

# POVERTY BAY MANAGED AQUIFER RECHARGE TRIAL Initial Injection Test

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REPORT



## POVERTY BAY MAR INITIAL TEST

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## 1.0 INTRODUCTION

Gisborne District Council (GDC) is investigating water management options in the Poverty Bay region with the aim of improving water security for all users. One option under investigation is the use of Managed Aquifer Recharge (MAR), to replenish and sustain groundwater yields from aquifers beneath the Poverty Bay Flats.

A MAR trial targeting the Makauri Aquifer has been initiated by GDC. The trial is based on taking water from the Waipaoa River via the Kaiaponi Farms irrigation water supply infiltration gallery and injecting the water, following treatment, into the Makauri Aquifer. The Kaiaponi MAR site is located on the Kaiaponi Farms property, on Bushmere Road. So far the trial has been designed, the necessary resource consents obtained, two bores have been drilled, headworks and delivery system has been constructed and initial testing of the system has started. This report outlines the results from the pre-injection trial as per condition 38 of Resource Consent (DW-2016-107113-00):

38) Following the pre-injection trial of 10,000 m<sup>3</sup> the consent holder shall provide a report to the GDC Manager on the performance of this preliminary trial, with particular reference to the water quality and water quantity effects that arose. Any updates to the Management Plan referred to in condition 35 that are required based on the results of the preliminary trial shall be made and re-certified in writing by the GDC Manager. The commencement of the main trial shall not commence until this reporting and potential re-certification (if required) has been completed.

## 2.0 BORE INSTALLATION

## 2.1 Pilot Bore

Drilling of the pilot bore at Kaiaponi Farm was started on 20 March 2017 and was completed as a monitoring bore on 31 March 2017. It has been assigned the GDC bore number GPE065. A copy of the drillers log for the pilot bore is provided in Appendix A. A summary of the bore structure is provided in Table 1.

## 2.2 Injection Bore

The injection bore was drilled and installed between 3 April 2017 and 24 April 2017. Development of this bore was carried out through a process of pumping and surging on 27 April 2017. The injection bore has been assigned the GDC bore number GPE066. A copy of the drillers log for the pilot bore is provided in Appendix A. A summary of the bore structure is provided in Table 1.

Parameter	Pilot bore	Injection bore
GDC ID	GPE065	GPE066
Easting	2938345	2938328
Northing	6276377	6276389
Distance from injection bore (m)	23	-
Bore depth (m bgl)	92	73.5
Screened interval (m bgl)	69.2 – 72.6	69.5 – 72
Casing internal diameter and material	50 mm PVC	225 mm uPVC
Height of casing above ground level (m)		1.3

#### Table 1: Bore structure summary.





## 3.0 AQUIFER CHARACTERISATION

## 3.1 Geology

Based on the lithologies intersected during the drilling program (refer drillers logs in Appendix A and Table 2 below, it appears that the Makauri Aquifer beneath the Pilot Trial site may be split into two layers. The upper layer is three metres thick and is at a level consistent with the general gradient and depth of the Makauri Aquifer beneath the Poverty Bay Flats. The lower layer, although thicker at approximately six metres, is considerably deeper than the regional aquifer trend would indicate for the position of the Makauri Aquifer. In addition, there is an 11 m thick clay aquitard between the two layers.

The hydraulic connection between the deeper layer and the wider Makauri Aquifer that is used as a horticultural water source is in doubt. For this reason the pilot bore monitoring well screen was installed in the shallower layer.

An air lift test was performed in this monitoring well and a hydraulic reaction to the test was detected in the nearest monitored well screened in the Makauri Aquifer approximately 100 m from the site (refer Section 3.2.1 and Appendix B). For this reason, the screen depth for the injection bore was targeted at the upper Makauri Aquifer layer.

Top of unit (m bgl)	Base of unit (m bgl)	Description	Interpretation
0	1	Topsoil	Aquitord
1	26	Clay	Aquitard
26	31.2	Gravel	Aquifer
31	69	Clay	Aquitard
69	72.6	Gravel	Makauri Aquifer
72.6	84.8	Clay	Aquitard
84.8	91	Gravel	Basal split of Makauri Aquifer?
91	92	Clay	Aquitard

#### Table 2: Lithological sequence.

## 3.2 Hydraulic Test Program

### 3.2.1 Air lift test on pilot bore monitoring well

An air lift test was performed in the pilot bore monitoring well on 30 March 2017 to gain an indication of the aquifer hydraulic characteristics prior to installation of the injection bore.

Air lifting was undertaken at an average rate of 1.8 L/s for 120 minutes. The recovery phase of the air lift test was monitored in the pilot bore and the entire test was monitored in an unused private bore GPE010 some 190 m away.

The drawdown and recovery data was analysed to provide an indication of the aquifer parameters to support the design process for the injection bore. The parameters and results of this preliminary test are presented in Table 3. The analysis sheets are provided in Appendix B.



Parameter	Pilot bore	GPE010
Distance from Pilot Bore (m)	-	190
Period of air lift (minutes)	120	-
Average rate of water abstraction (L/s)	1.8	-
Static water level (m btoc)	8.74	8.345
Maximum drawdown (m)	NA <sup>(1)</sup>	0.06
Recovery period monitored (minutes)	77	75
Aquifer transmissivity (m²/day) (2)	NA <sup>(1)</sup>	692 – 1,070
Aquifer hydraulic conductivity (m/day) (2)	NA <sup>(1)</sup>	231 - 357
Aquifer storativity (m <sup>3</sup> /m <sup>3</sup> ) (2)	NA <sup>(1)</sup>	1.7 x 10 <sup>-4</sup>

#### Table 3: Pilot bore monitoring well air lift test.

Note: 1) Could not be measured due to the nature of the test.

2) Initial estimate only for injection bore planning and design purposes.

### 3.2.2 Stepped rate test on injection bore

A stepped rate pumping test was carried out in the injection bore on 4 May 2017 at four flow rates (7 L/s, 10 L/s, 13 L/s and 16 L/s). The flow rates were checked regularly to maintain constant flow during each step. The first three steps were pumped for 120 minutes each. The duration of the last step at 16 L/s had to be cut back to 100 minutes due to large and increasing drawdown of the water column in the bore (refer to drawdown chart provided in Appendix B).

Toward the end of the stepped rate test an issue was encountered with large drawdown and accurate measurement of the flow rates. Both of these issues were due to the presence of dissolved gas (refer to Section 3.3.3) within the aquifer water, that degassed when depressurised. The drawdown of water in the bore during the final pumping stage resulted in depressurisation of the aquifer in the immediate vicinity of the bore sufficient to cause degassing in the gravels surrounding the well screen. The collected gas caused temporary clogging of the well screen, leading to reduced flow into the bore and increased drawdown in the bore. Once initiated this process let to a rapid increase in drawdown within the injection bore, although pressure responses in the aquifer at the Pilot Bore monitoring well did not reflect this drawdown.

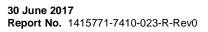
Analysis of the stepped rate test results indicated that the bore would have the capacity to accepted water injection at rates of between (between 10 L/s and 22 L/s). Gas in the existing aquifer water would not influence the rate at which water can be injected to the aquifer.

#### 3.2.3 Constant rate test on injection bore

A constant rate pumping test was started at 9:30 am on 5 May 2017 and recovery started on 8 May 2017 at 9:30 am. The pumping rate was controlled at 13 L/s to reduce the risk of uncontrolled drawdown in the injection bore due to degassing, as occurred in the stepped rate test.

Under the pumping rate of 13 L/s, the water level in the injection bore dropped from 8.3 m to 13 m bgl after three days of pumping. The maximum drawdown of 4.7 m indicated that injection rates at least equivalent to this flow should be able to be achieved.

The drawdown and recovery curves from the constant rate test are documented in Appendix B. The analyses of these curves to derive aquifer parameters are also presented in Appendix B. The hydraulic parameters derived from these analyses are presented in Table 4.





Test curve analysis <sup>(1)</sup>	Distance from injection bore (m)	Transmissivity (m²/day)	Hydraulic conductivity (m/day)	Storativity (m³/m³)
Injection bore (GPE066) drawdown <sup>(2)</sup>	-	250	80	-
Injection bore (GPE066) recovery	-	600	200	-
Pilot bore (GPE065) drawdown	23	770	260	3.0 x 10 <sup>-4</sup>
Pilot bore(GPE065) recovery	23	600	200	
GPE010 drawdown	190	780	260	1.6 x 10⁻⁵
GPE010 recovery	190	610	210	
GPE030 drawdown	365	760	250	1.8 x 10⁻⁵
GPE030 recovery	365	580	190	
Interpreted aquifer parameters		600 – 800		2 x 10 <sup>-5</sup> – 3.0 x 10 <sup>-4</sup> .

#### Table 4: Analysis results from injection bore constant rate test.

**Note:** 1) Analysis results rounded to two significant figures.

2) Lower confidence in the result of this analysis.

The pumping test analyses indicate the aquifer transmissivity is between 600 m<sup>2</sup>/day and 800 m<sup>2</sup>/day and the storativity is between  $1.5 \times 10^{-5}$  and  $3 \times 10^{-4}$ . No indications of hydraulic boundary conditions were identified during analysis of the test data. It is however recognised that the aquifer changes laterally in thickness, which means the calculated transmissivity and storativity are likely to differ for different monitoring wells.

The aquifer properties described above are similar to those used during the pre-feasibility assessment to project expected water level responses in nearby bores. Two of the nearby bores gave very consistent responses to the test and the analyses are indicating similar aquifer properties (GPE010 and GPE030). The data from two other bores monitored during the test (GPE012 and GPF105), located close to each other approximately 1 km southeast from the site, showed water level responses that appear to have been affected by more local domestic pumping. This interference means that with the drawdown and recovery data from these two bores has not been analysed.

Given the results of the constant rate pumping test, the estimated flow rates for injection of between 10 L/s and 22 L/s were considered reasonable, in advance of any injection testing.

## 3.3 Hydrogeochemistry

#### 3.3.1 Geochemistry

Samples of aquifer material obtained from both the 69 m to 72 m layer and the 85 m to 92 m deep gravel layers intersected in the pilot bore were sent to Waikato University for analysis.

X-Ray Fluorescence analysis of the samples was undertaken to provide information on the major element composition of the geological material. The high calcium concentrations measured in both samples are consistent with the presence of limestone in the aquifer, which was expected based on the nature of the catchment geology. The two samples contain trace elements at concentrations that are mostly lower than their average crustal abundance (Appendix C). Arsenic and sulphur are only present at low concentrations. From this data we consider it unlikely that there are significant concentrations of sulphur-bearing minerals in the local aquifer.

XRD analysis was undertaken to determine mineral content of the rock samples (Figure 1). The XRD results showed the sample to be quartz dominated with some calcium carbonate (from shell fragments and limestone).



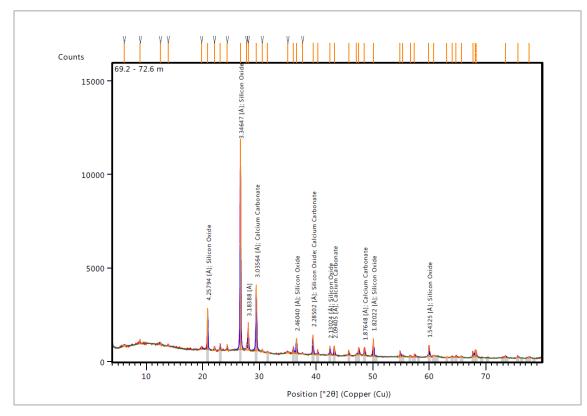


Figure 1: XRD analysis results.

### 3.3.2 Water quality

The groundwater quality data derived from sampling of the MAR pilot bore are very consistent with those from GDP115. The data from GDP115 were used as a basis for the iron oxidation modelling undertaken in support of the Assessment of Environmental Effects (Golder 2015).

A comparison of the major elements distribution in water samples from the pilot bore and a collection of other bores screened in the Makauri Aquifer is presented as a Piper Diagram in Figure 2. The major ion distributions in groundwater samples from bores within five kilometres of the injection bore are very similar to the sample obtained from the pilot bore. The scatter in major ion distributions increases slightly in bores further away.

#### 3.3.3 Dissolved gas

During the pumping tests a significant volume of gas was released from the discharged water within the stilling basin adjacent to the injection bore. Based on general knowledge of the aquifer chemistry, it was initially assumed that the primary components of the discharged gas would be methane and carbon dioxide.

The Health and Safety procedures for this initial test program were modified as soon as the gas discharges from the aquifer water were identified, to manage any risk resulting from methane degassing. Testing of the gas above the basin and in the mouth of the discharge pipe did not identify a critical lack of oxygen.





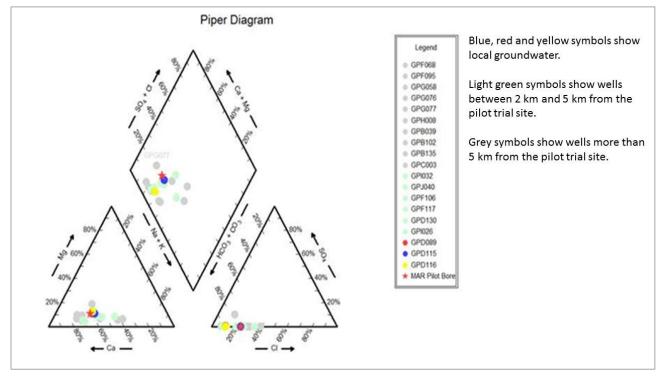


Figure 2: Major ion characteristics for water from wells screened in the Makauri Aquifer.

Sampling and analysis of the gas from the bore was undertaken during the initial testing program for the bore headworks and injection system. Landfill gas monitoring equipment, which can differentiate between gasses and provide relative percentages present, was used to evaluate the gas components.

During the sampling and analysis of the discharged gas, it was identified that both methane and oxygen were present in the sample in significant quantities. As this combination would not be chemically stable or naturally present in the dissolved gases in the aquifer, it was assumed that some mixing of air with the aquifer gases had occurred during the sampling and analysis. It was further assumed that 100 % of the oxygen in the sample was derived from air leakage, with corresponding fractions of nitrogen and other gases that naturally occur in the atmosphere. The components of each of the constituent gases derived from leakage could then be calculated and the residue components were assumed to be derived from the aquifer water. The calculation and the derived components of the dissolved gases in the aquifer water are presented in Table 5.

Due to the potential presence of methane gas at the site, health and safety precautions need to be taken when working in the area, especially when pumping out of the bore, but also following periods of operational rests. Additional air release valves have been added to the pipework design to facilitate gas release. Gas meters have been used on site during pipework installation.

The potential need for geochemical modelling of the dissolved gas has been assessed. It was concluded that a clear health and safety management approach for the pumping tests and trial period is a more worthwhile course of action than further modelling. When the site is used as an injection well it is unlikely that aquifer gas bubbles will form within the bore or the immediately surrounding aquifer, as the aquifer pressure is being increased rather than lowered.



Parameter	Sample (%)	Sample corrected <sup>(1)</sup> (%)	Average air constituents (%)	Air fraction <sup>(2)</sup> (%)	Aquifer fraction <sup>(3)</sup> (%)	Aquifer gas (%)
CH <sub>4</sub>	29.7	29.1	0	0	29.1	49.5
CO <sub>2</sub>	4.7	4.6	0.03	0.01	4.6	7.8
O <sub>2</sub>	8.8	8.6	20.95	8.6	0.0	0.0
CO	2	2.0	0	0	2.0	3.3
$H_2S$	0	0.0	0	0	0.0	0.0
Balance (4)	56.8	55.7	79.02	32.5	23.1	39.4
Sum	102	100	100	41.2	58.8	100

#### Table 5: Calculated aquifer gas components.

Note: 1) Corrected to total of 100 %.

2) Based on assumption that 100 % of  $O^2$  is derived from air leakage into sample.

3) Corrected sample components minus air components.

4) Primarily nitrogen, minor argon and trace other gases.

The low sulphate concentrations in water from almost all of the groundwater bores that were evaluated previously suggests that reducing conditions (and dissolved methane) are present in the Makauri Aquifer beneath much of the Poverty Bay Flats.

## 4.0 INJECTION TESTS

## 4.1 Stepped Rate Tests

A series of stepped rate injection tests were undertaken between 22 May 2017 and 7 June 2017. The objective of these tests was to:

- 1) Evaluate the rate at which water could potentially be introduced through the injection bore to the aquifer.
- 2) Identify factors limiting the rate at which water could be injected and, if possible, take steps to address the factors to improve injection rates.

Analysis of the data from the tests undertaken during the above period provides a good indication of the rates at which water can be introduced to the aquifer through the injection bore (GPE066).

Issues identified during these injection tests were primarily operational in nature. The main issues are summarised below.

- The Kaiaponi Farms water supply pump is located at the end of a pipeline approximately 570 m in length. Changing the power input to the pump does not result in an immediate change in flow rate at the injection bore but rather a gradual change over a period of up to 10 minutes. This issue has been addressed through defining a clear start-up procedure in the Operation Plan. During the constant rate injection test and for most of the Pilot Trial injection period these delays do not represent an issue.
- The Kaiaponi Farms water supply pump is optimised for a flow rate of approximately 25 L/s. At progressively lower flows the operation of the pump becomes less stable and the flows generated at pre-defined pump settings become less consistent. This issue has been addressed by setting a minimum operational flow for start-up purposes and operating the pump at the highest achievable flow for the constant rate injection test.





- Butterfly valves are used to control water flow at the off-take from the Kaiaponi water supply system and in the injection bore headworks. Flows through these valves are very sensitive to changes in position when the valve is almost closed. Rapid closure of some of these valves can result in unstable water level changes in the injection bore. This issue has been addressed through developing clear start-up procedures and incorporating these in the Operations Plan.
- During the initial stepped rate tests it was identified that entrainment of air bubbles in the injected water resulted in temporary clogging of the well screen with bubbles at flows above approximately 7.5 L/s. This in turn led to rapid rises in water level within the injection bore. This situation could also be triggered by sudden changes in flows at lower injection rates. This issue has been resolved through:
  - Modifying the inflow system at the well head through installation of a drop tube with a constriction at the terminal end. Instability due to air entrapment was not subsequently observed during the test.
  - Procedures for manually operating the butterfly valves in the Kaiaponi water line off-take and the headworks have been developed to minimise the risk of abrupt changes in flow rates to the injection bore. These procedures have been incorporated in the Operations Plan.

A compilation of the data from the various stepped rate tests is summarised in Figure 4. Each of the recorded datasets is presented in terms of water depth below the top of the injection bore casing, as these projections are used for planning of a full 100,000 m<sup>3</sup> injection test. The projections have been extended on the log scale chart (Figure 4) for a trial period of 100,000 minutes (slightly less than 80 days). The reasons for this time scale are presented in Section 4.2.

The stepped rate tests were performed at flows of up to 12.9 L/s. This flow was considered to be at the top end of the flows achievable through the drop tube installed in the injection bore based on engineering calculations of flows through a circular orifice and observations made during the testing process supported this expectation. Based on the outcomes from the stepped rate tests presented in Figure 4, operating the injection trial for a period of approximately 80 days at a flow rate of 12.9 L/s would result in a change in water level in the injection bore of approximately 2.5 m (Figure 5). The static water level at the end of these tests of 8.3 m below the top of the injection well casing, so there was adequate capacity in the bore to accept this injection rate.

## 4.2 Constant Rate Test

### 4.2.1 **Pressure responses**

A constant rate injection test was started on 13 June 2017 with the objective of injecting 10,000 m<sup>3</sup> into the Makauri Aquifer and enable the outcomes to be documented as required under the resource consent. Due to premature triggering of a shut-down relay, the test finished at 3:19 AM on Monday 19 June. During this time water totalling 8,811 m<sup>3</sup> was injected to the Makauri Aquifer (Figure 3).

Summary information on the constant rate injection test is presented in Table 6. Injection flow rates during the test were not manually changed, however some minor changes in rate did occur (see Table 6). The reasons for the changes were unclear, as the test generally operated at a relatively constant flow.

The water level data from the constant rate injection test is presented in Figure 4, separated into Main Test stages 1 and 2 corresponding to the two periods of slightly different flows. The flows are higher than was achieved during the earlier tests and the corresponding projected rise in water level in the bore over a period of 100,000 minutes (77 days) is therefore also higher. At the highest flow rate achieved (15.5 L/s) the water level in the injection bore is projected to be approximately 4.2 m below the top of the bore casing at the end of the full trial. In addition there will be natural rise in the regional groundwater pressure. The projected level is considered suitable to cover the expected rise.

At a consistent flow rate of 15.1 L/s to 15.5 L/s, the planned injection volume of 100,000 m<sup>3</sup> could be achieved in between 100,000 and 110,000 minutes (74 to 77 days). The logarithmic time scale in Figure 4 extends to 100,000 minutes for this reason.



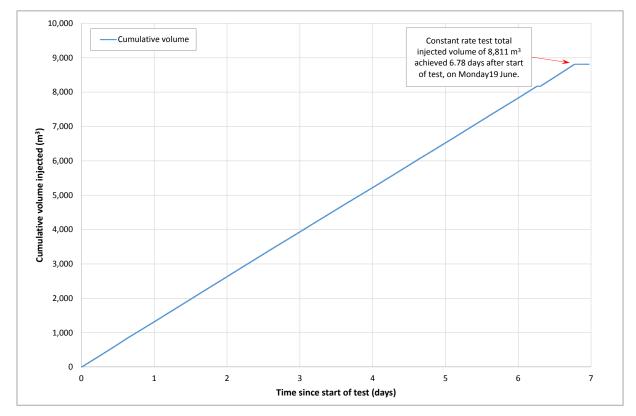


Figure 3: Cumulative water volume injected during constant rate test.

Parameter	Start date / time	Finish date / time	Period (minutes)	Average flow rate (L/s)	Injected volume (m <sup>3</sup> )	Resulting injection bore water level change (m) <sup>(1)</sup>
Flow stage 1	12/6/2017 08:44	13/6/2017 00:38	954	15.5	881	2.558
Flow stage 2	13/6/2017 00:38	14/6/2017 00:29	1,430	15.1	1,299	2.685
Flow stage 3	14/6/2017 00:29	18/6/2017 14:54	6,625	15.1	5,990	2.835
Temporary shutdown	18/6/2017 14:54	18/6/2017 15:59	65	0	0	N/A
Flow stage 4 <sup>(2)</sup>	18/6/2017 15:59	19/6/2017 03:19	680	15.8	641	2.886
Overall	12/6/2017 08:44	19/6/2017 03:19	9,755 (6.97 days)	15.2	8,811	2.886

Table 6: Constant rate in	jection test	summary data.
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Note: 1) Estimated average at the end of the injection stage.

30 June 2017

2) This stage was too short and the water levels too variable to provide adequate data to make 100,000 minute water level projections for the Pilot Trial.



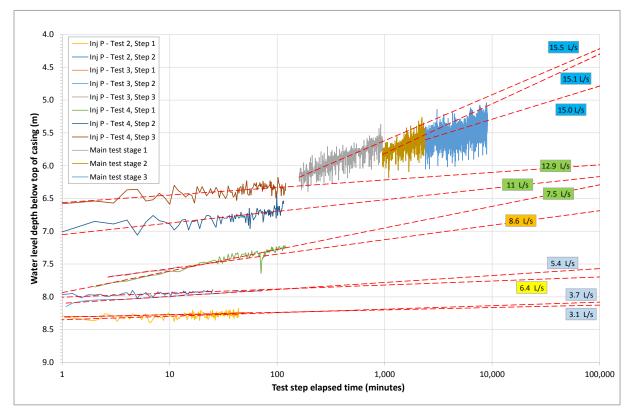


Figure 4: Injection bore water level trend curves and projections under different injection rates.

Calculated rises in water level within the injection bore by the end of the full pilot trial under a range of injection flow rates are presented in Table 7. These projections are presented visually in Figure 5, together with an indication of the potential effect of turbulence at the well screen on the final water level in the bore.

Test step / stage	Flow rate (L/s)	Projected injection bore water level (m btoc)	Bore water level rise after 100,000 minutes (m)
Test 3, Step 1	3.1	8.13	0.17
Test 2, Step 1	3.7	8.08	0.22
Test 3, Step 2	5.4	7.57	0.73
Test 2, Step 2	6.4	7.70	0.60
Test 4, Step 1	7.5	6.29	2.01
Test 3, Step 3	8.6	6.69	1.61
Test 4, Step 2	11	6.17	2.13
Test 4, Step 3	12.9	5.99	2.31
Main test, Stage 3	15.1	4.79	3.51
Main test, Stage 2	15.1	4.30	4.00
Main test, Stage 1	15.5	4.22	4.08

#### Table 7: Projected rise in injection bore water level at end of full pilot trial period.



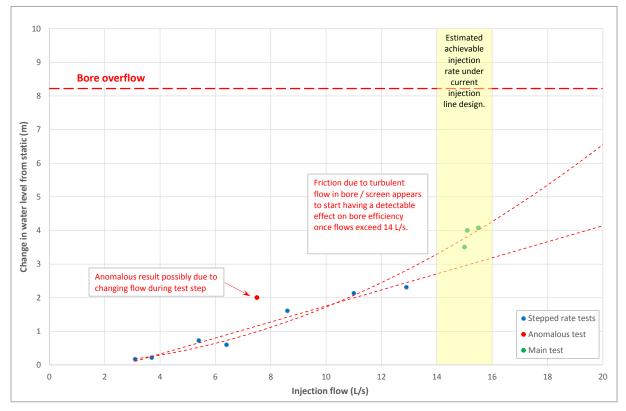


Figure 5: Projected changes in injection bore water level at the end of 100,000 minute (77 day) trial.

Water levels in the pilot monitoring bore (GPE 065) were very sensitive to changes in injection rates at the injection bore. Following the unplanned shut-downs, the water level recovery curves recorded from the monitoring bore were very similar to those recorded from the injection bore (Figure 6).

Water level responses in nearby bores (Figure 7) have been observed in the manual water level data. Bores GPE010 and GOE030 both showed a rise of approximately 1.3 m during injection. This is as expected as these bores responded rapidly to the pumping test. Small responses in other nearby bores may be present but are not obvious in the manual records. Further information will be gained in the full trial by using automated water level data.

### 4.2.2 Water quality responses

#### Temperature responses – Breakthrough observations

The natural groundwater temperature in the Makauri Aquifer in the area of the injection bore is approximately 14.7°C. The temperature of the water pumped from the intake gallery during the constant rate injection test varied on a 24 hour cycle, between 9.5°C and 10.3°C.

Water temperature was monitored inside the screened sections of the injection bore and the pilot monitoring bore during the stepped rate tests and the constant rate injection test. At the start of the constant rate test the water temperature in both bores was similar. Following the start of the test the water temperature in the injection bore decreased almost immediately. The water temperature in the pilot monitoring bore started to decrease approximately 328 minutes after the start of the test (Figure 8). This response indicates the injected water took a little less than 328 minutes to radiate outward a distance of 23 m from the injection bore. At that time about 294 m<sup>3</sup> of water had been injected during the constant rate test.



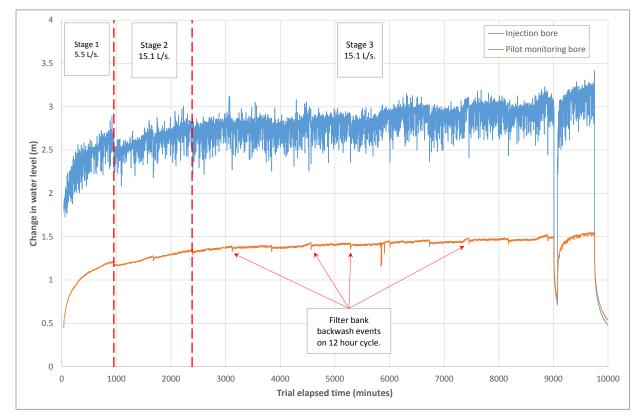


Figure 6: Water level increases in injection bore and pilot monitoring bore.

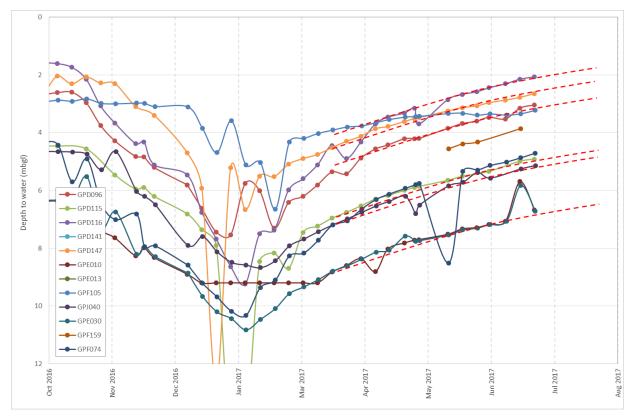


Figure 7: Manual groundwater levels in nearby monitoring bores.





The breakthrough can be used to calculate the time it will take for the bubble of injected water to reach various distances. The time it will take to reach GPE010 is estimated to be 16 days based on an injection rate of 15 L/s (Table 8). Following the full trial the radius of the bubble is expected to reach 420 m.

Parameter	Full trial	Breakthrough at GPE010	Units
Water volume	100,000	20,404	m <sup>3</sup>
Thickness	3	3	m
Porosity	0.06	0.06	
Area	176,929	113,354	m <sup>2</sup>
Radius of water quality influence	420	190	m
	15	15	L/s
Inflow rate	1,296	1,296	m <sup>3</sup> /day
Time required for influence to be detected	77	16	days

#### Table 8: Expected distances and travel times for injected water bubble.

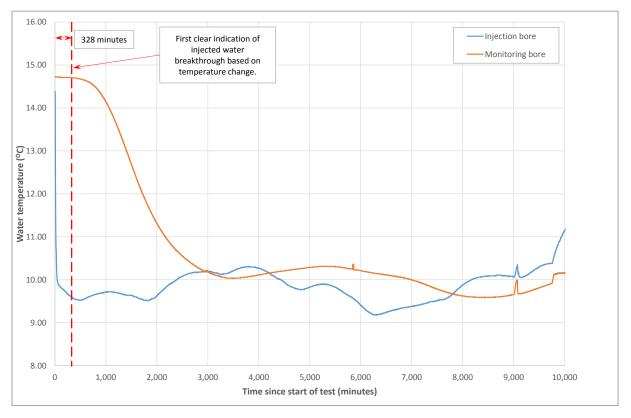


Figure 8: Temperature breakthrough curve recorded in pilot monitoring bore.

#### Water quality samples

Water samples have been taken from bores GPE066 (injection), GPE065 (monitoring) and GPE010 for full chemical analysis. The results of these analyses will be assessed as they are received. Initial water injected during commissioning of the trial and subsequently pumped out of the injection bore showed no unexpected





water quality changes. The injected water was resting in the aquifer/bore for approximately 11 days before being pumped out. These analysis results are included in Appendix C.

#### Microbiological responses

Groundwater and injected water has been tested for microbiological content using *Escherichia coli* (*E.coli*) as an indicator. The trial sampling procedure requires some refinement to ensure samples are representative. Results are available for the injection bore following initial commissioning (6 June 2017) and for injection bore and monitoring bores following the pre-injection trial of 8,811 m<sup>3</sup> (Table 9). Some increase in *E.coli* is observed in these results. However, a larger number of samples is required in order to be able to draw any conclusions as to the rate of die off and transport of *E.coli* in the Makauri Aquifer.

Site/Bore	Date	<i>Escherichia coli</i> (cfu/100 mL)
Injection Bore GPE066	8 May 2017	<1.6
Injection Bore GPE066	6 June 2017	1.6
Monitoring Bore GPE065	23 June 2017	6.6
Monitoring Bore GPE010	23 June 2017	<1.6
Injection Bore GPE066	26 June 2017	6.5

#### Table 9: Initial microbiological results.

The bubble of injected water will propagate outwards slowly and based on the observed break through at GPE065 the projected travel time to reach GPE010 is 16 days. Therefore the bubble of water with potentially higher E.coli levels is expected to be limited in extent. Much information can be gained during the early stages of the trial on the rates of decay of the bacterial content in the aquifer. This information is very important to support the planning of future trials and for the development of any larger scale groundwater replenishment scheme for the Poverty Bay Flats. Therefore Golder recommends that the trial be continued as proposed to gain further information on the microbiological transport characteristics of the Makauri Aquifer.

In continuing with the trial as proposed, it is important to recognise that any risks posed by potential localised microbiological contamination of the aquifer for aquifer users are very small. The site was specifically chosen for the trial as it is a substantial distance from any active bores, with the water travel time to these bores exceeding the period of the untreated stage of the trial.

## 5.0 CONCLUSIONS

Golder considers that the full trial (100,000 m<sup>3</sup>) can proceed based on the initial results gained from the commissioning and initial injection of 8,811 m<sup>3</sup> (Table 10). The pre-injection trial has shown that suitable flow rates can be achieved through the delivery system and injected with expected water level responses in the injection bore, and nearby bores. The travel times of the injected bubble are as expected and a small bubble of injected water (to a radius of approximately 420 m) is expected.

Further information on the microbiological transport characteristics of the Makauri Aquifer can be gained with further injection and appropriate testing. The bubble of injected water is only expected to reach 420 m from the bore following 77 days of injection at a rate of 15 L/s, so is not expected to significantly impact on water users.





Step	Decision - Reasoning
Step 1	<ul> <li>Proceed</li> <li>Coarse gravel layer suitable for trial identified from 69 to 72 m bgl.</li> <li>Preliminary airlift test performed on pilot bore gave indications of a high aquifer hydraulic conductivity.</li> </ul>
Step 2	<ul> <li>Proceed</li> <li>XRF and initial XRD analysis results raised no issues</li> <li>Pumping test shows highly transmissive layer suitable for injection.</li> <li>Pumping test issues due to de-gassing, which is not considered a significant concern for injection based on expected geochemical responses.</li> </ul>
Step 3	<ul> <li>Proceed</li> <li>Injection rates have been set at approximately 15 L/s with suitable projected long term water levels in the injection bore.</li> <li>Water level responses in surrounding bores are as expected based on available information.</li> <li>Time for the injected water to reach GPE065 was as expected based on analytical projections.</li> <li>Further information on the microbiological transport characteristics of the Makauri Aquifer can be gained with further injection and appropriate testing.</li> </ul>
Step 4	To be completed

#### Table 10: Recommendations for project decision stages.

## 6.0 LIMITATIONS

Your attention is drawn to the document, "Report Limitations", as provided in Appendix D below. The statements presented in that document are intended to advise you of what your realistic expectations of this report should be, and to present you with recommendations on how to minimise the risks to which this report relates which are associated with this project. The document is not intended to exclude or otherwise limit the obligations necessarily imposed by law on Golder Associates (NZ) Limited, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in so doing.

## 7.0 **REFERENCES**

Golder 2015. Poverty Bay managed aquifer recharge. Pilot trial – hydrogeology and water quality. Report produced for Gisborne District Council by Golder Associates (NZ) Limited. Golder report 1415771-7410-006.









## F2.7 Drillers Bore Log / Well Completion Report

CONSENT NU	MBER	PERMIT	NUMBER	E : 2938345
				N : 6276377
<b>OWNER / OCCUPIE</b>		Gisborne District	Council	
POSTAL ADDRESS		PO Box 747, Gisborne, 4040		
SITE / PROPERTY A	DDRESS	Kaiaponi Farms, Matawai Road, Gisborne		
Rapid Number / St or	Rd Number			
<b>START DATE</b> 20-03-2017		FINISH DATE	31-03-2017	

DEPTH FROM		DESCRIPTION OF GROUND PASSED THROUGH	SCREEN DIAGRAM
ТОР	BOTTOM		
(M)	(M)		
0	1	Topsoil	
1	6	Brown Clay	
6	25	Blue Clay	
25	26	Blue Clay Shell	
26	31.2	Blue Gravel	
31.2	36.2	Blue Clay	
36.2	36.4	Blue Clay Wood	
36.4	69.2	Blue Clay	
69.2	72.6	Gravel	
72.6	84.8	Blue Clay	
84.8	91	Gravel	
91	92	Blue Clay	
			SEE PAGE 2
WELL / I	BORE CONS	TRUCTION PUMPING TEST	
			1

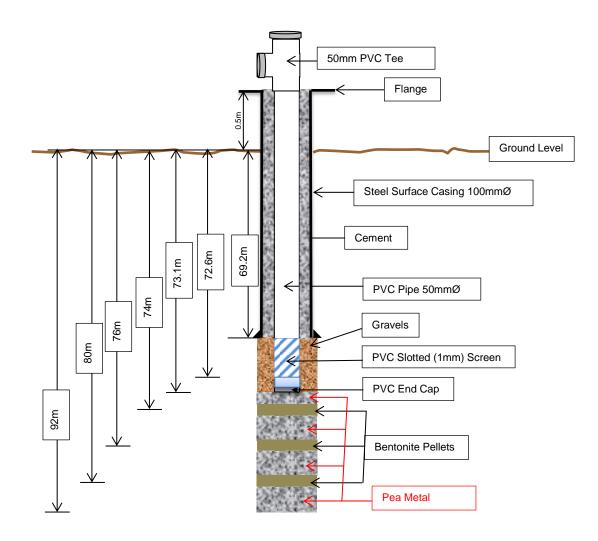
#### WELL / BORE CONSTRUCTION

COMPLETED AND **INSPECTED BY** 

BORE DEPTH (m)	92	STATIC WAT	-8.74	
CASING DEPTH (m)	69.2	PUMPING RA	TE (LPS)	
CASING DIAMETER (mm)	100 Steel	ARTESIAN JE	ET (")	
SCREEN ASSEMBLY :		DRAWDOWN (m)		
DIAMETER (mm)	50 PVC	DURATION O		
TOTAL LENGTH (m)	3.4			
FROM TOP	69.2m	WATER QUA		
TO BASE	73.1m	OBSER		
SLOT SIZE / TYPE	1mm Slot PVC		ANALYSED BY	
OPEN HOLE	From bottom of casing to Bottom of well	m	m	
GENERAL COMMENTS				



## GDC Pilot Bore - Single Zone PVC Screened Well





## F2.7 Drillers Bore Log / Well Completion Report

CONSEN	NT NUMBER	PERMIT	NUMBER	E : 2938328		
		N : 6276389		N : 6276389		
OWNER / OCC	UPIER	Gisborne District	Council			
POSTAL ADD	RESS	PO Box 747, Gisborne, 4040				
SITE / PROPE	RTY ADDRESS	Kaiaponi Farms, Matawai Road, Gisborne				
Rapid Number /	St or Rd Number					
<b>START DATE</b> 05-04-2017		FINISH DATE	10-05-2017			

DE	PTH FROM		DESCRIPTION OF GROUND PASSED THROUGH	SCREEN DIAGRAM
	TOP	BOTTOM		
-	<u>(M)</u>	(M)	Tanaail	
-	0	1		
-	1	6	Brown Clay	
-	6	25	Blue Clay	
-	25	26	Blue Clay Shell	
-	26	31.2	Blue Gravel	
_	31.2	36.2	Blue Clay	
	36.2	36.4	Blue Clay Wood	
	36.4	69.2	Blue Clay	
	69.2	72.6	Gravel	
	72.6	73.5	Blue Clay	
-				
-				
-				SEE PAGE 2
-				
-				
L		1	1	1
				• 1

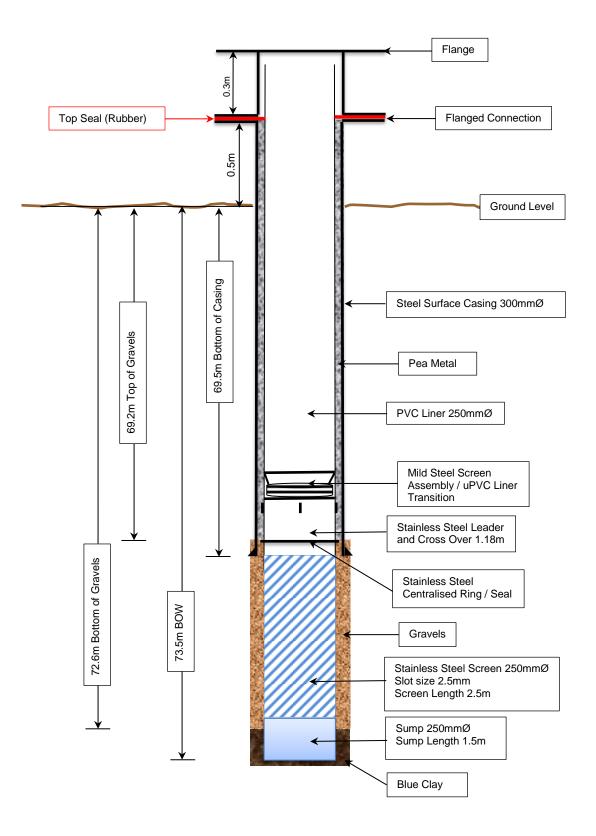
## WELL / BORE CONSTRUCTION PUMPING TEST ALL MEASUREMENTS ARE FROM GROUND LEVEL

BORE DEPTH (m)	73.5		STATIC WATE	-7.45	
CASING DEPTH (m)	69.5		PUMPING RAT	E (LPS)	* See Below
CASING DIAMETER (mm)	300 Steel with PVC Liner	250mm	ARTESIAN JET		
SCREEN ASSEMBLY :			DRAWDOWN f	rom SWL (m)	* See Below
DIAMETER (mm)	250		DURATION OF	PUMPING (hrs)	* See Below
TOTAL LENGTH (m)	5.18				
FROM TOP	68.32m		WATER QUALITY:		
TO BASE	73.5m		OBSERVATION ON SITE		
SLOT SIZE / TYPE	2.5mm Slot Stainless Stee		ANALYSED BY		
	From bottom	of casing			
OPEN HOLE	to Bottom of	o Bottom of well I		m	
GENERAL COMMENTS		* Refer to stepped and constant rate field sheet			field sheets

COMPLETED AND INSPECTED BY Chris Wallace

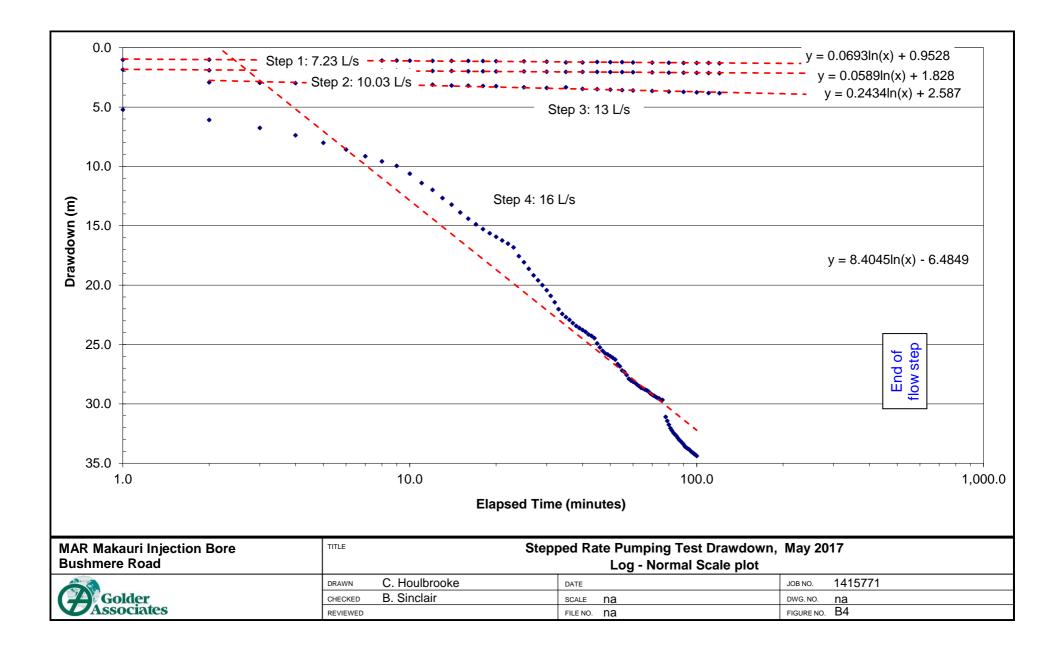


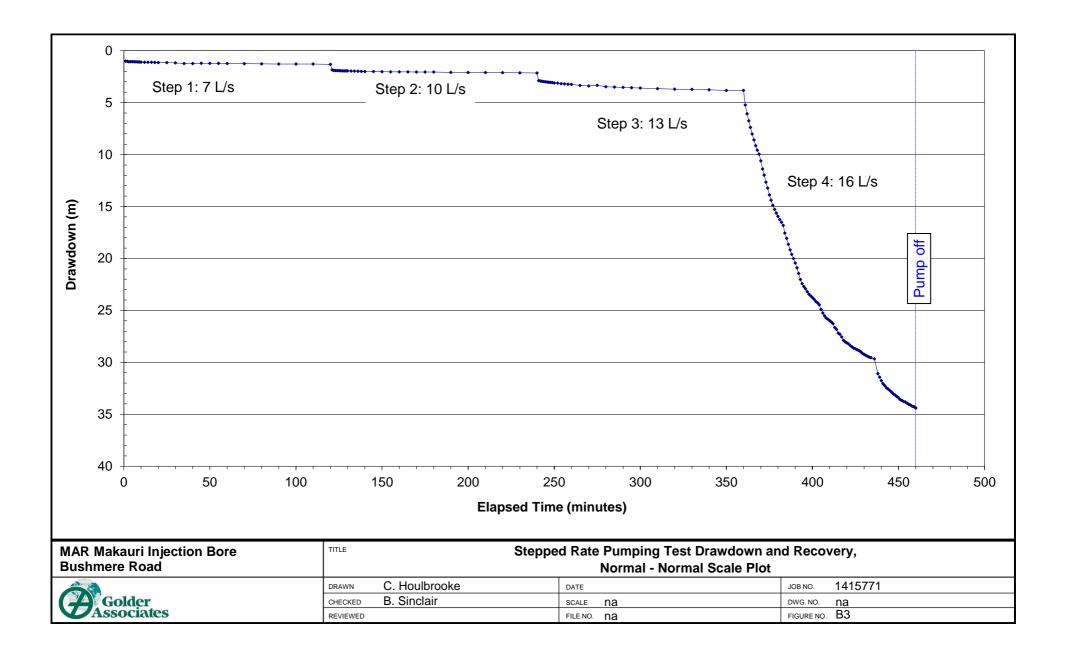
#### **GDC Injection Bore**

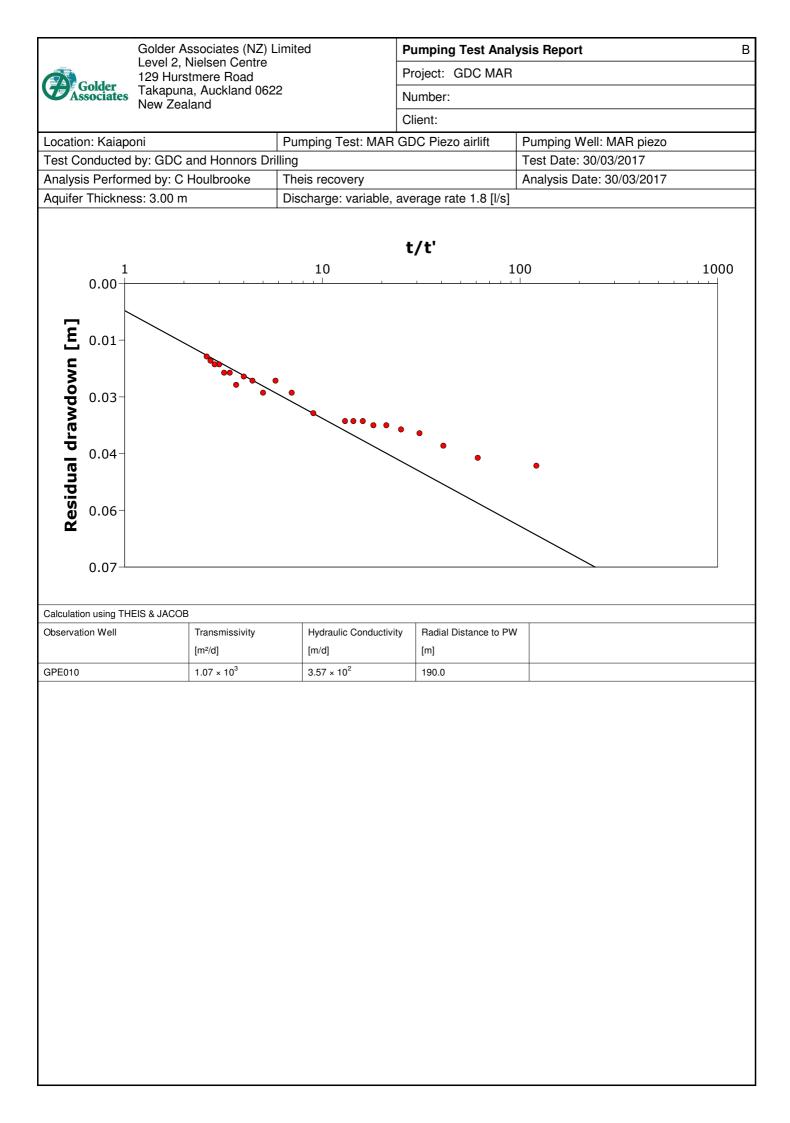


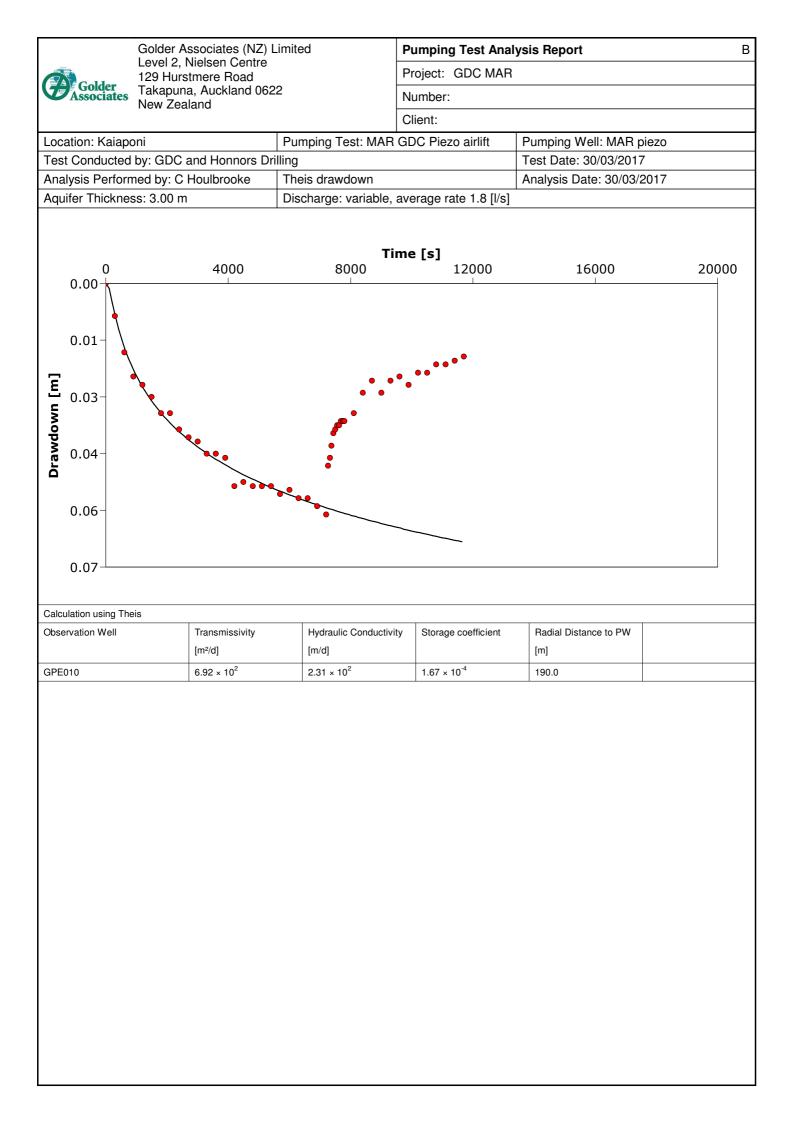
# **APPENDIX B** Pumping Test Analysis Sheets

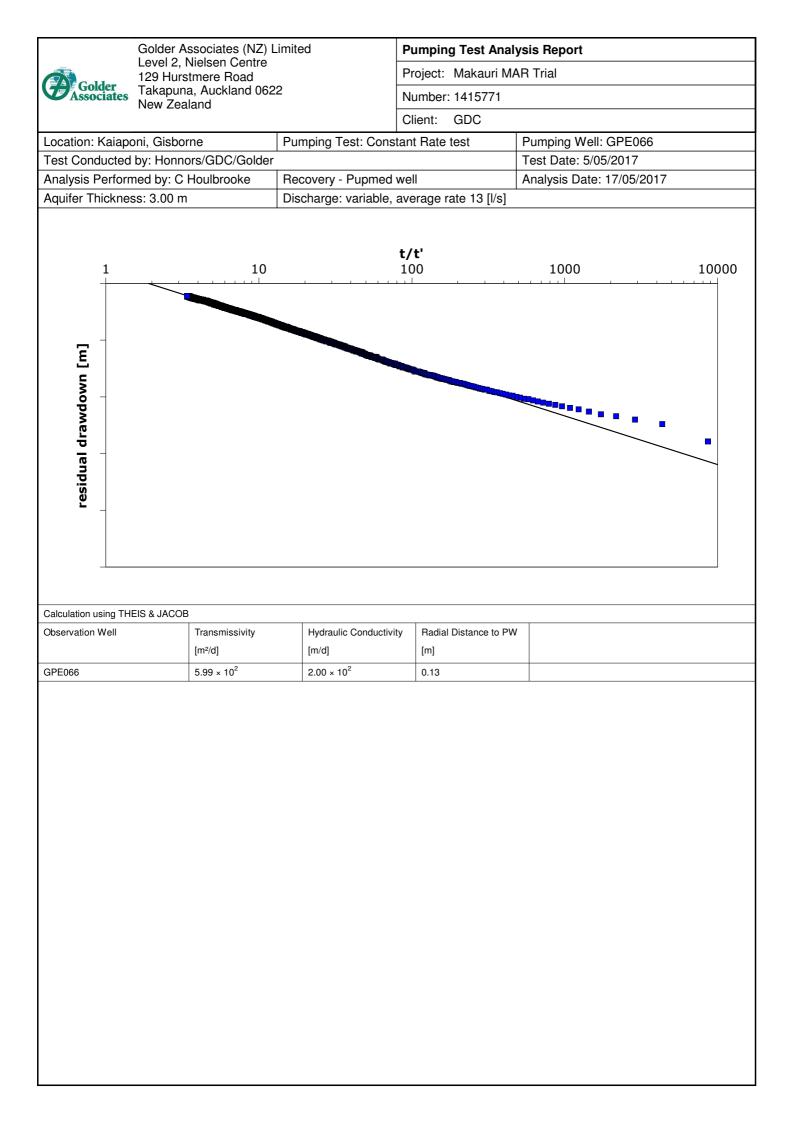


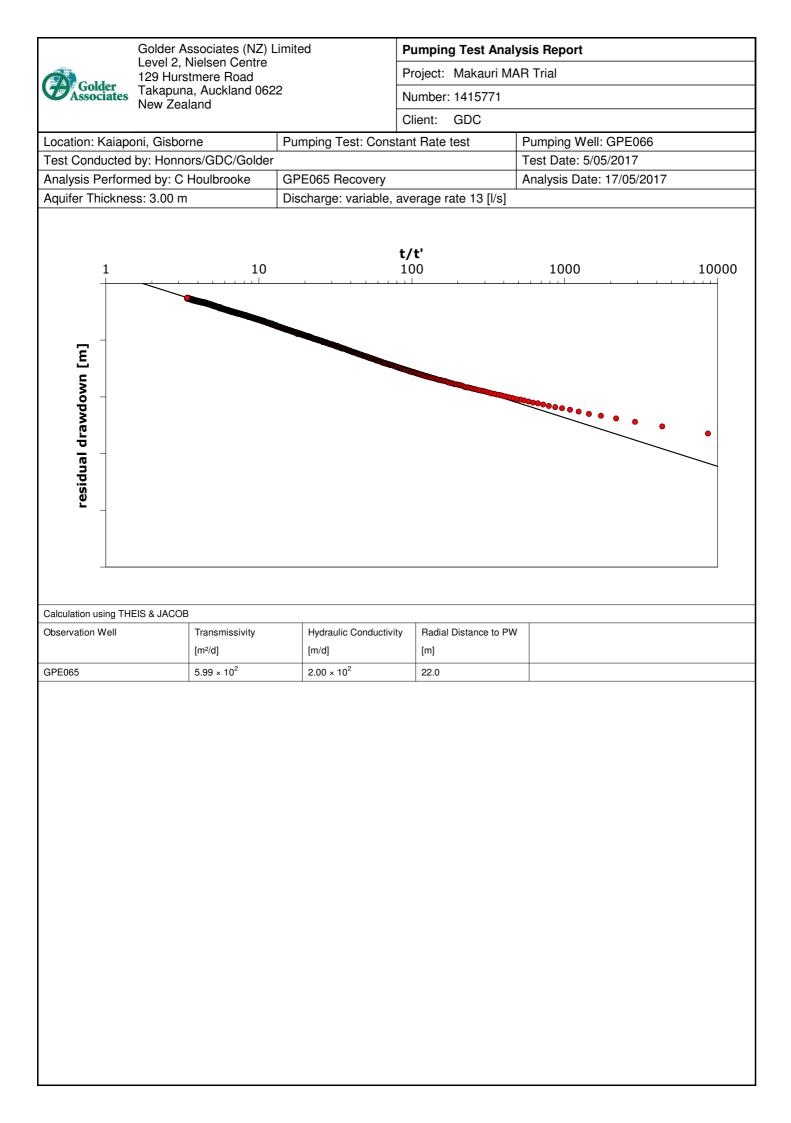


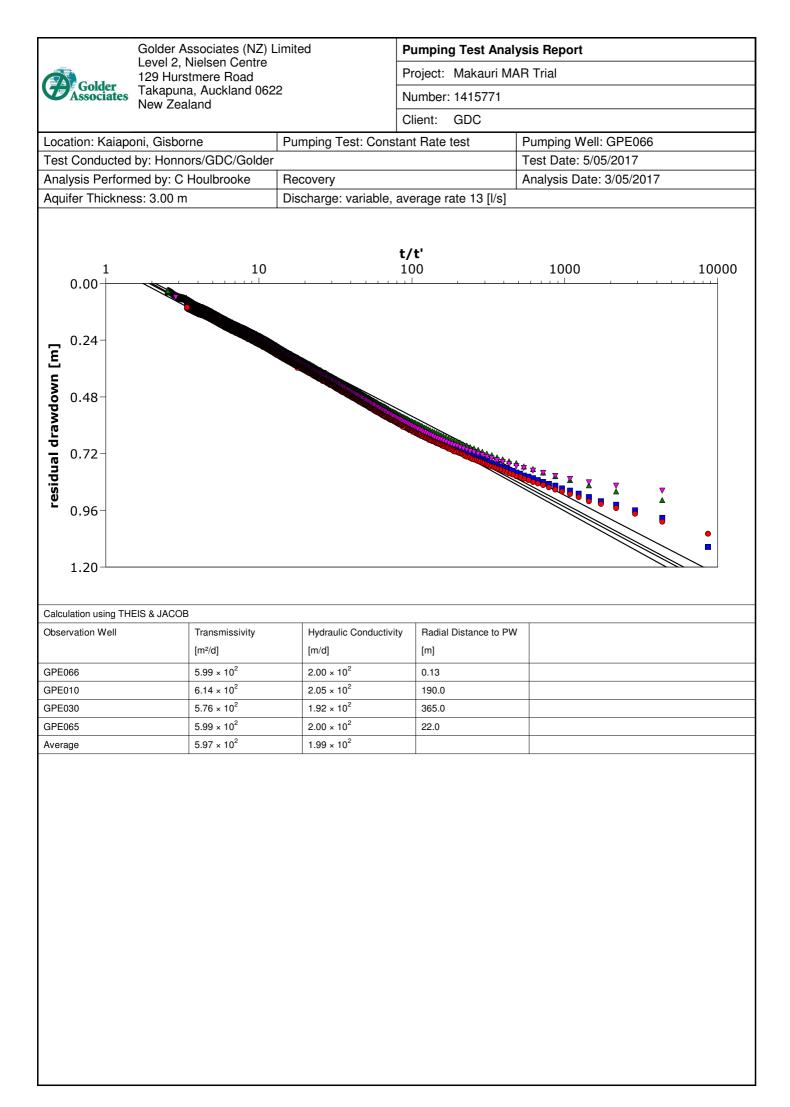


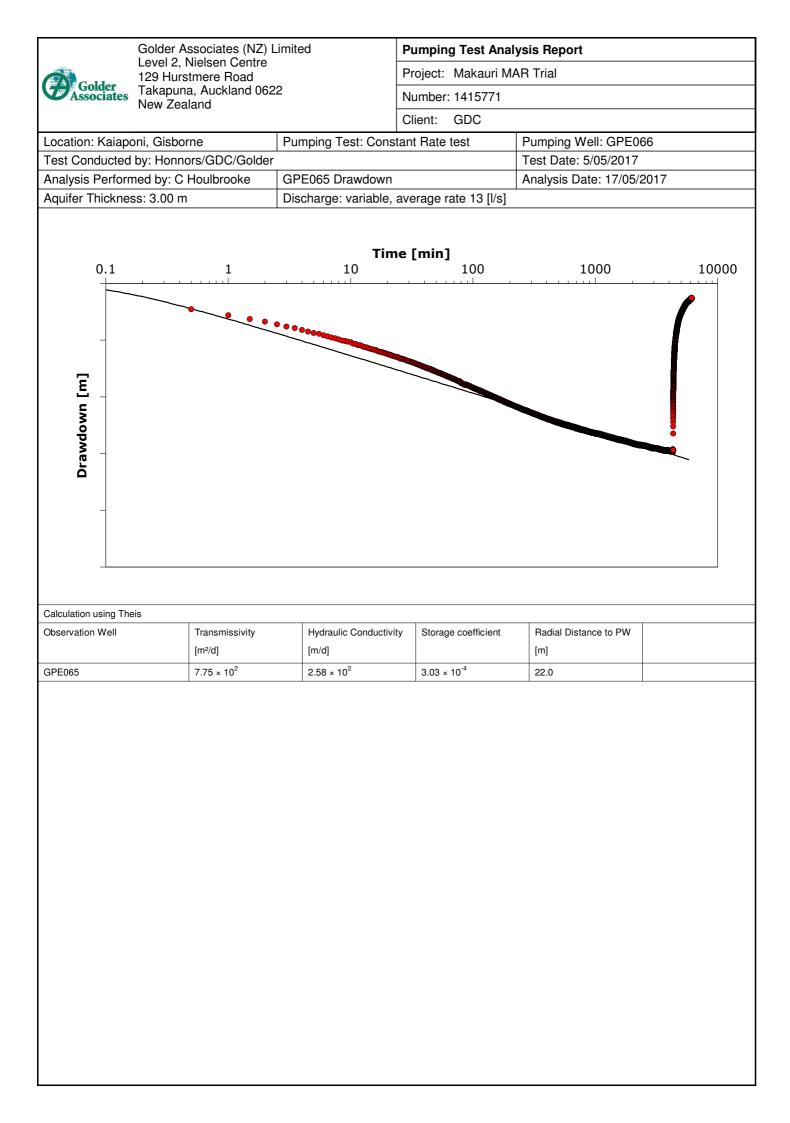


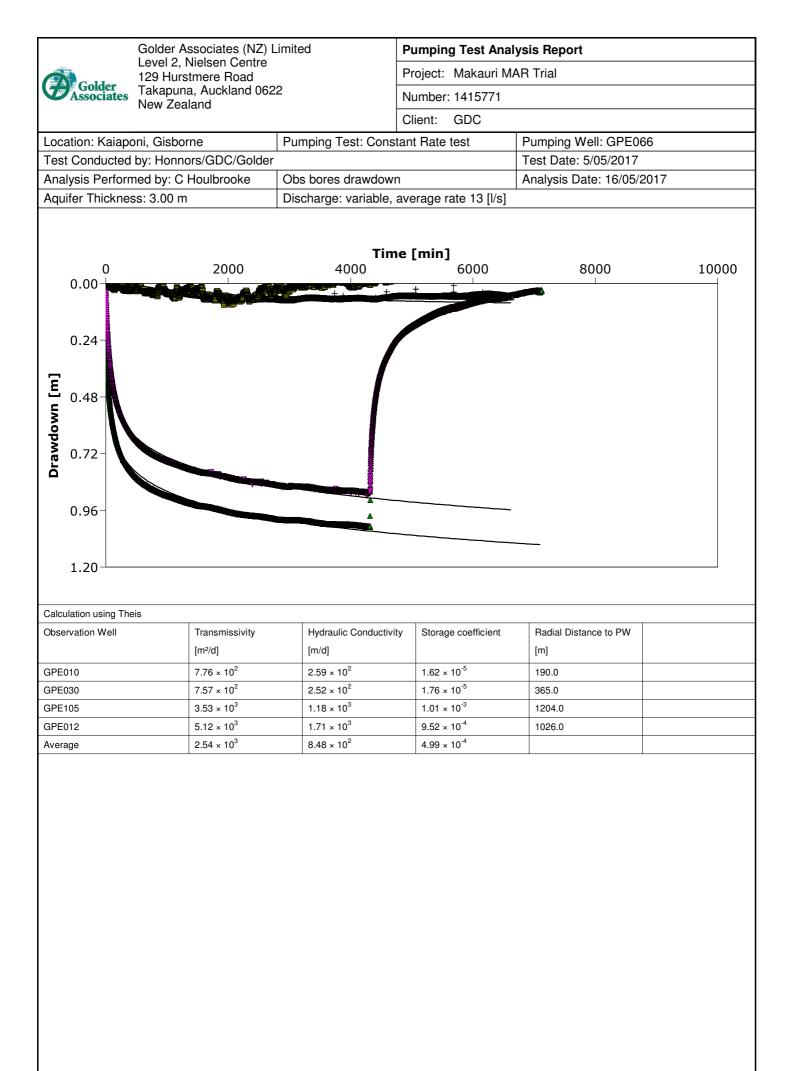


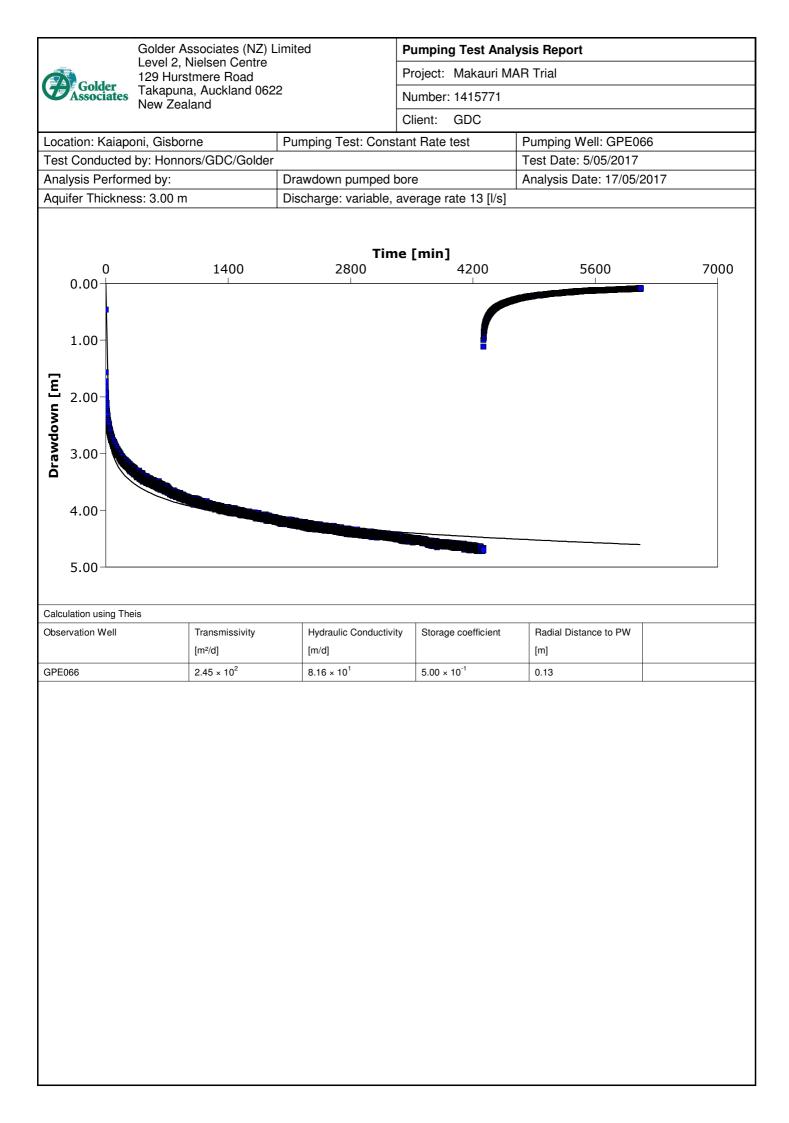














# **APPENDIX C**

Aquifer Geochemistry Analysis Sheets.



# Watercare Laboratory Services

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74 Glenda Drive PO Box 2614, Wakatipu,

(03) 409 0559

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www.watercarelabs.co.nz

			Cortificato of			
			Certificate of A			
		abo	pratory Reference	e:170509-082		
Attention: Client: Address: Client Reference: Purchase Order:	Hilltop Sampler GISBORNE DISTRICT COUNCIL PO Box 747, Gisborne, 4040 MAR 37/00/01/2104	-		Final Report: Report Issue Date: Received Date: Sampled By: Quote Reference :	228731-0 31-May-2017 09-May-2017 Peter Hancock 5880	
Sample Details			WATERS			
Lab Sample ID: Client Sample ID: Sample Date/Time: Description:			170509-082-1 20172081 08/05/2017 08:53 598 Bushmere Rd - MAR injection bore			
Chamietry Detailer	4		GPE066			
Chemistry Detailed						
	matography (0.45 µm Filterec		(00			
Chloride Nitrate (as N) Nitrite (as N) Sulphate	con (co N) by	mg/L mg/L mg/L mg/L	120 0.0048 0.0060 <0.04 0.011 *			
Total Oxidised Nitrog	yen (as iv) by	-3-4	0.011			
	s/Cations) by Calculation					
Anion Total		meq/L	15 *			
Cation Total		meq/L	15 *			
meq/L Difference		meq/L	0.25 *			
Percent Difference		%	0.85 *			
Sum of Anions + Ca	tions	meq/L	29 *			
General Testing						
Ammoniacal Nitroge	en (as N)	mg/L	2.0			
Ammoniacal Nitroge	, ,	mg/L	2.6 *			
Bicarbonate Alkalinit Calc		mg/L	690 *			
Bicarbonate Alkalinit	ty (as HCO3)	mg/L	680			
Carbonate Alkalinity	(as CO3)	mg/L	<0.6 *			
Carbonate Alkalinity	, ,	mg/L	<3.3			
Hydroxide Alkalinity	(as CaCO3)	mg/L	<3.3			
Nitrate (as NO3)		mg/L	0.021 *			
Nitrite (as NO2)		mg/L	0.020 *			
pH (at room temp c.	20 °C)	pH unit	7.1			
Sulfide		mg/L	<0.1 *			
Total Alkalinity (as C	,	mg/L	560			
Total Chlorine (as C		mg/L	0.09			
Total Dissolved Solid		mg/L	780			
Total Nitrogen (as N		mg/L mg/L	2.0			
Total Phosphorus (a Total Suspended So		mg/L	0.43 13			
Turbidity		NTU	37			
Metals			51			
	ICP-MS—Trace (Received F	mg/L	0.011			
Arsenic (Dissolved) Calcium (Dissolved)		mg/L	170			
Iron (Dissolved)		mg/L	5.1			

I

Semple Details (continued)		
Sample Details (continued)		WATERS
Lab Sample ID:		170509-082-1
Client Sample ID:		20172081
Sample Date/Time:		08/05/2017 08:53
Description:		598 Bushmere Rd -
		MAR injection bore
		GPE066
Metals		
Dissolved Metals by ICP-MS—Trace (I	Received Filtered)	
Magnesium (Dissolved)	mg/L	20
Manganese (Dissolved)	mg/L	0.96
Potassium (Dissolved)	mg/L	8.4
Sodium (Dissolved)	mg/L	88
Total Metals by ICP-MS—Trace (Defau	lt Digest)	
Arsenic (Total)	mg/L	0.011
Calcium (Total)	mg/L	170
Iron (Total)	mg/L	5.1
Magnesium (Total)	mg/L	19
Manganese (Total)	mg/L	0.94
Potassium (Total)	mg/L	8.2
Sodium (Total)	mg/L	86
Total Hardness (as CaCO3)	mg/L	520
Organics		
Total Organic Carbon by Non-dispers	ive infrared detectio	n
Total Organic Carbon	mg/L	5.2
Microbiology		
Escherichia coli by Membrane Filtrati	on	
Escherichia coli	cfu/100 mL	<1.6

Results marked with \* are not accredited to International Accreditation New Zealand

Where samples have been supplied by the client they are tested as received. A dash indicates no test performed.

#### **Reference Methods**

The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
Chemistry Detailed				
Anions by Ion Chromatography (0.45 µm Filtered)				
Chloride	In House based on APHA (online edition) 4110 B and EPA 300.0	0.02 mg/L	All	Auckland
Nitrate (as N)	In House based on APHA (online edition) 4110 B and EPA 300.0	0.002 mg/L	All	Auckland
Nitrite (as N)	In House based on APHA (online edition) 4110 B and EPA 300.0	0.002 mg/L	All	Auckland
Sulphate	In House based on APHA (online edition) 4110 B and EPA 300.0	0.02 mg/L	All	Auckland
Total Oxidised Nitrogen (as N) by Calculation	In House based on APHA (online edition) 4110 B and EPA 300.0	0.002 mg/L	All	Auckland
Ion Balance (Anions/Cations) by Calculation				
Anion Total	APHA (online edition) 1030 E	meq/L	All	Auckland
Cation Total	APHA (online edition) 1030 E	meq/L	All	Auckland
meq/L Difference	APHA (online edition) 1030 E	meq/L	All	Auckland
Percent Difference	APHA (online edition) 1030 E		All	Auckland
Sum of Anions + Cations	APHA (online edition) 1030 E		All	Auckland
General Testing				
Ammoniacal Nitrogen (as N) by Colorimetry/Discrete Analyser	HMSO (1981) ISBN 0117516139	0.005 mg/L	All	Auckland
Ammoniacal Nitrogen (as NH4) by Calculation	Calculation from Ammonia (as N)	0.006 mg/L	All	Auckland
Bicarbonate Alkalinity (as HCO3) by Calculation	APHA (online edition) 4500-CO2 D	1 mg/L	All	Auckland
Bicarbonate Alkalinity (as HCO3) by Titration	APHA (online edition) 2320 B	1 mg/L	All	Auckland
Carbonate Alkalinity (as CO3) by Titration	APHA (online edition) 2320 B	1 mg/L	All	Auckland
Carbonate Alkalinity (as CO3) by Calculation	APHA (online edition) 4500-CO2 D	1 mg/L	All	Auckland
Hydroxide Alkalinity (as CaCO3) by Titration	APHA (online edition) 2320 B	1 mg/L	All	Auckland
Nitrate (as NO3) by Calculation	Calculation	0.009 mg/L	All	Auckland
Nitrite (as NO2) by Calculation	Calculation	0.007 mg/L	All	Auckland
pH (at room temp c. 20 °C) by Electrode	APHA (online edition) 4500-H B	0.1 pH unit	All	Auckland

APHA (online edition) 4500-S2 D APHA (online edition) 2320 B APHA (online edition) 4500-Cl G APHA (online edition) 2540 C (Modified: Dried at 103 - 105 °C) APHA (online edition) 4500-P J (modified), 4500-NO3 I APHA (online edition) 4500-P J (modified) APHA (online edition) 2540 D	0.1 mg/L 1 mg/L 0.02 mg/L 15 mg/L 0.010 mg/L 0.004 mg/L	Ali Ali Ali Ali Ali Ali	Auckland Auckland Auckland Auckland Auckland
APHA (online edition) 4500-CI G APHA (online edition) 2540 C (Modified: Dried at 103 - 105 °C) APHA (online edition) 4500-P J (modified), 4500-NO3 I APHA (online edition) 4500-P J (modified) APHA (online edition) 2540 D	0.02 mg/L 15 mg/L 0.010 mg/L	All All All	Auckland Auckland
APHA (online edition) 2540 C (Modified: Dried at 103 - 105 °C) APHA (online edition) 4500-P J (modified), 4500-NO3 I APHA (online edition) 4500-P J (modified) APHA (online edition) 2540 D	15 mg/L 0.010 mg/L	All	Auckland
at 103 - 105 °C) APHA (online edition) 4500-P J (modified), 4500-NO3 I APHA (online edition) 4500-P J (modified) APHA (online edition) 2540 D	0.010 mg/L	All	
APHA (online edition) 4500-P J (modified), 4500-NO3 I APHA (online edition) 4500-P J (modified) APHA (online edition) 2540 D	C C		Auckland
APHA (online edition) 4500-P J (modified) APHA (online edition) 2540 D	0.004 mg/L	All	
			Auckland
	0.2 mg/l	All	Auckland
APHA (online edition) 2130 B (modified)	0	All	Auckland
In House based on EPA 200.8 by ICPMS	0.00010 mg/L	All	Auckland
In House based on EPA 200.8 by ICPMS	0.010 mg/L	All	Auckland
In House based on EPA 200.8 by ICPMS	0.002 mg/L	All	Auckland
•	Ū.	All	Auckland
	Ū.		Auckland
			Auckland
•	-	All	Auckland
	- J		
In House based on EPA 200.8 by ICPMS	0.00010 mg/L	All	Auckland
	0.010 mg/L	All	Auckland
	Ū.	All	Auckland
	Ū.	All	Auckland
	Ū.	All	Auckland
	5	All	Auckland
	0		Auckland
In House based on EPA 200.8 by ICPMS	0.03 mg/L	All	Auckland
on			
APHA (online edition) 5310 B	0.1 mg/L	All	Auckland
USEPA Method 1603	2 cfu/100 mL	All	Auckland
APHA (online edition) 3030 E (modified, 4:1 Nitric:Hydrochloric Acid)		All	Auckland
APHA (online edition) 2540 C (Filtration)		All	Auckland
APHA (online edition) 4500-P B (preliminary filtration)		All	Auckland
ainable in a relatively clean matrix. If dilutions are re	quired for analysis the de	etection limit m	ay be
higher.			
	APHA (online edition) 2130 B (modified) In House based on EPA 200.8 by ICPMS In House based on EPA 200.7 by ICPMS In House based on EPA 200.7 by ICPMS In House	APHA (online edition) 2130 B (modified) 0.05 NTU In House based on EPA 200.8 by ICPMS 0.00010 mg/L In House based on EPA 200.8 by ICPMS 0.010 mg/L In House based on EPA 200.8 by ICPMS 0.002 mg/L In House based on EPA 200.8 by ICPMS 0.001 mg/L In House based on EPA 200.8 by ICPMS 0.0005 mg/L In House based on EPA 200.8 by ICPMS 0.02 mg/L In House based on EPA 200.8 by ICPMS 0.02 mg/L In House based on EPA 200.8 by ICPMS 0.02 mg/L In House based on EPA 200.8 by ICPMS 0.02 mg/L In House based on EPA 200.8 by ICPMS 0.010 mg/L In House based on EPA 200.8 by ICPMS 0.010 mg/L In House based on EPA 200.8 by ICPMS 0.002 mg/L In House based on EPA 200.8 by ICPMS 0.010 mg/L In House based on EPA 200.8 by ICPMS 0.0005 mg/L In House based on EPA 200.8 by ICPMS 0.001 mg/L In House based on EPA 200.8 by ICPMS 0.001 mg/L In House based on EPA 200.8 by ICPMS 0.001 mg/L In House based on EPA 200.8 by ICPMS 0.005 mg/L In House based on EPA 200.8 by ICPMS 0.010 mg/L In House based on EPA 200.8 by ICPMS 0.010 mg/L In House based on EPA 200.8 by ICPMS 0.010 mg/L In House based on EPA 200.8 by ICPMS 0.010 mg/L In House based on EPA 200.8 by ICPMS 0.010 mg/L In House based on EPA 200.8 by ICPMS 0.01 mg/L In House based on EPA 200.8 by ICPMS 0.1 mg/L In House based on EPA 200.8 by ICPMS 0.1 mg/L In House based on EPA 200.8 by ICPMS 0.1 mg/L In House based on EPA 200.8 by ICPMS 0.1 mg/L In House based on EPA 200.8 by ICPMS 0.1 mg/L In House based on EPA 200.8 by ICPMS 0.1 mg/L In House based on EPA 200.8 by ICPMS 0.1 mg/L In House based on EPA 200.8 by ICPMS 0.1 mg/L In House based on EPA 200.8 by ICPMS 0.1 mg/L In House based on EPA 200.8 by ICPMS 0.1 mg/L In House based on EPA 200.8 by ICPMS 0.1 mg/L In House based on EPA 200.8 by ICPMS 0.1 mg/L In House based on EPA 200.8 by ICPMS 0.1 mg/L In House based on EPA 200.8 by ICPMS 0.1 mg/L In House based on EPA 200.7 mg/L IN HOUSE DATE TO THE PA (online edition) 3030 E (modified, 4:1 Nitric:Hydrochloric Acid) APHA (online edition) 2540 C (Filtration) APHA (online edition) 4500-P B (prelim	APHA (online edition) 2130 B (modified)       0.05 NTU       All         In House based on EPA 200.8 by ICPMS       0.0010 mg/L       All         In House based on EPA 200.8 by ICPMS       0.010 mg/L       All         In House based on EPA 200.8 by ICPMS       0.001 mg/L       All         In House based on EPA 200.8 by ICPMS       0.0005 mg/L       All         In House based on EPA 200.8 by ICPMS       0.0005 mg/L       All         In House based on EPA 200.8 by ICPMS       0.0005 mg/L       All         In House based on EPA 200.8 by ICPMS       0.00010 mg/L       All         In House based on EPA 200.8 by ICPMS       0.00010 mg/L       All         In House based on EPA 200.8 by ICPMS       0.00010 mg/L       All         In House based on EPA 200.8 by ICPMS       0.0010 mg/L       All         In House based on EPA 200.8 by ICPMS       0.0010 mg/L       All         In House based on EPA 200.8 by ICPMS       0.0010 mg/L       All         In House based on EPA 200.8 by ICPMS       0.0010 mg/L       All         In House based on EPA 200.8 by ICPMS       0.0010 mg/L       All         In House based on EPA 200.8 by ICPMS       0.0005 mg/L       All         In House based on EPA 200.8 by ICPMS       0.1 mg/L       All         In House based on EPA 200.8

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Report Signatory 31/05/2017

Anel Du Preez KTP Signatory

test instead and was subsampled from the bulk as requested by the client.

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PO Box 2614, Wakatipu,

(03) 409 0559

clientsupport@water.co.nz

www.watercarelabs.co.nz

Attention:	Hilltop Sampler	Final Report:	228730-0	
Client:	GISBORNE DISTRICT COUNCIL	Report Issue Date:	31-May-2017	
Address:	PO Box 747, Gisborne, 4040	Received Date:	05-May-2017	
Client Reference:	MAR	Sampled By:	Daniel Williams	
Purchase Order:	37/00/01/2104	Quote Reference :	5880	

Sample Details		WATERS	WATERS	WATERS	WATERS
Lab Sample ID:		170505-086-1	170505-086-2	170505-086-3	170505-086-4
Client Sample ID:		20172070	20172071	20172072	20172080
Sample Date/Time:		04/05/2017 09:20	04/05/2017 10:05	04/05/2017 11:05	04/05/2017 13:00
Description:		Mc Intyre 409 Matawai	Patterson 54 Bolitho	Stuart 370 Bushmere	590 Matawai Rd
Chamistry Datailad		Rd (SH2) GPD116	Rd GPD115	Rd	
Chemistry Detailed	-: ltored)				
Anions by Ion Chromatography (0.45 µm I Chloride	mg/L	65	130	320	27
Nitrate (as N)	mg/L	0.0080	0.0094	0.0050	0.0054
Nitrite (as N)	mg/L	< 0.002	< 0.002	<0.002	< 0.002
Sulphate	mg/L	<0.002	<0.002	<0.002	0.68
•	mg/L	0.004	0.0094 *	0.0050 *	0.0054 *
Total Oxidised Nitrogen (as N) by Calculation	J. –	0.0000	0.0004	0.0000	0.0004
Ion Balance (Anions/Cations) by Calculati	on				
Anion Total	meq/L	16 *	14 *	22 *	8.9 *
Cation Total	meq/L	16 *	14 *	22 *	8.5 *
meq/L Difference	meq/L	0.78 *	0.25 *	0.021 *	0.40 *
Percent Difference	%	2.4 *	0.88 *	0.046 *	2.3 *
Sum of Anions + Cations	meq/L	32 *	28 *	45 *	17 *
General Testing					
Ammoniacal Nitrogen (as N)	mg/L	1.4	4.1	2.0	0.42
Ammoniacal Nitrogen (as NH4)	mg/L	2.0 *	5.5 *	2.6 *	0.53 *
Bicarbonate Alkalinity (as HCO3) by Calc	mg/L	840 *	630 *	810 *	490 *
Bicarbonate Alkalinity (as HCO3)	mg/L	840	630	810	500
Carbonate Alkalinity (as CO3)	mg/L	0.6 *	<0.6 *	0.6 *	<0.6 *
Carbonate Alkalinity (as CO3)	mg/L	<3.3	<4.0	<3.3	<2.0
Hydroxide Alkalinity (as CaCO3)	mg/L	<3.3	<4.0	<3.3	<2.0
Nitrate (as NO3)	mg/L	0.035 *	0.042 *	0.022 *	0.024 *
Nitrite (as NO2)	mg/L	<0.007 *	<0.007 *	<0.007 *	<0.007 *
pH (at room temp c. 20 °C)	pH unit	7.2	7.0	7.2	7.2
Sulfide	mg/L	<0.1 *	<0.1 *	<0.1 *	-
Total Alkalinity (as CaCO3)	mg/L	690	520	660	410
Total Chlorine (as Cl2)	mg/L	0.07	0.06	0.09	0.03
Total Dissolved Solids	mg/L	850	780	1200	530
Total Nitrogen (as N)	mg/L	1.2	3.8	1.8	0.42
Total Phosphorus (as P)	mg/L	0.31	0.15	0.33	0.13
Total Suspended Solids	mg/L	200	30	220	2.0
Turbidity	NTU	310	150	110	12
Metals					
Dissolved Metals by ICP-MS—Trace					
Arsenic (Dissolved)	mg/L	-	-	-	0.0020
Calcium (Dissolved)	mg/L	-	-	-	100

Report Number: 228730-0

Sample Details (continued)		WATERS	WATERS	WATERS	WATERS
Lab Sample ID:		170505-086-1	170505-086-2	170505-086-3	170505-086-4
Client Sample ID:		20172070	20172071	20172072	20172080
Sample Date/Time:		04/05/2017 09:20	04/05/2017 10:05	04/05/2017 11:05	04/05/2017 13:00
Description:		Mc Intyre 409 Matawai Rd (SH2) GPD116	Patterson 54 Bolitho Rd GPD115	Stuart 370 Bushmere Rd	590 Matawai Rd
Metals	•				
Dissolved Metals by ICP-MS—Trace					
Iron (Dissolved)	mg/L	-	-	-	0.0025
Magnesium (Dissolved)	mg/L	-	-	-	11
Manganese (Dissolved)	mg/L	-	-	-	0.31
Potassium (Dissolved)	mg/L	-	-	-	5.2
Sodium (Dissolved)	mg/L	-	-	-	52
Dissolved Metals by ICP-MS—Trace (Rec	eived Filtered)				
Arsenic (Dissolved)	mg/L	0.0043	0.0053	0.0076	-
Calcium (Dissolved)	mg/L	190	160	220	-
ron (Dissolved)	mg/L	10	8.9	4.9	-
Magnesium (Dissolved)	mg/L	24	19	34	-
Manganese (Dissolved)	mg/L	1.5	0.70	1.4	-
Potassium (Dissolved)	mg/L	6.4	9.0	7.6	-
Sodium (Dissolved)	mg/L	100	89	180	-
Total Metals by ICP-MS—Trace (Default D	Digest)				
Arsenic (Total)	mg/L	0.0051	0.0051	0.0094	0.0022
Calcium (Total)	mg/L	190	160	230	110
Iron (Total)	mg/L	28	10	10	1.0
Magnesium (Total)	mg/L	25	19	37	11
Manganese (Total)	mg/L	1.6	0.68	1.5	0.32
Potassium (Total)	mg/L	7.5	9.0	8.6	5.8
Sodium (Total)	mg/L	98	89	190	54
Total Hardness (as CaCO3)	mg/L	570	480	730	320
Total Hardness (as CaCO3) Organics	mg/L	570	480	730	320
Organics			480	730	320
			480	4.7	320 2.5
Organics Total Organic Carbon by Non-dispersive Total Organic Carbon	infrared detect	ion			
Organics Total Organic Carbon by Non-dispersive Total Organic Carbon Microbiology	infrared detect	ion			
Organics Total Organic Carbon by Non-dispersive Total Organic Carbon Microbiology Escherichia coli by Membrane Filtration	infrared detect	ion			
Organics Total Organic Carbon by Non-dispersive Total Organic Carbon Microbiology Escherichia coli by Membrane Filtration Escherichia coli	infrared detect	tion 4.1 <1.6	3.3	4.7	2.5
Organics Total Organic Carbon by Non-dispersive Total Organic Carbon Microbiology Escherichia coli by Membrane Filtration Escherichia coli Sample Details	infrared detect	tion 4.1 <1.6 WATERS	3.3	4.7	2.5
Organics Total Organic Carbon by Non-dispersive Total Organic Carbon Microbiology Escherichia coli by Membrane Filtration Escherichia coli Sample Details Lab Sample ID:	infrared detect	tion 4.1 <1.6 WATERS 170505-086-5	3.3	4.7	2.5
Organics Total Organic Carbon by Non-dispersive Total Organic Carbon Microbiology Escherichia coli by Membrane Filtration Escherichia coli Sample Details Lab Sample ID: Client Sample ID:	infrared detect	tion 4.1 <1.6 WATERS	3.3	4.7	2.5
Organics Total Organic Carbon by Non-dispersive Total Organic Carbon Microbiology Escherichia coli by Membrane Filtration Escherichia coli Sample Details Lab Sample ID: Client Sample ID: Sample Date/Time:	infrared detect	tion 4.1 <1.6 VATERS170505-086-52017207405/05/2017 09:45	3.3	4.7	2.5
Organics Total Organic Carbon by Non-dispersive Total Organic Carbon Microbiology Escherichia coli by Membrane Filtration Escherichia coli Sample Details Lab Sample ID: Client Sample ID: Sample Date/Time: Description:	infrared detect	tion 4.1 <1.6 WATERS 170505-086-5 20172074	3.3	4.7	2.5
Organics Total Organic Carbon by Non-dispersive Total Organic Carbon Microbiology Escherichia coli by Membrane Filtration Escherichia coli Sample Details Lab Sample ID: Client Sample ID: Sample Date/Time: Description: Chemistry Detailed	infrared detect mg/L cfu/100 mL	tion 4.1 <1.6 VATERS170505-086-52017207405/05/2017 09:45	3.3	4.7	2.5
Organics Total Organic Carbon by Non-dispersive Total Organic Carbon Microbiology Escherichia coli by Membrane Filtration Escherichia coli Sample Details Lab Sample ID: Client Sample ID: Sample Date/Time: Description: Chemistry Detailed Anions by Ion Chromatography (0.45 µm	infrared detect mg/L cfu/100 mL	tion 4.1 <1.6 WATERS 170505-086-5 20172074 05/05/2017 09:45 Harper Road	3.3	4.7	2.5
Organics Total Organic Carbon by Non-dispersive Total Organic Carbon Microbiology Escherichia coli by Membrane Filtration Escherichia coli Sample Details Lab Sample ID: Client Sample ID: Client Sample ID: Sample Date/Time: Description: Chemistry Detailed Anions by Ion Chromatography (0.45 µm Chloride	infrared detect mg/L cfu/100 mL	tion 4.1 <1.6 VATERS 170505-086-5 20172074 05/05/2017 09:45 Harper Road 29	3.3	4.7	2.5
Organics Total Organic Carbon by Non-dispersive Total Organic Carbon Microbiology Escherichia coli by Membrane Filtration Escherichia coli Sample Details Lab Sample ID: Client Sample ID: Client Sample ID: Sample Date/Time: Description: Chemistry Detailed Anions by Ion Chromatography (0.45 µm Chloride Nitrate (as N)	infrared detect mg/L cfu/100 mL	tion 4.1 <1.6 VATERS 170505-086-5 20172074 05/05/2017 09:45 Harper Road 29 0.0028	3.3	4.7	2.5
Organics Total Organic Carbon by Non-dispersive Total Organic Carbon Microbiology Escherichia coli by Membrane Filtration Escherichia coli Sample Details Lab Sample ID: Client Sample ID: Client Sample ID: Sample Date/Time: Description: Chemistry Detailed Anions by Ion Chromatography (0.45 µm Chloride Nitrate (as N) Nitrite (as N)	infrared detect mg/L cfu/100 mL Filtered) mg/L mg/L	tion 4.1 4.1<1.6	3.3	4.7	2.5
Organics Total Organic Carbon by Non-dispersive Total Organic Carbon Microbiology Escherichia coli by Membrane Filtration Escherichia coli Sample Details Lab Sample ID: Client Sample ID: Sample Date/Time: Description: Chemistry Detailed Anions by Ion Chromatography (0.45 µm Chloride Nitrate (as N) Nitrite (as N) Sulphate	infrared detect mg/L cfu/100 mL filtered) mg/L mg/L mg/L	tion 4.1 4.1<1.6	3.3	4.7	2.5
Organics Total Organic Carbon by Non-dispersive Total Organic Carbon Microbiology Escherichia coli by Membrane Filtration Escherichia coli Sample Details Lab Sample ID: Client Sample ID: Sample Date/Time: Description: Chemistry Detailed Anions by Ion Chromatography (0.45 µm Chloride Nitrate (as N) Nitrite (as N) Sulphate Total Oxidised Nitrogen (as N) by	infrared detect mg/L cfu/100 mL Filtered) mg/L mg/L mg/L mg/L	tion 4.1 4.1<1.6	3.3	4.7	2.5
Organics Total Organic Carbon by Non-dispersive Total Organic Carbon Microbiology Escherichia coli by Membrane Filtration Escherichia coli Sample Details Lab Sample ID: Client Sample ID: Sample Date/Time: Description: Chemistry Detailed Anions by Ion Chromatography (0.45 µm Chloride Nitrate (as N) Nitrite (as N) Sulphate Total Oxidised Nitrogen (as N) by Calculation	infrared detect mg/L cfu/100 mL	tion 4.1 4.1<1.6	3.3	4.7	2.5
Organics Total Organic Carbon by Non-dispersive Total Organic Carbon Microbiology Escherichia coli by Membrane Filtration Escherichia coli Sample Details Lab Sample ID: Client Sample ID: Client Sample ID: Sample Date/Time: Description: Chemistry Detailed Anions by Ion Chromatography (0.45 µm Chloride Nitrate (as N) Nitrite (as N) Sulphate Total Oxidised Nitrogen (as N) by Calculation on Balance (Anions/Cations) by Calculation	infrared detect mg/L cfu/100 mL	tion 4.1 4.1<1.6	3.3	4.7	2.5
Organics Total Organic Carbon by Non-dispersive Total Organic Carbon Microbiology Escherichia coli by Membrane Filtration Escherichia coli Sample Details Lab Sample ID: Client Sample ID: Client Sample ID: Sample Date/Time: Description: Chemistry Detailed Anions by Ion Chromatography (0.45 µm Chloride Nitrate (as N) Nitrite (as N) Sulphate Total Oxidised Nitrogen (as N) by Calculation on Balance (Anions/Cations) by Calculat Anion Total	infrared detect mg/L cfu/100 mL cfu/100 mL Filtered) mg/L mg/L mg/L mg/L	tion 4.1 4.1   <1.6	3.3	4.7	2.5
Organics Total Organic Carbon by Non-dispersive Total Organic Carbon Microbiology Escherichia coli by Membrane Filtration Escherichia coli Sample Details Lab Sample ID: Client Sample ID: Client Sample ID: Sample Date/Time: Description: Chemistry Detailed Anions by Ion Chromatography (0.45 µm Chloride Nitrate (as N) Nitrite (as N) Sulphate Total Oxidised Nitrogen (as N) by Calculation on Balance (Anions/Cations) by Calculat Anion Total Cation Total	infrared detect mg/L cfu/100 mL cfu/100 mL filtered) mg/L mg/L mg/L mg/L tion	tion 4.1 4.1   <1.6	3.3	4.7	2.5
Organics Total Organic Carbon by Non-dispersive Total Organic Carbon Microbiology Escherichia coli by Membrane Filtration Escherichia coli Sample Details Lab Sample ID: Client Sample ID: Sample Date/Time: Description: Chemistry Detailed Anions by Ion Chromatography (0.45 µm Chloride Nitrate (as N) Nitrite (as N) Sulphate Total Oxidised Nitrogen (as N) by Calculation on Balance (Anions/Cations) by Calcular Anion Total Cation Total meq/L Difference Percent Difference	infrared detect mg/L cfu/100 mL cfu/100 mL filtered) mg/L mg/L mg/L mg/L mg/L mg/L mg/L	tion 4.1 4.1 <a href="https://www.science.org"></a> <a <="" a="" href="https://www.science.org"> <a <="" a="" href="https://www.science.org"></a></a></a></a></a></a></a></a></a>	3.3	4.7	2.5
Organics Total Organic Carbon by Non-dispersive Total Organic Carbon Microbiology Escherichia coli by Membrane Filtration Escherichia coli Sample Details Lab Sample ID: Client Sample ID: Client Sample ID: Sample Date/Time: Description: Chemistry Detailed Anions by Ion Chromatography (0.45 µm Chloride Nitrate (as N) Nitrite (as N) Sulphate Total Oxidised Nitrogen (as N) by Calculation on Balance (Anions/Cations) by Calcular Anion Total Cation Total meq/L Difference Percent Difference Sum of Anions + Cations	infrared detect mg/L cfu/100 mL cfu/100 mL filtered) mg/L mg/L mg/L mg/L tion	tion 4.1 4.1   <1.6	3.3	4.7	2.5
Organics         Total Organic Carbon by Non-dispersive         Total Organic Carbon         Microbiology         Escherichia coli by Membrane Filtration         Escherichia coli         Sample Details         Lab Sample ID:         Client Sample ID:         Sample Date/Time:         Description:         Chemistry Detailed         Anions by Ion Chromatography (0.45 µm)         Chloride         Nitrate (as N)         Sulphate         Total Oxidised Nitrogen (as N) by         Calculation         on Balance (Anions/Cations) by Calcular         Anion Total         Cation Total         meq/L Difference         Percent Difference         Sum of Anions + Cations	infrared detect mg/L cfu/100 mL cfu/100 mL filtered) mg/L mg/L mg/L mg/L mg/L mg/L mg/L	tion 4.1 4.1 <a href="https://www.science.org"></a> <a <="" a="" href="https://www.science.org"> <a <="" a="" href="https://www.science.org"></a></a></a></a></a></a></a></a></a>	3.3	4.7	2.5
Organics Total Organic Carbon by Non-dispersive Total Organic Carbon Microbiology Escherichia coli by Membrane Filtration Escherichia coli Sample Details Lab Sample ID: Client Sample ID: Client Sample ID: Sample Date/Time: Description: Chemistry Detailed Anions by Ion Chromatography (0.45 µm Chloride Nitrate (as N) Nitrite (as N) Sulphate Total Oxidised Nitrogen (as N) by Calculation on Balance (Anions/Cations) by Calcular Anion Total Cation Total meq/L Difference Percent Difference Sum of Anions + Cations General Testing	infrared detect mg/L cfu/100 mL cfu/100 mL filtered) mg/L mg/L mg/L mg/L mg/L mg/L mg/L	tion 4.1 4.1 <a href="https://www.science.org"></a> <a <="" a="" href="https://www.science.org"> <a <="" a="" href="https://www.science.org"></a></a></a></a></a></a></a></a></a>	3.3	4.7	2.5
Organics Total Organic Carbon by Non-dispersive	infrared detect mg/L cfu/100 mL cfu/100 mL	tion 4.1 4.1 4.1 4.1 4.1 4.1 4.1 4.1 4.1 4.1	3.3	4.7	2.5
Organics         Total Organic Carbon by Non-dispersive         Total Organic Carbon         Microbiology         Escherichia coli by Membrane Filtration         Escherichia coli by Membrane Filtration         Escherichia coli         Sample Details         Lab Sample ID:         Client Sample ID:         Client Sample ID:         Sample Date/Time:         Description:         Chemistry Detailed         Anions by Ion Chromatography (0.45 µm         Chloride         Nitrate (as N)         Sulphate         Total Oxidised Nitrogen (as N) by         Calculation         on Balance (Anions/Cations) by Calcular         Anion Total         Cation Total         meq/L Difference         Percent Difference         Sum of Anions + Cations         General Testing         Ammoniacal Nitrogen (as N)	infrared detect mg/L cfu/100 mL cfu/100 mL filtered) mg/L mg/L mg/L mg/L mg/L mg/L mg/L	tion 4.1 4.1 <1.6	3.3	4.7	2.5
Organics         Total Organic Carbon by Non-dispersive         Total Organic Carbon         Microbiology         Escherichia coli by Membrane Filtration         Escherichia coli by Membrane Filtration         Escherichia coli         Sample Details         Lab Sample ID:         Client Sample ID:         Client Sample ID:         Sample Date/Time:         Description:         Chemistry Detailed         Anions by Ion Chromatography (0.45 µm         Chloride         Nitrate (as N)         Nitrite (as N)         Sulphate         Total Oxidised Nitrogen (as N) by         Calculation         on Balance (Anions/Cations) by Calcular         Anion Total         meq/L Difference         Percent Difference         Sum of Anions + Cations         General Testing         Ammoniacal Nitrogen (as NH4)	infrared detect       mg/L       mg/L       cfu/100 mL       cfu/100 mL       mg/L       mg/L	tion 4.1 4.1 <1.6	3.3	4.7	2.5

Sample Details (continued)		WATERS			
Lab Sample ID:		170505-086-5			
Client Sample ID:		20172074			
Sample Date/Time:		05/05/2017 09:45			
Description:		Harper Road			
General Testing	l l				
Carbonate Alkalinity (as CO3)	mg/L	<0.6 *			
Carbonate Alkalinity (as CO3)	mg/L	<2.0			
Hydroxide Alkalinity (as CaCO3)	mg/L	<2.0			
Nitrate (as NO3)	mg/L	0.012 *			
Nitrite (as NO2)	mg/L	0.012 *			
pH (at room temp c. 20 °C)	pH unit	7.4			
Sulfide	mg/L	<0.1 *			
Total Alkalinity (as CaCO3)	mg/L	420			
Total Chlorine (as Cl2)	mg/L	0.02			
Total Dissolved Solids	mg/L	520			
Total Nitrogen (as N)	mg/L	0.29			
Total Phosphorus (as P)	mg/L	0.12			
Total Suspended Solids	mg/L	4.8			
Turbidity	NTU	17			
Vietals					
Dissolved Metals by ICP-MS—Trace (Rec	eived Filtered)				
Arsenic (Dissolved)	mg/L	0.0035			
Calcium (Dissolved)	mg/L	130			
Iron (Dissolved)	mg/L	1.6			
Magnesium (Dissolved)	mg/L	13			
Manganese (Dissolved)	mg/L	0.20			
Potassium (Dissolved)	mg/L	4.2			
Sodium (Dissolved)	mg/L	47			
otal Metals by ICP-MS—Trace (Default D	)igest)				
Arsenic (Total)	mg/L	0.0033			
Calcium (Total)	mg/L	130			
Iron (Total)	mg/L	1.6			
Magnesium (Total)	mg/L	13			
Manganese (Total)	mg/L	0.20			
Potassium (Total)	mg/L	5.2			
Sodium (Total)	mg/L	46			
Total Hardness (as CaCO3)	mg/L	360			
Organics					
Total Organic Carbon by Non-dispersive	infrared detecti	on			
Total Organic Carbon	mg/L	5.8			
Vicrobiology					
Escherichia coli by Membrane Filtration					
Escherichia coli	cfu/100 mL	<1.6			
I	Results marked wi	ith * are not accredited to International Accredita	ation New Zealand		
Where samples	: have been suppli	ied by the client they are tested as received. A d	dash indicates no test perfo	ormed.	
Reference Methods The sample(s) referred to in this report we	re analysed by t	the following method(s)			
Analyte		Method Reference	MDL	Samples	Location
Chemistry Detailed					
Anions by Ion Chromatography (0.45 μm	Filtered)				
Chloride		In House based on APHA (online edition)	0.02 mg/L	All	Auckland
		4110 B and EPA 300.0			
Nitrate (as N)		In House based on APHA (online edition)	0.002 mg/L	All	Auckland
Nitrite (26 NI)		4110 B and EPA 300.0	0.000"	A 11	Augkland
Nitrite (as N)		In House based on APHA (online edition)	0.002 mg/L	All	Auckland
Sulphate		4110 B and EPA 300.0	0.02 ma/L	All	Auckland

Sulphate

Total Oxidised Nitrogen (as N) by Calculation

Ion Balance (Anions/Cations) by Calculation Anion Total

APHA (online edition) 1030 E

4110 B and EPA 300.0

4110 B and EPA 300.0

In House based on APHA (online edition)

In House based on APHA (online edition)

Auckland

Auckland

Auckland

All

All

All

0.02 mg/L

0.002 mg/L

meq/L

bin Balance (Anione Cations) by Cateulation AP14 A contine editor) 1030 E negl. All Auckard med L Bifference AP14 A content editor) 1030 E negl. All Auckard Auckard San of Anios - Cations AP14 A content editor) 1030 E negl. All Auckard San of Anios - Cations AP14 A content editor 1030 E negl. All Auckard San of Anios - Cations AP14 A content editor 1030 E Negl All Auckard Auckard San of Anios - Cations AP14 A content editor 1030 E Negl All Auckard Auckard San of Anios - Cations AP14 A content editor 1030 E Negl All Auckard Auckard San of Anios - Cations AP14 A content editor 1030 E Negl All Auckard Auckard San of Anios - Cations AP14 A content editor 1040 C D 1 reg L All Auckard San of Anios - Cations AP14 A content editor 1040 C D 1 reg L All Auckard San of Anios - Cations AP14 A content editor 1040 C D 1 reg L All Auckard San of Anios - Cations AP14 A content editor 1040 C D 1 reg L All Auckard San of Anios - Cations AP14 A content editor 1040 C D 1 reg L All Auckard San of Anios - Cations AP14 A content editor 1040 C D 1 reg L All Auckard San of Anio - Cataolation AP14 Content editor 1040 C D 1 reg L All Auckard San of Anio - Cataolation C adaption C Catabtion C adaption C Catabtion C	Chemistry Detailed				
Calon Tobal         APPA (criting edition) 1030 E         meq.L         AL         Auxistud           Denome Tobal         APPA (criting edition) 1030 E         AI         Auxistud           Denome Tobal         APPA (criting edition) 1030 E         AI         Auxistud           Denome Tobal         APPA (criting edition) 1030 E         AI         Auxistud           Communitation Manages (table tobal)         APPA (criting edition) 1030 E         AI         Auxistud           Communitation Manages (table tobal)         AIA (criting edition) 1030 E         AI         Auxistud           Communitation Manages (table tobal)         Casualition tobal         AIA         Auxistud           Description (table tobal)         Casualition tobal         AIA         Auxistud           Caronation Andres (table tobal)         AIA         Auxistud         Auxistud           Caronation Andres (table tobal)         AIA         Auxistud         Auxistud           Caronation Andres (table tobal)         AIA         Auxistud					
mmp1APMA (contre extor) (305 Cme3/LAllAuxidantShare A norms - ContronsAPMA (contre extor) (305 CAllAuxidantChancal ToritoriaAPMA (contre extor) (305 CAllAuxidantChancal ToritoriaAPMA (contre extor) (305 CAllAuxidantChancal ToritoriaShare A norma (300 N)0.005 mp1.AllAuxidantChancal ToritoriaCaculation from Amorais (as N)0.005 mp1.AllAuxidantArronotas (100 N)Caculation from Amorais (as N)0.005 mp1.AllAuxidantBiotandra Malarity (as HCOS) by TrationAPMA (contre extor) (202 B)1 mp1.AllAuxidantBiotandra Malarity (as HCOS) by TrationAPMA (contre extor) (202 B)1 mp1.AllAuxidantCaculation Inter (as COS) by TrationCaculation0.007 mp1.AllAuxidantCaculation Inter (as COS) by CaculationAPMA (contre extor) (400: COS D)1 mp1.AllAuxidantCaculationCaculationCaculation0.007 mp1.AllAuxidantDiff CaculationCaculation0.005 mp1.AllAuxidantTime Star (MS V) by CaculationAPMA (contre extor) (400: COS D)1 mp1.AllAuxidantTime Chance (as V) by Parsadpale Digetion and FlowAPMA (contre extor) (400: CO Modified, Deci1 mp1.AllAuxidantTime Chance (as V) by Parsadpale Digetion and FlowAPMA (contre extor) (400: CO Modified, Deci1 mp1.AllAuxidantTime Chance (as V) by Parsadpale Digetion and Flow <t< td=""><td>Cation Total</td><td>APHA (online edition) 1030 E</td><td>meg/L</td><td>All</td><td>Auckland</td></t<>	Cation Total	APHA (online edition) 1030 E	meg/L	All	Auckland
Partiest Diversion         APH A (parties edition) 1030 E         Aux Band           Concent Treatment         HI         Aux Band           Concent Treatment         HISSO (1981) 1058 AUT 173 10139         0.005 mg/L         AU         Aux Band           Concent Treatment         HISSO (1981) 1058 AUT 173 10139         0.005 mg/L         AU         Aux Band           Destroatment Autoning         HISSO (1981) 1058 AUT 173 10139         0.005 mg/L         AU         Aux Band           Destroatment Autoning (1981) 50 Calculation         APIA (parties edition) 2320 B         1 mg/L         AU         AuxBand           Destroatment Autoning (1980) 50 Calculation         APIA (parties edition) 2320 B         1 mg/L         AU         AuxBand           Calculater Multing (1980) 500 Calculation         APIA (parties edition) 2320 B         1 mg/L         AU         AuxBand           Parties Calculation         Calculation         Calculation         Au AuxBand         AuxBand           Parties Calculation         Calculation         AuxBand         AuxBand         AuxBand           Parties Calculation         Calculation         AuxBand         AuxBand         AuxBand           Parties Calculation         Calculation         AuxBand         AuxBand         AuxBand           Parties Calculation	meq/L Difference	, ,	•	All	Auckland
Sim of Anotas + Cathons + Cathons + Cathons + MISO (1191) ISBN 0117316139         O.005 mpl.         Al         Aukshard           Cathon in Cathon + Cathons + MISO (1191) ISBN 0117316139         O.005 mpl.         Al         Aukshard           Cathon + Cathons + Mison	Percent Difference		- 1	All	Auckland
Amenomia Navegen (as N.) by Calculation Amenomia Navegen (as N.) by Calculation Amenomia Navegen (as N.) by Calculation Amenomia (as N.) Amenomia Navegen (as N.) by Calculation Amenomia (as N.)	Sum of Anions + Cations			All	Auckland
Amenomia Navegen (as N.) by Calculation Amenomia Navegen (as N.) by Calculation Amenomia Navegen (as N.) by Calculation Amenomia (as N.) Amenomia Navegen (as N.) by Calculation Amenomia (as N.)	Concret Testing	· · ·			
Analysis         Control         Control           Amplian         Consultation         Consultation         All         Auckland           Bicrotone: Akkining (ns. NCO) by Calculation         APHA (online cation) (500 CO2 D         1 mpL         All         Auckland           Bicrotone: Akkining (ns. NCO) by Calculation         APHA (online cation) (200 B         1 mpL         All         Auckland           Catornation         APHA (online cation) (200 B         1 mpL         All         Auckland           Catornation         APHA (online cation) (200 B         1 mpL         All         Auckland           Catornation         APHA (online cation) (200 B         Calculation         0.097 mpL         All         Auckland           Station         Calculation         APHA (online eattion) (200 S 2 D         1 mpL         All         Auckland           Station         APHA (online eattion) (200 S 2 D         1 mpL         All         Auckland           Station         APHA (online eattion) (200 S 2 D         1 mpL         All         Auckland           Station         APHA (online eattion) (200 S 2 D         1 mpL         All         Auckland           Station         APHA (online eattion) (200 S 2 D         1 mpL         All         Auckland           Station <td></td> <td>LIMEO (1091) IEDN 0117516120</td> <td>0.005 mg/l</td> <td>All</td> <td>Augkland</td>		LIMEO (1091) IEDN 0117516120	0.005 mg/l	All	Augkland
Ammunication (set NHs) by Calculation         Calculation fore Ammonia (set N)         0.06 mg/L         All         Auskand           Bistenbrands Mallinky (set HCO3) by Tittetion         APHA (online editor) 3202 B         1 mg/L         All         Auskand           Bistenbrands Mallinky (set HCO3) by Tittetion         APHA (online editor) 3202 B         1 mg/L         All         Auskand           Carbotale Adatinity (set CO3) by Tittetion         APHA (online editor) 3203 B         1 mg/L         All         Auskand           Carbotale Adatinity (set CO3) by Tittetion         APHA (online editor) 3203 B         1 mg/L         All         Auskand           Whate (set NO3) by Calculation         Carbotale Adatinity (set CO3) by Tittetion         Carbotale Adatinity (set CO3) by Tittetion         Carbotale Adatinity (set CO3) by Tittetion         Auskand           Mitter (set NO2) by Calculation         Carbotale Adatinity (set CO3) by Tittetion         Carbotale Adatinity (set CO3) by Tittetion         Auskand           Mitter (set NO2) by Calculation         Carbotale Adatinity (set CO3) by Tittetion         Auskand         Carbotale Adatinity (set CO3) by Tittetion         Auskand           Mitter (set NO2) by Calculation         APHA (set me edition) 4500-C1 (set CO3) by Tittetion         Auskand         Auskand           Mitter (set NO2) by Calculation         APHA (set me edition) 4500-C1 (set CO3) by Tittetion         Auskand		HMSO (1981) ISBN 0117516139	0.005 mg/L	All	Auckianu
Bishon Availably (set MCG10 by Calculation         APIA (nomine editor) 320 B         1 mgl.         AI         Auksland           Carbonal Akalinity (set CACG1 by Tration         APIA (nomine editor) 320 B         1 mgl.         AI         Auksland           Carbonal Akalinity (set CACG1 by Tration         APIA (nomine editor) 320 B         1 mgl.         AI         Auksland           Carbonal Akalinity (set CACG3 by Tration         APIA (nomine editor) 420 B         1 mgl.         AI         Auksland           Marine (set NG0) (set CACG3 by Tration         Calculation         000 7 mgl.         AI         Auksland           Nintle (set NG0) (set CACG3 by Tration         Calculation         000 7 mgl.         AI         Auksland           Calculation         Calculation         000 7 mgl.         AI         Auksland		Calculation from Ammonia (as N)	0.006 mg/l	All	Auckland
Direct Aubainty (set MCO2) by Thatian         APH (contine detice) 3220 B         1 mgL         All         Aukaind (aubainty (set CO2) by Thatian           Carbonat Aubainty (set CO2) by Thatian         APH (contine detice) 3220 B         1 mgL         All         Aukaind (aubainty (set CO2) by Thatian         All         Aukaind (aubainty (set CO2) by Thatian <td></td> <td></td> <td>5</td> <td></td> <td></td>			5		
Carbonic Mailwing (so CO3) to Trainion         APH (crime estion) 2320 B         1 mgL         All         Aukkand           Carbonic Mailwing (so CO3) to Collocation         APH (crime estion) 2320 B         1 mgL         All         Aukkand           Nitrae (so NG3) to Calculation         Calculation         0.005 mgL         All         Aukkand           Nitrae (so NG3) to Calculation         Calculation         0.007 mgL         All         Aukkand           Station (So Not Calculation         Calculation         0.007 mgL         All         Aukkand           Station (So Not Calculation)         APH (crime estion) 4200-ED         0.1 mgL         1.2.3.5         Aukland           Station (So Not Calculation)         APH (crime estion) 4200-ED         0.0 mgL         All         Aukland           Station (So Not Calculation)         APH (crime estion) 4200-ED         0.0 S mgL         All         Aukland           Station (So Not Persighatio Digeston and Flav         APH (crime estion) 4200-ED (modified)         0.0 S mgL         All         Aukland           Calculation (So Not Persighatio Digeston and Flav         APH (crime estion) 4200-ED (modified)         0.0 S mgL         All         Aukland           Calculation (So Not Persighatio Digeston and Flav         APH (crime estion) 4200-ED (modified)         0.0 S mgL         All         Au			-		
Carbonate Allallanity (as CQ3) by Calculation         APHA (critine edition) 2320 B         1 mpL         All         Auckland           Write (as NG3) by Calculation         Calculation         0.000 mpL         All         Auckland           Write (as NG3) by Calculation         Calculation         0.000 mpL         All         Auckland           Builde (as NG3) by Calculation         Calculation         0.000 mpL         All         Auckland           Builde (as NG3) by Calculation         Calculation         0.000 mpL         All         Auckland           Builde Str CQ3 by Enclose         APHA (critine edition) 4500-H         0.01 mpL         All         Auckland           Build Allanithy (as CQ3) by Calculation         APHA (critine edition) 2500 D         1.0 mpL         All         Auckland           High Allanithy (as CQ3) by Calculation         APHA (critine edition) 2500 D         1.0 mpL         All         Auckland           High Allanithy (as CQ3) by Descriptionant (From All (as Critice edition) 2500 D-1 (modified)         0.02 mpL         All         Auckland           High All (as Olice edition) 2500 D-1 (modified)         0.03 mpL         All         Auckland           High All (as Olice edition) 2500 D-1 (modified)         0.03 mpL         All         Auckland           High Allanithy (as CQ3) by Descriptionant (From All (as CQ3		, ,	U U		
hydroxid Allahiniy (as GuiO 2013 by Traticion         API (online editor.) 2320 B         1 mgL         AII         AuxBand           hydroxid (as NO2) by Calculation         Calculation         0.007 mgL         AII         AuxBand           hydroxid (as NO2) by Calculation         Calculation         0.007 mgL         AII         AuxBand           hydroxid (as NO2) by Calculation         APIA (online editor.) 4500-R3 D         0.1 mgL         AII         AuxBand           Toll Allahinity (as CuCO3) by Traticion         APIA (online editor.) 4500-R3 D         0.1 mgL         AII         AuxBand           Toll Allahinity (as CuCO3) by Spectrophotementy according to APIA (online editor.) 4500-F3 C         0.010 mgL         AII         AuxBand           Toll Allahinity (as CuCO3) by Persolphate Digestion and Flow         APIA (online editor.) 4500-F3 (modified)         0.010 mgL         AII         AuxBand           Toll Societt Societts (as P) by Persolphate Digestion and         APIA (online editor.) 4500-F3 (modified)         0.024 mgL         AII         AuxBand           Turadity by Appendementy         APIA (online editor.) 4500-F3 (modified)         0.024 mgL         AII         AuxBand           Turadity by Appendementy         APIA (online editor.) 4500-F3 (modified)         0.024 mgL         AII         AuxBand           Turadity by Appendementy         APIA (online editor			-		
Ninetic set X031 by Calculation         Quid prime         Quid prime         Quid prime         All         Auckland           Pri (d) room temp c 20 °C by Exclusion         APH4 (centine edition) 4500-H B         0.1 mgL         All         Auckland           Stafies by Colour Comparison (Methyleno Blue Method)         APH4 (centine edition) 2302 B         11 mgL         All         Auckland           Stafies by Colour Comparison (Methyleno Blue Method)         APH4 (centine edition) 2302 B         11 mgL         All         Auckland           Flaid Distance Color (G)         APH4 (centine edition) 2500 C (Modified Dired)         15 mgL         All         Auckland           Flaid Distance Color (G)         APH4 (centine edition) 2500 C (Modified) Dired)         15 mgL         All         Auckland           Flaid Distance Color (G)         APH4 (centine edition) 2500 C (Modified) Dired)         Dired II mgL         All         Auckland           Flaid Distance Color (G)         APH4 (centine edition) 2500 C (Modified) Dired)         Dired II mgL         All         Auckland           Flaid Distance Color (G)         APH4 (centine edition) 2500 D         Dired III mgL         All         Auckland           Flaid Distance Color (G)         APH4 (centine edition) 2500 D         Dired III mgL         All         Auckland           Flaid Distance Color (G)         A		. ,	-		
Nithis (as N2) by Calculation         Calculation         0.07 mg/L         All         Auxiliard           ptl (at noom temp c. 20 Top State)         APHA (conline edition) 3500-S2 D         D.1 mg/L         All         Auxiliard           Toll Akaline by Councy (Diry Spectrophonetry according to APHA (conline edition) 2500-CI G         D.1 mg/L         All         Auxiliard           Toll Akaline by Councy (Diry Spectrophonetry according to APHA (conline edition) 2500-CI G         D.01 mg/L         All         Auxiliard           Toll Diresolved States by Gravity         APHA (conline edition) 2500-CI (Coll Gird)         D.010 mg/L         All         Auxiliard           Toll Diresolved States by Gravity         APHA (conline edition) 2500-CI (Incollinet), at 100-105 rC)         D.010 mg/L         All         Auxiliard           Toll Diresolved States by CPMA         APHA (conline edition) 2500-D         D.004 mg/L         All         Auxiliard           Toll Diresolved States by CPMA         APHA (conline edition) 2500 D         D.05 NTU         All         Auxiliard           Turbid by by bybelatenetry         APHA (conline edition) 2500 D         D.05 NTU         All         Auxiliard           Turbid by by bybelatenetry         APHA (conline edition) 2500 D         D.05 NTU         All         Auxiliard           Turbid by bybelatenetry         APHA (conline edition) 2500 D					
pil (af izon tamps: 2 20 °C) by Electrode       API4 (conline edition) 4500-H 8       0.1 prij.u.       A.I.       Auckland         Suitide by Colour Comparison (Methylene Blue Method)       API4 (conline edition) 2302 B       1 mgl.       1, 2, 3, 5       Auckland         Suitide by Colour Comparison (Methylene Blue Method)       API4 (conline edition) 2302 B       1 mgl.       AI       Auckland         Tatal Description (as CD2) by Tambe       API4 (conline edition) 2500 C G       0.02 mgl.       AI       Auckland         Tatal Description (as CD2) by Spectrophotometry according to that) (0.500 C G       API4 (conline edition) 2500 C J (modified)       0.010 mgl.       AI       Auckland         Apple (conline edition) 2500 C J (modified)       0.010 mgl.       AI       Auckland         Apple (conline edition) 2500 C J (modified)       0.004 mgl.       AI       Auckland         Apple (conline edition) 2500 C J (modified)       0.004 mgl.       AI       Auckland         Table Descriptiona (as P) by Persulphate Digestion and       API4 (online edition) 2500 C J (modified)       0.004 mgl.       AI       Auckland         Table Descriptiona (as P) by Persulphate Digestion and       API4 (online edition) 2500 C J (modified)       0.005 mgl.       4       Auckland         Table Descriptiona (as P) by Persulphate Digestion and       PPA (online edition) 2500 C J (modified)       0.0001 m					
Sundia Produce Comparison (Methylene Blue Method)         APHA (conline edition) 3500-52 D         0.1 mgL         1, 2, 3, 5         Auxistand           Total Alkalimity (as CaC03) by Treation         APHA (conline edition) 2520 B         1 mgL         All         Auxistand           Total Alkalimity (as CaC03) by Spectrophometry according to APHA (conline edition) 2500 C (Modified) Dred at 103 - 105 * 0')         15 mg/L         All         Auxistand           Total Instructed Soft SP Gravinethy         APHA (conline edition) 2500 C (Modified) Dred at 103 - 105 * 0')         D.010 mg/L         All         Auxistand           Total Instructed Soft SP Gravinethy         APHA (conline edition) 2500 P J (modified)         D.010 mg/L         All         Auxistand           Total Subspectid Soft Soft Sy Gravinethy         APHA (conline edition) 2500 P J (modified)         D.014 mg/L         All         Auxistand           Turbuity by Maphebemetry         APHA (conline edition) 2500 P J (modified)         D.004 mg/L         All         Auxistand           Turbuity by Maphebemetry         APHA (conline edition) 2500 P J (modified)         D.0010 mg/L         4         Auxistand           Turbuity by Maphebemetry         APHA (conline edition) 2500 P J (modified)         D.0010 mg/L         4         Auxistand           Turbuity by Maphebemetry         APHA (conline edition) 2500 P J (modified)         D.0010 mg/L         4					
Total Alkalinity (as CaC03) by Titration       APHA costine estion) 2320 B       tmgl,       All       Auckland         Total Alkalinity (as CaC03) by Extration       APHA costine estion) 6300-C1 G       0.02 mgl,       All       Auckland         Total Disorder Structure (as CaC03) by Extration       APHA (conline estion) 2540 C (Modified; Direid       15 mgl,       All       Auckland         Total Disorder (as P) by Persulphate Digestion and Flow       APHA (conline estion) 2540 C (Modified; Direid       0.01 mgl,       All       Auckland         Total Disorder (as P) by Persulphate Digestion and Flow       APHA (conline estion) 2540 D       0.2 mgl,       All       Auckland         Total Disorder (as P) by Persulphate Digestion and       APHA (conline estion) 2540 D       0.2 mgl,       All       Auckland         Total Disorder (as P) by Persulphate Digestion and       APHA (conline estion) 2540 D       0.2 mgl,       All       Auckland         Metal       Areadime       APHA (conline estion) 2540 D       0.2 mgl,       4       Auckland         Total Disorder (Disorder)       In House based on EPA 200.8 by (CPMS       0.000 mgl,       4       Auckland         Calcum (Disorder)       In House based on EPA 200.8 by (CPMS       0.001 mgl,       4       Auckland         Magnese (Disorder)       In House based on EPA 200.8 by (CPMS       0.000 mgl,<		, ,	•		
Table Chlorine (as G12) by Spectrophotometry according to APHA (conline edition) 4500-C1 G         0.02 mg/L         All         Auckland All All All All All All All All All All			•		
APHA (critine editor) 550 C (Modified: Dired Total Dissolved Solids by Gravimetry APHA (critine editor) 4500 -P J (modified), Total Nitrogen (as N) by Persulphate Digestion and Flow APHA (critine editor) 4500 -P J (modified), 100 (Phogenetic Analyset Total Notione (as P) by Persulphate Digestion and Flow APHA (critine editor) 4500 -P J (modified), 100 (Phogenetic Analyset Total Nitrogen (as N) by Persulphate Digestion and 400 - NO2 J 100 (Phogenetic Analyset Total Solids by Gravimetry APHA (critine editor) 2540 D 0.2 mg/L All Auckland 400 - NO2 J 100 (Phogenetic Analyset Total Solids by Gravimetry APHA (critine editor) 2540 D 0.2 mg/L All Auckland A					
Total Dissolved Solids by Gravimetry         APHA (online edition) 2540 C (Modified: Dried)         15 mg/L         All         Auckland           Total Nitopoen (as N) by Persulphate Digestion and Flow         APHA (online edition) 4500-P J (modified)         0.010 mg/L         All         Auckland           Colon regions (as P) by Persulphate Digestion and         APHA (online edition) 4500-P J (modified)         0.004 mg/L         All         Auckland           Colon regions (as P) by Persulphate Digestion and         APHA (online edition) 2500 P         0.2 mg/L         All         Auckland           Colon regions (as P) by Persulphate Digestion and         APHA (online edition) 2500 P         0.204 mg/L         All         Auckland           Colon regions (as P) by Persulphate Digestion and         APHA (online edition) 2500 P         0.0001 mg/L         4         Auckland           Materia         Colon regions (as P) by Persulphate Digestion and in house based on EPA 200.8 by ICPMS         0.0001 mg/L         4         Auckland           Magnesium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.0001 mg/L         4         Auckland           Magnesium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.0001 mg/L         1.2.3, 5         Auckland           Magnesium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.0001 mg/L         1.2.3, 5         A		APHA (online edition) 4500-CI G	0.0∠ mg/L	All	Auckland
at 103 - 105 °C)       at 103 - 105 °C)       0.010 mg/L       All       Auckland         Total Nitrogen (as N) by Persulphate Digestion and       APHA (online edition) 4500-P J (modified)       0.004 mg/L       All       Auckland         Total Nitrogen (as P) by Persulphate Digestion and       APHA (online edition) 2540 D       0.204 mg/L       All       Auckland         Total Nitrogen Management (Starbork)       APHA (online edition) 2540 D       0.20 mg/L       All       Auckland         Total Nitrogen Management (Starbork)       APHA (online edition) 2540 D       0.25 NTU       All       Auckland         Metals       Dissolved Motals by ICP-MS—Trace		APHA (online edition) 2540 C (Madified: Dried	15 mg/l	All	Auckland
Tail Microgen (as N) by Persulphate Digestion and Flow         APHA (online edition) 450.P-J (modified).         0.010 mg/L         All         Auckland           Total Phosphorus (as P) by Persulphate Digestion and         APHA (online edition) 2500 P.J (modified)         0.004 mg/L         All         Auckland           Coloneary/Discrete Analyser         APHA (online edition) 2500 P.J (modified)         0.05 NTU         All         Auckland           Titulidity by Nephelometry         APHA (online edition) 2500 B (modified)         0.55 NTU         All         Auckland           Metals         Disolved Microso Disolved Microso Disol B (PAMS)         0.0010 mg/L         4         Auckland           Calcium (Dissolved)         In House based on EPA 200.8 by (CPMS)         0.002 mg/L         4         Auckland           Manganese (Dissolved)         In House based on EPA 200.8 by (CPMS)         0.0005 mg/L         4         Auckland           Manganese (Dissolved)         In House based on EPA 200.8 by (CPMS)         0.0005 mg/L         4         Auckland           Sodium (Dissolved)         In House based on EPA 200.8 by (CPMS)         0.0005 mg/L         1.2.3, 5         Auckland           Colcound Dissolved)         In House based on EPA 200.8 by (CPMS)         0.0005 mg/L         1.2.3, 5         Auckland           Colcound Dissolved)         In House based on EPA 200	Total Dissolved Collas by Cravineary		10 mg/L	7.41	Addition
Analysis         400.44031         400.44031         Auckland           Total Phosphons (as P) by Persuphate Digestion and         APHA (online edition) 4500-P J (modified)         0.00 4 mg/L         All         Auckland           Total Separate Analyser         APHA (online edition) 2540 D         0.2 mg/L         All         Auckland           Total Supported Solias by Gravinatry         APHA (online edition) 2540 D         0.65 NTU         All         Auckland           Metizit         Environme Ottoson 2000 By (CPMS         0.00010 mg/L         4         Auckland           Metizit         Environme Ottoson 2000 By (CPMS         0.0010 mg/L         4         Auckland           Calcium (Dissolved)         In House based on EPA 200.8 by (CPMS         0.0010 mg/L         4         Auckland           Magnesium (Dissolved)         In House based on EPA 200.8 by (CPMS         0.001 mg/L         4         Auckland           Margines (Dissolved)         In House based on EPA 200.8 by (CPMS         0.001 mg/L         4         Auckland           Potastim (Dissolved)         In House based on EPA 200.8 by (CPMS         0.010 mg/L         1.2.3, 5         Auckland           Dissolved Metals by ICP-MS—Trace (Received Filterod)         In House based on EPA 200.8 by (CPMS         0.010 mg/L         1.2.3, 5         Auckland           Dis	Total Nitrogen (as N) by Persulphate Digestion and Flow		0.010 ma/L	All	Auckland
Total Procesphones (ase P) by Porsubptate Digestion and Colorimetry/Discret Analyser         APIA (online edition) 2540 D         0.004 mgl.         All         Auckland           Colorimetry/Discret Analyser         APIA (online edition) 2100 B (modified)         0.05 NTU         All         Auckland           Mater         APIA (online edition) 2100 B (modified)         0.05 NTU         All         Auckland           Mater         Disolved Matals by ICP-MS—Trace         -         -         Auckland           Globin (Dissolved)         In House based on EPA 200.8 by ICPMS         0.0010 mgl.         4         Auckland           Magnesium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.000 mgl.         4         Auckland           Magnesium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.000 mgl.         4         Auckland           Magnesium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.000 mgl.         1,2,3,5         Auckland           Globin (Dissolved)         In House based on EPA 200.8 by ICPMS         0.000 mgl.         1,2,3,5         Auckland           Globin (Dissolved)         In House based on EPA 200.8 by ICPMS         0.001 mgl.         1,2,3,5         Auckland           Globin (Dissolved)         In House based on EPA 200.8 by ICPMS         0.001 mgl.         1,2,3,5					
Calorimetry Discrete Analyser         All         Auxidand           Tarbidity by Nephelometry         APHA (online edition) 2540 D         0.2 mg/L         All         Auxidand           Turbidity by Nephelometry         APHA (online edition) 2540 D         0.06 NTU         All         Auxidand           Metals         Unable State (Dissolved)         In House based on EPA 200.8 by ICPMS         0.00010 mg/L         4         Auxidand           Magnesium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.0002 mg/L         4         Auxidand           Magnesium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.0005 mg/L         4         Auxidand           Magnesium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.005 mg/L         4         Auxidand           Solum (Dissolved)         In House based on EPA 200.8 by ICPMS         0.05 mg/L         4         Auxidand           Solum (Dissolved)         In House based on EPA 200.8 by ICPMS         0.010 mg/L         1, 2, 3, 5         Auxidand           Solum (Dissolved)         In House based on EPA 200.8 by ICPMS         0.0010 mg/L         1, 2, 3, 5         Auxidand           Solum (Dissolved)         In House based on EPA 200.8 by ICPMS         0.0010 mg/L         1, 2, 3, 5         Auxidand           Solum (Dissolved)	-		0.004 mg/L	All	Auckland
Turbidity by Nephelometry         APHA (online edition) 2130 B (modified)         0.05 NTU         All         Auxidiand           Metas         Dissolved         In House based on EPA 200.8 by ICPMS         0.00010 mg1.         4         Auxidiand           Calcium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.00010 mg1.         4         Auxidiand           Magnesium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.000 mg1.         4         Auxidiand           Magnesium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.000 mg1.         4         Auxidiand           Magnesium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.001 mg1.         4         Auxidiand           Sodium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.010 mg1.         1, 2, 3, 5         Auxidiand           Sodium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.0010 mg1.         1, 2, 3, 5         Auxidiand           Sodium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.0010 mg1.         1, 2, 3, 5         Auxidiand           Nagnesium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.0010 mg1.         1, 2, 3, 5         Auxidiand           Nagnesium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.0010 mg1.	Colorimetry/Discrete Analyser		Ū		
Areanic Obsolved Metals by ICP-MS—Trace       In House based on EPA 200.8 by ICPMS       0.00010 mg/L       4       Auckland         Calcium (Dissolved)       In House based on EPA 200.8 by ICPMS       0.010 mg/L       4       Auckland         Magnesium (Dissolved)       In House based on EPA 200.8 by ICPMS       0.001 mg/L       4       Auckland         Magnesium (Dissolved)       In House based on EPA 200.8 by ICPMS       0.001 mg/L       4       Auckland         Magnesium (Dissolved)       In House based on EPA 200.8 by ICPMS       0.000 mg/L       4       Auckland         Magnesium (Dissolved)       In House based on EPA 200.8 by ICPMS       0.001 mg/L       4       Auckland         Dissolved Metals by ICP-MS—Trace (Received Filtered)       In House based on EPA 200.8 by ICPMS       0.0010 mg/L       1, 2, 3, 5       Auckland         Dissolved Metals by ICP-MS—Trace (Received Filtered)       In House based on EPA 200.8 by ICPMS       0.0010 mg/L       1, 2, 3, 5       Auckland         Magnesium (Dissolved)       In House based on EPA 200.8 by ICPMS       0.0010 mg/L       1, 2, 3, 5       Auckland         Magnesium (Dissolved)       In House based on EPA 200.8 by ICPMS       0.001 mg/L       1, 2, 3, 5       Auckland         Magnesium (Dissolved)       In House based on EPA 200.8 by ICPMS       0.000 mg/L       1, 2, 3, 5       Auckl	Total Suspended Solids by Gravimetry	APHA (online edition) 2540 D	0.2 mg/L	All	Auckland
Dissolved Metals by ICP-MS—Trace         Arsenic (Dissolved)       In House based on EPA 200.8 by ICPMS       0.00010 mg/L       4       Auckland         Calcium (Dissolved)       In House based on EPA 200.8 by ICPMS       0.0010 mg/L       4       Auckland         Magnesium (Dissolved)       In House based on EPA 200.8 by ICPMS       0.0001 mg/L       4       Auckland         Magnesium (Dissolved)       In House based on EPA 200.8 by ICPMS       0.0005 mg/L       4       Auckland         Marganese (Dissolved)       In House based on EPA 200.8 by ICPMS       0.0005 mg/L       4       Auckland         Dissolved Missolved)       In House based on EPA 200.8 by ICPMS       0.00010 mg/L       4       Auckland         Dissolved Mista by ICP-MS—Trace (Received Filtered)       In House based on EPA 200.8 by ICPMS       0.00010 mg/L       1.2.3.5       Auckland         Dissolved Mista by ICP-MS—Trace (Received Filtered)       In House based on EPA 200.8 by ICPMS       0.00010 mg/L       1.2.3.5       Auckland         Calcium (Dissolved)       In House based on EPA 200.8 by ICPMS       0.00010 mg/L       1.2.3.5       Auckland         Magnesium (Dissolved)       In House based on EPA 200.8 by ICPMS       0.0010 mg/L       1.2.3.5       Auckland         Magnesium (Dissolved)       In House based on EPA 200.8 by ICPMS       0.0010 mg/L	Turbidity by Nephelometry	APHA (online edition) 2130 B (modified)	0.05 NTU	All	Auckland
Dissolved Metals by ICP-MS—Trace         Arsenic (Dissolved)       In House based on EPA 200.8 by ICPMS       0.00010 mg/L       4       Auckland         Calcium (Dissolved)       In House based on EPA 200.8 by ICPMS       0.0010 mg/L       4       Auckland         Magnesium (Dissolved)       In House based on EPA 200.8 by ICPMS       0.0001 mg/L       4       Auckland         Magnesium (Dissolved)       In House based on EPA 200.8 by ICPMS       0.0005 mg/L       4       Auckland         Marganese (Dissolved)       In House based on EPA 200.8 by ICPMS       0.0005 mg/L       4       Auckland         Dissolved Missolved)       In House based on EPA 200.8 by ICPMS       0.00010 mg/L       4       Auckland         Dissolved Mista by ICP-MS—Trace (Received Filtered)       In House based on EPA 200.8 by ICPMS       0.00010 mg/L       1.2.3.5       Auckland         Dissolved Mista by ICP-MS—Trace (Received Filtered)       In House based on EPA 200.8 by ICPMS       0.00010 mg/L       1.2.3.5       Auckland         Calcium (Dissolved)       In House based on EPA 200.8 by ICPMS       0.00010 mg/L       1.2.3.5       Auckland         Magnesium (Dissolved)       In House based on EPA 200.8 by ICPMS       0.0010 mg/L       1.2.3.5       Auckland         Magnesium (Dissolved)       In House based on EPA 200.8 by ICPMS       0.0010 mg/L	Metals				
Arsenic (Dissolved)       In House based on EPA 200.8 by ICPMS       0.00010 mg/L       4       Auckland         Calcium (Dissolved)       In House based on EPA 200.8 by ICPMS       0.0010 mg/L       4       Auckland         Inro (Dissolved)       In House based on EPA 200.8 by ICPMS       0.001 mg/L       4       Auckland         Magnesium (Dissolved)       In House based on EPA 200.8 by ICPMS       0.001 mg/L       4       Auckland         Magnese (Dissolved)       In House based on EPA 200.8 by ICPMS       0.0005 mg/L       4       Auckland         Polasium (Dissolved)       In House based on EPA 200.8 by ICPMS       0.0001 mg/L       4       Auckland         Sodium (Dissolved)       In House based on EPA 200.8 by ICPMS       0.0010 mg/L       1.2.3,5       Auckland         Obisolved/bisolved)       In House based on EPA 200.8 by ICPMS       0.0010 mg/L       1.2.3,5       Auckland         Galcium (Dissolved)       In House based on EPA 200.8 by ICPMS       0.0010 mg/L       1.2.3,5       Auckland         Magnesium (Dissolved)       In House based on EPA 200.8 by ICPMS       0.0001 mg/L       1.2.3,5       Auckland         Magnesium (Dissolved)       In House based on EPA 200.8 by ICPMS       0.0001 mg/L       1.2.3,5       Auckland         Magnesium (Dissolved)       In House based on EPA 200.8 by I					
Calcium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.010 mg/L         4         Auckland           Magnesium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.001 mg/L         4         Auckland           Magnesium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.000 mg/L         4         Auckland           Magnesium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.005 mg/L         4         Auckland           Sodium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.005 mg/L         4         Auckland           Sodium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.0001 mg/L         1, 2, 3, 5         Auckland           Dissolved Mitals by ICP-MS—Trace (Received Filtered)         In House based on EPA 200.8 by ICPMS         0.0001 mg/L         1, 2, 3, 5         Auckland           Ino (Dissolved)         In House based on EPA 200.8 by ICPMS         0.0002 mg/L         1, 2, 3, 5         Auckland           Magnesium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.0002 mg/L         1, 2, 3, 5         Auckland           Magnesium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.0007 mg/L         1, 2, 3, 5         Auckland           Magnesium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.0007 mg/L </td <td>Arsenic (Dissolved)</td> <td>In House based on EPA 200.8 by ICPMS</td> <td>0.00010 mg/L</td> <td>4</td> <td>Auckland</td>	Arsenic (Dissolved)	In House based on EPA 200.8 by ICPMS	0.00010 mg/L	4	Auckland
Inn House based on EPA 200.8 by ICPMS         0.002 mg/L         4         Auckland           Magnesieu (Dissolved)         In House based on EPA 200.8 by ICPMS         0.0005 mg/L         4         Auckland           Magnarese (Dissolved)         In House based on EPA 200.8 by ICPMS         0.0005 mg/L         4         Auckland           Potassium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.0001 mg/L         1, 2, 3, 5         Auckland           Potassium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.0010 mg/L         1, 2, 3, 5         Auckland           Potasolved Metals by ICP-MS—Trace (Received Filtered)         In House based on EPA 200.8 by ICPMS         0.0010 mg/L         1, 2, 3, 5         Auckland           Calcium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.0010 mg/L         1, 2, 3, 5         Auckland           Magnesium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.001 mg/L         1, 2, 3, 5         Auckland           Magnesium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.001 mg/L         1, 2, 3, 5         Auckland           Magnesium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.001 mg/L         1, 2, 3, 5         Auckland           Magnesium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.001 mg/L		,	8	4	Auckland
Magnesium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.001 mg/L         4         Auckland           Manganese (Dissolved)         In House based on EPA 200.8 by ICPMS         0.005 mg/L         4         Auckland           Potassium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.05 mg/L         4         Auckland           Dissolved (Dissolved)         In House based on EPA 200.8 by ICPMS         0.010 mg/L         1, 2, 3, 5         Auckland           Calcium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.0001 mg/L         1, 2, 3, 5         Auckland           Calcium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.001 mg/L         1, 2, 3, 5         Auckland           Iron (Dissolved)         In House based on EPA 200.8 by ICPMS         0.001 mg/L         1, 2, 3, 5         Auckland           Magnesium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.001 mg/L         1, 2, 3, 5         Auckland           Magnese (Dissolved)         In House based on EPA 200.8 by ICPMS         0.000 mg/L         1, 2, 3, 5         Auckland           Potassium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.000 mg/L         1, 2, 3, 5         Auckland           Sodium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.000 mg/L         AII		,	8		
Manganese (Dissolved)         In House based on EPA 200.8 by ICPMS         0.0005 mg/L         4         Auckland           Potassium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.15 mg/L         4         Auckland           Sodium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.0005 mg/L         4         Auckland           Dissolved Metals by ICP-MS—Trace (Received Filtered)         In House based on EPA 200.8 by ICPMS         0.00010 mg/L         1, 2, 3, 5         Auckland           Calcium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.00010 mg/L         1, 2, 3, 5         Auckland           Iron (Dissolved)         In House based on EPA 200.8 by ICPMS         0.0001 mg/L         1, 2, 3, 5         Auckland           Magnesium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.0005 mg/L         1, 2, 3, 5         Auckland           Magnesium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.0005 mg/L         1, 2, 3, 5         Auckland           Magnesium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.0001 mg/L         1, 2, 3, 5         Auckland           Magnesium (Dissolved)         In House based on EPA 200.8 by ICPMS         0.001 mg/L         AII         Auckland           Magnesium (Dissolved)         In House based on EPA 200.8 by ICPMS		,	5		Auckland
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Arsenic (Dissolved)       In House based on EPA 200.8 by ICPMS       0.00010 mg/L       1, 2, 3, 5       Auckland         Calcium (Dissolved)       In House based on EPA 200.8 by ICPMS       0.010 mg/L       1, 2, 3, 5       Auckland         Iron (Dissolved)       In House based on EPA 200.8 by ICPMS       0.001 mg/L       1, 2, 3, 5       Auckland         Magnesium (Dissolved)       In House based on EPA 200.8 by ICPMS       0.001 mg/L       1, 2, 3, 5       Auckland         Magnesium (Dissolved)       In House based on EPA 200.8 by ICPMS       0.000 mg/L       1, 2, 3, 5       Auckland         Potassium (Dissolved)       In House based on EPA 200.8 by ICPMS       0.001 mg/L       1, 2, 3, 5       Auckland         Sodium (Dissolved)       In House based on EPA 200.8 by ICPMS       0.001 mg/L       1, 2, 3, 5       Auckland         Sodium (Dissolved)       In House based on EPA 200.8 by ICPMS       0.1 mg/L       1, 2, 3, 5       Auckland         Arsenic (Total)       In House based on EPA 200.8 by ICPMS       0.101 mg/L       All       Auckland         Arsenic (Total)       In House based on EPA 200.8 by ICPMS       0.0010 mg/L       All       Auckland         Iron (Total)       In House based on EPA 200.8 by ICPMS       0.001 mg/L       All       Auckland         Magnesium (Total)       In House based		In house based on El A 200.0 by for Mo	0.1 mg/L	•	, aonana
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Magnesium (Total)In House based on EPA 200.8 by ICPMS0.001 mg/LAllAucklandManganese (Total)In House based on EPA 200.8 by ICPMS0.005 mg/LAllAucklandPotassium (Total)In House based on EPA 200.8 by ICPMS0.05 mg/LAllAucklandSodium (Total)In House based on EPA 200.8 by ICPMS0.1 mg/LAllAucklandTotal Hardness (as CaCO3)In House based on EPA 200.8 by ICPMS0.03 mg/LAllAucklandOrganicsTotal Organic Carbon by Non-dispersive infrared detectionTotal Organic CarbonAPHA (online edition) 5310 B0.1 mg/LAllAucklandMicrobiologyEscherichia coli by Membrane FiltrationUSEPA Method 16032 cfu/100 mLAllAucklandPreparationsUSEPA Method 16032 cfu/100 mLAllAuckland	Iron (Dissolved) Magnesium (Dissolved) Manganese (Dissolved) Potassium (Dissolved) Sodium (Dissolved) <b>Total Metals by ICP-MS—Trace (Default Digest)</b> Arsenic (Total)	In House based on EPA 200.8 by ICPMS In House based on EPA 200.8 by ICPMS	0.002 mg/L 0.001 mg/L 0.0005 mg/L 0.02 mg/L 0.1 mg/L	1, 2, 3, 5 1, 2, 3, 5	Auckland Auckland Auckland Auckland Auckland
Manganese (Total)In House based on EPA 200.8 by ICPMS0.0005 mg/LAllAucklandPotassium (Total)In House based on EPA 200.8 by ICPMS0.05 mg/LAllAucklandSodium (Total)In House based on EPA 200.8 by ICPMS0.1 mg/LAllAucklandTotal Hardness (as CaCO3)In House based on EPA 200.8 by ICPMS0.03 mg/LAllAucklandOrganicsTotal Organic Carbon by Non-dispersive infrared detectionTotal Organic Carbon by Membrane FiltrationEscherichia coli by Membrane FiltrationUSEPA Method 16032 cfu/100 mLAllAucklandPreparations	Iron (Dissolved) Magnesium (Dissolved) Manganese (Dissolved) Potassium (Dissolved) Sodium (Dissolved) <b>Total Metals by ICP-MS—Trace (Default Digest)</b> Arsenic (Total) Calcium (Total)	In House based on EPA 200.8 by ICPMS In House based on EPA 200.8 by ICPMS	0.002 mg/L 0.001 mg/L 0.0005 mg/L 0.02 mg/L 0.1 mg/L	1, 2, 3, 5 1, 2, 3, 5 All	Auckland Auckland Auckland Auckland Auckland
Potassium (Total)In House based on EPA 200.8 by ICPMS0.05 mg/LAllAucklandSodium (Total)In House based on EPA 200.8 by ICPMS0.1 mg/LAllAucklandTotal Hardness (as CaCO3)In House based on EPA 200.8 by ICPMS0.03 mg/LAllAucklandOrganicsTotal Organic Carbon by Non-dispersive infrared detectionTotal Organic Carbon by Non-dispersive infrared detectionTotal Organic Carbon by Non-dispersive infrared detectionTotal Organic Carbon by Non-dispersive infrared detectionAPHA (online edition) 5310 B0.1 mg/LAllAucklandMicrobiologyEscherichia coli by Membrane FiltrationEscherichia coliUSEPA Method 16032 cfu/100 mLAllAucklandPreparations	Iron (Dissolved) Magnesium (Dissolved) Manganese (Dissolved) Potassium (Dissolved) Sodium (Dissolved) <b>Total Metals by ICP-MS—Trace (Default Digest)</b> Arsenic (Total)	In House based on EPA 200.8 by ICPMS In House based on EPA 200.8 by ICPMS	0.002 mg/L 0.001 mg/L 0.0005 mg/L 0.02 mg/L 0.1 mg/L 0.00010 mg/L 0.010 mg/L	1, 2, 3, 5 1, 2, 3, 5 All All	Auckland Auckland Auckland Auckland Auckland Auckland
Sodium (Total) Total Hardness (as CaCO3)In House based on EPA 200.8 by ICPMS0.1 mg/LAllAucklandOrganicsTotal Organic Carbon by Non-dispersive infrared detectionTotal Organic Carbon by Membrane FiltrationEscherichia coli by Membrane FiltrationEscherichia coliUSEPA Method 16032 cfu/100 mLAllAucklandPreparations	Iron (Dissolved) Magnesium (Dissolved) Manganese (Dissolved) Potassium (Dissolved) Sodium (Dissolved) <b>Total Metals by ICP-MS—Trace (Default Digest)</b> Arsenic (Total) Calcium (Total)	In House based on EPA 200.8 by ICPMS In House based on EPA 200.8 by ICPMS	0.002 mg/L 0.001 mg/L 0.0005 mg/L 0.02 mg/L 0.1 mg/L 0.00010 mg/L 0.010 mg/L 0.002 mg/L	1, 2, 3, 5 1, 2, 3, 5 All All All	Auckland Auckland Auckland Auckland Auckland Auckland Auckland
Total Hardness (as CaCO3)       In House based on EPA 200.8 by ICPMS       0.03 mg/L       All       Auckland         Organics       Total Organic Carbon by Non-dispersive infrared detection       APHA (online edition) 5310 B       0.1 mg/L       All       Auckland         Microbiology       Escherichia coli by Membrane Filtration       USEPA Method 1603       2 cfu/100 mL       All       Auckland         Preparations       USEPA Method 1603       2 cfu/100 mL       All       Auckland	Iron (Dissolved) Magnesium (Dissolved) Manganese (Dissolved) Potassium (Dissolved) Sodium (Dissolved) <b>Total Metals by ICP-MS—Trace (Default Digest)</b> Arsenic (Total) Calcium (Total) Iron (Total) Magnesium (Total) Magnese (Total)	In House based on EPA 200.8 by ICPMS In House based on EPA 200.8 by ICPMS	0.002 mg/L 0.001 mg/L 0.0005 mg/L 0.02 mg/L 0.1 mg/L 0.00010 mg/L 0.000 mg/L 0.002 mg/L 0.001 mg/L	1, 2, 3, 5 1, 2, 3, 5 All All All All	Auckland Auckland Auckland Auckland Auckland Auckland Auckland Auckland
Organics       Total Organic Carbon by Non-dispersive infrared detection       Total Organic Carbon     APHA (online edition) 5310 B     0.1 mg/L     All     Auckland       Microbiology       Escherichia coli by Membrane Filtration       Escherichia coli     USEPA Method 1603     2 cfu/100 mL     All     Auckland	Iron (Dissolved) Magnesium (Dissolved) Manganese (Dissolved) Potassium (Dissolved) Sodium (Dissolved) <b>Total Metals by ICP-MS—Trace (Default Digest)</b> Arsenic (Total) Calcium (Total) Iron (Total) Magnesium (Total)	In House based on EPA 200.8 by ICPMS In House based on EPA 200.8 by ICPMS	0.002 mg/L 0.001 mg/L 0.0005 mg/L 0.02 mg/L 0.1 mg/L 0.00010 mg/L 0.000 mg/L 0.002 mg/L 0.001 mg/L 0.001 mg/L 0.0005 mg/L	1, 2, 3, 5 1, 2, 3, 5 All All All All All All	Auckland Auckland Auckland Auckland Auckland Auckland Auckland Auckland Auckland
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Microbiology Escherichia coli by Membrane Filtration Escherichia coli USEPA Method 1603 2 cfu/100 mL All Auckland Preparations	Iron (Dissolved) Magnesium (Dissolved) Manganese (Dissolved) Potassium (Dissolved) Sodium (Dissolved) Total Metals by ICP-MS—Trace (Default Digest) Arsenic (Total) Calcium (Total) Calcium (Total) Iron (Total) Magnesium (Total) Manganese (Total) Potassium (Total) Sodium (Total) Sodium (Total) Total Hardness (as CaCO3) Organics	In House based on EPA 200.8 by ICPMS In House based on EPA 200.8 by ICPMS	0.002 mg/L 0.001 mg/L 0.0005 mg/L 0.02 mg/L 0.1 mg/L 0.00010 mg/L 0.000 mg/L 0.002 mg/L 0.0005 mg/L 0.05 mg/L 0.1 mg/L	1, 2, 3, 5 1, 2, 3, 5 All All All All All All All All All Al	Auckland Auckland Auckland Auckland Auckland Auckland Auckland Auckland Auckland Auckland Auckland
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Preparations	Iron (Dissolved) Magnesium (Dissolved) Manganese (Dissolved) Potassium (Dissolved) Sodium (Dissolved) Total Metals by ICP-MS—Trace (Default Digest) Arsenic (Total) Calcium (Total) Calcium (Total) Iron (Total) Manganese (Total) Manganese (Total) Potassium (Total) Potassium (Total) Sodium (Total) Sodium (Total) Total Hardness (as CaCO3) Organics Total Organic Carbon by Non-dispersive infrared detecti Total Organic Carbon	In House based on EPA 200.8 by ICPMS In House based on EPA 200.8 by ICPMS	0.002 mg/L 0.001 mg/L 0.0005 mg/L 0.02 mg/L 0.1 mg/L 0.00010 mg/L 0.000 mg/L 0.002 mg/L 0.0005 mg/L 0.05 mg/L 0.1 mg/L 0.03 mg/L	1, 2, 3, 5 1, 2, 3, 5 All All All All All All All All All Al	Auckland Auckland Auckland Auckland Auckland Auckland Auckland Auckland Auckland Auckland Auckland Auckland
	Iron (Dissolved) Magnesium (Dissolved) Manganese (Dissolved) Potassium (Dissolved) Sodium (Dissolved) Total Metals by ICP-MS—Trace (Default Digest) Arsenic (Total) Calcium (Total) Iron (Total) Magnesium (Total) Manganese (Total) Manganese (Total) Potassium (Total) Sodium (Total) Sodium (Total) Total Hardness (as CaCO3) Organics Total Organic Carbon by Non-dispersive infrared detecti Total Organic Carbon	In House based on EPA 200.8 by ICPMS In House based on EPA 200.8 by ICPMS	0.002 mg/L 0.001 mg/L 0.0005 mg/L 0.02 mg/L 0.1 mg/L 0.010 mg/L 0.001 mg/L 0.002 mg/L 0.005 mg/L 0.05 mg/L 0.1 mg/L 0.03 mg/L	1, 2, 3, 5 1, 2, 3, 5 All All All All All All All Al	Auckland Auckland Auckland Auckland Auckland Auckland Auckland Auckland Auckland Auckland Auckland Auckland
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	Iron (Dissolved) Magnesium (Dissolved) Manganese (Dissolved) Potassium (Dissolved) Sodium (Dissolved) Total Metals by ICP-MS—Trace (Default Digest) Arsenic (Total) Calcium (Total) Calcium (Total) Iron (Total) Manganese (Total) Manganese (Total) Potassium (Total) Potassium (Total) Sodium (Total) Sodium (Total) Total Hardness (as CaCO3) Organics Total Organic Carbon by Non-dispersive infrared detecti Total Organic Carbon	In House based on EPA 200.8 by ICPMS In House based on EPA 200.8 by ICPMS	0.002 mg/L 0.001 mg/L 0.0005 mg/L 0.02 mg/L 0.1 mg/L 0.010 mg/L 0.001 mg/L 0.002 mg/L 0.005 mg/L 0.05 mg/L 0.1 mg/L 0.03 mg/L	1, 2, 3, 5 1, 2, 3, 5 All All All All All All All Al	Auckland Auckland Auckland Auckland Auckland Auckland Auckland Auckland Auckland Auckland Auckland Auckland

APHA (online edition) 3030 E (modified, 4:1	All	Auckland
Nitric:Hydrochloric Acid)		
APHA (online edition) 2540 C (Filtration)	All	Auckland
APHA (online edition) 4500-P B (preliminary	All	Auckland
filtration)		
	Nitric:Hydrochloric Acid) APHA (online edition) 2540 C (Filtration) APHA (online edition) 4500-P B (preliminary	Nitric:Hydrochloric Acid)AllAPHA (online edition) 2540 C (Filtration)AllAPHA (online edition) 4500-P B (preliminaryAll

higher.

For more information please contact the Operations Manager

Samples, with suitable preservation and stability of analytes, will be held by the laboratory for a period of two weeks after results have been reported, unless otherwise advised by the submitter.

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Report Signatory 31/05/2017

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	Lab	Certificate of oratory Reference		2		
Attention: Client: Address: Client Reference: Purchase Order:	Hilltop Sampler GISBORNE DISTRICT COUNCIL PO Box 747, Gisborne, 4040 MAR (Micro) 37/00/01/2104		Final Report: Report Issue Date: Received Date: Sampled By: Quote Reference :	232646-0 29-Jun-2017 27-Jun-2017 Alice Trevelya 5880	n	
Sample Details	;	WATERS				
Lab Sample ID: Client Sample ID: Sample Date/Time Description:	:	170627-092-1 20172897 26/06/2017 09:20 598 Bushmere Rd - MAR injection bore GPE066				
Vicrobiology						
	Membrane Filtration	1				
Escherichia coli	cfu/100 mL	0.5	// I.A. 1// // AI			
		I with * are not accredited to Inte oplied by the client they are teste			rmed	
Reference Meth		· · ·				
Analyte		Method Reference	Ι	MDL	Samples	Location
Microbiology						
	Membrane Filtration	USEPA Method 1603		2 cfu/100 mL	All	Auckland
Escherichia coli		USEFA Melliou 1003	4		A11	AUGRIAIIU

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		Certificate o				
	Labo	oratory Referen	nce:170624-05	2		
Attention: Client: Address: Client Reference: Purchase Order:	Hilltop Sampler GISBORNE DISTRICT COUNCIL PO Box 747, Gisborne, 4040 MAR (Micro) 37/00/01/2104		Final Report: Report Issue Date: Received Date: Sampled By: Quote Reference :	232100-0 26-Jun-2017 24-Jun-2017 Alice Trevelyan 5880		
Sample Details	5	WATERS	WATERS			
Lab Sample ID: Client Sample ID: Sample Date/Time Description:	e:	<b>170624-052-1</b> 20172875 23/06/2017 09:42 599 Bushmere Road GPE010	170624-052-2 20172878 23/06/2017 10:49 598 Bushmere Road MAR Pilot Bore GPE 065			
Microbiology						
Escherichia coli by Escherichia coli	y Membrane Filtration cfu/100 mL Results marked	<1.6	6.6	w Zeolond		
	Where samples have been supp				ned.	
<b>Reference Meti</b> The sample(s) refe	<b>hods</b> erred to in this report were analysed by	/ the following method(s)				
Analyte		Method Reference	e	MDL	Samples	Location
Microbiology	y Membrane Filtration					

higher.

For more information please contact the Operations Manager

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	Laboratory Reference:170607-106						
Client: C Address: F Client Reference: 5	Hilltop Sampler SISBORNE DISTRICT COUNCIL 20 Box 747, Gisborne, 4040 198 Bushmere Road MAR Injectio 17/00/01/2104	n Bo	re GPE066	Final Report: Report Issue Date: Received Date: Sampled By: Quote Reference :	231671-0 22-Jun-2017 07-Jun-2017 Mark Joblin 5880	Replaces Report	230948-0
Sample Details			WATERS				
Lab Sample ID: Client Sample ID: Sample Date/Time: Description:			170607-106-1 20172586 06/06/2017 11:30 598 Bushmere Road MAR Injection Bore GPE066				
Chemistry Detailed							
Anions by Ion Chrom	atography (0.45 µm Filtered)						
Chloride		mg/L	15				
Nitrate (as N)		mg/L	0.0055				
Nitrite (as N)		mg/L	<0.002				
Sulphate		mg/L	76				
Total Oxidised Nitroge Calculation	en (as N) by	mg/L	0.0055 *				
Ion Balance (Anions/	Cations) by Calculation		1				
Anion Total	n	neq/L	6.4 *				
Cation Total		neq/L	6.5 *				
meq/L Difference	n	neq/L	0.54e-1 *				
Percent Difference		%	0.42 *				
Sum of Anions + Cati	ons <sup>n</sup>	neq/L	13 *				
General Testing							
Ammoniacal Nitrogen	(	mg/L	0.55				
Ammoniacal Nitrogen	(	mg/L	0.71 *				
Bicarbonate Alkalinity		mg/L	270				
Carbonate Alkalinity (		mg/L nS/m	<2.0				
Conductivity (at 25 °C	•)	mg/L	60.6				
Hydroxide Alkalinity (a pH (at room temp c. 2		Hunit	<2.0				
Total Alkalinity (as Ca	,	mg/L	7.6 220				
Total Chlorine (as Cl2	•	mg/L	0.04				
Total Dissolved Solids		mg/L	460				
Total Nitrogen (as N)		mg/L	1.1				
Total Phosphorus (as		mg/L	0.018				
Total Suspended Soli	• )	mg/L	3.0				
Turbidity		NTU	0.65				
Metals							
	CP-MS—Trace (Received Filt	ered	)				
Arsenic (Dissolved)		mg/L	0.0027				
Calcium (Dissolved)		mg/L	78				
Iron (Dissolved)		mg/L	0.035				
Magnesium (Dissolve	d)	mg/L	8.5				
Manganese (Dissolve		mg/L	0.21				
		ma/	4.0				

Total Metals by ICP-MS—Trace (Default Digest)

Report Number: 231671-0

Potassium (Dissolved)

Sodium (Dissolved)

4.9

39

mg/L

mg/L

Sample Details (continued)	WATERS			
Lab Sample ID:	170607-106-1			
Client Sample ID:	20172586			
Sample Date/Time:	06/06/2017 11:30			
Description:	598 Bushmere Road			
	MAR Injection Bore			
	GPE066			
Metals				
Fotal Metals by ICP-MS—Trace (Default Digest)				
Arsenic (Total)	mg/L 0.0027			
Iron (Total)	<sup>mg/L</sup> 0.063			
Manganese (Total)	mg/L 0.20			
Potassium (Total)	mg/L 4.9			
Sodium (Total)	mg/L 35			
Organics				
otal Organic Carbon by Non-dispersive infrared				
Total Organic Carbon Microbiology	mg/L 3.7			
scherichia coli by Membrane Filtration				
	/100 mL 1.6			
	marked with * are not accredited to International Accred	litation New Zealand		
	een supplied by the client they are tested as received.		formed	
· · · · · · · · · · · · · · · · · · ·			onneu.	
Reference Methods The sample(s) referred to in this report were analy	ysed by the following method(s)			
Analyte	Method Reference	MDL	Samples	Locatio
Chemistry Detailed			· · · ·	
Anions by Ion Chromatography (0.45 µm Filtered	 d)			
Chloride	In House based on APHA (online edition)	0.02 mg/L	All	Auckland
	4110 B and EPA 300.0			
Nitrate (as N)	In House based on APHA (online edition)	0.002 mg/L	All	Auckland
Nitrite (as N)	4110 B and EPA 300.0	0.002 mg/L	All	Auckland
	In House based on APHA (online edition) 4110 B and EPA 300.0	0.002 mg/L	, 11	
Sulphate	In House based on APHA (online edition)	0.02 mg/L	All	Auckland
	4110 B and EPA 300.0	č		
Total Oxidised Nitrogen (as N) by Calculation	In House based on APHA (online edition)	0.002 mg/L	All	Auckland
	4110 B and EPA 300.0			
on Balance (Anions/Cations) by Calculation				A
	APHA (online edition) 1030 E	meq/L	All	Auckland
Cation Total	APHA (online edition) 1030 E	meq/L	All	Auckland
neq/L Difference	APHA (online edition) 1030 E	meq/L	All	Auckland
Percent Difference Sum of Anions + Cations	APHA (online edition) 1030 E		All All	Auckland Auckland
	APHA (online edition) 1030 E			
General Testing	ADHA (option adition) 4500 NU2 U	0.005 mall	A11	Auckland
Ammoniacal Nitrogen (as N) by Flow Analysis	APHA (online edition) 4500-NH3 H	0.005 mg/L	Ali	Auckland
Ammoniacal Nitrogen (as NH4) by Calculation	Calculation from Ammonia (as N)	0.006 mg/L	All	Auckland Auckland
Bicarbonate Alkalinity (as HCO3) by Titration	APHA (online edition) 2320 B	1 mg/L	All All	Auckland
	APHA (online edition) 2320 B	1 mg/L 0.5 mS/m	All	Auckland
	APHA (online edition) 2510 B		AII	/ wordand
Conductivity (at 25 °C) by Electrode	APHA (online edition) 2510 B			Auckland
Conductivity (at 25 °C) by Electrode Hydroxide Alkalinity (as CaCO3) by Titration	APHA (online edition) 2320 B	1 mg/L	All	Auckland Auckland
Conductivity (at 25 °C) by Electrode Hydroxide Alkalinity (as CaCO3) by Titration pH (at room temp c. 20 °C) by Electrode	APHA (online edition) 2320 B APHA (online edition) 4500-H B	1 mg/L 0.1 pH unit	All All	Auckland
Conductivity (at 25 °C) by Electrode Hydroxide Alkalinity (as CaCO3) by Titration pH (at room temp c. 20 °C) by Electrode Total Alkalinity (as CaCO3) by Titration	APHA (online edition) 2320 B APHA (online edition) 4500-H B APHA (online edition) 2320 B	1 mg/L 0.1 pH unit 1 mg/L	All All All	Auckland Auckland
Carbonate Alkalinity (as CO3) by Titration Conductivity (at 25 °C) by Electrode Hydroxide Alkalinity (as CaCO3) by Titration pH (at room temp c. 20 °C) by Electrode Total Alkalinity (as CaCO3) by Titration Total Chlorine (as Cl2) by Spectrophotometry according APHA (2005) 4500-Cl G	APHA (online edition) 2320 B APHA (online edition) 4500-H B APHA (online edition) 2320 B	1 mg/L 0.1 pH unit	All All	Auckland
Conductivity (at 25 °C) by Electrode Hydroxide Alkalinity (as CaCO3) by Titration pH (at room temp c. 20 °C) by Electrode Total Alkalinity (as CaCO3) by Titration Total Chlorine (as Cl2) by Spectrophotometry according APHA (2005) 4500-Cl G	APHA (online edition) 2320 B APHA (online edition) 4500-H B APHA (online edition) 2320 B	1 mg/L 0.1 pH unit 1 mg/L 0.02 mg/L	All All All	Auckland Auckland
Conductivity (at 25 °C) by Electrode Hydroxide Alkalinity (as CaCO3) by Titration pH (at room temp c. 20 °C) by Electrode Total Alkalinity (as CaCO3) by Titration Total Chlorine (as Cl2) by Spectrophotometry according APHA (2005) 4500-Cl G	APHA (online edition) 2320 B APHA (online edition) 4500-H B APHA (online edition) 2320 B to APHA (online edition) 4500-Cl G	1 mg/L 0.1 pH unit 1 mg/L 0.02 mg/L	All All All All	Auckland Auckland Auckland
Conductivity (at 25 °C) by Electrode Hydroxide Alkalinity (as CaCO3) by Titration pH (at room temp c. 20 °C) by Electrode Total Alkalinity (as CaCO3) by Titration Total Chlorine (as Cl2) by Spectrophotometry according APHA (2005) 4500-Cl G Total Dissolved Solids by Gravimetry	APHA (online edition) 2320 B APHA (online edition) 4500-H B APHA (online edition) 2320 B to APHA (online edition) 4500-Cl G APHA (online edition) 2540 C (Modified: D at 103 - 105 °C)	1 mg/L 0.1 pH unit 1 mg/L 0.02 mg/L Dried 15 mg/L	All All All All	Auckland Auckland Auckland
Conductivity (at 25 °C) by Electrode Hydroxide Alkalinity (as CaCO3) by Titration pH (at room temp c. 20 °C) by Electrode Total Alkalinity (as CaCO3) by Titration	APHA (online edition) 2320 B APHA (online edition) 4500-H B APHA (online edition) 2320 B to APHA (online edition) 4500-Cl G APHA (online edition) 2540 C (Modified: D at 103 - 105 °C)	1 mg/L 0.1 pH unit 1 mg/L 0.02 mg/L Dried 15 mg/L ), 0.010 mg/L	Ali Ali Ali Ali	Auckland Auckland Auckland Auckland

Analysis Total Phosphorus (as P) by Persulphate Digestion and

Colorimetry/Discrete Analyser Total Suspended Solids by Gravimetry

Turbidity by Nephelometry

Metals

Dissolved Metals by ICP-MS—Trace (Received Filtered)

APHA (online edition) 2540 D

APHA (online edition) 4500-P J (modified)

APHA (online edition) 2130 B (modified)

0.004 mg/L

0.2 mg/L

0.05 NTU

Auckland

Auckland

Auckland

All

All

All

d)			
In House based on EPA 200.8 by ICPMS	0.00010 mg/L	All	Auckland
In House based on EPA 200.8 by ICPMS	0.010 mg/L	All	Auckland
In House based on EPA 200.8 by ICPMS	0.002 mg/L	All	Auckland
In House based on EPA 200.8 by ICPMS	0.001 mg/L	All	Auckland
In House based on EPA 200.8 by ICPMS	0.0005 mg/L	All	Auckland
In House based on EPA 200.8 by ICPMS	0.02 mg/L	All	Auckland
In House based on EPA 200.8 by ICPMS	0.1 mg/L	All	Auckland
In House based on EPA 200.8 by ICPMS	0.00010 mg/L	All	Auckland
In House based on EPA 200.8 by ICPMS	0.002 mg/L	All	Auckland
In House based on EPA 200.8 by ICPMS	0.0005 mg/L	All	Auckland
In House based on EPA 200.8 by ICPMS	0.05 mg/L	All	Auckland
In House based on EPA 200.8 by ICPMS	0.1 mg/L	All	Auckland
APHA (online edition) 5310 B	0.1 mg/L	All	Auckland
USEPA Method 1603	2 cfu/100 mL	All	Auckland
APHA (online edition) 3030 E (modified, 4:1		All	Auckland
Nitric:Hydrochloric Acid)			
APHA (online edition) 2540 C (Filtration)			Auckland
APHA (online edition) 4500-P B (preliminary filtration)		All	Auckland
-	equired for analysis the de	etection limit m	nay be
higher.			
	In House based on EPA 200.8 by ICPMS In House ba	In House based on EPA 200.8 by ICPMS 0.00010 mg/L In House based on EPA 200.8 by ICPMS 0.010 mg/L In House based on EPA 200.8 by ICPMS 0.002 mg/L In House based on EPA 200.8 by ICPMS 0.001 mg/L In House based on EPA 200.8 by ICPMS 0.0005 mg/L In House based on EPA 200.8 by ICPMS 0.02 mg/L In House based on EPA 200.8 by ICPMS 0.1 mg/L In House based on EPA 200.8 by ICPMS 0.002 mg/L In House based on EPA 200.8 by ICPMS 0.002 mg/L In House based on EPA 200.8 by ICPMS 0.002 mg/L In House based on EPA 200.8 by ICPMS 0.0005 mg/L In House based on EPA 200.8 by ICPMS 0.0005 mg/L In House based on EPA 200.8 by ICPMS 0.005 mg/L In House based on EPA 200.8 by ICPMS 0.05 mg/L In House based on EPA 200.8 by ICPMS 0.1 mg/L <b>External</b> In House based on EPA 200.8 by ICPMS 0.1 mg/L USEPA Method 1603 2 cfu/100 mL APHA (online edition) 5310 B 0.1 mg/L APHA (online edition) 3030 E (modified, 4:1 Nitric:Hydrochloric Acid) APHA (online edition) 2540 C (Filtration) APHA (online edition) 4500-P B (preliminary filtration) it attainable in a relatively clean matrix. If dilutions are required for analysis the de	In House based on EPA 200.8 by ICPMS 0.00010 mg/L All In House based on EPA 200.8 by ICPMS 0.010 mg/L All In House based on EPA 200.8 by ICPMS 0.002 mg/L All In House based on EPA 200.8 by ICPMS 0.001 mg/L All In House based on EPA 200.8 by ICPMS 0.005 mg/L All In House based on EPA 200.8 by ICPMS 0.02 mg/L All In House based on EPA 200.8 by ICPMS 0.1 mg/L All In House based on EPA 200.8 by ICPMS 0.00010 mg/L All In House based on EPA 200.8 by ICPMS 0.0002 mg/L All In House based on EPA 200.8 by ICPMS 0.0005 mg/L All In House based on EPA 200.8 by ICPMS 0.0005 mg/L All In House based on EPA 200.8 by ICPMS 0.0005 mg/L All In House based on EPA 200.8 by ICPMS 0.05 mg/L All In House based on EPA 200.8 by ICPMS 0.1 mg/L All In House based on EPA 200.8 by ICPMS 0.1 mg/L All In House based on EPA 200.8 by ICPMS 0.1 mg/L All In House based on EPA 200.8 by ICPMS 0.1 mg/L All In House based on EPA 200.8 by ICPMS 0.1 mg/L All In House based on EPA 200.8 by ICPMS 0.1 mg/L All In House based on EPA 200.8 by ICPMS 0.1 mg/L All In House based on EPA 200.8 by ICPMS 0.1 mg/L All In House based on EPA 200.8 by ICPMS 0.1 mg/L All In House based on EPA 200.8 by ICPMS 0.1 mg/L All In House based on EPA 200.8 by ICPMS 0.1 mg/L All In House based on EPA 200.8 by ICPMS 0.1 mg/L All In House based on EPA 200.8 by ICPMS 0.1 mg/L All In House based on EPA 200.8 by ICPMS 0.1 mg/L All In House based on EPA 200.8 by ICPMS 0.1 mg/L All In House based on EPA 200.8 by ICPMS 0.1 mg/L All In House based on EPA 200.8 by ICPMS 0.1 mg/L All In House based on EPA 200.9 E (modified, 4:1 All In House based on EPA 200.9 E (modified, 4:1 All In House based on EPA 200.9 E (preliminary All In House based ba

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			Certificate of	Analysis	
		Laho		ice:170518-07	3
		Lau			5
Attention: Client: Address: Client Reference: Purchase Order:	Hilltop Sampler GISBORNE DISTRICT COUNC PO Box 747, Gisborne, 4040 MAR 37/00/01/2104	SIL		Final Report: Report Issue Date: Received Date: Sampled By: Quote Reference :	229077-0 04-Jun-2017 18-May-2017 Peter Hancock 5880
Sample Details			WATERS	WATERS	
Lab Sample ID:			170518-076-1	170518-076-2	
Client Sample ID:			20172234	20172235	
Sample Date/Time.			17/05/2017 12:14	17/05/2017 14:02	
Description:			598 Bushmere Rd MAR Pilot Bore GPE 065	599 Bushmere Rd GPE010	
Chemistry Detaile	ed				
	omatography (0.45 µm Filter	ed)			
Chloride		mg/L	120	140	
Nitrate (as N)		mg/L	0.0071	0.0072	
Nitrite (as N)		mg/L	0.013	0.011	
Sulphate		mg/L	0.11	<0.02	
Total Oxidised Nitro	ogen (as N) by	mg/L	0.020 *	0.018 *	
Calculation					
	s/Cations) by Calculation				
Anion Total		meq/L	15 *	16 *	
Cation Total		meq/L	15 *	16 *	
meq/L Difference		meq/L %	0.063 *	0.38 *	
Percent Difference Sum of Anions + C	ationa	meq/L	0.21 * 30 *	1.2 * 32 *	
General Testing	allons	meqre	30	52	
Ammoniacal Nitrog	en (as N)	mg/L	2.0	2.5	
Ammoniacal Nitrog		mg/L	2.5 *	3.2 *	
Bicarbonate Alkalin		mg/L	700	710	
Carbonate Alkalinit		mg/L	<4.0	<4.0	
Hydroxide Alkalinity		mg/L	<4.0	<4.0	
Nitrate (as NO3)		mg/L	0.031 *	0.032 *	
Nitrite (as NO2)		mg/L	0.043 *	0.036 *	
pH (at room temp o		pH unit	7.1	7.2	
Total Alkalinity (as		mg/L	580	580	
Total Chlorine (as 0		mg/L	0.07	0.04	
Total Dissolved Sol		mg/L	850	860	
Total Nitrogen (as N		mg/L	1.9	2.3	
Total Phosphorus (		mg/L mg/L	0.39	0.33	
Total Suspended S Turbidity	UlluS	NTU	69 65	42 160	
Metals			00	100	
	VICE MS_ Troop (Dessing	Filtored			
Arsenic (Dissolved	y ICP-MS—Trace (Received	mg/L	0.0080	0.0068	
Calcium (Dissolved		mg/L	180	200	
Iron (Dissolved)	'/	mg/L	5.5	15	
Magnesium (Dissol	ved)	mg/L	20	22	
Manganese (Disso		mg/L	0.92	1.0	
Potassium (Dissolv		mg/L	10	9.6	
Sodium (Dissolved		mg/L	87	79	

Sample Details (continued)		WATERS	WATERS
Lab Sample ID:		170518-076-1	170518-076-2
Client Sample ID:		20172234	20172235
Sample Date/Time:		17/05/2017 12:14	17/05/2017 14:02
Description:		598 Bushmere Rd	599 Bushmere Rd
		MAR Pilot Bore GPE	GPE010
		065	
Metals			
Total Metals by ICP-MS—Trace (Default Dig	est)		
Arsenic (Total)	mg/L	0.0095	0.0072
Calcium (Total)	mg/L	180	180
Iron (Total)	mg/L	8.3	16
Magnesium (Total)	mg/L	22	24
Manganese (Total)	mg/L	0.95	1.0
Potassium (Total)	mg/L	9.0	8.9
Sodium (Total)	mg/L	90	82
Total Hardness (as CaCO3)	mg/L	550	560
Organics			
Total Organic Carbon by Non-dispersive inf	rared detect	tion	
Total Organic Carbon	mg/L	5.4	3.7
Microbiology			
Escherichia coli by Membrane Filtration			
Escherichia coli	cfu/100 mL	<1.6	<1.6
Res	sults marked v	with * are not accredited to Int	ternational Accreditation N

ts marked with \* are not accredited to International Accreditation New Zealand Resul

Where samples have been supplied by the client they are tested as received. A dash indicates no test performed.

**Reference Methods** The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
Chemistry Detailed				
Anions by Ion Chromatography (0.45 µm Filtered)				
Chloride	In House based on APHA (online edition)	0.02 mg/L	All	Auckland
	4110 B and EPA 300.0			
Nitrate (as N)	In House based on APHA (online edition) 4110 B and EPA 300.0	0.002 mg/L	All	Auckland
Nitrite (as N)	In House based on APHA (online edition) 4110 B and EPA 300.0	0.002 mg/L	All	Auckland
Sulphate	In House based on APHA (online edition) 4110 B and EPA 300.0	0.02 mg/L	All	Auckland
Total Oxidised Nitrogen (as N) by Calculation	In House based on APHA (online edition) 4110 B and EPA 300.0	0.002 mg/L	All	Auckland
Ion Balance (Anions/Cations) by Calculation				
Anion Total	APHA (online edition) 1030 E	meq/L	All	Auckland
Cation Total	APHA (online edition) 1030 E	meq/L	All	Auckland
meq/L Difference	APHA (online edition) 1030 E	meq/L	All	Auckland
Percent Difference	APHA (online edition) 1030 E		All	Auckland
Sum of Anions + Cations	APHA (online edition) 1030 E		All	Auckland
General Testing				
Ammoniacal Nitrogen (as N) by Colorimetry/Discrete	HMSO (1981) ISBN 0117516139	0.005 mg/L	All	Auckland
Analyser				
Ammoniacal Nitrogen (as NH4) by Calculation	Calculation from Ammonia (as N)	0.006 mg/L	All	Auckland
Bicarbonate Alkalinity (as HCO3) by Titration	APHA (online edition) 2320 B	1 mg/L	All	Auckland
Carbonate Alkalinity (as CO3) by Titration	APHA (online edition) 2320 B	1 mg/L	All	Auckland
Hydroxide Alkalinity (as CaCO3) by Titration	APHA (online edition) 2320 B	1 mg/L	All	Auckland
Nitrate (as NO3) by Calculation	Calculation	0.009 mg/L	All	Auckland
Nitrite (as NO2) by Calculation	Calculation	0.007 mg/L	All	Auckland
pH (at room temp c. 20 °C) by Electrode	APHA (online edition) 4500-H B	0.1 pH unit	All	Auckland
Total Alkalinity (as CaCO3) by Titration	APHA (online edition) 2320 B	1 mg/L	All	Auckland
Total Chlorine (as Cl2) by Spectrophotometry according to APHA (2005) 4500-Cl G	APHA (online edition) 4500-Cl G	0.02 mg/L	All	Auckland
Total Dissolved Solids by Gravimetry	APHA (online edition) 2540 C (Modified: Dried at 103 - 105 °C)	15 mg/L	All	Auckland
Total Nitrogen (as N) by Persulphate Digestion and Flow Analysis	APHA (online edition) 4500-P J (modified), 4500-NO3 I	0.010 mg/L	All	Auckland

General Testing				
Total Phosphorus (as P) by Persulphate Digestion and	APHA (online edition) 4500-P J (modified)	0.004 mg/L	All	Auckland
Colorimetry/Discrete Analyser				
Total Suspended Solids by Gravimetry	APHA (online edition) 2540 D	0.2 mg/L	All	Auckland
Turbidity by Nephelometry	APHA (online edition) 2130 B (modified)	0.05 NTU	All	Auckland
Metals				
Dissolved Metals by ICP-MS—Trace (Received Filtere	·			
Arsenic (Dissolved)	In House based on EPA 200.8 by ICPMS	0.00010 mg/L	All	Auckland
Calcium (Dissolved)	In House based on EPA 200.8 by ICPMS	0.010 mg/L	All	Auckland
Iron (Dissolved)	In House based on EPA 200.8 by ICPMS	0.002 mg/L	All	Auckland
Magnesium (Dissolved)	In House based on EPA 200.8 by ICPMS	0.001 mg/L	All	Auckland
Manganese (Dissolved)	In House based on EPA 200.8 by ICPMS	0.0005 mg/L	All	Auckland
Potassium (Dissolved)	In House based on EPA 200.8 by ICPMS	0.02 mg/L	All	Auckland
Sodium (Dissolved)	In House based on EPA 200.8 by ICPMS	0.1 mg/L	All	Auckland
Total Metals by ICP-MS—Trace (Default Digest)				
Arsenic (Total)	In House based on EPA 200.8 by ICPMS	0.00010 mg/L	All	Auckland
Calcium (Total)	In House based on EPA 200.8 by ICPMS	0.010 mg/L	All	Auckland
Iron (Total)	In House based on EPA 200.8 by ICPMS	0.002 mg/L	All	Auckland
Magnesium (Total)	In House based on EPA 200.8 by ICPMS	0.001 mg/L	All	Auckland
Manganese (Total)	In House based on EPA 200.8 by ICPMS	0.0005 mg/L	All	Auckland
Potassium (Total)	In House based on EPA 200.8 by ICPMS	0.05 mg/L	All	Auckland
Sodium (Total)	In House based on EPA 200.8 by ICPMS	0.1 mg/L	All	Auckland
Total Hardness (as CaCO3)	In House based on EPA 200.8 by ICPMS	0.03 mg/L	All	Auckland
Organics				
Total Organic Carbon by Non-dispersive infrared dete	ection			
Total Organic Carbon	APHA (online edition) 5310 B	0.1 mg/L	All	Auckland
Microbiology				
Escherichia coli by Membrane Filtration				
Escherichia coli	USEPA Method 1603	2 cfu/100 mL	All	Auckland
Preparations				
Digest for Total Metals in Liquids	APHA (online edition) 3030 E (modified, 4:1		All	Auckland
	Nitric:Hydrochloric Acid)			المعتر المعالم
Glass Fibre Filtration (1.2 µm)	APHA (online edition) 2540 C (Filtration)		All	Auckland
Membrane Filtration (0.45 μm)	APHA (online edition) 4500-P B (preliminary filtration)		All	Auckland
The method detection limit (MDL) listed is the lim	it attainable in a relatively clean matrix. If dilutions are	required for analysis the d	etection limit m	ay be
	higher.			
For	nore information please contact the Operations Manac	ner		

For more information please contact the Operations Manager

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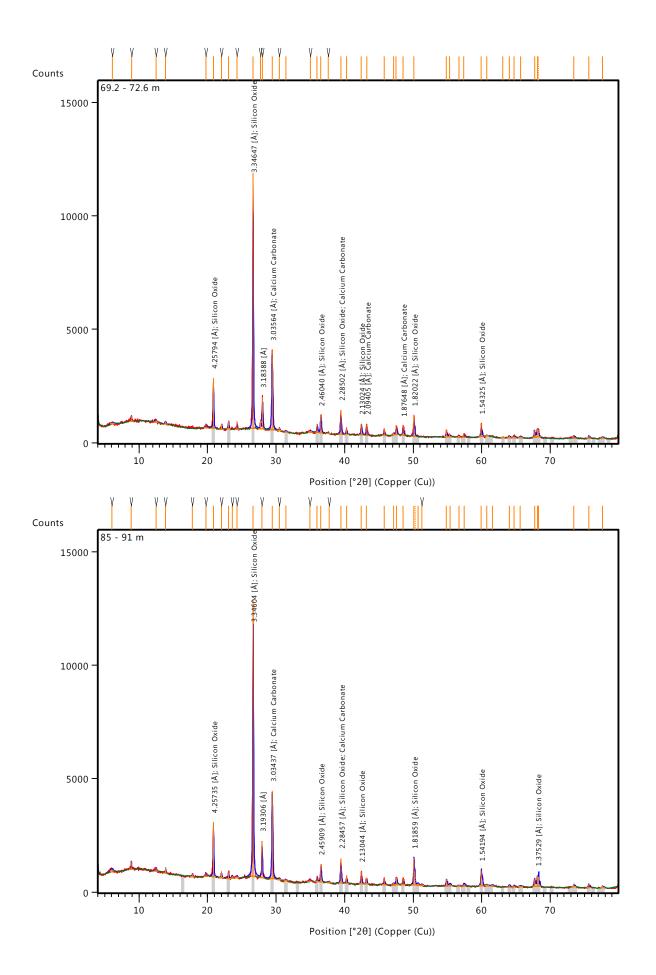
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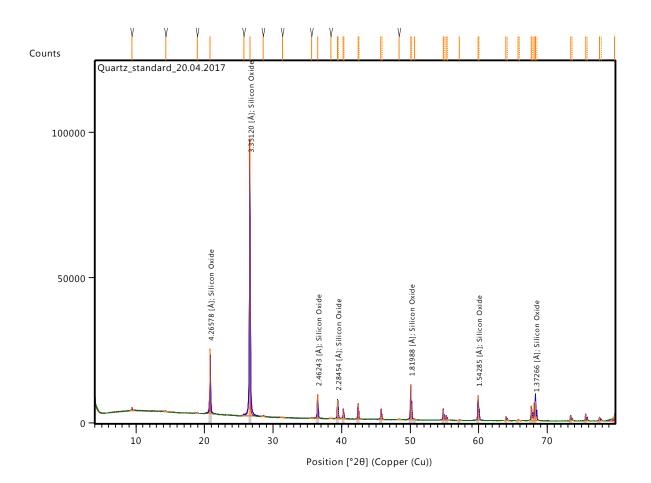


Report Signatory 04/06/2017

Tayle

Carol Taylor KTP Signatory







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