Council understood that they could demonstrate compliance for Kaingaroa water supply under section 10 of DWSNZ, which requires a WSP. However, in late 2017, the DWA considered the supply eligible for compliance this was not currently possible under Section 10.

<sup>20</sup> Summary and relevant documents provided in Stantec's 6-monthly report titled "*Water and Wastewater – Operation and Maintenance Summary Report: January 2018 – June 2018*" (see Section 2.2.2 and Appendix G)

<sup>21</sup> Extension into deeper water proposed to ensure certainty of supply for Kaingaroa, It is hoped that this will also improve raw water quality (ie not so impacted by prevailing wind altering lake level and disturbing sediments).

<sup>22</sup> Activated carbon filter proposed to remove organics and hence enable the existing UV disinfection to be effective as well as enable residual chlorination to be installed without the risk of forming disinfection by-products.

<sup>23</sup> Ministry of Health, "Handbook for Preparing a Water Safety Plan", May 2019.

The current version of the CCP documentation for macrolite filtration is provided in Appendix H.

Council has now secured funding to provide treatment at Kaingaroa to remove dissolved organics (and hence improve UV transmittance) as well as provide chlorine disinfection. Once this upgrade is fully implemented, the existing UV disinfection system and the new chlorine disinfection system will become CCPs.

### 2.2.3 Monitoring Regime

Monitoring is undertaken within the water supply for WSP compliance as well as for WTP operation as per the WSP. This monitoring is summarised in Table 3. It reflects the new DWSNZ requirement for total coliform monitoring from 1 March 2019, although it is noted the Council has been doing this voluntarily since 2013.

**Table 3: Kaingaroa Water Quality Monitoring Regime**

	Sampling Requirement		WSP Compliance		Operational Requirement	
	Frequency <sup>24</sup>	Location <sup>25</sup>	Parameter	Limit	Parameter	Target
<b>Source Compliance</b>						
Bacterial	Monthly	Raw water	-	-	E. coli	-
	Weekly		-	-	Turbidity	-
<b>Treatment Compliance</b>						
Bacterial and Protozoal	Monthly	Treated water	E. coli	<1 MPN/100mL	Total coliforms	<1 MPN/100mL
	Weekly <sup>26</sup>		Total coliforms	no limit		Turbidity
<b>Distribution Compliance</b>						
Bacterial	Monthly	Reticulation	E. coli	<1 MPN/100mL	Total coliforms	<1 MPN/100mL
			Total coliforms	no limit		

Turbidity has been analysed in the raw and treated water by on-line instruments, with values recorded manually during operator WTP visits, since 30 July 2017.

Macrolite filtration is a CCP, with documentation provided in Appendix H. It is not clear at this time if CCP monitoring will comprise part of the new DWSNZ requirements.

### 2.2.4 Monitoring Results

Table 4 summarises the monitoring results from the reporting period in the context of DWSNZ compliance and operational requirements as per the approved WSP.

<sup>24</sup> Maximum interval for parameters monitored monthly is 45 days and weekly is 11 days. Kaingaroa Water Supply is exempt from sampling on a minimum number of days of the week due to logistics of transporting samples to laboratory.

<sup>25</sup> Manual sampling locations are: raw water - at the WTP, before the multimedia filter; treated water - at the WTP after the treated water reservoirs, before entering the reticulation; reticulation - one of two locations within the reticulation (Club, North Whaitiri), with location alternating each month. Turbidity sampling locations at the WTP are prior to multimedia filter (raw water) and after the softener but prior to the UV disinfection

<sup>26</sup> Turbidity analysed continuously in raw and treated water by on-line instruments. Continuous dataset is not able to be downloaded. Displayed value is manually recorded each time the operator visits the site (at least once a week).

Table 4: Kaingaroa Water Monitoring Results For Reporting Period

	DWSNZ Compliance	Operational Requirement
<b>Source</b>		
Bacterial		E.coli and total coliforms: All required raw water samples analysed. E.coli detected in the majority of samples and total coliforms detected in all raw water samples. Typical for surface water source.
<b>Treatment</b>		
Bacterial and protozoal	E. coli: All required treated water samples analysed. No E. coli detected. Total coliforms: All required treated water samples analysed. No limit.  Non-compliant as inadequate treatment in place. (Note: weekly sampling of treated water required under section 4; WSP requires monthly sampling)  Note: MoH funding secured to upgrade treatment process	Total coliforms: All required treated water samples analysed. Reduction seen through treatment process.  Turbidity: All treated water results recorded less than operational limit. Adequate solids removal through filters.
<b>Distribution</b>		
Bacterial	E.coli: All required samples analysed. No E. coli detected.  Compliant.	Total Coliforms: All required samples analysed. No total coliforms detected.

To better understand the state of the environment, Environment Canterbury analyse water from Lake Rangitai (i.e. raw water source) four times a year for range of parameters. The available data from 2005 to the end of this reporting period is provided in Appendix C to augment the raw water quality data obtained as part of the water supply monitoring.

Based on the raw water quality data during this reporting period, the water at Lake Rangitai generally falls within the range observed since 2005, nutrients (nitrogen and phosphorus), conductivity and salinity were typically at the upper end of this range. Ongoing monitoring is required to understand if this reflects the extended period of low lake levels seen during this period or a deterioration in health of Lake Rangitai. Dissolved organic carbon reported on 11/12/20 was significantly lower than the normal range observed since 2005 and may not accurately reflect typical water quality.

### 2.2.5 Key Maintenance Works

Key maintenance and one-off works undertaken in the reporting period over and above routine works allowed for in the lump sum prices for the O&M Contract are summarised in Appendix A.

### 2.2.6 Water Demand Management

There is a flow meter downstream of the UV reactors that records totalised flow. Manual recording of the totalised daily flow by the WTP Operator commenced on 30 July 2016.

The maximum daily flow observed during this reporting period was 30 m<sup>3</sup>/day, with the daily flows typically being between 6 and 20 m<sup>3</sup>/day.

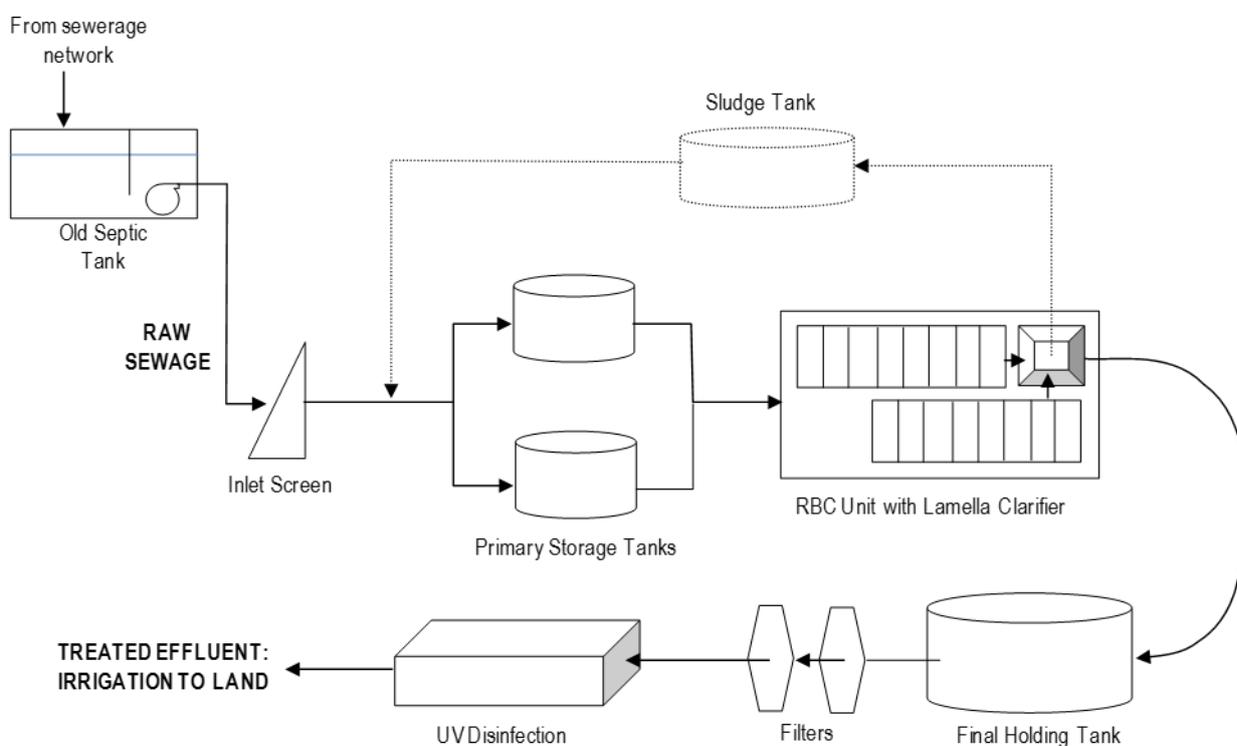
The average daily flow for this reporting period was 13 m<sup>3</sup>/day. Based on a population of 60 people, this equates to an average usage of 217 L/person/day. This is similar to the previous reporting period.

## 3.0 WAITANGI WASTEWATER SCHEME

### 3.1 PROCESS OVERVIEW

Raw wastewater is collected from the Waitangi Township via a reticulated sewer network and pumped to the Waitangi Wastewater Treatment Plant (WWTP). At the WWTP (Figure 1), wastewater passes through an inlet screen into two flow balancing tanks, prior to being pumped to the Rotating Biological Contactor (RBC) unit for biological treatment and clarification. In the clarification section of the RBC unit, particles in the wastewater settle to the bottom, while the clarified liquid continues through into the final holding tank. The settled particles from the clarifier are pumped to a waste sludge tank, which is periodically cleaned, and the accumulated sludge is disposed of, either to landfill or buried on site and supernatant is returned to the inlet.

From the final holding tank, the wastewater is pumped via the irrigation pump through two filters to further reduce the suspended solids before entering the UV unit. The UV unit requires low suspended solids to ensure effective transmittance of UV light through the wastewater. The UV disinfects the wastewater, which is then irrigated to land at the WWTP site.



**Figure 1: Waitangi Wastewater Treatment Plant Schematic**

Remedial work is urgently required at the WWTP. Central Government funding to progress these works was secured through a mixture of Ministry of Health (MoH) and 3 Waters Stimulus Funding packages in late 2020; urgent remedials on the pump station and RBC were carried out in November-December 2020. Other works are planned in 2021.

#### 3.1.1 Resource Consent Requirements and Monitoring

There are three resource consents for the Waitangi WWTP; discharge of treated wastewater to land, discharge of contaminants to air, and discharge of contaminants into groundwater from monitoring bores. The first of these consents has monitoring and reporting requirements and the second has reporting requirements. All three consents were granted on 25 February 2005 for a period of 35 years (i.e. expire in 2040).

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The current monitoring regime, including both resource consent requirements and operational requirements, is summarised in Table 1. As noted in the table, the current monitoring regime departs slightly from that outlined in the resource consent. For the purpose of this report, the WWTP operation is considered to comply with the resource consent if the consent limits given in the fourth column of Table 1 are not exceeded.

**Table 1: Wastewater Monitoring Regime**

Sampling Location	Sampling Frequency <sup>1</sup>	Parameter	Consent Limit <sup>2</sup>	Operational Target	Comment
UV Reactor	Continuous (online)	UV intensity	-	-	Review data weekly
Treated Wastewater, prior to land discharge	Monthly <sup>1</sup>	TSS	25 mg/L	-	
		Ammonia N	25 mg/L	-	Consent limit of 30 mg/L for total nitrogen, assumed ammonia N limit informally adopted post consent award for compliance Consent also requires nitrate monitoring but no consent limit and not done
		Total COD	75 mg/L	-	Consent limit of 25 mg/L for BOD, assumed total COD limit informally adopted post consent award for compliance
		E. coli	500 cfu/100mL	-	
		Total Coliforms	-	-	Monitored but no consent limit or operational target
		pH	-	6-9	
		Electrical conductivity	-	<200 mS/m	
Discharge Meter	Daily	Volume	126 m <sup>3</sup> /d	-	Maximum daily volume
Irrigation Area	Daily	Irrigation depth	5mm	-	Average to individual irrigation area over 5 consecutive days
		Irrigation depth	8mm	-	Maximum depth of single application

**Note**

- 1 Consent requires two monthly sampling but monthly sampling is done for WWTP operation
- 2 All limits and targets are annual medians unless stated otherwise in column titled "comment"

In addition to the monitoring departures given in Table 1, the following monitoring is required under the consent but is not currently undertaken.

- Groundwater in bores upstream and downstream of the site twice annually for E. coli and nitrate nitrogen (Condition 15). This has not been carried out to date as groundwater is typically not seen in

the bores. Surface water was sampled on some occasions, but it is not an appropriate surrogate due to potential contamination from other sources (e.g., stock).

- Soil layers in the irrigation area once every two years for total phosphorous, major exchangeable ions, pH and conductivity (Condition 17). This has not been carried out. Existing treated wastewater discharge has appeared to enhance growth of vegetation in land application area.

We recommend that:

- Council re-request that Environment Canterbury review the appropriateness of the existing consent conditions and advise the Council whether an application to amend the consent conditions should be lodged so that the monitoring being carried out is consistent with consent requirements. Part of the Council's 3 Waters Stimulus funding package has been allocated to varying the existing resource consent conditions to address these matters.

### **3.1.1.1 UV Performance**

The WWTP Operator monitors the UV intensity and any UV disinfection system alarms as part of the routine WWTP operational inspection carried out at least once a week. The UV lamps are cleaned as required (e.g., on or prior to a low UV intensity alarm). The UV lamps were replaced during the annual service in November 2020.

### **3.1.1.2 Treated Wastewater Quality**

The treated wastewater quality data available since 2008 are provided in Appendix E with the results from this reporting period shaded grey. Both RBCs were operating during the reporting period. All required treated water samples were collected and analysed for the required parameters during this reporting period.

Overall, the monitoring of the treated wastewater carried out during the reporting period shows:

- Compliance with the annual TSS and COD consent median limits during the reporting period.
- Non-compliance with the annual nitrogen and E. coli consent limits during the reporting period. Continuing factors include increased influent nitrogen loads from increased domestic tourists, seen due to COVID-19 international travel restrictions, large quantity of sludge build-up (removed in November-December 2020), as well as the UV lamps being at or near the end of useful life during the majority of the reporting period (replaced Nov 2020). It is also noted the WWTP was not designed for ammonia reduction and so the operators have no ability to control the reduction achieved at the WWTP.
- It is noted that the land application system will further reduce TSS, COD, ammonia, and E.coli prior to reaching groundwater, particularly now that the sprinklers have been maintained and have been moved further from the property boundary (carried out in November 2020).

MoH funding has been used to carry out urgent remedial work on the pump station and the RBC in November-December 2020. Part of the Council's 3 Waters Stimulus funding package (Tranche 1) will be used to carry out urgent remedial works, extend the land application system and design a new WWTP to located at the same site in 2021. Collectively these works will go some way to addressing consent non-compliance and/or mitigating any adverse environmental effects associated with the treated wastewater discharge. The design is being carried out in anticipation of additional funding being available via Tranche 2 of the 3 Waters Stimulus funding.

### **3.1.1.3 Treated Wastewater Volume and Irrigation Rate**

Appendix E (Figure E-8) shows the daily volume of treated wastewater discharged from the WWTP to the land irrigation area since 2008, with this reporting period shaded grey. The irrigation flow meter became dysfunctional on 4 March 2019. New flow meter was installed and operational from 25<sup>th</sup> September 2019, with data available from this day onwards.

The daily volume did not exceed the consent limit of 126 m<sup>3</sup>/day during this reporting period.

Data required to assess the average and maximum irrigation rates, including size frequency of dosing to individual areas and irrigation volume, was not available for this reporting period. This information would enable a comparison with the consented limits.

### 3.1.1.4 Complaints Received

The Council has received a written public complaint about the operation of the wastewater system in relation to concern about treated wastewater run-off from the land application system into the adjacent property. This follows previous complaints from the same landowner about the same issue.

Stantec and Fulton Hogan have identified options to mitigate surface water ponding and runoff associated with the land application system. The Council included an allowance for this work in its Long Term Plan (LTP), however until recently had been unsuccessful in securing funding for this work.

In this reporting period the Council has secured funding to carry out urgent works to mitigate this issue, and subsequently engaged a local nursery to propagate appropriate vegetation to absorb water and the dilapidated boundary fence has been replaced – this was required to prevent farm animals in the neighbouring property from eating any new vegetation that will be planted. Planting will be carried out in 2021 when plants are mature enough. Following a site visit in November 2020 by Stantec wastewater engineers, the irrigation pipework has been repaired and irrigators have been relocated to increase effective area of irrigation (and hence minimise runoff).

The Council has also allocated part of its 3 Waters Stimulus funding to design and construct an extended land application system, which will go further to mitigating this issue. In November 2020, Stantec wastewater engineers collected information to prepare an accurate as-built plan of the existing land application system and carried out a site and soil investigation to inform the design of the extended land application system. Design is anticipated to be completed in mid-2021 and construction planned for summer 2021/22.

### 3.1.1.5 Summary

Table 2 summarises the monitoring results from the reporting period in the context of consent compliance and operational requirements.

**Table 2: Waitangi Wastewater Monitoring Results for Reporting Period**

Item	Consent Compliance	Operational Requirement
UV intensity	UV intensity and UV alarms reviewed several times a week.	
Treated wastewater Quality	Annual median TSS and COD less than or equal to the limit at end of reporting period. Annual median ammonia and E. coli exceeded limit at end of reporting period.  Note: 3 Waters Tranche 1 funding secured to carry out urgent remedial works at WWTP and design a new WWTP for the site in anticipation of additional funding via Tranche 2.	Electrical conductivity and pH within operational targets. No target for total coliforms.
Treated wastewater volume	All daily flows recorded less than the limit.	
Irrigation Rate	Insufficient data to determine irrigation rates for reporting period.	
Complaints Log	Council received a written public complaint in relation to concern about treated wastewater run-off from the land application system into the adjacent property.	

Item	Consent Compliance	Operational Requirement
	<p>No other operational or odour complaints from public.</p> <p>Note: Appropriate plants are being propagated locally; once mature they will be planted to mitigate surface water ponding/runoff from land application system. 3 Waters Tranche 1 funding secured to extend land application system to further mitigate issue.</p>	

### 3.1.2 Key Maintenance Works

Key maintenance and one-off works undertaken in the reporting period over and above routine works allowed for in the lump sum prices for the O&M Contract are summarised in Appendix A.

## 4.0 CONCLUSION AND RECOMMENDATIONS

Key findings and recommended actions for this reporting period are summarised below.

Scheme	Key findings	Recommended actions	Progress
Waitangi Water	<ul style="list-style-type: none"> <li>Non-complying with Drinking-water Standards for New Zealand, primarily due to inadequate treatment.</li> <li>Despite this, no E. coli detected in raw, treated or reticulated water.</li> </ul>	<ul style="list-style-type: none"> <li>Urgently replace existing, dysfunctional UV disinfection system.</li> </ul>	<ul style="list-style-type: none"> <li>MoH funding for new UV secured, site visit carried out with supplier Nov 2020, design is in progress.</li> </ul>
Kaingaroa Water	<ul style="list-style-type: none"> <li>Non-complying with Drinking-water Standards for New Zealand, primarily due to poor water intake and inadequate treatment.</li> <li>Despite this, no E. coli was detected in treated or reticulated water.</li> </ul>	<ul style="list-style-type: none"> <li>Urgently extend water intake into deeper water and upgrade treatment process to include organics removal and chlorination.</li> </ul>	<ul style="list-style-type: none"> <li>MoH funding for intake and WTP upgrade secured, site visit carried out with contractor Nov 2020, design is in progress.</li> </ul>
Waitangi Wastewater	<ul style="list-style-type: none"> <li>Non-complying with resource consent, primarily due to elevated nitrogen and E. coli.</li> <li>Complying with solids and organics limits.</li> </ul>	<ul style="list-style-type: none"> <li>Urgently carry out various remedial works on wastewater scheme.</li> </ul>	<ul style="list-style-type: none"> <li>MoH funding for critical repairs secured, remedials carried out in Nov-Dec which should improve compliance.</li> <li>3 Waters Stimulus funding secured for improvement works (planning and construction) site visit carried out with contractor Nov 2020.</li> </ul>

Overall, the water and wastewater schemes urgently require remedial or upgrade works to address substantial limitations, meet current best practice and achieve compliance. Central Government Funding to progress these works has been secured through a mixture of MoH and 3 Waters Stimulus Funding (Tranche 1) packages in late 2020, with work in progress and the majority due to be completed in 2021. Some design is being carried out under Tranche 1 in anticipation of additional funding being available via Tranche 2 of the 3 Waters Stimulus funding.

# Appendices

## Appendix A CONTRACT MEETINGS AND DAYWORKS

### Chatham Islands Water & Wastewater Maintenance Contract Meeting Record

Record of monthly contract meeting for November/December 2020.

Present: Richard Bennett, Kirsten Norquay, Bill Lind

Water and Wastewater update – November and December 2020	
Contract Documentation	
Project:	Current Status:
<b>Water Compliance</b>	<ul style="list-style-type: none"> <li>Health (Drinking Water) Amendment Act 2019 came into force 1 August 2019. All suppliers now <u>must</u> comply with the DWSNZ (rather than take all practicable steps).</li> <li>Drinking-water Standards for New Zealand 2005 (revised 2018), DWSNZ, came into force on 1 March 2019. Both water supplies are currently non-complying with DWSNZ primarily due to inadequate treatment barriers being in place. Stantec, in consultation with FH and CIC, has identified required upgrade works and funding is now available through a mixture of sources (MoH and 3 Waters Reform). CIC also needs to carry out a catchment log credit assessment for both supplies and radiological testing for Tikitiki bore water.</li> <li>Further revisions to the DWSNZ are expected to be made in 2021.</li> <li>Revised Water Safety Plan (WSP) framework was released in December 2018. The current WSPs, which require reviewing by June 2021, need substantial revision to comply with the new framework. However, new requirements for WSPs as well as for source water management are expected in 2021, along with revised timeframes for implementation. Currently, WSPs are not mandatory as each supply serves less than 500 people (unless CIC elects to comply with DWSNZ via section 10), and so CIC has elected to not review its WSPs at this stage.</li> </ul>
Water Supply	
Project:	Current Status:
<b>All Supplies – Funding and Site Visit</b>	<ul style="list-style-type: none"> <li>MoH have provided a signed contract to provide funding of \$339,900.01 for urgent priority works. There is insufficient funding to undertake all urgent works.</li> <li>Council has signed the Memorandum of Understanding (MoU) for the three waters reform, which gives access to \$320k for three waters work not committed in this year's annual plan. The Canterbury Councils have agreed to pro-rata share the regional allocation of funds, which gives access to a further \$320k (ie \$640k in total). <b>The Delivery Plan for the \$640k expenditure prepared by Stantec and submitted by CIC has now been approved.</b> First payment (\$320k) will follow, with the balance paid in quarterly payments over 2021 calendar year.</li> <li>If funding is secured for the proposed Waitangi water supply upgrade, the preliminary design will need to be reviewed against the DWSNZ current at that time. (Noting further investigations are required to confirm the bore supply at the MPA site is sustainable).</li> <li><b>Stantec carried out a site visit on week of 23 November. This visit coincided with Filtec's annual service visit of the water treatment plants as well as Steve Riley's annual service visit of the wastewater treatment plant. Several matters that need addressing were identified by Stantec, Filtec and Steve Riley.</b></li> </ul>
<b>Kaingaroa – Lake Rangitai</b>	<ul style="list-style-type: none"> <li>A boil water notice is to be put in place prior to intake trench reinstatement work being undertaken as previous reinstatement saw elevated E.coli in the treated water.</li> <li>Pegs to hold down the rising main have arrived on the island. <b>No change.</b></li> <li><b>Stantec are progressing a specification for the new intake pipeline.</b></li> </ul>

## Water and Wastewater update – November and December 2020

<p><b>Waitangi water supply upgrade</b></p>	<ul style="list-style-type: none"> <li>• Assessment of the MPA bore test results indicates that the maximum yield of the MPA bore is reducing, and therefore is not suitable as the new source for the drinking water supply upgrade. From a water supply perspective, the current bore site is the optimum location as it will enable utilisation of the existing treated water storage tanks and will enable conveyance of treated water around the network including extension to Te One without any requirement for a booster pumping system. Following review of historical reports, the Stantec hydrogeologist has concluded that it is worthwhile to install a larger and slightly deeper bore at the MPA site. Stantec have confirmed that the design flowrates derived during the preliminary design phase generally align with the Airport Business Case population growth projections. <b>Stantec have prepared a specification to drill a new bore and contacted McMillan’s, Webster’s and Washington’s Explorations. Quotes have come in significantly higher than budgeted. Stantec to review way forward.</b></li> <li>• CIC to consider introduction of rules for enforcement of repairs within a certain timeframe to minimise loss of water and ensure the supply network can be maintained. Ongoing.</li> <li>• CIC to consider whether charges are applied for taking water from the FH yard and/or if water is only able to be taken during hours when the yard is manned (ie locked at other times). Ongoing.</li> <li>• CIC to consider procurement options as detailed in the Waitangi water supply upgrade preliminary design report – ON HOLD pending resolution of the above.</li> </ul>
<p><b>Reporting/ Monitoring/ Sampling November 2020.</b></p> <p><b>December results will be reported on in January.</b></p>	<p><b>All water supplies are now non-complying with the amended DWSNZ <u>and</u> revised Health Act.</b></p> <ul style="list-style-type: none"> <li>• <b>Waitangi Water Supply</b> <ul style="list-style-type: none"> <li>○ Complies with WSP for bacteria (E.coli not detected in raw, treated or network sample).</li> <li>○ Non-compliance with DWSNZ for protozoa as existing UV disinfection inadequate. <b>NB: Treatment upgrades required to comply with DWSNZ will be done using MoH funding.</b></li> <li>○ Total coliforms not detected in raw, treated or network sample. (NB: Low levels were detected in raw water in May, June, July and August 2019, in treated water in December 2019 and in network in January 2020 which is atypical for Waitangi).</li> <li>○ Raw and treated water turbidity satisfactory (&lt;0.1 NTU and &lt;0.2 NTU respectively).</li> </ul> </li> <li>• <b>Kaingaroa Water Supply</b> <ul style="list-style-type: none"> <li>○ Complies with WSP for bacteria (E.coli not detected in treated or network sample).</li> <li>○ Non-compliance with DWSNZ for protozoa, however consistent with approved WSP. <b>NB: Treatment upgrades required to comply with DWSNZ will be done using MoH funding (subject to DWA confirmation on catchment).</b></li> <li>○ Total coliforms not detected in treated or network sample.</li> <li>○ Total coliforms and E.coli detected in raw water as expected with lake water source, but at no higher levels than normal. E.coli not detected this month. <b>NB: Intake will be extended into deeper part of lake using MoH funding.</b></li> </ul> </li> <li>• <b>MPA Batching Bore (Potential Future Water Supply)</b> <ul style="list-style-type: none"> <li>○ MPA bore no longer in operation (or sampled). See June 2018 monthly update for results and conclusions.</li> </ul> </li> </ul>

Water and Wastewater update – November and December 2020	
Project:	Current Status:
<p><b>WWTP maintenance</b></p>	<ul style="list-style-type: none"> <li>• <b>Replacement of the corroded balance tanks and repairs required to address oil leaking from gearbox. Estimate has been received from Steve Riley. Work to be undertaken within MoH funding though this may not be sufficient to replace the corroded balance tanks. In progress.</b></li> <li>• <b>The duty WWTP feed pump at the septic tank site requires replacement. A new pump has been delivered and will be installed next month. Faulty check valves to be replaced. Faulty check valves have been replaced by Steve Riley as part of the annual servicing.</b></li> <li>• <b>FH/Stantec have received an updated estimate for supply of plants / trees, which has been approved by CIC. FH has placed the order for the planting. NB: Funding will be available to extend land application system through 3 Waters stimulus package</b></li> <li>• <b>FH has completed fencing work to make the fence line stockproof. This is required prior to undertaking planting work in the land application area</b></li> </ul>
<p><b>Reporting/ Monitoring/ Sampling November 2020</b></p> <p><b>December results will be reported on in January.</b></p>	<ul style="list-style-type: none"> <li>• <b>Waitangi Treated Wastewater Discharge</b> <ul style="list-style-type: none"> <li>○ <b>The treated wastewater exceeded the consented annual median limits for all parameters this month. This is atypical and is likely to be a combination of: large quantity of sludge build-up (being addressed), additional tourist numbers, urgent need for WWTP maintenance (will be addressed in part by works planned in 2021). It is noted that the land application system will further reduce TSS, COD, ammonia and E.coli prior to reaching groundwater, particularly now that the sprinklers have been maintained and have been moved further from the property boundary.</b></li> </ul> </li> </ul>
General	
	<ul style="list-style-type: none"> <li>• <b>Rfl and LTP needs progressing in December and January.</b></li> </ul>

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**Table A-1 Approved Day works Items**

Scheme	Date	Comment
Waitangi WWTP	July 2020	Pump replacement Tiki Tiki.
Kaingaroa/Waitangi WTP	November 2020	Filtec annual maintenance and servicing, coinciding with site visit by Stantec
Waitangi WTP	July 2020	Repair bore pump cable
Waitangi WTP	July 2020	Repair chlorine dosing pump plug.
Kaingaroa/Waitangi WTP	August 2020	Water leak repair
Waitangi WWTP	September 2020	WWTP fencing & planting. Clearing gorse from new fence line.
Waitangi WWTP	September 2020	Blockage. Water blaster used.
Kaingaroa/Waitangi WTP	September 2020	Materials for annual servicing purchased (Filtec)
Waitangi WWTP	October 2020	Main sewer PS electrical fault
Kaingaroa WTP	October 2020	Diesel for Kaingaroa Pump
Kaingaroa WTP	November 2020	Dig out Kaingaroa Intake.
Waitangi WWTP	November 2020	Annual WWTP Service, coinciding with site visit by Stantec. Six UV lamps installed.
Waitangi WWTP	December 2020	Replace check valves Main PS.
Waitangi WWTP	November – December 2020	Sludge removal from WWTP

Note: These are items over and above those allowed for in lump sum prices in Operation and Maintenance contract.

**Table A-2 Additional Works Carried out by Stantec**

Scheme	Date	Comment
All Schemes	Aug-Sep 2020	Liase with MoH and secure funding. Develop Delivery Plan for 3Waters Stimulus Funding.
	Nov-Dec 2020	Site visit by Stantec water and wastewater engineers Co-ordinate and prepare Request for Information Response for 3 waters Reform & Canterbury Mayoral Forum

## Appendix B WAITANGI WTP DATA

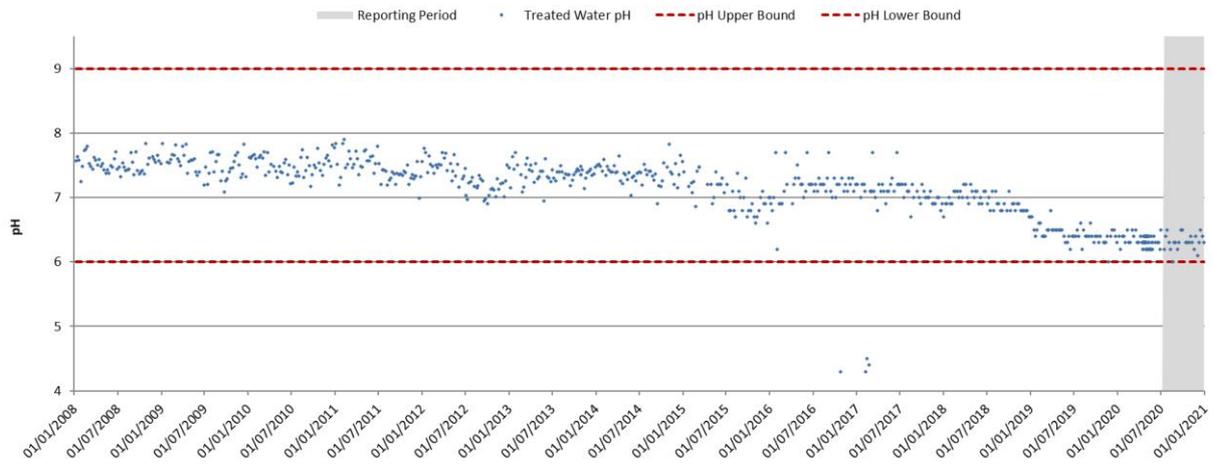


Figure B-1 Waitangi Water pH Data from January 2008

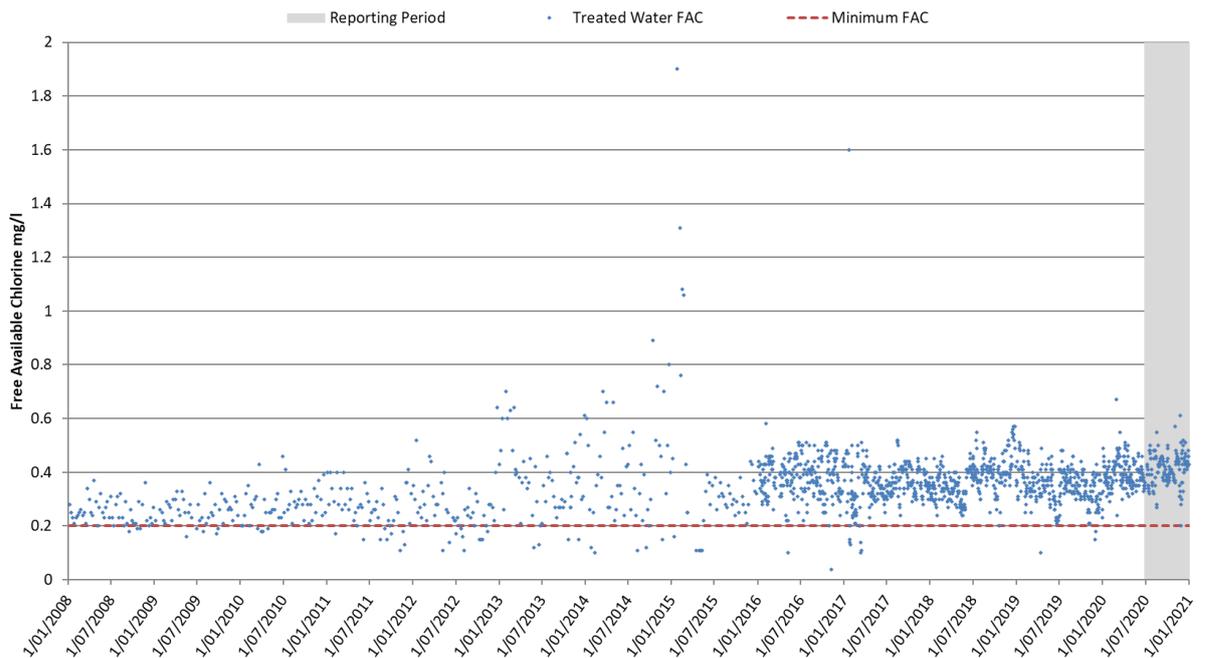
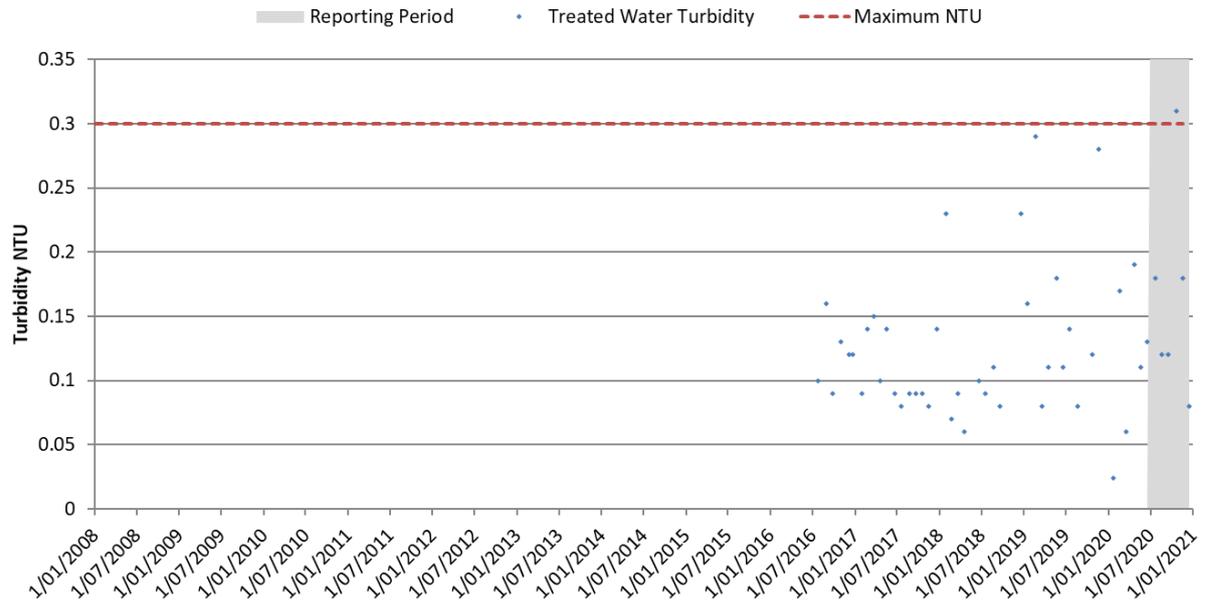


Figure B-2 Waitangi Water FAC Data from January 2008

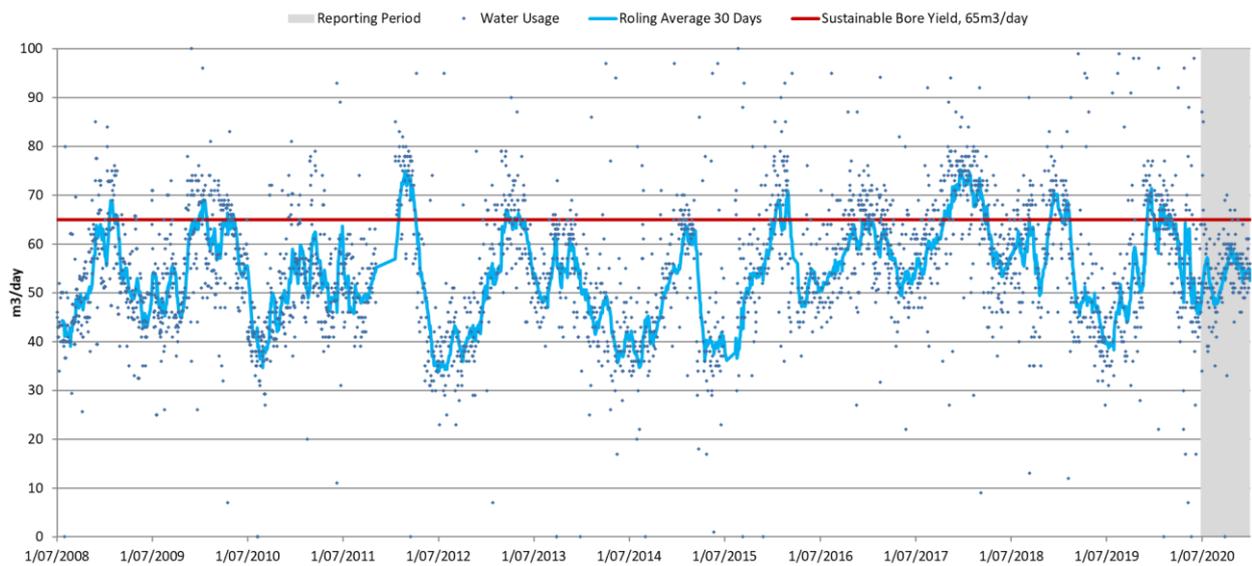
(Note: Result on 3 January 2016 of 6.32 mg/L not shown)

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Appendix B Waitangi WTP Data



**Figure B-3 Waitangi Treated Water Turbidity Data from January 2008**



**Figure B-4 Tikitiki Bore Meter Readings from July 2008**

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Appendix B Waitangi WTP Data

**Table B-1 Waitangi WTP Microbiological Data From 2008**

Date of Sampling	Days between samples	E.coli (MPN/ 100mL)			Date of Sampling	Days between samples	Total Coliforms (MPN/100mL)		
		Raw	Treated	Reticulation			Raw	Treated	Reticulation
01/02/2008		<1		<1					
26/02/2008	25	<1		<1					
25/03/2008	28	<1		<1					
27/05/2008	63	<1		<1					
01/07/2008	35	<1		<1					
29/09/2008	90	<1		<1					
29/10/2008	30	<1		<1					
25/11/2008	27	<1		<1					
23/12/2008	28	<1		<1					
27/01/2009	35	<1		<1					
24/02/2009	28	<1		<1					
31/03/2009	35	<1		<1					
30/04/2009	30	<1		<1					
29/05/2009	29	<1		<1	29/09/2008			<1	
30/06/2009	32	<1		<1	29/10/2008	30	<1	<1	<1
30/07/2009	30	<1		<1	25/11/2008	27	<1	<1	<1
27/08/2009	28	<1		<1	23/12/2008	28	<1	<1	<1
29/09/2009	33	<1	<1		27/01/2009	35	<1	<1	<1
29/10/2009	30	<1	<1		24/02/2009	28	<1		<1
24/11/2009	26	<1	<1		31/03/2009	35	<1		<1
22/12/2009	28	<1	<1		30/04/2009	30	<1		<1
26/01/2010	35	<1	<1		29/05/2009	29	<1		<1
23/02/2010	28	<1	<1	<1	30/06/2009	32	<1		<1
30/03/2010	35	<1	<1		30/07/2009	30	<1		<1
27/04/2010	28	<1	<1		27/08/2009	28	<1		<1
28/05/2010	31	<1			29/09/2009	33	<1		
29/06/2010	32	<1	<1	<1	29/10/2009	30	<1		
20/07/2010	21	<1	<1		24/11/2009	26	<1		
27/07/2010	7	<1			22/12/2009	28	<1		
04/08/2010	8	<1			26/01/2010	35	<1		
10/08/2010	6	<1			23/02/2010	28	<1	1	<1
17/08/2010	7	<1			30/03/2010	35	<1	<1	
24/08/2010	7	<1			27/04/2010	28	<1	<1	
02/09/2010	9	<1	<1	<1	28/05/2010	31	<1		
07/09/2010	5	<1			29/06/2010	32	<1	<1	
14/09/2010	7	<1							
21/09/2010	7	<1			27/07/2010			<1	
28/09/2010	7	<1	<1		02/09/2010	37	<1	<1	<1
05/10/2010	7	<1			28/09/2010	26		<1	
12/10/2010	7	<1			02/11/2010	35	1	<1	
02/11/2010	21	<1	<1		30/11/2010	28	<1	<1	
30/11/2010	28	<1	<1		29/12/2010	29	<1	<1	<1
29/12/2010	29	<1	<1	<1	02/02/2011	35	<1	<1	<1
02/02/2011	35	<1	<1	<1	01/03/2011	27	<1	<1	
01/03/2011	27	<1	<1	<1	26/04/2011	56	<1	<1	<1
26/04/2011	56	<1	<1	<1	31/05/2011	35	<b>38</b>	<1	<b>1</b>
31/05/2011	35	<1	<1	<1	07/06/2011	7	<b>&gt;201</b>	<1	<1
07/06/2011	7	<1	<1	<1	14/06/2011	7	<b>4</b>		
14/06/2011	7	<1	<1	<1	28/06/2011	14	<b>1</b>	<b>1</b>	<1
28/06/2011	14	<1	<1	<1	05/07/2011	7	<1	<1	
05/07/2011	7	<1	<1	<1	27/07/2011	22	<1	<1	<1
27/07/2011	22	<1	<1	<1	30/08/2011	34	<1	<1	<1
30/08/2011	34	<1	<1	<1	15/09/2011	16	<1	<1	
15/09/2011	16	<1	<1	<1	27/09/2011	12	<1	<1	<1
27/09/2011	12	<1	<1	<1					

\* Reticulation samples taken from following locations: Works Yard, Wilson Place, Council House

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Appendix B Waitangi WTP Data

**Table B-1 Waitangi WTP Microbiological Data (Continued)**

Date of Sampling	Days between samples	E.coli (MPN/ 100mL)			Date of Sampling	Days between samples	Total Coliforms (MPN/100mL)		
		Raw	Treated	Reticulation			Raw	Treated	Reticulation
05/10/2011	8	<1	<1		05/10/2011	8	<1	<1	
11/10/2011	6	<1	<1		11/10/2011	6	<1	<1	
25/10/2011	14	<1	<1	<1	25/10/2011	14	<1	<1	<1
29/11/2011	35	<1	<1	1	29/11/2011	35	9	<1	1
06/12/2011	7	<1	<1	<1	06/12/2011	7	<1	<1	<1
20/12/2011	14	<1	<1	<1	20/12/2011	14	2	<1	<1
31/01/2012	42	<1	<1	<1	31/01/2012	42	<1	<1	1
07/02/2012	7	<1	<1		07/02/2012	7	<1	<1	
29/02/2012	22	<1	<1	<1	29/02/2012	22	<1	<1	<1
27/03/2012	27	<1	<1		27/03/2012	27	<1	<1	<1
24/04/2012	28	<1	<1	<1	24/04/2012	28	<1	<1	>201
08/05/2012	13			<1	08/05/2012	14			<1
29/05/2012	21	<1	<1		29/05/2012	21	<1	<1	<1
26/06/2012	28	<1	<1	<1	26/06/2012	28	<1	<1	<1
31/07/2012	35	<1	<1	<1	31/07/2012	35	<1	<1	<1
28/08/2012	28	<1			28/08/2012	28	<1		
25/09/2012	28	<1			25/09/2012	28	<1		
30/10/2012	35	<1			30/10/2012	35	<1		
27/11/2012	28	<1			27/11/2012	28	<1		
18/12/2012	21	<1	<1	<1	18/12/2012	21	<1	<1	<1
29/01/2013	42	<1	<1	<1	29/01/2013	42	<1	<1	1
12/02/2013	14			1	12/02/2013	14			2
19/02/2013	7			<1	19/02/2013	7			<1
26/02/2013	7	<1	<1	<1	26/02/2013	7	<1	<1	<1
26/03/2013	28	<1	<1	<1	26/03/2013	28	<1	<1	<1
30/04/2013	35	<1	<1	<1	30/04/2013	35	NT	<1	<1
29/05/2013	29	<1	<1	<1	29/05/2013	29	<1	<1	<1
25/06/2013	27	<1	<1	<1	25/06/2013	27	<1	<1	<1
30/07/2013	35	<1	<1	<1	30/07/2013	35	<1	<1	<1
27/08/2013	28	<1	<1	<1	27/08/2013	28	<1	<1	<1
24/09/2013	28	<1	<1	<1	24/09/2013	28	<1	<1	<1
29/10/2013	35	<1	<1	<1	29/10/2013	35	<1	<1	<1
26/11/2013	28	<1	<1	<1	26/11/2013	28	<1	<1	<1
17/12/2013	21	<1	<1	<1	17/12/2013	21	<1	<1	<1
28/01/2014	42	<1	<1	<1	28/01/2014	42	<1	<1	<1
25/02/2014	28	2	<1	<1	25/02/2014	28	5	<1	<1
04/03/2014	7	<1	<1	NT	04/03/2014	7	4	<1	NT
11/03/2014	7	<1		NT	11/03/2014	7	<1		NT
25/03/2014	14	<1			25/03/2014	14	<1		
29/04/2014	14	>201	<1	<1	29/04/2014	14	<1	<1	<1
06/05/2014	7	<1	<1	NT	06/05/2014	7	<1	<1	NT
28/05/2014	22	<1	<1	<1	28/05/2014	22	<1	<1	<1
24/06/2014	27	<1	<1	<1	24/06/2014	27	<1	<1	<1
29/07/2014	35	<1	<1	<1	29/07/2014	35	<1	<1	<1
26/08/2014	28	<1	<1	<1	26/08/2014	28	<1	<1	<1
30/09/2014	35	<1	<1	<1	30/09/2014	35	<1	<1	<1
28/10/2014	28	<1	<1	<1	28/10/2014	28	<1	<1	<1
02/12/2014	35	<1	<1	<1	02/12/2014	35	<1	<1	<1
23/12/2014	21	<1	<1	<1	23/12/2014	21	<1	<1	<1
27/01/2015	35	<1	<1	<1	27/01/2015	35	<1	<1	<1
24/02/2015	28	<1	<1	<1	24/02/2015	28	<1	<1	<1
31/03/2015	35	<1	<1	<1	31/03/2015	35	<1	<1	<1
28/04/2015	28	<1	<1	<1	28/04/2015	28	<1	<1	<1
26/05/2015	28	<1	<1	<1	26/05/2015	28	<1	<1	<1
7/07/2015	42	<1	<1	<1	7/07/2015	42	<1	<1	<1
28/07/2015	21	<1	<1	<1	28/07/2015	21	<1	<1	<1
25/08/2015	28	<1	<1	<1	25/08/2015	28	<1	<1	<1
29/09/2015	35	<1	<1	<1	29/09/2015	35	<1	<1	<1
27/10/2015	28	<1	<1	<1	27/10/2015	28	<1	<1	<1
24/11/2015	28	<1	<1	<1	24/11/2015	28	<1	<1	<1

\* Reticulation samples taken from following locations: [Works Yard](#), [Wilson Place](#), [Council House](#)

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Appendix B Waitangi WTP Data

**Table B-1 Waitangi WTP Microbiological Data (Continued)**

Date of Sampling	Days between samples	E.coli (MPN/ 100mL)			Date of Sampling	Days between samples	Total Coliforms (MPN/100mL)		
		Raw	Treated	Reticulation			Raw	Treated	Reticulation
26/01/2016	35	<1	<1	<1	26/01/2016	35	<1	<1	<1
23/02/2016	28	<1	<1	<1	23/02/2016	28	<1	<1	<1
29/03/2016	35	<1	<1	<1	29/03/2016	35	<1	<1	<1
26/04/2016	28	<1	<1	<1	26/04/2016	28	<1	<1	<1
31/05/2016	35	<1	<1	<1	31/05/2016	35	<1	<1	<1
5/07/2016	35	<1	<1	<1	5/07/2016	35	<1	<1	<1
26/07/2016	21	<1	<1	<1	26/07/2016	21	<1	<1	<1
30/08/2016	35	<1	<1	<1	30/08/2016	35	<1	<1	<1
27/09/2016	28	<1	<1	<1	27/09/2016	28	<1	<1	<1
1/11/2016	35	<1	<1	<1	1/11/2016	35	<1	<1	<1
6/12/2016	35	<1	<1	<1	6/12/2016	35	<1	<1	<1
30/12/2016	24	<1	<1	<1	30/12/2016	24	<1	<1	<1
31/01/2017	32	<1	<1	<1	31/01/2017	32	<1	<1	<1
31/01/2017	0	Na	Na	<1	31/01/2017	0	Na	Na	1
21/02/2017	21	<1	<1	<1	21/02/2017	21	<1	<1	<1
21/03/2017	28	<1	<1	<1	21/03/2017	28	<1	<1	<1
18/04/2017	28	<1	<1	<1	18/04/2017	28	4	<1	<1
16/05/2017	28	<1	<1	<1	16/05/2017	28	16	<1	<1
20/06/2017	35	<1	<1	<1	20/06/2017	35	3	<1	<1
24/07/2017	34	<1	<1	<1	24/07/2017	34	1	<1	<1
22/08/2017	29	<1	<1	<1	22/08/2017	29	<1	<1	<1
19/09/2017	28	<1	<1	<1	19/09/2017	28	<1	<1	<1
17/10/2017	28	<1	<1	<1	17/10/2017	28	<1	<1	<1
14/11/2017	28	<1	<1	<1	14/11/2017	28	1	<1	<1
19/12/2017	35	<1	<1	<1	19/12/2017	35	<1	<1	<1
30/01/2018	42	<1	<1	<1	30/01/2018	42	<1	<1	<1
20/02/2018	21	<1	<1	<1	20/02/2018	21	<1	<1	<1
20/03/2018	28	<1	<1	<1	20/03/2018	28	<1	<1	<1
17/04/2018	28	<1	<1	<1	17/04/2018	28	<1	<1	<1
15/05/2018	28	<1	<1	<1	15/05/2018	28	<1	<1	<1
20/06/2018	36	<1	<1	<1	20/06/2018	36	<1	<1	<1
17/07/2018	27	<1	<1	<1	17/07/2018	27	<1	<1	<1
21/08/2018	35	<1	<1	<1	21/08/2018	35	<1	<1	<1
18/09/2018	28	<1	<1	<1	18/09/2018	28	<1	<1	<1
16/10/2018	28	<1	<1	<1	16/10/2018	28	<1	<1	<1
20/11/2018	35	<1	<1	<1	20/11/2018	35	<1	<1	<1
18/12/2018	28	<1	<1	<1	18/12/2018	28	<1	<1	<1
15/01/2019	28	<1	<1	<1	15/01/2019	28	<1	<1	<1
19/02/2019	35	<1	<1	<1	19/02/2019	35	<1	<1	<1
19/03/2019	28	<1	<1	<1	19/03/2019	28	<1	<1	<1
16/04/2019	28	<1	<1	<1	16/04/2019	28	<1	<1	<1
21/05/2019	35	<1	<1	<1	21/05/2019	35	6	<1	<1
18/06/2019	28	<1	<1	<1	18/06/2019	28	1	1	<1
16/07/2019	28	<1	<1	<1	16/07/2019	28	2	<1	<1
20/08/2019	35	<1	<1	<1	20/08/2019	35	3	<1	<1
17/09/2019	28	<1	<1	<1	17/09/2019	28	<1	<1	<1
22/10/2019	35	<1	<1	<1	22/10/2019	35	<1	<1	<1
19/11/2019	28	<1	<1	<1	19/11/2019	28	<1	<1	<1
24/12/2019	35	<1	<1	<1	24/12/2019	35	<1	1	<1
21/01/2020	28	<1	<1	<1	21/01/2020	28	<1	<1	34
18/02/2020	28	<1	<1	2	18/02/2020	28	<1	<1	>200
21/02/2020	3	<1	<1	<1	21/02/2020	3	<1	<1	<1
24/02/2020	3	<1	<1	<1	24/02/2020	3	<1	<1	<1
25/02/2020	1	<1	<1	<1	25/02/2020	1	<1	<1	<1
3/03/2020	7	<1	<1	<1	3/03/2020	7	<1	<1	<1
17/03/2020	14	<1	<1	<1	17/03/2020	14	<1	<1	<1
21/04/2020	35	<1	<1	<1	21/04/2020	35	<1	<1	<1
19/05/2020	28	<1	<1	<1	19/05/2020	28	<1	<1	<1
16/06/2020	28	<1	<1	<1	16/06/2020	28	<1	<1	<1
21/07/2020	35	<1	<1	<1	21/07/2020	35	<1	<1	<1
18/08/2020	28	<1	<1	<1	18/08/2020	28	<1	<1	<1
15/09/2020	28	<1	<1	<1	15/09/2020	28	<1	<1	<1
20/10/2020	35	<1	<1	<1	20/10/2020	35	<1	<1	<1
17/11/2020	28	<1	<1	<1	17/11/2020	28	<1	<1	<1
15/12/2020	28	<1	<1	<1	15/12/2020	28	3	<1	<1

\* Reticulation samples taken from following locations: Works Yard, Wilson Place, Council House

Appendix C Lake Rangitai Water Quality

## **Appendix C LAKE RANGITAI WATER QUALITY**

*Source: Environment Canterbury*

The approximate sampling location of Lake Rangitai when lake levels allow is illustrated with a teal dot in the figure below. When the lake level is low, the sample is taken from the raw water intake trench for the water supply.



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Appendix C Lake Rangitai Water Quality

Source: Lake Rangitai (Chatham) eastern shore off Taia-Hapupu Rd Site No: SQ34846

Site ID	Date	Time	E coli	Ammonia Nitrogen	Chlorophyll a	Chlorophyll a (plankton)	Dissolved Organic Carbon	Dissolved Organic Carbon (DOC)	Dissolved Reactive Phosphorus	Electrical Conductivity (EC)	Nitrate and Nitrite Nitrogen	pH	Total Nitrogen	Total Phosphorus	Conductivity field	pH field	Rain	Rain Previously	Salinity, Field	Clarity Tube	Chatham's Water Colour	Dissolved Oxygen	Dissolved Oxygen % saturation	Water Clarity	Water Colour	Water Temperature	Wind Direction	Wind Strength
SQ34846	6-Apr-05	1720		0.011			7.6		0.003		0.006	8.2	0.7	0.027	90		not raining	no rain		>100		8.66	91	clear	clear	17.6		
SQ34846	14-Sep-05	1100		0.009	0.5	7.8		<0.001		0.014		0.49	<0.008	93	8.2					100+		9.57	94.6	clear	brown/yellow	14.2		
SQ34846	8-Dec-05	1630		<0.005	0.8	8.6		0.002		0.019		0.57	0.01		8.7	not raining	no rain		100		9.22	96.1	clear	clear	17.6			
SQ34846	30-Mar-06	1305		0.01	1.4	7.7		<0.001		0.008		0.61	0.011		8.6	raining	light rain	0.5	100+		10.1	101.3	clear	clear	15.8			
SQ34846	14-Jun-06	1100		0.009	1.4	9.3		0.002		0.011		0.57	0.015	53.5	8.2	not raining	moderate	0.3	38		7.49	75.3	clear	rose red	7.4			
SQ34846	19-Oct-06	1600	2		0.9	8						0.36	0.012	92	8.5	not raining	light rain				10.99	106.9	clear	clear	13.9			
SQ34846	30-Nov-06	1040	11			6.7						0.47	0.01	92	8.5	not raining	no rain	0.5	81		7.9	102.3	clear	brown/yellow	18			
SQ34846	29-Mar-07	1300	370		0.4	8.8						0.34	<0.008	104	8.8	not raining	no rain	0.5	100+		12	125	clear	clear	17.4			
SQ34846	21-Jun-07	1600	7		0.6	7.3						0.37	<0.008	93.3	9.1	raining	heavy	0.5	100+		11.9	99	clear	clear	8.2			
SQ34846	10-Jul-07	1530	<10		0.3	7.8						0.42	<0.008	87.1	7.3	not raining	light rain	0.4	98		11.5	102	clear	clear	11			
SQ34846	17-Dec-07	1500	43		0.9	7.9						0.71	0.042	102.6	7.4	not raining	no rain	0.5	64				clear	clear	23.8			
SQ34846	30-Mar-08	1630	650		4.6	8.4						0.73	0.21	37.8	8.9	raining	moderate	0.2	100+		10.1	104	clear	green	17			
SQ34846	29-Jun-08	1700			0.7	6.9						0.31	0.008	59.5	8.2	not raining	heavy	0.4	100+		11.4	99.2	clear	clear	9.8			
SQ34846	21-Sep-08	1500	25		1.1	7.5						0.48	0.008	71	8.5	not raining	no rain	0.4	100+		10.78	104	clear	clear	14.1			
SQ34846	18-Dec-08	1330	79		1	7						0.39	0.009	62	8.6	not raining	light rain	0.3			9.7	102	clear	clear	17.6			
SQ34846	23-Mar-09	1800	3		0.4	7.8						0.57	<0.008	96.9	9	not raining	moderate	0.6	100+	clear	10.02	105.9	clear		18			
SQ34846	18-Jun-09	1500	16		0.7	8						0.28	<0.008	103.7	8.4	not raining	moderate	0.5	100	clear	11.7	100.2	clear		8.3			
SQ34846	20-Sep-09	1030	11	0.007	0.9	7.6		<0.001		<0.005	8.3	0.48	<0.008	105.9	N/A	not raining	no rain	0.5	100+	clear	10.1	89.6	clear		10.4			
SQ34846	14-Dec-09	1440	66	<0.005	0.8	9.7		0.002		<0.005		0.75	0.025	101.6	N/A	not raining	no rain	0.4	75	clear	8.64	101.1	clear		23.5			
SQ34846	17-Mar-10	1545	5		6.8	7.9						0.54	0.013	98.9	8.6	not raining	moderate	0.6	100+	clear			clear		12.9			
SQ34846	14-Jun-10	1330		0.013	1.3	6.6		<0.001		0.022		0.51	0.008	82	8.4	not raining	light rain	0.2	<100	clear	11.8	100.2	clear		8.3			
SQ34846	28-Jun-10	1350	8																									
SQ34846	20-Sep-10	1350	11	0.011	2.3	9.8		<0.001		<0.005		0.53	0.015	79.4	7.2	not raining	light rain	0.5	85	clear	11.05	102	clear		12			
SQ34846	13-Dec-10	1440	<1	0.006	0.5	7.8		<0.001		<0.005		0.53	0.011	105.8	8.4	not raining	no rain	0.6	>100		9.14	96.5	clear		18			
SQ34846	24-Feb-11	1206				8.7				0.002		0.54	0.13	118.1	8.5	not raining	no rain	0.7	>100	green/yellow	9.37	99.4	clear		18.4			
SQ34846	13-Jun-11	1330	91	0.008		10		<0.001		0.017		0.61	0.013	72.6	8.1	not raining	light rain	0.5	55	clear	11.28	98.5	turbid		9.6			
SQ34846	12-Sep-11	1415	2	0.007		5.8		<0.001		0.035		0.19	<0.008	74.9	no pH meter	not raining	moderate	0.5	>100	red/brown/yellow	7.6	77.2	clear		14.2			
SQ34846	28-Nov-11	1400	3	0.008		9		<0.001		<0.005		0.41	0.018	75.4	7	not raining	no rain	0.5	62	clear	10.19	101.7	clear		14.7			
SQ34846	15-Mar-12	1500	16	0.009	1.2	8.3		<0.001		<0.005		0.46	0.009	100.8	8.4	not raining	no rain	0.5	100	brown	9.77	99	clear		15.8			
SQ34846	18-Jun-12	1603		0.016	2.2	7.1		0.001		0.007		0.43	<0.008	97.7	8.5	not raining	no rain	0.48	>100	clear	12.54	106.6	clear		7.8			
SQ34846	25-Jun-12	1509	3																									
SQ34846	10-Sep-12	1515	730	0.008	<0.2	7.6		<0.001		<0.005		0.33	0.013	77	8.5	not raining	moderate	0.45	72	clear	101.8	105.1			12.9			
SQ34846	10-Dec-12	1510	9	<0.010	0.0007	8.7		<0.004		<0.002		0.38	0.008	102.5	8.61	not raining	light	0.51	>100		9.7	100.5	clear	no colour				
SQ34846	11-Mar-13	1605	2420	<0.010	0.001	7.6		<0.004		<0.002		0.44	0.018	108.9	8.64	not raining	nil	0.94	75		9.76	163.3	clear	no colour	18			
SQ34846	10-Jun-13	1529	52	<0.010	0.0012	6.7		<0.004		<0.002		0.33	0.005	106	8.37	not raining	nil	0.53	>100		11.08	100	clear	colourless	11.5			
SQ34846	2-Sep-13	1457	<10	0.011	0.0008	5.5		<0.004		<0.002		0.34	0.007	104		not raining	light	0.52	>100				clear	colourless	11.1			
SQ34846	9-Dec-13	1340	9	<0.010	0.0006	7.6		<0.004	105.1	<0.002	8.2	0.39	<0.004	109.3		not raining	nil	0.5	100+	no colour	8.96	106.1	clear		23.5			
SQ34846	4-Mar-14	1010	56	<0.010	0.0004		9.8	<0.004	94.5	<0.002	8.3	0.36	<0.004	90	8.55	not raining	moderate	0.5	>100	red/ brown	8.77	102.3	clear		15.1			
SQ34846	16-Jun-14	1516	2	<0.010	0.0005		4.7	<0.004	50.1	<0.002	8.3	0.23	<0.004	1020	8.66	not raining	nil	0.5	>100	no colour	10.12	103.8	clear		9.7			
SQ34846	8-Sep-14	1540		<0.010	0.0009		7.5	<0.004	81.6	<0.002	8.3	0.36	0.007			not raining	moderate		75	green	11.03	100	turbid		11.1			
SQ34846	10-Dec-14	1020	1	<0.010	0.0004		8.4	<0.004	97.5	<0.002	8.3	0.37	<0.004	103.1		not raining	nil	0.51	100+	green	10.4	102.2	clear		14			
SQ34846	9-Mar-15	1430	4	<0.010	0.0002		8.5	<0.004	114.2	<0.002	8.3	0.38	0.005	118.8		not raining	moderate	0.59	>100	no colour	9.6	98.9	clear		19.6			
SQ34846	12-Jun-15	1342	12	<0.010	0.0003		7.4	<0.004	106.2	0.004	8.2	0.4	<0.004	110.2		not raining	nil	0.55	>100	no colour	10.62	96.4	clear		9.4			
SQ34846	21-Sep-15	1549	<10	<0.010	0.001		8.6	<0.004	105.3	0.036	8.2	0.53	0.01	103.4		not raining	light	0.51	85	no colour	9.52	87.6	clear		11.3			
SQ34846	14-Dec-15	1635	25	0.012	0.0004		6.3	<0.004	74.3	0.013	8.2	0.35	0.009	114.4		not raining	moderate	0.57	100	no colour	8.59	92.5	clear		14.8			
SQ34846	13-Mar-16	1100	7	<0.010	<0.0002		8.2	<0.004	129.8	<0.002	8.1	0.43	<0.004	134		not raining	light	0.67	>100	no colour	10.11	97.6	clear		14.3			
SQ34846	10-Jun-16	1130	30	<0.010	0.0006		6.8	<0.004	121.6	<0.002	8.1	0.38	<0.004	122.5		not raining	light	0.61	>100	no colour	4.62	53.7	clear		12.7	N	strong	
SQ34846	12-Sep-16	1509	56	<0.010	0.0048		8.2	<0.004	117.7	0.007	8.2	2.3	0.156	119.8		not raining	nil	0.6		coffee	10.68	101	turbid		13.1	NW	moderate	
SQ34846	19-Dec-16	1712	28	<0.010	0.0003		11.5	<0.004	139.6	<0.002	8.6	0.54	0.006	134.2		not raining	nil	0.67	100	no colour	7.97	92.5	clear		20.2	W	moderate	
SQ34846	10-Mar-17	1102	23	<0.010	<0.0002		9.1	<0.004	111.9	<0.002	8.3	0.35	0.005	155.9		not raining	nil	0.79	100	no colour	9.69	97.7	clear		16.1	NW	light	
SQ34846	9-Jun-17	1144	6	<0.010	0.0009		4.9	<0.004	103.6	<0.002	8.2	0.39	0.009	131.2		not raining	moderate	0.66		no colour	11.34	99.5	clear		9.6	S	moderate	
SQ34846	11-Sep-17	1520	579		0.0012		9.1	<0.004	118.8	0.003	8.2	0.57	0.009															
SQ34847	11-Dec-17	1356	3	<0.010	0.0003		6	<0.004	126	<0.002	8	0.42	<0.004															

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Appendix C Lake Rangitai Water Quality

Site Name	Date	Time	Sample Parameters							Ammoniacal Nitrogen	Chlorophyll a (planktonic)	Clarity Tube	Conductivity	Conductivity (Field)	Dissolved Organic Carbon	Dissolved Oxygen	Dissolved Oxygen % Saturati	Dissolved Reactive Phosphor	E. coli	Nitrate-N + Nitrite-N	Salinity (Field)	Total Nitrogen	Total Phosphorus	Water Temperature (Field)	pH	Comments
			Rain	Rain Previously	Site is dry	Water Clarity	Water Colour	Wind Direction	Wind Strength	(mg/L)	(ug/L)	(cm)	(mS/m)	(mS/m)	(mg/L)	(mg/L)	(%)	(mg/L)	(MPN/100ml)	(g/m3)	(ppt)	(g/m3)	(g/m3)	(C)		
Site Name: Lake Rangitai (Chathams) east shore off Taia-Hapupu Rd																										
SQ34846	11-Dec-2017	13:56:00	not raining	nil	no	clear	no colour	NW	strong	<0.010	0.30	100.00	126.00	129.80	6.00	8.06	94.90	<0.0040	3.00	<0.002	0.65	0.42	<0.004	23.30	8.00	Lab mistakenly did not test for Enterococci
SQ34846	12-Mar-2018	13:54:00	not raining	nil	no	clear	no colour	NE	light	<0.010	0.20	100.00	144.20	154.20	7.30	9.29	98.30	<0.0040	4.00	<0.002	0.78	0.47	0.01	18.20	8.20	Lab mistakenly did not test for Enterococci
SQ34846	07-Jun-2018	10:11:00	not raining	light	no	clear	colourless	SW	light	0.02	0.40	100.00	128.60	90.80		12.08	105.00	<0.0040		<0.002	0.43	0.37	0.01	8.60	8.30	Lab mistakenly did not test for E.coli, Enterococci and DOC
SQ34846	17-Sep-2018	14:30:00	not raining	light	No	clear	coffee	W	moderate	<0.010	0.80	96.00	122.00	121.50	9.60	9.38	93.80	<0.0040		0.00	0.61	0.43	0.01	15.60	8.10	
SQ34846	17-Sep-2018	14:48:00	not raining	light	No	clear	coffee	N	moderate										7.00							
SQ34846	10-Dec-2018	15:20:00	not raining	light	No	clear	no colour		strong	<0.010	0.50	100.00	163.70		6.10	9.30	104.40	<0.0040	126.00	<0.002		0.45	0.00	20.50	8.10	ProODO used = no EC or Salinity
SQ34846	18/Mar/2019	16:24:00								0.011	0.3	100	166.6	187.1	10.7	8.32	84	<0.0040	27	0.003	0.96	0.63	<0.004	16.1	8.1	
SQ34846	30/May/2019	15:00:00								0.35	0.5	100	131.2	153.6	13.2	7.67	75.5	<0.0040		0.018	0.78	0.86	0.008	14.2	8.3	E.coli sample frozen- not able to be processed by lab.
SQ34846	12/Feb/2019	3:16:00 pm	not raining	nil		clear	no colour												291							
SQ34846	18/Mar/2019	4:24:00 pm	not raining	nil		clear	no colour			0.011	0.3	100	166.6		10.7	8.32	84	<0.0040			0.96	0.63	<0.004	16.1	8.1	
SQ34846	18/Mar/2019	4:26:00 pm	Not raining	Nil		Clear	No colour												27							
SQ34846	30/May/2019	3:00:00 pm	not raining	nil		clear	no colour			0.35	0.5	100	131.2		13.2	7.67	75.5	<0.0040			0.78	0.86	0.008	14.2	8.3	
SQ34846	3/June/2019	3:54:00 pm	not raining	moderate		clear	no colour																			
SQ34846	16/Sep/2019	2:48:00 pm	not raining	light		clear	no colour			<0.010	3	82	121.5		12.8	7.93	79.5	<0.0040			0.62	0.63	0.015	15.2	8.2	
SQ34846	16/Sep/2019	2:56:00 pm	not raining	light		clear	no colour												63							
SQ34846	2/Dec/2019	3:16:00 pm	not raining	nil		clear	no colour			0.015	1.2	100	96.4		9.2	6.23	70.9	0.006			0.71	0.35	<0.004	21.3	8.4	
SQ34846	16/03/2020	3:03:00 pm	Lake level very low	Not Raining	Nil	Opaque	Green	E	Light	0.121	1	11	121.1	151.7	8.5	11.42	114.9	<0.0040	20	0.007	0.77	0.72	0.022	15.4	8.2	
SQ34846	15/06/2020	2:45:00 pm	Water level low	Not Raining	Nil	Clear	Colourless		Calm	0.105	0.4	100	130.8	155.8	6	11.83	100.2	<0.0040	137	<0.002	0.79	0.54	<0.0040	8.6	8.2	
SQ34846	14/09/2020	14:19:00	Not raining	Light	No	Colourless	Clear			0.01	0.5	100	74.6	152.6	9.91	105.6	105.6	0.004		0.002	0.77	0.34	0.004	18.5	8.6	
SQ34846	14/09/2020	14:45:00	Not raining	Nil	No	Colourless	Clear	NW	Light										10							
SQ34846	11/12/2020	11:17:00	Not raining	Moderate	No	Colourless	Clear	N	Light			100		151.6	0.02		86.5		28		0.77			18		

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Appendix D Kaingaroa WTP Data

## Appendix D KAINGAROA WTP DATA

Table D-1 Kaingaroa WTP Microbiological Data From 2013

Date of Sampling	Days between samples	E.coli (MPN/ 100mL)			Total Coliforms (MPN/100mL)		
		Raw	Treated	Network*	Raw	Treated	Network*
30/07/2013		<1			<1		
27/08/2013	28	<1			<1		
24/09/2013	28	<1			<1		
29/10/2013	35	<1			<1		
26/11/2013	28	<1			<1		
17/12/2013	21	<1			<1		
28/01/2014	42	1			2		
4/02/2014	7	<1			2		
11/02/2014	7	<1			12		
11/02/2014	0	<1			8		
11/02/2014	0	<1			18		
11/02/2014	0	<1			12		
18/02/2014	7	<1			>201		
25/02/2014	7	<1			201		
29/04/2014	63	<1			3		
6/05/2014	7	<1			19		
28/05/2014	22	<1			<1		
24/06/2014	27	<1			<1		
29/07/2014	35	<1	<1	NT	<1	<1	NT
26/08/2014	28	1	<1	NT	5	<1	NT
30/09/2014	35	<1	<1	NT	2	<1	NT
28/10/2014	28	<1	<1	<1	1	<1	NT
2/12/2014	35	<1	<1	<1	<1	<1	NT
23/12/2014	21	2	<1	<1	9	<1	NT
27/01/2015	35	NT	<1	<1	NT	<1	<1
24/02/2015	28	NT	<1	<1	NT	1	<1
31/03/2015	35	2	<1	<1	11	<1	<1
28/04/2015	28	12	<1	<1	41	<1	<1
26/05/2015	28	5	<1	<1	14	<1	<1
7/07/2015	42	<1	<1	<1	24	<1	<1
28/07/2015	21	<1	<1	<1	6	<1	<1
25/08/2015	28	<1	<1	<1	1	<1	1
29/09/2015	35	<1	<1	<1	1	<1	<1
27/10/2015	28	<1	<1	<1	<1	<1	<1
24/11/2015	28	1	<1	<1	2	<1	<1
22/12/2015	28	<1	<1	<1	3	<1	<1
26/01/2016	35	<1	<1	<1	4	<1	15
2/02/2016	7	1	<1	<1	9	<1	4
23/02/2016	21	6	<1	<1	62	1	1
29/03/2016	35	4	<1	<1	6	1	1

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Appendix D Kaingaroa WTP Data

Table D-1 Kaingaroa WTP Microbiological Data From 2013 continued

Date of Sampling	Days between samples	E.coli (MPN/ 100mL)			Total Coliforms (MPN/100mL)		
		Raw	Treated	Network*	Raw	Treated	Network*
26-04-16	28	94	<1	<1	118	18	6
31-05-16	35	56	<1	<1	70	1	3
05-07-16	35	3	<1	<1	17	<1	2
26-07-16	21	9	<1	<1	15	<1	<1
30-08-16	35	1	<1	<1	1	<1	<1
27-09-16	28	<1	<1	<1	11	1	<1
01-11-16	35	8	<1	<1	15	<1	1
06-12-16	35	<1*	1*	<1	<1*	2*	<1
13-12-16	7	<1	<1	<1	<1	<1	1
20-12-16	7	3	<1	<1	10	<1	<1
31-01-17	42	1	<1	<1	8	<1	<1
21-02-17	21	3	<1	<1	43	4	<1
21-03-17	28	21	<1	<1	165	6	50
18-04-17	28	14	<1	<1	62	29	25
16-05-17	28	1	<1	<1	94	19	48
20-06-17	35	<1	<1	<1	15	8	4
24-07-17	34	1	<1	<1	4	<1	2
22-08-17	29	6	<1	<1	21	<1	11
29-08-17	7	2	N/A	N/A	6	N/A	N/A
19-09-17	21	1	<1	<1	5	<1	<1
17-10-17	28	11	<1	<1	53	5	8
14-11-17	28	<1	<1	<1	3	1	<1
19-12-17	35	<1	<1	<1	15	<1	<1
30-01-18	42	14	<1	<1	109	3	2
20-02-18	21	12	<1	<1	>200	1	<1
20-03-18	28	1	<1	<1	16	31	19
27-03-18	7	1	<1	<1	15	16	3
17-04-18	21	8	<1	<1	36	16	12
15-05-18	28	<1	<1	<1	<1	1	<1
20-06-18	36	2	<1	<1	9	9	6
17-07-18	27	3	<1	<1	5	4	9
21-08-18	35	4	<1	>200	14	<1	>200
28-08-18	7	11	2	1	27	2	1
28-08-18	0			3			4
11-09-18	14	3	<1	<1	8	<1	<1
11-09-18	0			<1			1
18-09-18	7	8	<1	<1	9	<1	<1
18-09-18	0			<1			1
16-10-18	28	1	<1	<1	3	<1	<1
20-11-18	35	<1	<1	<1	5	<1	1
18-12-18	28	16	<1	<1	45	<1	200
15-01-19	28	<1	<1	<1	2	2	5
19-02-19	35	18	<1	<1	83	<1	1
19-03-19	28	16	<1	<1	130	<1	6
16-04-19	28	11	<1	<1	130	19	25
23-05-19	37	16	<1	<1	109	4	10
28-05-19	5	10	>200	<1	48	>200	<1
04-06-19	7	2	<1	<1	12	<1	8
11-06-19	7	8	<1	<1	21	<1	<1
18-06-19	7	8	<1	<1	>200	2	5

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Appendix D Kaingaroa WTP Data

Table D-1 Kaingaroa WTP Microbiological Data From 2013 continued

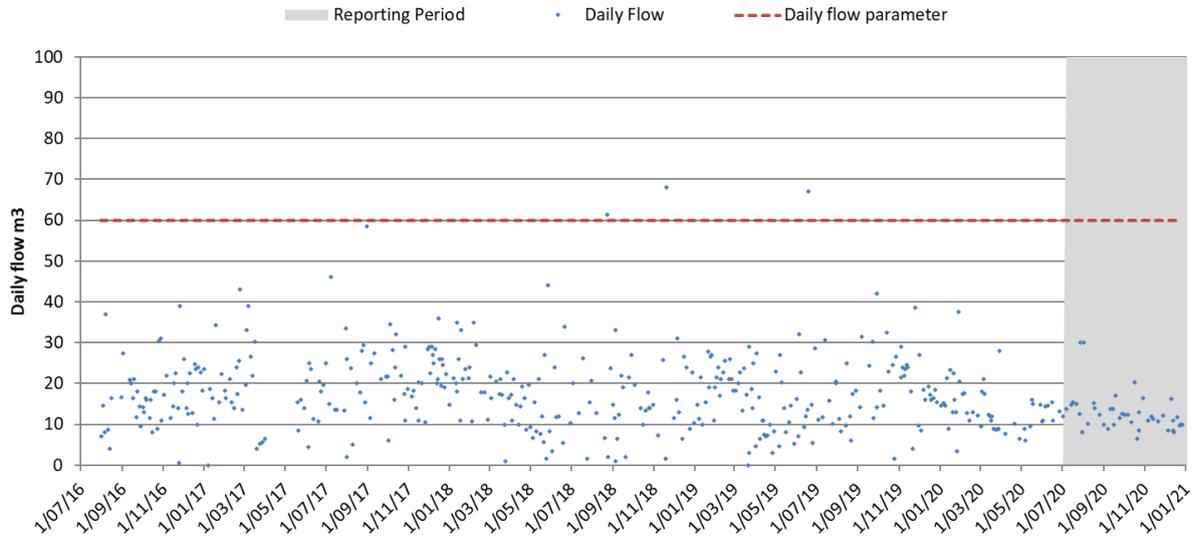
Date of Sampling	Days between samples	E.coli (MPN/ 100mL)			Total Coliforms (MPN/100mL)		
		Raw	Treated	Network*	Raw	Treated	Network*
16/07/2019	28	5	<1	<1	15	2	<1
20/08/2019	35	5	<1	<1	18	<1	<1
17/09/2019	28	5	<1	<1	165	<1	1
22/10/2019	35	6	<1	<1	16	<1	<1
19/11/2019	28	12	<1	<1	29	<1	<1
24/12/2019	35	3	<1	<1	11	3	<1
21/01/2020	28	8	<1	<1	94	<1	<1
18/02/2020	28	<1	<1	<1	43	<1	<1
17/03/2020	28	9	3	<1	74	53	8
23/03/2020	6	1	<1	<1	>200	36	1
24/03/2020	1	4	<1	<1	62	27	6
21/04/2020	28	1	<1	<1	88	3	4
5/05/2020	14	<1	5	<1	<1	70	1
19/05/2020	14	<1	<1	<1	4	<1	1
26/05/2020	7	21	<1	<1	34	11	4
9/06/2020	14	2	<1	<1	6	<1	<1
16/06/2020	7	5	<1	<1	19	2	<1
21/07/2020	35	<1	<1	<1	3	<1	<1
18/08/2020	28	<1	<1	<1	3	<1	<1
15/09/2020	28	1	<1	<1	8	<1	<1
20/10/2020	35	1	<1	<1	3	<1	<1
17/11/2020	28	32	<1	<1	38	<1	<1
15/12/2020	28	1	<1	<1	4	<1	<1

NT – sample Not Taken

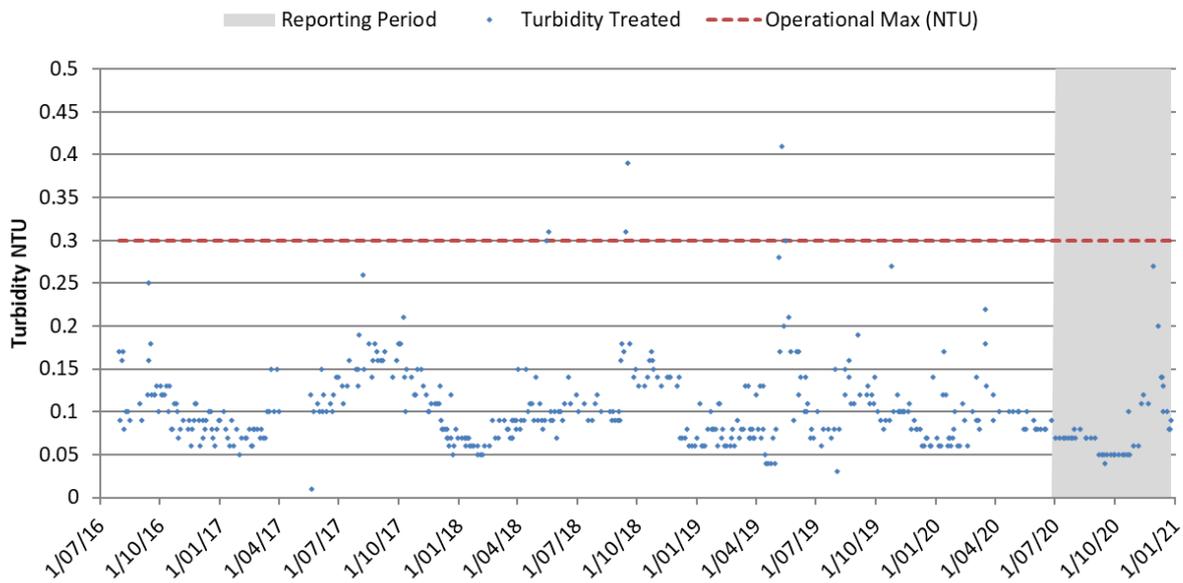
\* Reticulation samples taken from the following locations: Club and North Whaitiri

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Appendix D Kaingaroa WTP Data



**Figure D-1 Kaingaroa Water Daily Flow Data from July 2016**



**Figure D-2 Kaingaroa Water Treated Turbidity Data from July 2016**

## Appendix E WAITANGI WWTP DATA

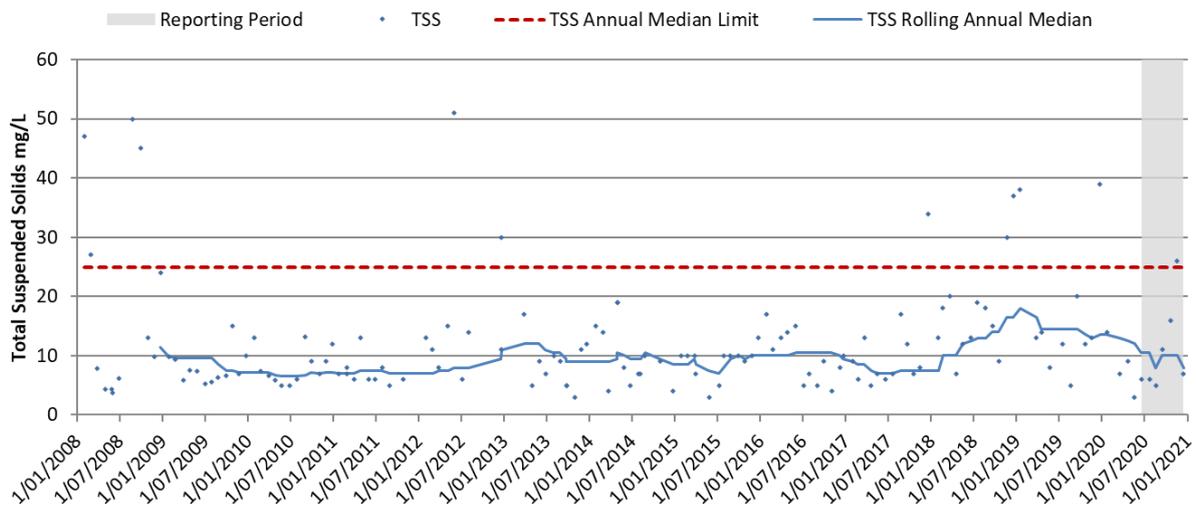


Figure E-1 Total Suspended Solids Concentrations from 2008

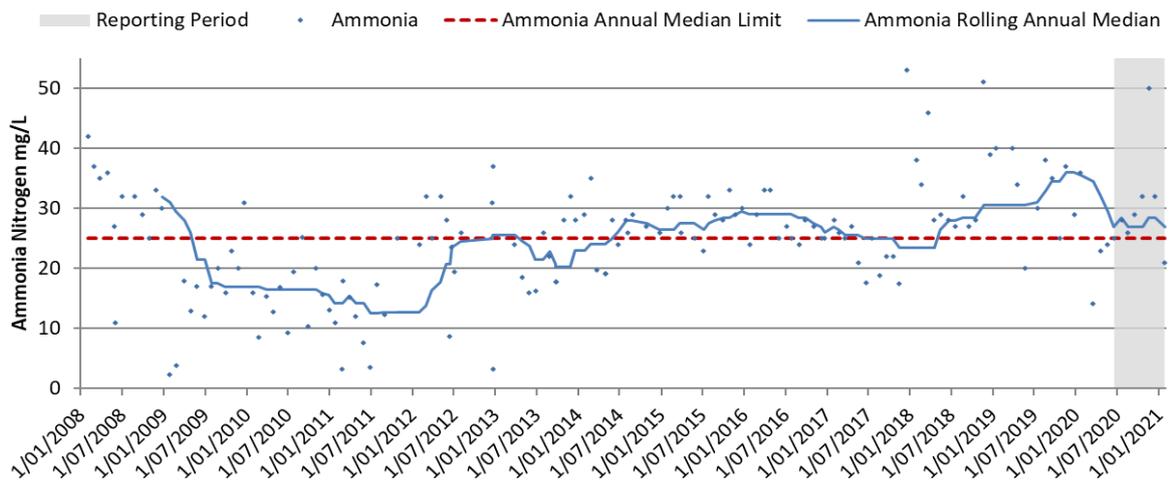


Figure E-2 Ammonia Nitrogen Concentrations from 2008.

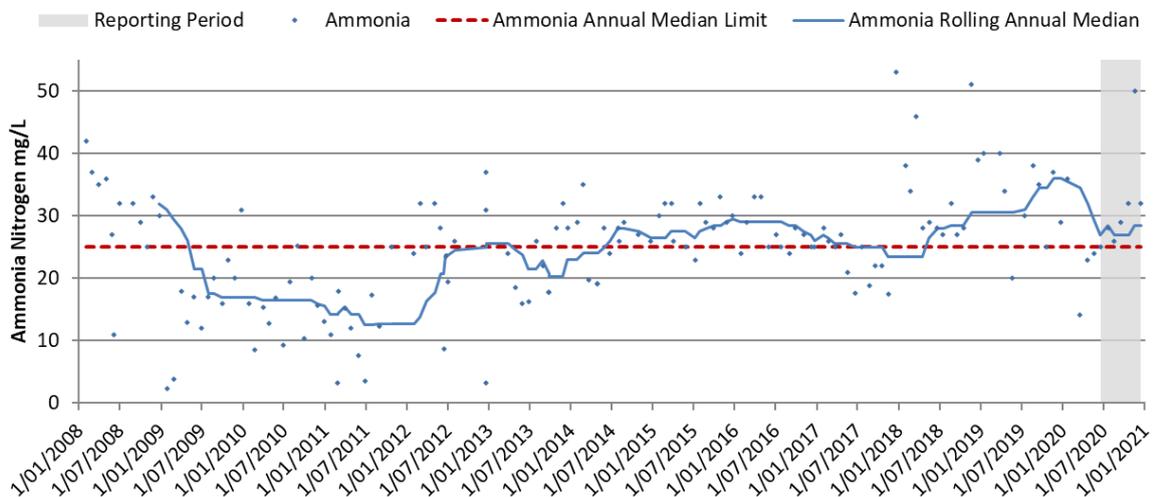
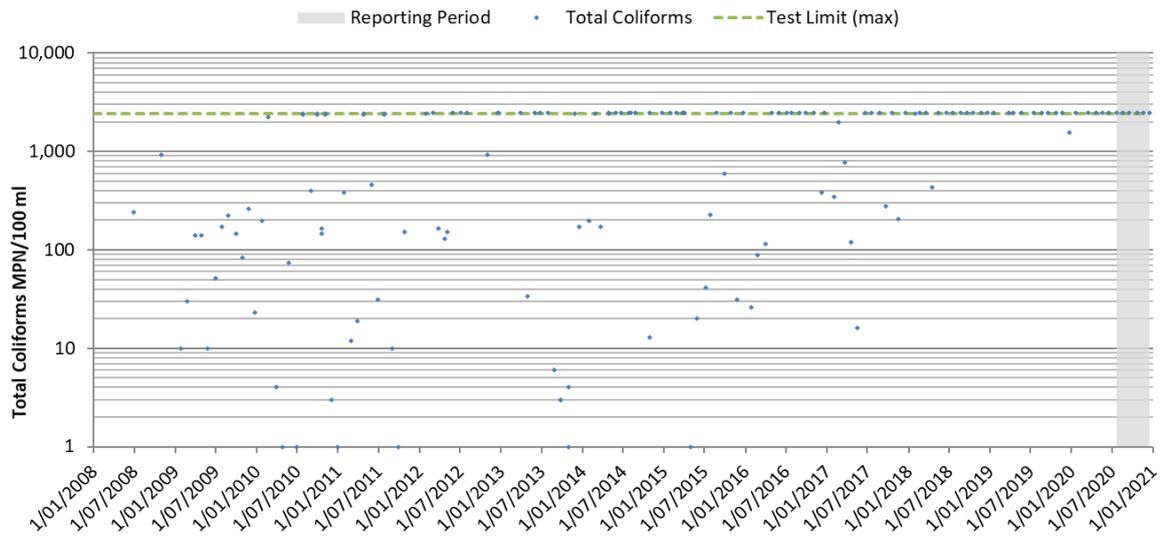
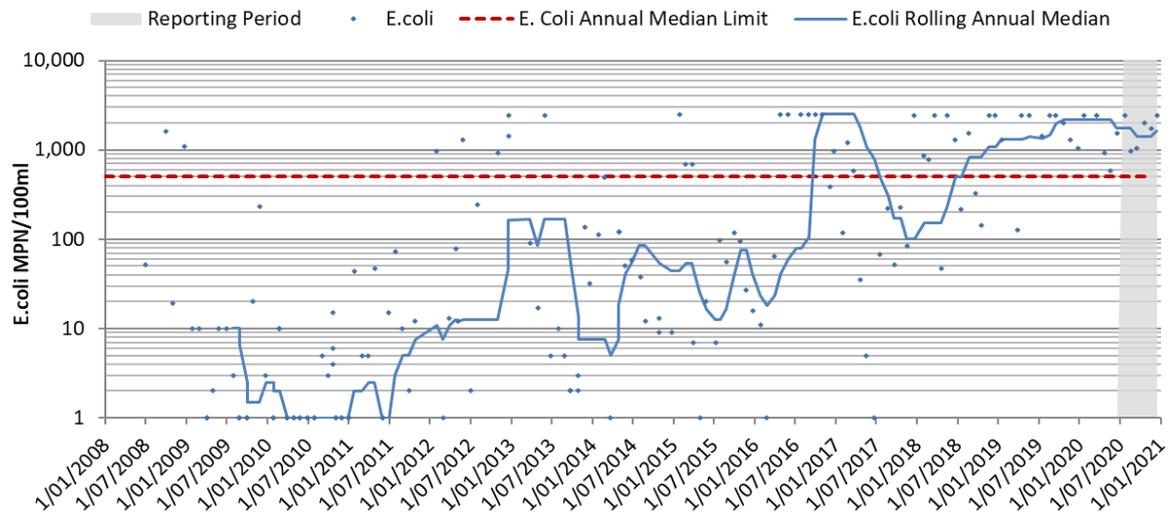


Figure E-3 Treated Wastewater Total Chemical Oxygen Demand Concentrations from 2008

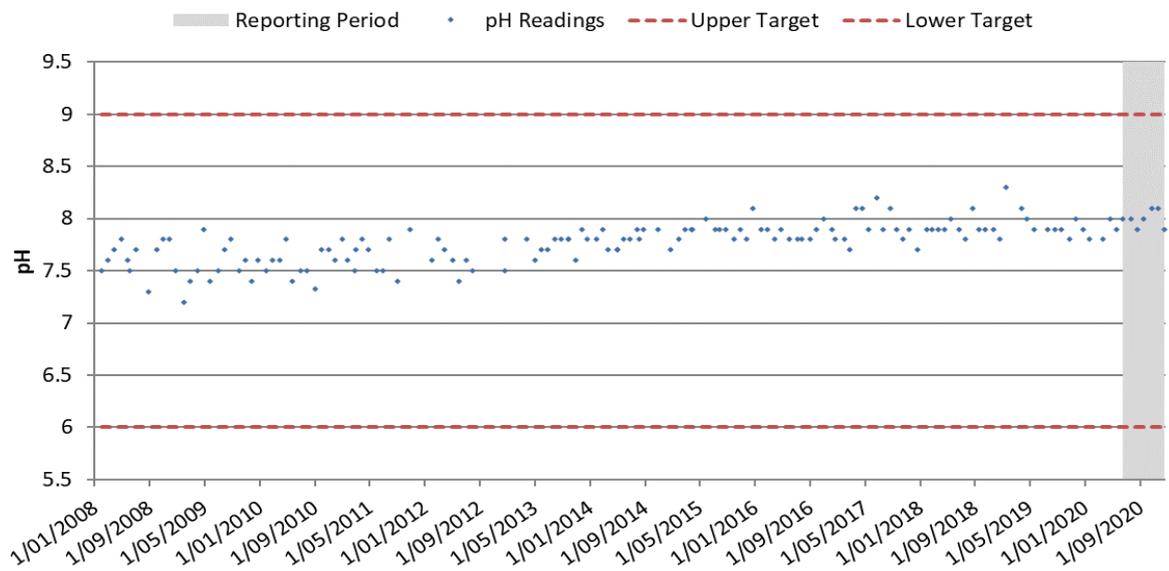
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**Figure E-4 Total Coliform Concentrations from 2008**

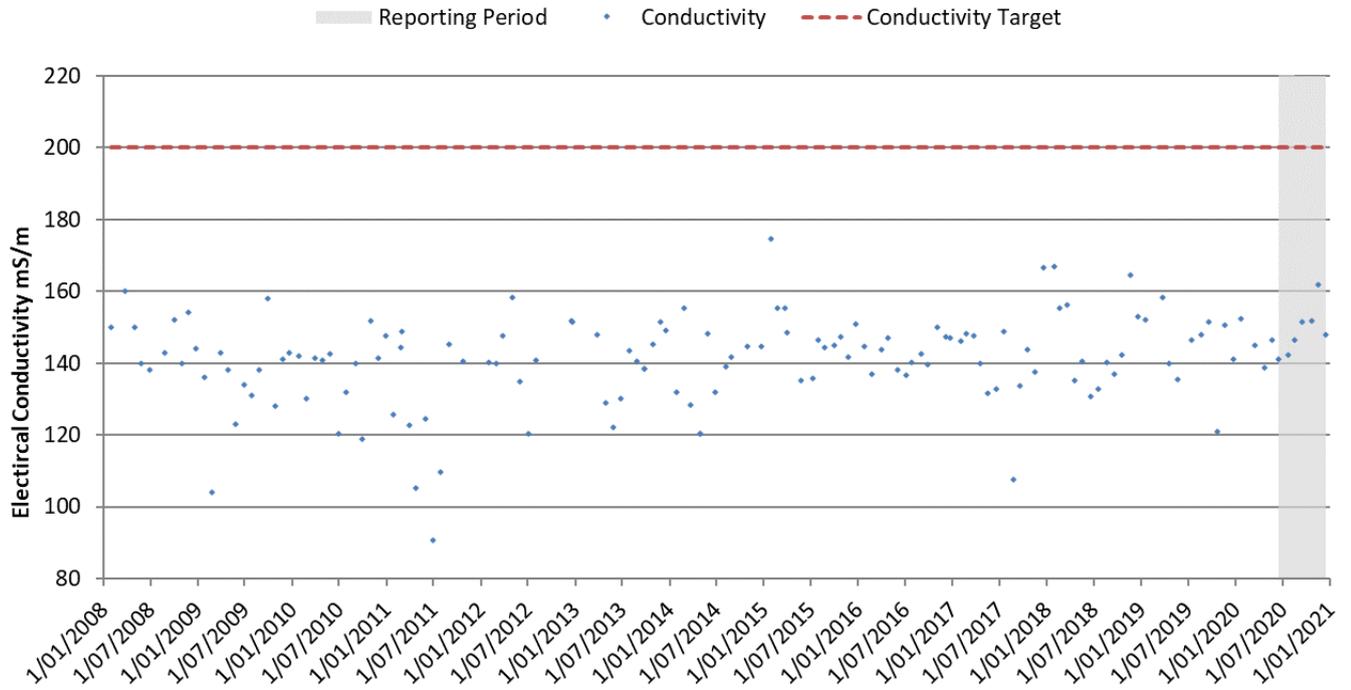


**Figure E-5 E. coli Concentrations from 2008**

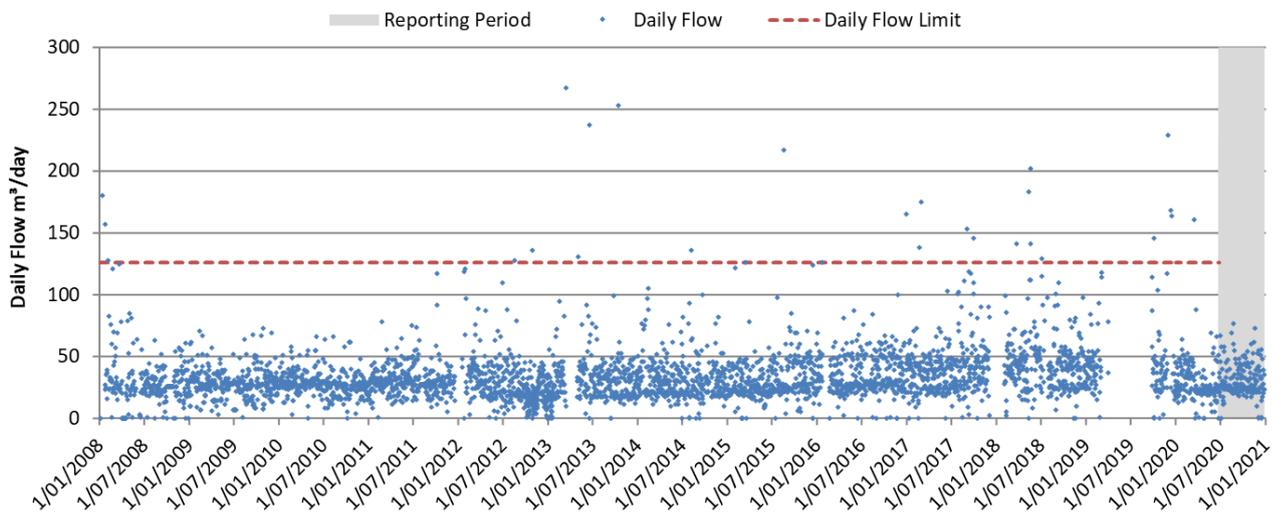


**Figure E-6 pH from 2008**

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**Figure E-7 Electrical Conductivity from 2008**



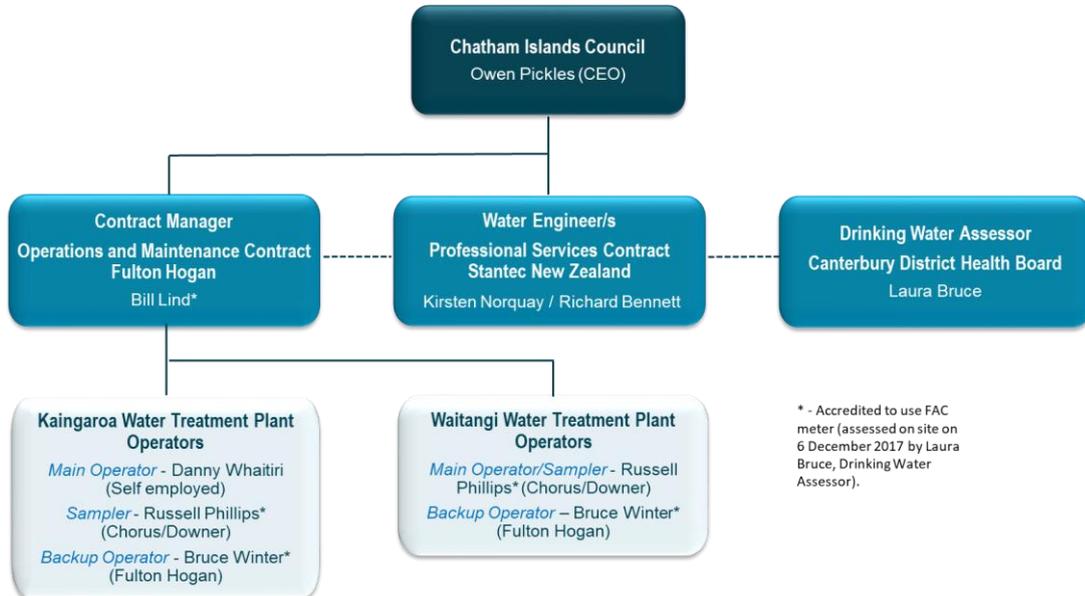
**Figure E-8 Irrigation flow from 2008.** Note: Irrigation meter not functional March – September 2019

## **Appendix F ORGANISATION INFORMATION**

This Appendix includes the following organisation information:

- Organisation Chart.
- CVs of key staff.
- Training Register of key staff.

## Organisation Chart



## Qualifications/Experience Chart

Photo	Name / Organisation / Role	Qualifications / Experience	Contact Details
	<p><b>Kirsten Norquay</b>  <b>Stantec NZ</b>  <b>Water Engineer</b></p>	<p>Kirsten is a chartered civil and environmental engineer who has been with Stantec for 15 years. Her qualifications include:</p> <ul style="list-style-type: none"> <li>• BSc (Hons), Biochemistry.</li> <li>• BE (Hons), Civil.</li> <li>• Chartered Professional Engineer of Engineering New Zealand (CPEng)</li> <li>• Chartered Member of Engineering New Zealand (CMEngNZ).</li> </ul> <p>Prior to joining Stantec she worked as a Biochemistry Teaching Fellow at the University of Otago. Kirsten is a versatile engineer, whose experience includes water, wastewater and solid waste management. Kirsten has worked on various projects, ranging from investigation, feasibility &amp; consenting to design, tendering, construction &amp; commissioning. Many of these projects have been reconsenting or plant upgrades to meet more stringent resource consent requirements or drinking water standards. Some relevant water projects include:</p> <ul style="list-style-type: none"> <li>• Water and Wastewater Engineer, Chatham Islands Council, 2014 to present</li> <li>• Water Safety Plans, Chatham Islands Council, 2015-16</li> <li>• Water Safety Plans, Dunedin City Council, 2016 to 2018.</li> <li>• Waitangi Water Scheme Upgrade, Chatham Islands Council, 2015-2017</li> <li>• Outram Water Treatment upgrade, Dunedin City Council, 2009 to 2018.</li> <li>• Riverton Water Treatment Plant Upgrade, Southland District Council, 2013 to 2016.</li> <li>• Maitai Alternative Water Source, Nelson City Council, 2014 to 2015.</li> <li>• Kyogle Water Treatment Plant Upgrade, Kyogle Council, 2013</li> <li>• Richmond Water Treatment Plant, Tasman District Council, 2012 to 2013</li> <li>• Rural Water Scheme Upgrades, Waimate District Council, 2012.</li> <li>• Port Chalmers Water Treatment Plant, Dunedin City Council 2007 to 2010.</li> <li>• Rotary Park Distribution Watermain, Dunedin City Council, 2007 to 2008</li> </ul> <p>Kirsten is a founding member of Stantec's Water Safety Group, formed in 2016 to ensure Stantec is proactive in implementing best practice for management of safe drinking water supplied throughout NZ. Kirsten attended the WaterNZ Drinking Water Workshop in September 2017 and the WaterNZ Havelock North Inquiry Outcomes Seminar in February 2018.</p>	<p><b>Email:</b>                  Kirsten.Norquay@stantec.com</p> <p><b>Work Phone:</b> +64 3 474 3097</p> <p><b>Mobile Phone:</b> +64 27 582 5171</p>

**CHATHAM ISLANDS COUNCIL  
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Photo	Name / Organisation / Role	Qualifications / Experience	Contact Details
	<p><b>Richard Bennett</b> <b>Stantec NZ</b> <b>Water Engineer</b></p>	<p>Richard has over 25 years' experience as a civil engineer and has worked on complex infrastructure projects throughout his career. He has managed all the stages of water and wastewater projects from conception through to completion of commissioning. His qualifications include:</p> <ul style="list-style-type: none"> <li>• BEng, Civil Engineering, University of Newcastle upon Tyne, 1993</li> <li>• Chartered Engineer, Institution of Civil Engineers (ICE), UK</li> <li>• Member, Institution of Civil Engineers, UK (MICE)</li> <li>• Project Management Professional (PMP), International Management Institute, 2008.</li> </ul> <p>He understands the need to provide robust proven treatment solutions, but through his role as Technical Discipline Leader for Stantec Asia Pacific Civil Water, he is also familiar with new products and industry capabilities.</p> <p>Richard is also a member of Stantec's Water Safety Group and is proactive in implementing best practice for management of safe drinking water supplied throughout NZ. He also attended the WaterNZ Drinking Water Workshop in Hamilton in September 2017.</p> <p>Richard is skilled at focusing on critical problems and finding the best possible outcome. He is proud that all treatment plants that he has had an involvement with recently have been commissioned and operate in accordance with the design expectations.</p> <p>He has extensive experience managing contracts under FIDIC including Design and Build contracts.</p>	<p><b>Email:</b> Richard.Bennett@stantec.com</p> <p><b>Work Phone:</b> +64 3 4743096</p> <p><b>Mobile Phone:</b> +64 27 224 7198</p>
	<p><b>Bill Lind</b> <b>Fulton Hogan</b> <b>Contract Manager</b></p>	<p>Bill Lind has been involved in the contracting industry for over 34 years with the last 20 of them directly involved with water utilities, hands on, supervisory, managerial and for over 10 years, in a technical advisory, troubleshooting and pricing capacity. Bill managed the Upper Clutha area of the QLDC infrastructure for nearly 10 years before managing the Lake Hayes Water and Wastewater scheme. He also had, until recently, a technical advisory and pricing role with the Clutha District Council Three Waters Contract, as well as the Southland District Council when Fulton Hogan held the contract. Other relevant qualifications and experience include:</p> <ul style="list-style-type: none"> <li>• NZIM Executive Management Diploma</li> <li>• STMS Level 1</li> <li>• Workplace First Aid</li> <li>• Forklift Operator Certificate</li> <li>• Rural Fire Officer</li> </ul>	<p><b>Email:</b> <a href="mailto:Bill.Lind@fultonhogan.com">Bill.Lind@fultonhogan.com</a></p> <p><b>Work Phone:</b> +64 3 305 0791</p> <p><b>Mobile Phone:</b> +64 27 433 5728</p>

**CHATHAM ISLANDS COUNCIL  
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Photo	Name / Organisation / Role	Qualifications / Experience	Contact Details
		<ul style="list-style-type: none"> <li>• Various NZQA Level 5 subjects relevant to the water industry including First Aid, Health and Safety, Civil Works and Services</li> <li>• NZQA Certificates in Civil Engineering Works Supervisors – Roding, Civil Engineering Works - Senior Supervisor</li> <li>• Filtec Training on water treatment plant operation in Nov 2017.</li> </ul>	
	<p><b>Danny Whaitiri</b> <b>Self Employed</b></p> <ul style="list-style-type: none"> <li>• <b>Kaingarua WTP – Main Operator</b></li> </ul>	<p>Danny has been the Kaingaroa WTP Operator since 2013. He previously operated the Kaingaroa Fish Factory Filtration Water Treatment Plant since 1981. Other relevant experience, qualifications and skills include:</p> <ul style="list-style-type: none"> <li>• Operates and maintains the Kaingaroa Electricity Board and diesel generation plant</li> <li>• Refrigeration technician who manages most of the refrigeration infrastructure on the Chatham Island</li> <li>• Certified Fitter and Turner Engineer</li> <li>• Apprenticeship training and Fitter and Turner at Bluff Engineering and Welding from 1969 to 1976</li> <li>• Served in the NZ Army for 3 months under National Service 31<sup>st</sup> (and last) intake in 1972</li> <li>• Involved in boat maintenance/engineering of various vessel in Chatham Islands</li> <li>• Filtec Training on water treatment plant operation in Nov 2017.</li> </ul>	<p><b>Email:</b> <a href="mailto:dandale@xtra.co.nz">dandale@xtra.co.nz</a> <b>Work Phone:</b> N/a <b>Home phone:</b> 03 305 0251 <b>Mobile Phone:</b> n/a</p>
	<p><b>Russell Philips</b> <b>Chorus/Downer</b></p> <ul style="list-style-type: none"> <li>• <b>Waitangi WTP - Main Operator &amp; Sampler</b></li> <li>• <b>Kaingarua WTP – Sampler</b></li> </ul>	<p>Russell has been the WTP and WWTP operator at Waitangi since it was built in 2004. Other relevant experience, qualifications and skills include:</p> <ul style="list-style-type: none"> <li>• Telecommunication technician for all the telecom work on the Chatham Islands including Chorus and Spark, Farmside satellite and their infrastructure</li> <li>• Traineeship at Telecom New Zealand from 1987 to 1990</li> <li>• St Johns First Aid Certificate</li> <li>• National Certificate in Water Reticulation Level (Service Person) Level 3 Wastewater, 2013</li> <li>• National Certificate in Water Reticulation Level (Service Person) Level 3 Water</li> <li>• National Certificate in Telecommunications (Maintenance and Repair) Level 4, Mechanical, 2013</li> <li>• Volunteer Fireman</li> <li>• Filtec Training on water treatment plant operation in Nov 2017.</li> </ul>	<p><b>Email:</b> <a href="mailto:Russell.Phillips@downer.co.nz">Russell.Phillips@downer.co.nz</a> <b>Work Phone:</b> 03 305 0055 <b>Home phone:</b> 03 305 0150 <b>Mobile Phone:</b> n/a</p>

**CHATHAM ISLANDS COUNCIL  
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Photo	Name / Organisation / Role	Qualifications / Experience	Contact Details
	<p><b>Bruce Winter</b> <b>Fulton Hogan</b> <b>Backup WTP Operator</b></p>	<p>Bruce has been the backup operator for the Waitangi WTP and Kaingaroa WTP operator since October 2016. Other relevant experience, qualifications and skills include:</p> <ul style="list-style-type: none"> <li>• Factory/Compliance Manager of fish factory at Rekohu/Waitangi Seafood's between 2007 to 2011. Duties included staff coordination, organising and documentation of processing, storage and shipment of product, and also included management of the company's Risk Management Programme (MAF Food Safety)</li> <li>• Experience in building and installing pivot irrigation units for PGG Plumbing and Irrigation, NZ between 2003-2004</li> <li>• Various other experience as fuel tanker driver, bar manager, fishing boat deckhand and farmhand on dairy farm including skills in building, landscaping, chemical spraying, operating machinery and commercial fishing</li> <li>• Qualified fire fighter volunteering at the Chatham Island's Fire Brigade and operating the New Zealand Fire Service electronic certification system. Passed NZFS courses in basic rural firefighting, breathing apparatus recertification, MVA pump rescue tender and Volunteer recruit Pre TMS</li> <li>• Filtec Training on water treatment plant operation in Nov 2017.</li> </ul>	<p><b>Email:</b> <a href="mailto:brucewinter@hotmail.co.nz">brucewinter@hotmail.co.nz</a></p> <p><b>Work Phone:</b> 03 305 0682</p> <p><b>Home phone:</b> 03 305 0747</p> <p><b>Mobile Phone:</b> n/a</p>

## Training Activities

Name / Organisation / Role	Training Activity	Trainer	Date	Duration
<b>Kirsten Norquay</b> <b>Stantec NZ</b> <b>Water Engineer</b>	<ul style="list-style-type: none"> <li>IPWEA Conference</li> </ul>	IPWEA	December 2020	3 days
	<ul style="list-style-type: none"> <li>Water NZ Conference</li> </ul>	Water NZ	November 2020	3 days
	<ul style="list-style-type: none"> <li>Water NZ Conference</li> </ul>	Water NZ	19-21 Sept 2018	1 day
	<ul style="list-style-type: none"> <li>Water NZ Drinking Water Workshop</li> </ul>	Water NZ	19 Sept 2017	1 day
	<ul style="list-style-type: none"> <li>Borehead Security Training</li> </ul>	Stu Clarke	8 Sept 2017	4 hours
	<ul style="list-style-type: none"> <li>Site Safe Consultants Passport</li> </ul>	Site Safe	6 April 2016	1 hour
	<ul style="list-style-type: none"> <li>Ethics and Business Conduct for Global Employees</li> </ul>	Stantec	14 Dec 2017	1 hour
	<ul style="list-style-type: none"> <li>Process Control and Instrumentation Modules 1-3</li> </ul>	MWH	2015	3 hours
	<ul style="list-style-type: none"> <li>Safety in Design Training</li> </ul>	MWH	2015	1 day
<b>Richard Bennett</b> <b>Stantec NZ</b> <b>Water Engineer</b>	<ul style="list-style-type: none"> <li>Water NZ Conference</li> </ul>	Water NZ	Sept 2015 & Sept 2017	3 days per conference
	<ul style="list-style-type: none"> <li>Water NZ Drinking Water Workshop</li> </ul>	Water NZ	19 Sept 2017	1 day
	<ul style="list-style-type: none"> <li>Borehead Security Training</li> </ul>	Stu Clarke	8 Sept 2017	5 hours
	<ul style="list-style-type: none"> <li>Ethics and Business Conduct for Global Employees</li> </ul>	Stantec	14 Dec 2017	1 hour
				2015

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Name / Organisation / Role	Training Activity	Trainer	Date	Duration	
	<ul style="list-style-type: none"> <li>Safety in Design Training</li> </ul>	MWH			
<b>Bill Lind</b> <b>Fulton Hogan</b> <b>Contract Manager</b>	<ul style="list-style-type: none"> <li>Filtec Onsite Training at Waitangi and Kaingaroa WTPs</li> </ul>	Filtec	7 & 8 Nov 2017	2 hours	
	<ul style="list-style-type: none"> <li>Site Traffic Management Supervisor Refresher STMS Level 1</li> </ul>	NZ Transport Agency	28 April 2015	1 day	
	<ul style="list-style-type: none"> <li>Skills for Life Workplace First Aid Recertification</li> </ul>	MediTrain	19 Nov 2014	1 day	
	<ul style="list-style-type: none"> <li>Forklift Operator's Certificate</li> </ul>	DriveTech Ltd, Invercargill	14 Jan 2014	1 day	
	<ul style="list-style-type: none"> <li>Quality Start to Finish Course</li> </ul>	Fulton Hogan	20-27 Sept 2003	7 days	
	<ul style="list-style-type: none"> <li>Esco Executive staff course the discovery</li> </ul>	NZ Institute of Management	13-16 May 2003	4 days	
	<ul style="list-style-type: none"> <li>Leadership, Motivation and Team Building course</li> </ul>		August 2002		
	<ul style="list-style-type: none"> <li>Management – the skills and Process</li> </ul>	NZ Institute of Management	31 October 2000	3 weeks	
	<ul style="list-style-type: none"> <li>The New Manager Course</li> </ul>		9 July 1996	1 day	
	<ul style="list-style-type: none"> <li>Understanding NZ3910 Conditions of Contract</li> </ul>	NZ Institute of Management		1 day	
			NZ Institute of Management		

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Name / Organisation / Role	Training Activity	Trainer	Date	Duration
		NZ Institute of Highway Technology Ltd		
<b>Danny Whaitiri</b> <b>Self Employed</b> <ul style="list-style-type: none"> <li>• <b>Kaingaroa WTP – Main Operator</b></li> </ul>	<ul style="list-style-type: none"> <li>• Filtec Onsite Training at Kaingaroa</li> </ul>	Filtec	7 Nov 2017	2 hours
<b>Russell Philips</b> <b>Chorus/Downer</b> <ul style="list-style-type: none"> <li>• <b>Waitangi WTP - Main Operator &amp; Sampler</b></li> <li>• <b>Kaingaroa WTP – Sampler</b></li> </ul>	<ul style="list-style-type: none"> <li>• Filtec Onsite Training at Waitangi and Kaingaroa WTPs</li> <li>• NZQA unit 6401 and 6402 – Provide First Aid and Provide Basic Life Support</li> <li>• NZQA Unit 5627 Operate as a Traffic Controller (TC) for low volume and Level 1 roads</li> <li>• National Certificate in Water Reticulation (Service Person)Level 3 Wastewater and also Level 3 Water</li> </ul>	Filtec  NZQA  NZQA  NZQA	7 & 8 Nov 2017  21 Jan 2017  1 Nov 2015  18 June 2013	2 hours  Not specified  Not specified  Not specified
<b>Bruce Winter</b> <b>Fulton Hogan</b> <b>Backup Operator</b>	<ul style="list-style-type: none"> <li>• Filtec Onsite Training at Waitangi and Kaingaroa WTPs</li> <li>• Growsafe Introductory Certificate – for Management of Agrichemicals</li> </ul>	Filtec  NZ Agrichemical Education Trust	7 & 8 Nov 2017  19 Sep 2017  2 Sept 2017	2 hours   3 hours

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Name / Organisation / Role	Training Activity	Trainer	Date	Duration
	<ul style="list-style-type: none"> <li>St Johns First Aid Recertification</li> </ul>	St John	July 2012	8 hours
	<ul style="list-style-type: none"> <li>Accelerated Business Growth Programme, NZ Trade and Enterprise</li> </ul>	Aoraki Development Trust	6 Sept 2009	Not known
	<ul style="list-style-type: none"> <li>NZQA unit 3288 - Load Water and Additives for Aerial Operations and NZQA 20388 – Work Safely with Aircraft at Emergency Incidents</li> </ul>	PF Olsen Ltd	2012	6 hours
	<ul style="list-style-type: none"> <li>Work Safely in the Construction Industry</li> </ul>	Elmo Accredited	9/5/2009	1 day
	<ul style="list-style-type: none"> <li>MVA PRT Rev4602 firefighting qualification</li> </ul>	NZ Fire Service	7-10 Sept 2007	3 days
	<ul style="list-style-type: none"> <li>TAPs Qualified Firefighter</li> </ul>	NZ Fire Service		

## Appendix G SUPPORTING REPORTS

This Appendix includes:

- Stantec's letter to Audit New Zealand regarding service performance reporting, dated 28 October 2020.
- Drinking Water Assessor's 2019-20 Compliance Report for Waitangi and associated covering letter.  
*Note: Kaingaroa is not included in the Compliance Report as the Drinking Water Assessor is not required to report on compliance for supplies with a population less than 100 people.*
- Filtec's Service Report for Waitangi WTP (November 2020).
- Filtec's Service Report for Kaingaroa WTP (November 2020).
- Schedule 1 of MoH Funding Agreement. CIC has a copy of the full funding agreement
- Three Waters Stimulus Grant Delivery Plan. CIC has a copy of the Memorandum of Understanding (MoU) and funding agreement.

28 October 2020

Audit New Zealand  
PO Box 2  
CHRISTCHURCH 8140

**Attention:** **Richard Gray**  
Appointed Auditor

Dear Richard

**Audit of the Chatham Islands Council for the year ended 30 June 2020**  
**Chatham Islands Council Water and Wastewater Monitoring**

This letter is in response to your query to me, Kirsten Norquay, from Stantec, email received 22 October 2020 regarding the Chatham Islands Council (the Council) water and wastewater monitoring.

**Question 1: Competence and Capability**

Please outline for us your expertise in reporting on water and wastewater monitoring. Relevant information. Please include your organisation's experience in conducting such work and the qualifications and professional memberships you hold. If there are any technical performance standards or professional requirements relevant to this work then it would also be helpful to outline these for us.

We would appreciate it if you could also briefly describe the quality control processes you have in place in relation to conducting the monitoring, and analysing and reporting the results.

**Response to Question 1**

*Stantec is a global expert in water and wastewater management, including monitoring at water and wastewater treatment plants (WTP and WWTP, respectively). Stantec has carried out water and wastewater monitoring work at a range of plants in New Zealand including those in Chatham Islands, Auckland, Nelson/Tasman, Waitaki District, Dunedin City, and Southland District. Stantec is an accredited employer of Engineering New Zealand (formerly Institution of Professional Engineers of New Zealand, IPENZ) and is a member of organisations including Water New Zealand and Institute of Public Works Engineering Australasia.*

*All engineers currently working on the project hold a degree in engineering and are either Chartered Professional Engineers or Chartered Members of Engineering New Zealand (formerly called IPENZ) or equivalent (eg Chartered Engineer of the Engineering Council, UK) or supervised by such a person.*

*Sample collection is carried out by the Operations and Maintenance Contractor in accordance with the requirements of the relevant resource consent, Drinking-water Standards for New Zealand 2005 (revised 2018) and Hill Laboratories Ltd. The Operations and Maintenance Contractor was Fulton Hogan for the 2019/20 financial year.*

*Sample analysis and reporting is carried out by Hill Laboratories Ltd, which is accredited by International Accreditation New Zealand (IANZ). The exception is for pH and FAC, which are measured on-site by the operator using a hand-held meter calibrated in accordance with the manufacturer's instructions. Fulton*

**Stantec New Zealand**

Level 3 John Wickliffe House  
265 Princes Street  
Dunedin 9016

PO Box 13-052  
Armagh  
Christchurch 8141

TEL +64 3 477 0885  
FAX +64 3 477 0616

Ref Nos., Parent: 80509413, Child: 0203

Hogan (Chatham Islands) is authorised by South Island Drinking Water Assessment Unit to perform measurement of FAC by a hand-held meter. The authorisation is based on an assessment of Fulton Hogan staff carried by the Drinking Water Assessment on 6 December 2018 and is valid until January 2021.

Data analysis and reporting is carried out by Stantec, which has an internal quality assurance process that is certified to ISO 9001.

### **Question 2: Objectivity**

Objectivity refers to a freedom from bias or conflict of interest. Please confirm that you acted independently of Chatham Islands Council in conducting the report and that you are not aware of any matters that may create an actual or perceived conflict of interest. If there are any professional or ethical requirements relevant to this work then it would also be helpful to outline these.

### **Response to Question 2**

Stantec has acted independently of Chatham Islands Council in preparing the two six monthly reports that cover this reporting period. These are both titled "Water and Wastewater – Operation and Maintenance Summary Report", dated "July 2019 to December 2019" and "January 2020 to June 2020".

In addition, the majority of engineers currently working on the project are members of the Engineering New Zealand (formerly IPENZ) or its equivalent and as such are bound by Engineering New Zealand's Code of Ethical Conduct (or equivalent). A copy of the Engineering New Zealand's Code of Ethics is available from [www.engineeringnz.org](http://www.engineeringnz.org).

### **Question 3: Methodology**

It is important for us to understand the methodology used in conducting the monitoring data/work papers. Can you please briefly outline this for us? In particular, how the data set was obtained? Any assumptions used?

### **Response to Question 3**

Samples are collected by the Operations and Maintenance Contractor in accordance with the requirements of the relevant resource consent, Drinking-water Standards for New Zealand 2005 (revised 2018) and Hill Laboratories Ltd. The Operations and Maintenance Contractor was Fulton Hogan from 1 July 2019 to 30 June 2020. Samples are then transported to the accredited testing laboratory, which is not located in the Chatham Islands. Samples are typically collected within 1-2 hours of the aircraft leaving the Chatham Islands and then transported directly to the testing laboratory to minimise the interval between sampling and laboratory analysis.

Sample analysis and reporting is carried out by Hill Laboratories Ltd for all parameters except pH and FAC which are measured on-site by the plant operator using a hand-held meter. Sample results are taken from the Analysis Report sheets provided by Hill Laboratories or the plant operator log sheets. The Analysis Report and plant operator log sheets are not reproduced in the six monthly reports titled "Water and Wastewater – Operation and Maintenance Summary Report" dated "July 2019 to December 2019" and "January 2020 to June 2020" but can be provided to Audit New Zealand if required.

Data analysis and reporting is carried out by Stantec. All sample results provided by Hill Laboratories Ltd are included in the data set used to prepare the report. Where atypical results are observed (eg that may indicate water quality issues), additional samples are collected, analysed and included in the data set used to prepare the report and a commentary is included in the report. There were two periods when boil water notices were put in place – one in Waitangi and one in Kaingaroa, as discussed in the section titled

"Performance Measures". These were put in place and subsequently lifted in consultation with the Drinking Water Assessor.

### Six Monthly Reports

Please provide us a copy of the two six monthly reports.

#### Response

A copy of the two six monthly reports will be emailed to you with this letter.

### Performance Measures

Please outline Stantec's role in monitoring the Chatham Islands Council's performance measures and confirm if the targets have been met for the 2019/20 financial year. The performance measures we are focusing on are:

- a) Council's drinking water complies with part 4 and 5 of the drinking water standards.
- b) Compliance with resource consent for discharge from sewerage system.

#### Response

Sample collection, analysis and reporting, including Stantec's role, is partly outlined in the above response to Questions 1 to 3. In addition to this Stantec reviews the monthly water and wastewater quality data as it is available from the laboratory and, where atypical results are observed (eg that may indicate performance issues), contacts the Operations and Maintenance Contractor, the Chatham Islands Council's Chief Executive Officer and if appropriate the Drinking Water Assessor. Stantec also reviews data on a six-monthly and annual basis and compares this to Council's performance measures.

- a) Council's drinking water complies with part 4 and 5 of the drinking water standards.

Stantec understands that the Chatham Islands Council has a range of level of service measures for water, which Audit NZ has not requested Stantec to comment on.

The Council's drinking water supplies (Waitangi and Kaingaroa) did not comply with the DWSNZ in the 2019/20 financial year. However, the Council considers it was taking 'all practicable steps' to comply with the DWSNZ and hence met all its duties as a water supplier under the Health (Drinking-Water) Amendment Act for the 2019/20 financial year. Key points of note for both supplies are:

- Both supplies have an approved Water Safety Plan (WSP), and have been audited by the Drinking Water Assessor to confirm they are implementing the WSPs. Both supplies have Critical Control Point (CCP) monitoring in place.
- All compliance monitoring required in the WSPs was carried out. However, additional monitoring is required to comply with Section 4-9 of DWSNZ.
- For Waitangi, no E.coli was detected in raw water, treated water or reticulation samples (demonstrating bacterial compliance). The exception was E.coli was detected on one occasion in the reticulated water sample, resulting in a boil water notice being in place from 19 February to 3 March 2020. It is likely this was due to a sampling error. Protozoal treatment is inadequate (ie protozoal noncompliance) and needs to be addressed urgently. The Council sought central government assistance to urgently replace the existing UV disinfection system (no longer functional) to achieve compliance through various avenues. This funding has recently been granted, with works due to be completed in 2021.
- For Kaingaroa, no E.coli was detected in treated water or reticulation samples (demonstrating bacterial compliance). The exception was E.coli was detected on two occasions in the reticulated

water sample, resulting in a boil water notice being in place from 19 March to 17 June 2020. It is likely this was due to the sampling method when the WTP was offline – this issue has been rectified by installing a dedicated sampling point that can be used when the WTP feed pump is not operating. The boil water notice period was prolonged due to Covid19, rather than ongoing water quality issues. Protozoal treatment is also inadequate (ie protozoal noncompliance) and needs to be addressed urgently. The Council sought central government assistance through various avenues to urgently upgrade the raw water intake (existing trench requires a high level of on-going maintenance), install pre-treatment to enable existing UV disinfection system to be effective and install chlorination to achieve compliance. This funding has recently been granted, with works due to be completed during 2021.

- Council explored various avenues for funding to address the urgent needs at Waitangi and Kaingaroa, including non-compliance, in 2019/20 year. Some funding has recently been granted, with works due to be completed during the 2021 calendar year. Additional funding through the 3 waters stimulus fund will also go towards rectifying these issues, assuming the application is accepted.
- Based on the 2019/20 monitoring results, pro-active use of Boil Water Notices, the existing treatment processes, and inability to secure funding to upgrade the supplies, the Council considers it is taking 'all practicable steps' to comply with the DWSNZ and hence met all its duties as a water supplier under the Health (Drinking-Water) Amendment Act.

In summary, the Council's water supplies were not complying with the drinking water standards for 2019/20 year. Distribution zone compliance was achieved, except when boil water notices were in place. Council is seeking funding for long-term solutions to achieve compliance.

b) Compliance with resource consent for discharge from sewerage system.

Stantec understands that the Chatham Islands Council has a range of level of service measures for wastewater, which Audit NZ has not requested Stantec to comment on.

Stantec understands that Council compliance with resource consents for discharge from sewerage system is measured by the number of abatement notices, infringement notices, enforcement orders and convictions and that these should not occur more than twice per year.

No abatement notices, infringement notices, enforcement orders or convictions were issued this financial year. On this basis, the Council met this target for the 2019/20 financial year.

Please contact me by phone on (03) 474 3097 or by email on [kirsten.norquay@stantec.com](mailto:kirsten.norquay@stantec.com) if you wish to discuss the above.

Yours sincerely



Kirsten Norquay  
**Principal Process Engineer**  
**Stantec New Zealand**

Reviewed By: Richard Bennett

Copy to: Manaia Cunningham and Owen Pickles, Chatham Islands Council



# **Report on Compliance with the Drinking-water Standards for New Zealand 2005 (revised 2018) and duties under Health Act 1956**

**For Period: 1<sup>st</sup> July 2019 – 30<sup>th</sup> June 2020**

**Drinking Water Supply:**  
Waitangi (WAI158)

**Water Supplier:**  
Chatham Islands Council

**PHU/Drinking Water Assessment Unit**  
South Island Drinking Water Assessment Unit  
PO Box 1475, Christchurch 8140

**Report Identifier**  
ChathamIslandsCouncil\_DWSNZ2005/18Compliance\_261120\_v1

## Terminology

CRA – Catchment Risk Assessment

DWO – Drinking Water Online

DWSNZ2005/18 – Drinking Water Standards for New Zealand 2005 (Revised 2018)

GW – Ground water

Non-Compliance - Areas where the drinking water supply does not comply with the Drinking Water Standards for New Zealand 2005 (revised 2018) (DWSNZ)

## Summary of DWSNZ Compliance

### Treatment Plants

Plant Name and DWO code	Bacterial Compliance	Protozoa Compliance	Chemical Compliance	Cyanotoxin Compliance	Radiological Compliance	Overall Compliance
Waitangi (TP02307)	NO	NO	N/A	N/A	NO	NO

### Distribution Zones

Distribution zone name and DWO code	Bacterial Compliance	Chemical Compliance	Cyanotoxin Compliance	Overall Compliance
Waitangi (WAI158WA)	NO	N/A	N/A	YES

## Treatment Plants

Bacterial compliance is under section 4 of the DWSNZ 2005/18  
Protozoal compliance is under section 5 of the DWSNZ 2005/18  
Cyanotoxin compliance is under section 7 of the DWSNZ 2005/18  
Chemical compliance is under section 8 of the DWSNZ 2005/18  
Radiological compliance is under section 9 of the DWSNZ 2005/18

### Treatment Plant: Bacterial Compliance

#### Summary of *E.coli* sampling results

Plant name and DWO code	Number of <i>E.Coli</i> (total coliform) samples required	Number of samples collected	Number of <i>E. coli</i> transgressions	Compliance
Waitangi (TP02307)	52	12	0	Non-compliant

#### Summary of compliance with sampling / analytical / remedial / operational requirements

Sampling compliance was not achieved for number of samples and maximum days between samples for *E.coli* and total coliforms. Due to the geographical complexities involved with sending samples to the mainland, leniency has been applied for the minimum days of the week used for sampling. A MoH recognised laboratory was used for the sample analyses and appropriate sampling methods and sites were used.

### Treatment Plant: Protozoa Compliance

Plant Name and DWO code	Protozoa Log Credit requirement	Log credit determined through what process
Waitangi	Not assigned	Not assigned

#### Summary of Treatment Processes and associated Log Credits

Formal CRA and log credit assignment have not been completed for Waitangi. At the time the WSP was approved, this supply had secure ground water status and therefore required 0 log credits. Since losing ground water status in 2017, log credits have not been assigned.

Waitangi has UV disinfection, however the unit is not validated and therefore there is no treatment that meets the protozoa removal/inactivated requirements of the DWSNZ.

## Treatment Plant: Cyanotoxin Compliance

Not applicable to groundwater supplies and supplies not considered at risk ie no management protocol required.

## Treatment Plant: Chemical Compliance

No Priority 2 determinands were assigned to the treatment plan in the 2019/20 compliance year.

## Treatment Plant: Radiological Compliance

### Results Summary

Plant/Source Name	Date of last sample	Exceedances of MAVs	Compliance
Waitangi	N/A	N/A	NO

The DWSNZ requires all new wells to be tested before connecting them to the reticulation. Section 9.4 of the DWSNZ states that monitoring frequency for established sources is ten years. Radiological testing has never been completed for Waitangi and therefore does not comply with the radiological requirements of the DWSNZ.

## Distribution Zones

Distribution zone bacterial compliance is under section 4.4 of the DWSNZ 2005/18

Cyanotoxin compliance is under section 7 of the DWSNZ 2005/18

Chemical compliance is under section 8 of the DWSNZ 2005/18

The following compliance information is derived from sampling results provided by Hills Laboratories.

### Distribution Zone: Bacterial Compliance

#### Summary of *E.coli* sampling results

Distribution zone name and DWO code	Number of <i>E.Coli</i> ( total coliform) samples required	Number of samples collected	Number of transgressions	Compliance
Waitangi (WAI158WA)	12	12	1	Non-compliant

#### Summary of compliance with general sampling / analytical / remedial action requirements

Sampling compliance was achieved for number of samples and maximum days between samples for *E.coli* and total coliforms. Due to the geographical complexities involved with sending samples to the mainland, leniency has been applied for the minimum days of the week used for sampling. A MoH recognised laboratory was used for the sample analyses and appropriate sampling methods and sites were used.

## Summary of Audit Activities to Verify DWSNZ Monitoring Data

CIC do not enter their own data on DWO. All *E.coli* results for the compliance period were sent directly from Hills Laboratories to CPH and entered on DWO by the DWA.

### Assessment of Compliance with Duties of drinking-water suppliers under the Health Act

The duties of the water supplier under the Health Act have not been fully met.

Section 69S – Duty of suppliers in relation to the provision of drinking water	MET
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There have been no supply disruptions reported during the compliance period.

Section 69U – Duty to take reasonable steps to contribute to protection of source of drinking water	MET
---	-----

CIC have a WSP and are implementing this plan. The WSPs improvement schedule states that CIC will continue to monitor and control catchment activities through resource consents and as part of the National Environmental Standards for Sources of Human Drinking Water.

Section 69Y – Duty to monitor drinking water	NOT MET
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The monitoring requirements of the DWSNZ were not met for the treatment plant as not enough samples were taken during the compliance period.

Section 69Z – Duty to prepare and implement a WSP	MET
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CIC have an approved WSP.

Section 69ZD – Duty to keep records and make them available	MET
---	-----

*E.coli* and total coliform laboratory results are sent automatically to the DWA on a monthly basis.

Section 69ZE – Duty to investigate complaints	MET
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CIC maintain a register which has been viewed on previous implementation visits to the supply.

Section 69ZF – Duty to take remedial actions if drinking-water standards are breached	MET
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There was one transgression during the compliance period. CIC issued a boil water notice, reported the transgression to the DWA and investigated the cause of the transgression.

The results in this report relate only to the compliance of the above listed treatment plants and distribution zones.

Information in this report may be provided to the Ministry of Health at their request. With the exception of the Ministry of Health, this report shall not be reproduced without the approval of the Public Health Unit/Drinking Water Assessment Unit and Chatham Islands Council.

Completed 26<sup>th</sup> November 2020



Laura Bruce  
Drinking Water Assessor  
South Island Drinking Water Assessment Unit

## Assessment Report Information

<b>Report identifier</b>	ChathamIslandsCouncil_DWSNZ2005/18Compliance_261120_v1
<b>Public Health Unit/Drinking Water Assessment Unit (Inspection Body)</b>	South Island Drinking Water Assessment Unit PO Box 1475, Christchurch 03 364 1777
<b>Drinking Water Assessor</b>	Laura Bruce
<b>Assessment Date</b>	29 <sup>th</sup> October 2020
<b>Description of assessment work</b>	Assessment of Compliance with DWSNZ for Waitangi (WAI158) supply Waitangi (TP2307) treatment plant Waitangi (WAI158WA) distribution zone.
<b>Equipment Used</b>	Nil
<b>Water Supply Owner / Person Responsible</b>	Owen Pickles Chatham Islands Council
<b>Assessment method</b>	Standard assessment as per DWA Function 1 Drinking Water Standards for New Zealand 2005 (revised 2018)
<b>Documents and Information</b>	Drinking Water Standards for New Zealand 2005 (revised 2018) Part 2A Health Act 1956 Water Safety Plan for Waitangi Hill Laboratories E.coli and total coliform results.
<b>Site of Assessment</b>	Community and Public Health 310 Manchester Street Christchurch
<b>Omissions from proposed assessment</b>	Neighbourhood supplies have been omitted from this report.
<b>Sub-contracted work</b>	Nil
<b>Document checked by:</b>	David Speedy Appointed Drinking Water Assessor
<b>Release of report authorised by:</b>	Laura Bruce Appointed Drinking Water Assessor  26 <sup>th</sup> November 2020

If you do not agree with the findings of this report a written appeal must be lodged with the Technical Advisor, South Island Drinking Water Assessment Unit within two months of receipt of this report. The Technical Advisor will arrange for a review to be undertaken using the Ministry of Health appeals procedure.

## SERVICING REPORT

Wednesday, 23 December 2020

Bill Lind  
Fulton Hogan  
Email: Bill.lind@fultonhogan.com

### WAITANGI W.T.P EQUIPMENT SERVICE 25-11-2020

The following is our report on a recent service carried out on the following equipment.

#### Equipment Serviced:

- Multimedia Filter
- Softener Filters
- UV Filters
- DDE Dosing Pump

#### Notes/faults/recommendations:

- Replaced valves and diaphragm on DDE dosing pump
- Replaced media in multimedia filter.
- Replaced Steriflo Sleeve and Lamp.
- Softeners Regenerated and hardness at 6ppm
- Post plant reservoir hardness at high level so adjusted blend and next day was 79ppm(good)
- Checked bore cover for any leaks or possible contamination areas.
- Chlorine level tested at 0.32ppm
- Replaced backwash solenoid valve.
- Took apart pressure relief valve and fixed relief fault

Full service, included;

- Assessing site prior to work.
- Isolating, removing, stripping, cleaning and inspection of equipment.
- Installing new kits and replacing any other internal items as may be required.
- Reassembly, checking operation of equipment.

I hope the work was carried out to your satisfaction. Please give me a call if you have any questions.

Regards,  
Leighton Greaves  
Filtration Technology Ltd.



## SERVICING REPORT

Wednesday, 23 December 2020

Bill Lind  
Fulton Hogan  
Email: Bill.lind@fultonhogan.com

### KAINGAROA W.T.P EQUIPMENT SERVICE 25-11-2020

The following is our report on a recent service carried out on the following equipment.

#### Equipment Serviced:

- Trojan Viqua Pro 50 UV
- 2 x Hach Turbidity Meters
- Softener Unit
- Media Filter Units

#### Notes/faults/recommendations:

- Macrolite filter media checked and looks in good condition. (replace media 2021)
- Both turbidity serviced and calibrated
- A manual backwash was done on the softener filter, macrolite and 2 x multi media filters.
- UV lamp replaced, sensor cleaned.
- New Media Installed in RHS multimedia filter
- Reservoir tanked checked for sand buildup.
- Hardness reading at 6ppm
- Mapped out plant for installation of new carbon filters.

#### Full service, included;

- Assessing site prior to work.
- Isolating, removing, stripping, cleaning and inspection of equipment.
- Installing new kits and replacing any other internal items as may be required.
- Reassembly, checking operation of equipment.
- Calibration of Turbidity Meters (stablcal).

I hope the work was carried out to your satisfaction. Please give me a call if you have any questions.

Regards,  
Leighton Greaves  
Filtration Technology Ltd.



## SCHEDULE 1

### Ministry Funding

The Ministry Funding payable by the Ministry to the Provider is up to a maximum of \$339,900.01 plus GST.

### Payment Schedule

**Milestone payments:** The Ministry Funding of up to \$339,900.01 plus GST shall be paid in milestone payments as listed below

Milestone	Milestone Payment	Estimated Date
Waitangi WTP New UV unit	\$30,000	April 2021
Confirm feasibility of MPA bore for Waitangi	\$85,000	December 2020
Extend Kaingaroa intake into deeper water	\$149,900	April 2021
Add organics and chlorate removal to Kaingaroa WTP treatment system	\$50,000	April 2021
Repairs to Waitangi WWTP RBC shaft	\$10,000	December 2020
WWTP inlet feed pump check valves replacement	\$15,000	December 2020

## SCHEDULE 2

### The estimated Capital Cost of Works (clause 2.2)

The estimated capital cost of the works is \$339,900.01 plus GST.

## SCHEDULE 4

### Engineer (clause 7)

The Certifying Engineers in terms of clause 7.1 are Richard Bennett, Project Manager, Stantec New Zealand Ltd and Kirsten Norquay, Senior Engineer, Stantec New Zealand.

## SCHEDULE 5

### The Works

The Participating Community comprises the residents of the Chatham Islands. The scheme consists of a number of improvements to the water treatment and reticulation systems at the Chatham Island

townships of Waitangi and Kaingaroa, and improvements to the wastewater treatment and reticulation system at Waitangi, as described in the Stantec report Chatham Island Water and Wastewater Priority Infrastructure Needs dated 11 September 2019 and updated in an email to the Ministry of Health on 2 July 2020.

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## THREE WATERS STIMULUS GRANT DELIVERY PLAN

**Instructions for completion:** A single Delivery Plan is to be completed for the full Expenditure Programme. Territorial Authorities may elect to provide appendices providing further detail of specific elements of the proposed expenditure programme.

The draft Delivery Plan must be submitted by the Territorial Authority as soon as possible and in any event by no later than 30 September 2020 to [threewaters@dia.govt.nz](mailto:threewaters@dia.govt.nz), with a copy to [3waters@crowinfrastructure.govt.nz](mailto:3waters@crowinfrastructure.govt.nz). The Delivery Plan will be assessed by the Department of Internal Affairs and Crown Infrastructure Partners Limited, who may elect to provide feedback and require further detail, additions or alterations. A revised version of the Delivery Plan, incorporating all agreed changes, must be submitted for approval thereafter, with the final Delivery Plan to be in an approved form by 31 October 2020.

Where the Department of Internal Affairs requires additional reporting or other assurance based on a specific Delivery Plan, this will be included in section 17 below following the Department of Internal Affairs/Crown Infrastructure Partners Limited review. Section 17 will form part of the Delivery Plan. All figures in this Delivery Plan should be GST exclusive.

Capitalised terms in this Delivery Plan have the meaning given to them in the Funding Agreement, where applicable.

### Territorial Authority information

1. Programme Title:	Chatham Islands Council Tranche 1 Water Stimulus Programme
2. Territorial Authority:	Chatham Islands Council
3. Total Maximum Amount Payable (NZ\$M):	\$0.64M, \$0.32M direct allocation to Chatham Islands Council and \$0.32M allocation from Canterbury regional pool
4. Organisation Lead Contact:	
Name:	Owen Pickles
Position:	Chief Executive Officer
Email:	owen@cic.govt.nz

### Expenditure Programme overview

5. Please provide a brief description of the expenditure programme to be undertaken:

The programme that will be delivered by Chatham Islands Council includes the following:

1. Wastewater improvement project to mitigate adverse public health and environmental impacts and hence address consent non-compliance as well as to improve resilience. This will involve extension of the land application system, design of new wastewater treatment plant,

and investigation and remedial works to enable the existing system to continue to operate.

2. Water safety improvement project to enable real-time monitoring and reporting of treated water from Council-owned reticulated water supplies. This will include critical alarms being able to be relayed in real-time. In two projects separate to this expenditure programme, cell phone coverage is being deployed to Chatham Islands and both water treatment plants are being upgraded. When all three projects are complete, the supplies will be able to meet the drinking water standards. This water safety improvement project will also address drinking water non-compliances due to weather-related delays in sample transport.
3. Water resilience project to improve availability of water supply for communities, particularly during peak summer periods. This will involve replacement of aging assets to reduce network losses, provision of additional water storage tanks in Owenga to reduce need to tanker potable water from Waitangi, and provision of non-potable water tanks to ensure sustainable, reliable supply of potable water for communities.

6. Location/address of the programme:

(if this is a series of investments, please identify each location where relevant)

Waitangi, Kaingaroa, Owenga

7. What is the **total** estimated cost of the programme (NZ\$M)?

\$0.64M

8. If the total estimated cost exceeds the Total Maximum Amount Payable, please specify the funding source(s) and amount(s):

Funding Source	Amount (NZ\$M)
N/A	\$
	\$
<b>Total</b>	<b>\$</b>

9. Please provide a high-level breakdown of the expenditure programme including a cost schedule identifying estimated costs for each major component:

	Project	Indicative Cost (NZ\$M)
1	Wastewater improvement	\$0.24
2	Water safety improvement	\$0.22
3	Water resilience	\$0.18
	<b>Total</b>	<b>\$0.64M</b>

The indicative costs given above are based on previous estimates prepared for strategic planning or funding purposes. Once contractor's prices are obtained, Chatham Islands Council expect there is an ability to expand or reduce the scope of the three projects. This will be done to ensure the overall programme remains within the allocated stimulus funding, whilst measurably improving the overall public health, environmental performance, and resilience of water and wastewater systems on Chatham Island.

10. What is the expected number of people employed, and net jobs created through the expenditure programme? How has this been estimated?

	People Employed (FTEs)	Jobs Created
Direct impacts	4	3
Indirect impacts	2	1
Induced impacts	2	1

The projects will employ council staff, consultants, and contractors' staff. We have used the Job Multipliers spreadsheet-based tool provided by the Three Waters Steering Committee to calculate the number of people employed in terms of Full Time Equivalents (FTEs). We assumed that 90% of the \$0.64M investment is construction services and 10% is scientific & engineering services, and rounded the result to the nearest 0.5 FTE.

There is limited capacity within the existing construction sector on the island and so we have assumed that 75% will be new positions for direct impacts. We have assumed 50% will be new positions for indirect and induced impacts.

In addition to the employment and jobs created through the expenditure programme, the programme will alleviate capacity issues seen during peak summer periods. Combined with the airport extension project, this will enable growth in the tourism sector, which in turn will result in increased local job creation in the longer term. This job creation will be over and above that allowed for above.

**Expenditure Programme commencement**

11. Please describe the initial activity to be undertaken on expenditure programme commencement:

Chatham Islands' remoteness poses unique challenges for successful delivery of water and wastewater services. Chatham Islands Council has a professional services contract with Stantec and an O&M contract with Fulton Hogan, both parties been involved in the high-level project scoping. To ensure timely project delivery and positive long-term outcomes, at programme commencement Stantec will be engaged to oversee delivery of the stimulus programme. Projects will then be planned and procured directly with the local O&M contractor, with other preferred suppliers identified through an RFI process as necessary. Additional resource will be employed within the local O&M team to deliver the projects.

**Expenditure Programme completion**

12. Please outline below the high-level plan that will ensure the expenditure programme is completed by 31 March 2022 (these should largely mirror the milestones below):

Chatham Islands Council lack of cash resources has seen deferral of critical capital and operational maintenance programmes for many years. Hence successful completion of the programme is reliant

on the Council receiving the funding instalments in advance of incurring costs.

Stantec will work with the local O&M contractor to obtain costs for identified projects and, where appropriate, confirm supply lead times to the Chatham Islands. Programme scope and schedule will then be confirmed to ensure it delivers best value for money for the Island, whilst mirroring the allocated stimulus funding instalment schedule and enabling projects to start well before the required commencement date of 31 March 2021 and be completed by 31 March 2022.

Programme progress will be closely monitored, with monthly reporting by Stantec to the Council.

### Expenditure Programme funding status

13. Please indicate below the expenditure programme funding status:

The three projects all include work previously identified in Council's Combined Financial and Infrastructure Strategy, with allowance for this work to be carried out between 2019 and 2025. These allowances were included in the Strategy and carried forward into the Council's LTP on the basis that external funding would be available from central government. However, as this funding was not available and the Council did not have sufficient cash resources, the Council has deferred the works indefinitely in subsequent annual plans. Additional work that has been recently identified has also been included in the projects.

Wastewater improvement project	Y/N	Amounts NZ\$	Year
Included in LTP	N	N/A	N/A
Included in Annual Plan 2020/21	N	N/A	N/A
Not funded in any plan	Y	\$0.24M	N/A
Was funded but COVID-19 deferred	N	N/A	N/A
Is any Territorial Authority co-funding being contributed?	N	N/A	N/A

Water safety improvement project	Y/N	Amounts NZ\$	Year
Included in LTP	N	N/A	N/A
Included in Annual Plan 2020/21	N	N/A	N/A
Not funded in any plan	Y	\$0.22M	N/A
Was funded but COVID-19 deferred	N	N/A	N/A
Is any Territorial Authority co-funding being contributed?	N	N/A	N/A

Water resilience project	Y/N	Amounts NZ\$	Year
Included in LTP	N	N/A	N/A
Included in Annual Plan 2020/21	N	N/A	N/A
Not funded in any plan	Y	\$0.18M	N/A
Was funded but COVID-19 deferred	N	N/A	N/A
Is any Territorial Authority co-funding being contributed?	N	N/A	N/A

14. Please set out the key milestones of the expenditure programme to be undertaken, and for each milestone the planned completion date and budget:<sup>1</sup>

	Expenditure Programme Milestone (including a description of how the milestone is identified)	Completion Date	Maximum Funding instalment amount (NZ\$) <sup>2</sup>	Budgeted costs to complete the expenditure programme (NZ\$)	[DIA USE ONLY] Funding Conditions
1.	Commencement Date occurring under the Funding Agreement	31 October 2020 (or such date agreed otherwise in writing with DIA under the Funding Agreement)	NZ\$0.32M	Nil	
2.	Commencement of expenditure programme	31 October 2020	Nil	Nil	
3.	First quarterly payment	31 March 2021	NZ\$0.08M	NZ\$0.1M	
4.	Second quarterly payment	30 June 2021	NZ\$0.08M	NZ\$0.2M	
5.	Third quarterly payment	30 September 2021	NZ\$0.08M	NZ\$0.14M	
6.	Final quarterly payment	31 December 2021	NZ\$0.08M	NZ\$0.1M	
7.	Completion of expenditure programme	31 March 2022	Nil	NZ\$0.1M	
	<b>TOTAL</b>		NZ\$0.64M	NZ\$0.64M	

15. Briefly outline the final expected outcomes/objectives of the expenditure programme:

<ol style="list-style-type: none"> <li>1. Wastewater improvement project – address run-off of treated wastewater from the land application system, address critical issues with wastewater treatment plant and, since the plant is at the end of its serviceable life, develop a design for a new treatment plant.</li> <li>2. Water safety project – provide on-line monitoring and reporting of both reticulated water supplies to improve water safety and drinking water compliance.</li> <li>3. Water resilience project – improve availability of water supply for communities and alleviate demand on Waitangi and Kaingaroa potable water supply, particularly during summer when demand can exceed available supply.</li> </ol>
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16. Briefly outline an assessment of how the expenditure programme supports the reform

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<sup>1</sup> All figures should be GST exclusive.

<sup>2</sup> You may choose to determine each maximum Funding instalment amount for a milestone on the basis of seeking funds either for application towards costs incurred for that milestone, or for application towards costs to be incurred for the following milestone.

objectives set out in the Memorandum of Understanding relating to Three Waters Services Reform between you and the Sovereign in Right of New Zealand acting by and through the Minister of Local Government:

Chatham Islands' remoteness poses unique challenges for successful delivery of water and wastewater services. In addition, the Council's lack of cash resources and very small rating base has seen deferral of critical capital and maintenance programmes for many years due to lack of affordability.

The expenditure programme will go some way to address the affordability challenge faced by the Council and enable the most urgent water and wastewater matters to be resolved. It will also give many residents of Chatham Islands equitable access to a level of service similar to the mainland.

The three projects also support other reform objectives including:

1. Wastewater improvement project – significantly improves the environmental performance of the wastewater system by addressing consent noncompliance, increases resilience in the short term by carrying out urgent maintenance, and plans for future resilience by designing a new treatment plant that is able to be serviced and maintained locally.
2. Water safety project – significantly improves safety and quality of drinking water services by providing on-line monitoring and reporting for Council-owned reticulated water supplies. Together with other projects, this project will enable the compliance with the drinking water standards and address non-compliances due to weather-related delays in sample transport.
3. Water resilience project – significantly improves the resilience of Council's potable water supplies by improving availability and alleviating demand, particularly during summer when demand can exceed available supply. More extended dry periods are expected with climate change, which will worsen this situation (eg low lake levels, reduced aquifer recharge)

**DIA USE ONLY**

17. Additional requirements in respect of the Funding Agreement (such as specific reporting requirements):

The parties acknowledge and agree that this is the agreed Delivery Plan.

**SIGNATURES**

**SIGNED** by the **SOVEREIGN IN RIGHT OF NEW ZEALAND** acting by and through the Chief Executive of the Department of Internal Affairs or his or her authorised delegate:

\_\_\_\_\_  
Name:  
Position:  
Date:

**SIGNED** for and on behalf of

\_\_\_\_\_  
by the person(s) named below, being a person(s) duly authorised to enter into obligations on behalf of that territorial authority:



Name: Owen Pickles  
Position: Chief Executive  
Date: 20 September, 2020

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Name:  
Position:  
Date:

## **Appendix H CCP AND BACKGROUND**

This Appendix includes the following:

- Waitangi Water Supply – CCP for chlorination
- Kaingaroa Water Supply – CCP for filtration (macrolite)
- Background information on water quality parameters monitored in water supplies.

## Waitangi Water Treatment Plant

### Critical Control Point Process Control Summary – Chlorination

#### Process objectives

1. Provide a **primary disinfection Critical Control Point** to inactivate bacterial and viral pathogens that may have entered upstream of dosing point
2. Provide a **residual disinfection control point** to help inactive pathogens entering downstream of the dosing point.

<b>Operational day-to-day monitoring of control process</b>		
What	<ul style="list-style-type: none"> <li>• Free Available Chlorine (FAC) concentration in mg/L</li> <li>• pH in pH units. (Note: pH is not able to be adjusted if outside ideal range.)</li> </ul>	
When	<ul style="list-style-type: none"> <li>• At least 5 days per week</li> </ul>	
Where	<ul style="list-style-type: none"> <li>• Collect water sample from designated treated water sampling point</li> </ul>	
How	<ul style="list-style-type: none"> <li>• Analyse sample using handheld meter (eXact Micro 20 Photometer) and record result</li> </ul>	
Who	<ul style="list-style-type: none"> <li>• Operator</li> </ul>	
Records	<ul style="list-style-type: none"> <li>• Log book hard copy. Contract Manager inputs data into Water Outlook, a proprietary database that the Water Engineer can access.</li> </ul>	
<b>Process performance criteria at monitoring point</b>		<b>Correction if performance criteria are not met</b>
Target Range:	<ul style="list-style-type: none"> <li>• FAC: 0.2 - 0.5 mg/L</li> <li>• pH: &lt;8</li> <li>• Turbidity: &lt;0.3 NTU</li> </ul>	<ul style="list-style-type: none"> <li>• Operator to adjust chlorine dosing system to achieve target range if identified as outside of target range during routine checks</li> </ul>
Action Limits:	<ul style="list-style-type: none"> <li>• FAC:                             <ul style="list-style-type: none"> <li>◦ &lt;0.2 mg/L</li> <li>◦ &gt;0.6 mg/L</li> </ul> </li> <li>• pH: &gt;8.5</li> <li>• Turbidity: &gt;0.5 NTU</li> </ul>	<ul style="list-style-type: none"> <li>• Operator to respond by adjusting chlorine dosing to within targets.</li> <li>• Operator to undertake troubleshooting as required (eg checking dosing pump function, age of solution)</li> <li>• Operator to notify Contract Manager</li> </ul>
Critical Limits:	<ul style="list-style-type: none"> <li>• FAC:                             <ul style="list-style-type: none"> <li>◦ &lt;0.1 mg/L</li> <li>◦ &gt;2 mg/L</li> </ul> </li> <li>• pH: &gt;9</li> <li>• Turbidity: &gt;1 NTU</li> </ul>	<ul style="list-style-type: none"> <li>• Operator to isolate supply and run off storage until rectified and back within critical limits</li> <li>• Operator to notify Contract Manager</li> <li>• Contract Manager to notify Water Engineer.</li> <li>• Water Engineer to notify CEO and DWA if water outside of critical limits needs to be supplied or has been supplied and follow Contingency Plan 3 in the Water Safety Plan.</li> </ul>

#### Supporting programmes

1. Routine checks by operator at least 5 days a week.
2. Operators authorised to perform FAC analysis with handheld meter. Note: DWA authorisation expires Jan 2021.
3. Annual verification of FAC analyser by service agent (Filtec) using a second meter as part of annual WTP servicing.
4. Annual service and condition assessment of chlorine dosing system by service agent (Filtec).
5. Annual refresher training of operator in operation, maintenance and troubleshooting of treatment process units and instrumentation by service agent (Filtec).

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6. Monthly laboratory verification checks for E. coli, total coliforms and turbidity. Laboratory reports sent directly to Contract Manager and Water Engineer, Water Engineer reports monthly to CEO, and Water Engineer reports transgressions as soon as practicable to CEO and DWA if results are outside the DWSNZ.

**Planned programmes**

1. Interim upgrade of Waitangi water supply, including a new UV disinfection system to replace the existing system that has no longer effective. Dependent on central government funding.
2. Upgrade of Waitangi water supply, including a new bore, new treatment plant with online monitoring and modifications to the network. Upgrade (and extent of upgrade) is dependent on central government funding and additional tests at the new bore site.

*Date of Issue: January 2020*

## Kaingaroa Water Treatment Plant

### Critical Control Point Process Control Summary – Filtration (Macrolite)

#### Process objectives

1. Provide a **primary particle removal Critical Control Point** to physically trap pathogens that may have entered the system.
2. Provide a **primary particle removal Critical Control Point** to separate material that will compromise the efficacy of subsequent disinfection barriers.

<b>Operational day-to-day monitoring of control process</b>	
What	<ul style="list-style-type: none"> <li>• Filtrate turbidity in NTU</li> </ul>
When	<ul style="list-style-type: none"> <li>• At least 2 times per week</li> </ul>
Where	<ul style="list-style-type: none"> <li>• At online turbidity meter (Hach SC200) downstream of macrolite filter (ie treated water)</li> </ul>
How	<ul style="list-style-type: none"> <li>• Record value from online turbidity meter</li> </ul>
Who	<ul style="list-style-type: none"> <li>• Operator</li> </ul>
Records	<ul style="list-style-type: none"> <li>• Log book hard copy. Contract Manager inputs data into an Excel spreadsheet and forwards to Water Engineer.</li> </ul>
<b>Process performance criteria at monitoring point</b>	
<b>Target Range:</b>	<b>Correction if performance criteria are not met</b>
<ul style="list-style-type: none"> <li>• Turbidity: &lt;0.3 NTU</li> </ul>	<ul style="list-style-type: none"> <li>• Operator to check headloss across filter and manually backwash filter as required to achieve target range if identified as outside of target range during routine checks</li> </ul>
<ul style="list-style-type: none"> <li>• Turbidity: &gt;0.5 NTU</li> </ul>	<ul style="list-style-type: none"> <li>• Operator to respond by checking headloss across macrolite and multimedia filters then manually backwashing as required.</li> <li>• Operator to undertake troubleshooting as required (eg checking raw water intake, softener operation)</li> <li>• Operator to notify Contract Manager</li> </ul>
<ul style="list-style-type: none"> <li>• Turbidity: &gt;1 NTU</li> </ul>	<ul style="list-style-type: none"> <li>• Operator to isolate supply and run off storage until rectified and back within critical limits</li> <li>• Operator to notify Contract Manager</li> <li>• Contract Manager to notify Water Engineer.</li> <li>• Water Engineer to notify CEO and DWA if water outside of critical limits needs to be supplied or has been supplied and follow Contingency Plan 3 in the Water Safety Plan.</li> </ul>

#### Supporting programmes

1. Routine checks by operator at least twice a week.
2. Annual calibration of turbidity meter by service agent (Filtec) using StablCal (or equivalent) as part of annual WTP servicing.
3. Annual service and condition assessment of filter (including media condition) by service agent (Filtec).
4. Annual refresher training of Operator in operation, maintenance and troubleshooting of treatment process units and instrumentation by service agent (Filtec).

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5. Monthly laboratory verification checks for E. coli and total coliforms. Laboratory reports sent directly to Contract Manager and Water Engineer, Water Engineer reports monthly to CEO, and Water Engineer reports transgressions as soon as practicable to CEO and DWA if results are outside the DWSNZ.
6. Operator training using a Hach ICE-PIC to verify turbidity meter readings (by DCC operators, 17 April 2018, Mt Grand WTP, Dunedin) for planned monthly verification using this method (see planned programmes).
7. Flow restrictor on UV unit limits process flow so filter hydraulic design capacity not exceeded and six-monthly checks of water demand (based on manual flow meter readings).

**Planned programmes**

1. Monthly verification of turbidity meter using a Hach ICE-PIC (or equivalent). The cost of the portable unit for verification has been included in the Waitangi Upgrade Project, however until this project proceeds there is insufficient funding to purchase this unit. The portable unit would be used at Kaingaroa and Waitangi WTPs.
2. Upgrade of Kaingaroa water supply, including improving raw water quality by extending raw water intake into deeper water in Lake Rangitai and improving level of treatment by reducing dissolved organics which will improve effectiveness of existing UV disinfection and by providing residual chlorination. Upgrade (and extent of upgrade) is dependent on central government funding.

*Date of Issue: January 2020*

## Background Information

### E. coli and Total Coliforms

Coliform bacteria are abundant in the faeces of warm-blooded animals, but can also be found in the aquatic environment, in soil and on vegetation. DWSNZ compliance for bacterial quality of drinking water leaving the treatment plant and within the distribution is based on a prevalence of the coliform bacteria *Escherichia coli* (*E. coli*) of less than 1 MPN/100ml. For compliance testing, a method that enumerates *E. coli* and total coliforms is required. DWSNZ compliance for protozoal quality of untreated water from a 'secure' bore is currently based on the same criteria and so, whilst Tikitiki bore no longer has 'secure' status, results from the raw water provide some perspective on the public health risk.

Whilst the new DWSNZ require monitoring of total coliforms, they do not include maximum values. The Ministry of Health's summary of the DWSNZ changes notes: "*A high total coliform reading does not necessarily pose a risk to human health as the subset of faecal coliforms, and specifically E. coli, is recognised as the primary indicator that the drinking-water supply may be contaminated with pathogens. However, total coliforms are a useful indicator of drinking-water quality and may detect abnormalities and changes in quality over time. Monitoring total coliforms may provide warning to a water supplier that water quality is changing, such that further testing and assessment is appropriate.*"<sup>27</sup>

In addition, the guidelines to the new DWSNZ<sup>28</sup> note:

- "*Total coliforms have limited interest in their own right, but with one important exception: when total coliforms are detected in the absence of E.coli, it is important that the source be investigated as their presence may be indicative of a barrier failure or biofilm development.*" (Chapter 6.3.2)
- "*Frequently finding total coliforms in distribution system and service reservoir samples in the absence of E.coli suggests biofilm development, which tends to occur more often in the summer, or contamination from the environment... Maintaining a chlorine residual is an effective technique for controlling this problem, if not the cause.*" (Chapter 5.3.2).

### FAC, pH and Turbidity

Free Available Chlorine (FAC), pH and turbidity monitoring are not currently required for DWSNZ compliance under the approved WSP. However, at Waitangi WTP, these parameters provide an indication of the level of bacterial protection provided by residual chlorine in water leaving the WTP. At both water treatment plants turbidity also provides an indication of the effectiveness of the filtration processes at removing any turbidity in the raw water as well as the level of bacterial and protozoal protection provided by the UV disinfection process.

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<sup>27</sup> Ministry of Health. 2018 "*Drinking-water Standards for New Zealand 2005 (Revised 2018): Summary of changes*"

<sup>28</sup> Ministry of Health. 2019. "*Guidelines for Drinking-water Quality Management for New Zealand*"

# CREATING COMMUNITIES

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