

Greymouth Petroleum Ltd Seismic Surveys

Monitoring Programme Report
2020-2023

Technical Report 2024-83



Greymouth Petroleum Ltd

Seismic Surveys

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Taranaki Regional Council
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Executive summary

Greymouth Petroleum Limited held consents 10870-1, 10871-1, 10874-1, and 10875-1.

This report for the period December 2020 to October 2023 describes the monitoring programme implemented by Taranaki Regional Council (the Council) in relation to the discharges to land associated with two seismic surveys. The activity spans three monitoring periods, 2020/21, 2021/22 and 2022/23. The report details the results of the monitoring undertaken, assesses the Company's environmental performance during the period under review and the environmental effects of each seismic survey.

During the period, the Company demonstrated a high level of environmental performance and a high level of administrative performance with the resource consents.

The Company held four resource consents in relation to the discharges and potential effects associated with a seismic survey. Consents included a total of 28 conditions setting out the requirements that the Company must satisfy.

The consents authorised discharges from two separate survey areas. The first undertaken, Turangi 3D seismic survey, was authorized two consents, 10870-1 and 10871-1 was across an area approximately 72.5km² across Tikorangi extending east toward Urenui township. Consent 10870-1 permitted the discharge of explosives related to a seismic survey to land. Consent 10871-1 permitted the discharge of contaminants to land from the use of drilling muds associated with undertaking a seismic survey.

The second, Tariki 3D Survey, covered an area approximately 71km² across Ratapiko and extending outward toward Tarata. The remaining two consents 10874-1 and 10875-1 were issued in relation to drilling a well within 100m of a water supply well and for the discharge of contaminants into land from the use of drilling muds respectively.

This report covers the results and findings of the monitoring programme implemented by the Council in respect of the consents held by the Company. This is the sole report to be prepared by the Council to cover the Company's discharges and potential effects in relation to the Turangi and Tariki 3D seismic surveys.

The Council's monitoring programme for the period under review included 50 groundwater samples collected for physicochemical analysis. The monitoring programme also included a significant data review component, with all data submitted by the Company assessed for compliance on receipt.

The monitoring showed that the Company's activities were carried out in compliance with the conditions of the applicable resource consents. There were no unauthorised incidents recording non-compliance in respect of the resource consents held by the Company in relation to these activities or provisions in regional plans, during the period under review. The results of groundwater quality monitoring undertaken show no adverse effects of the activity on local groundwater resources.

During the period, the Company demonstrated a high level of environmental performance and a high level of administrative performance with the resource consents.

For reference, in the 2020/21 year, consent holders were found to achieve a high level of environmental performance and compliance for 86% of the consents monitored through the Taranaki tailored monitoring programmes, while for another 11% of the consents, a good level of environmental performance and compliance was achieved.

For reference, in the 2021/22 year, consent holders were found to achieve a high level of environmental performance and compliance for 88% of the consents monitored through the Taranaki tailored monitoring programmes, while for another 10% of the consents, a good level of environmental performance and compliance was achieved.

For reference, in the 2022/23 year, consent holders were found to achieve a high level of environmental performance and compliance for 878 (87%) of a total of 1007 consents monitored through the Taranaki tailored monitoring programmes, while for another 96 (10%) of the consents a good level of environmental performance and compliance was achieved. A further 27 (3%) of consents monitored required improvement in their performance, while the remaining one (<1%) achieved a rating of poor.

In terms of overall environmental and compliance performance by the Company over the last several years, this report shows that the Company's performance generally remains at a high level.

This report includes recommendations to be implemented during any subsequent seismic surveys.

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1. Introduction

1.1 Compliance monitoring programme reports and the Resource Management Act 1991

1.1.1 Introduction

This report is for the period December 2020 to October 2023 by Taranaki Regional Council (the Council) on the monitoring programme associated with resource consents held by Greymouth Petroleum in relation to seismic survey activities. During the period under review, the Company held four resource consents. Two for the discharge of contaminants to land related to the detonation of explosives. Two in relation to the discharge to land of drilling muds associated with undertaking a seismic survey. The consents authorised discharges from two separate survey areas. The first survey (Turangi 3D) was approximately 72.5km² across Tikorangi extending east toward Urenui township. Consent 10870-1 permitted the discharge of explosives related to a seismic survey to land. Consent 10871-1 permitted the discharge of contaminants to land from the use of drilling muds associated with undertaking a seismic survey.

The second survey (Tariki 3D) was undertaken under consents 10874-1 and 10875-1 across an area approximately 71km² covering Ratapiko and extending outwards toward Tarata. Consent 10874-1 permitted the discharge of explosives related to a seismic survey to land. Consent 10875-1 was issued for the discharge to land of drilling muds associated with the Tariki 3D seismic drilling programme.

This report covers the results and findings of the monitoring programme implemented by the Council in respect of the consents held by the Company. This is the sole report to be prepared by the Council to cover the Company's seismic surveys and their effects.

1.1.2 Structure of this report

Section 1 of this report is a background section. It sets out general information about:

- consent compliance monitoring under the *Resource Management Act 1991* (RMA) and the Council's obligations;
- the Council's approach to monitoring sites through annual programmes;
- the resource consents held by the Company for activities related to a seismic survey;
- the nature of the monitoring programme in place for the period under review; and
- a description of the activities and operations conducted by the Company.

Section 2 presents the results of monitoring during the period under review, including scientific and technical data.

Section 3 discusses the results, their interpretations, and their significance for the environment.

Section 4 presents recommendations to be implemented in future programmes.

A glossary of common abbreviations and scientific terms, and a bibliography, are presented at the end of the report.

1.1.3 The Resource Management Act 1991 and monitoring

The RMA primarily addresses environmental 'effects' which are defined as positive or adverse, temporary or permanent, past, present or future, or cumulative. Effects may arise in relation to:

- a. the neighbourhood or the wider community around an activity, and may include cultural and social-economic effects;
- b. physical effects on the locality, including landscape, amenity and visual effects;
- c. ecosystems, including effects on plants, animals, or habitats, whether aquatic or terrestrial;
- d. natural and physical resources having special significance (for example recreational, cultural, or aesthetic); and
- e. risks to the neighbourhood or environment.

In drafting and reviewing conditions on discharge permits, and in implementing monitoring programmes, the Council is recognising the comprehensive meaning of 'effects' in as much as is appropriate for each activity. Monitoring programmes are not only based on existing permit conditions, but also on the obligations of the RMA to assess the effects of the exercise of consents. In accordance with Section 35 of the RMA, the Council undertakes compliance monitoring for consents and rules in regional plans, and maintains an overview of the performance of resource users and consent holders. Compliance monitoring, including both activity and impact monitoring, enables the Council to continually re-evaluate its approach and that of consent holders to resource management and, ultimately, through the refinement of methods and considered responsible resource utilisation, to move closer to achieving sustainable development of the region's resources.

1.1.4 Evaluation of environmental performance

Besides discussing the various details of the performance and extent of compliance by the consent holders, this report also assigns a rating as to each Company's environmental and administrative performance during the period under review. The rating categories are high, good, improvement required and poor for both environmental and administrative performance. The interpretations for these ratings are found in Appendix II.

For reference, in the 2020/21 year, consent holders were found to achieve a high level of environmental performance and compliance for 86% of the consents monitored through the Taranaki tailored monitoring programmes, while for another 11% of the consents, a good level of environmental performance and compliance was achieved.

For reference, in the 2021/22 year, consent holders were found to achieve a high level of environmental performance and compliance for 88% of the consents monitored through the Taranaki tailored monitoring programmes, while for another 10% of the consents, a good level of environmental performance and compliance was achieved.

For reference, in the 2022/23 year, consent holders were found to achieve a high level of environmental performance and compliance for 878 (87%) of a total of 1007 consents monitored through the Taranaki tailored monitoring programmes, while for another 96 (10%) of the consents a good level of environmental performance and compliance was achieved. A further 27 (3%) of consents monitored required improvement in their performance, while the remaining one (<1%) achieved a rating of poor.¹

¹ The Council has used these compliance grading criteria for more than 20 years. They align closely with the 4 compliance grades in the MfE Best Practice Guidelines for Compliance, Monitoring and Enforcement, 2018

1.2 Process description

Hydrocarbon exploration activities, with the authorisation of New Zealand Petroleum and Minerals, can include a seismic survey designed to gather information about the geological structure at depth. Surveys are conducted by deploying an array of energy sources and an array of sensors or receivers in the area of interest. The source of the seismic waves is either an explosive, which directly generates the seismic wavelet, or a mechanical source which is commonly a vibrator, that uses a steel base plate in contact with the ground to transmit seismic waves beneath the ground. The seismic waves that travel through the ground are received on geophone sensors planted on the surface at different offsets or incremental distances away from the source point. The seismic traces are recorded as a function of time delay from the initiation of the source.

In a two-dimensional (2D) seismic survey both the energy source and the sensors are set along a straight line with the same line containing recording cables and sensors as well as the source points.

In a three-dimensional (3D) seismic survey, the energy source and sensors are planted in a grid or "array" formation with sensors set in way that enables them to pick up waves from multiple sources.

The primary risks related to a Seismic Survey are those related to point source contamination from the explosives themselves (detonated and undetonated) and diffuse or point source contamination created by the open drill holes which may provide a pathway to the aquifer from surface runoff.

The key products² that may arise from the detonation of explosives during a seismic survey are:

- Aluminium oxide; (as a solid)
- Carbon; (soot as a solid)
- Carbon dioxide; (gas)
- Carbon monoxide; (gas)
- Nitrogen (gas) which has the potential to convert to nitrate and ammonia; and
- Water.

The main contaminants related to any undetonated charges² are:

- Trinitrotoluene (TNT);
- Pentaerythritol tetranitrate (PETN); and
- Aluminium powder.

² Pattle Delamore Partners Limited (PDP) April 2016. Kapuni 2016 Seismic Survey – Discharge of Explosive Residues to Land and Water

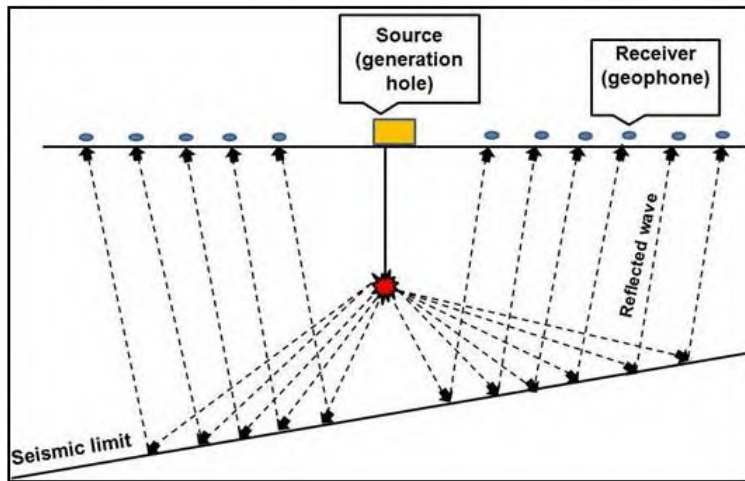


Figure 1 Seismic survey schematic example

1.3 Resource consents

The Company held four consents during the monitoring period being reported. A summary of each consent is included in Table 1 below. Summaries of the conditions attached to each permit are set out in Section 3 of this report. All four consents are due to expire in June 2025.

A summary of the various consent types issued by the Council is included in Appendix I, as are copies of all permits held by the Company during the period under review.

Consents 10870-1 and 10874-1 were issued for the discharge of contaminants related to the detonation and degradation of explosive charges in relation to the Turangi 3D and Tariki 3D seismic surveys respectively. Consents 10871-1 and 10875-1 were issued for the discharge of drilling muds in relation to the Turangi and Tariki 3D surveys.

Table 1 summarises the details of all four consents which are due to expire in June 2025.

Figure 2 shows the location of the Turangi 3D survey and Figure 3 the location of the Tariki 3D survey.

Table 1 Resource consents held by the Company during the monitoring period

Consent number	Purpose	Granted	Review	Expires
<i>Discharges to land related to a Seismic Survey</i>				
10870-1	To discharge contaminants to land where they may enter groundwater, including residues from detonation of explosive charges and degradation of unexploded charges, associated with undertaking a seismic survey.	03 December 2020	N/A	01 June 2025
10874-1	To discharge contaminants to land where they may enter groundwater, including residues from detonation of explosive charges and degradation of unexploded charges, associated with undertaking a seismic survey.	11 February 2021	N/A	01 June 2025
10871-1	To discharge contaminants into land where they may enter groundwater from use of drilling muds associated with undertaking a seismic survey	03 December 2020	N/A	01 June 2025
10875-1	To discharge contaminants into land where they may enter groundwater from use of drilling muds associated with undertaking a seismic survey	11 February 2021	N/A	01 June 2025

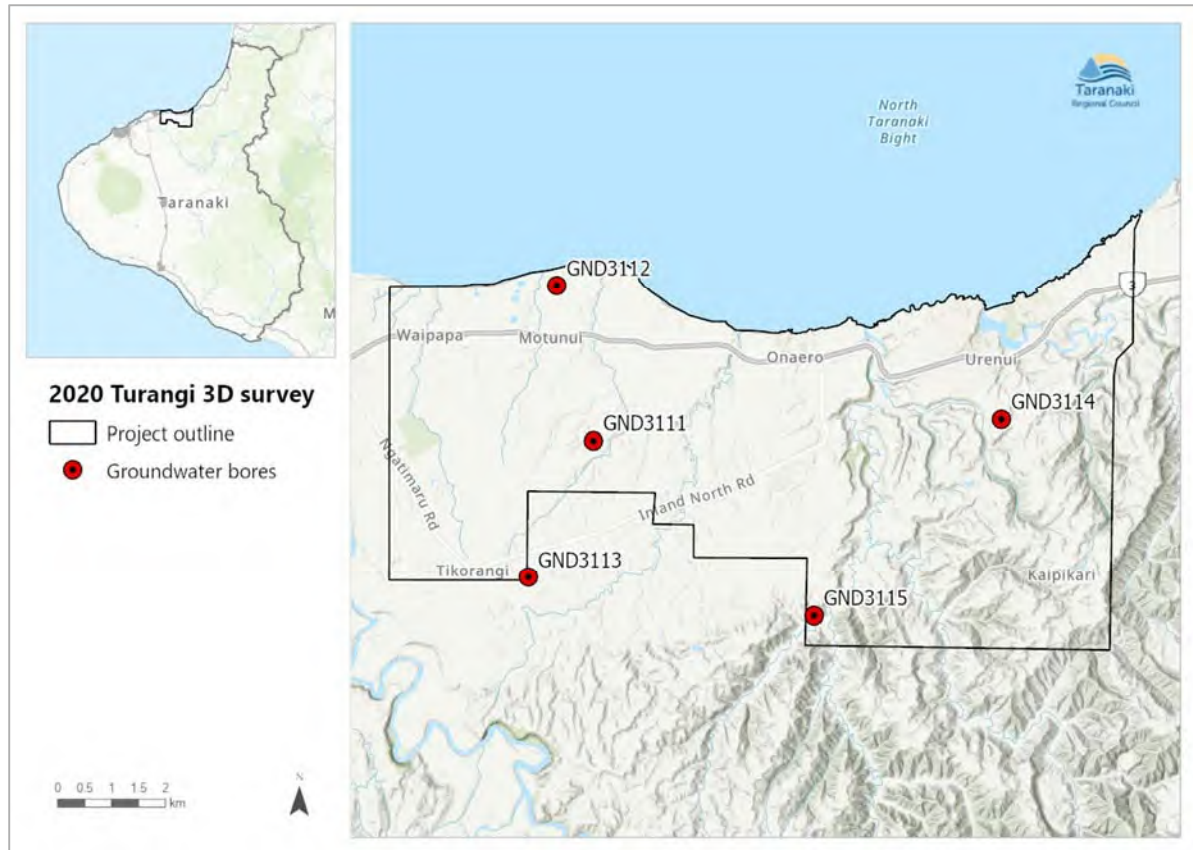


Figure 2 Turangi 3D seismic survey area and monitoring site locations

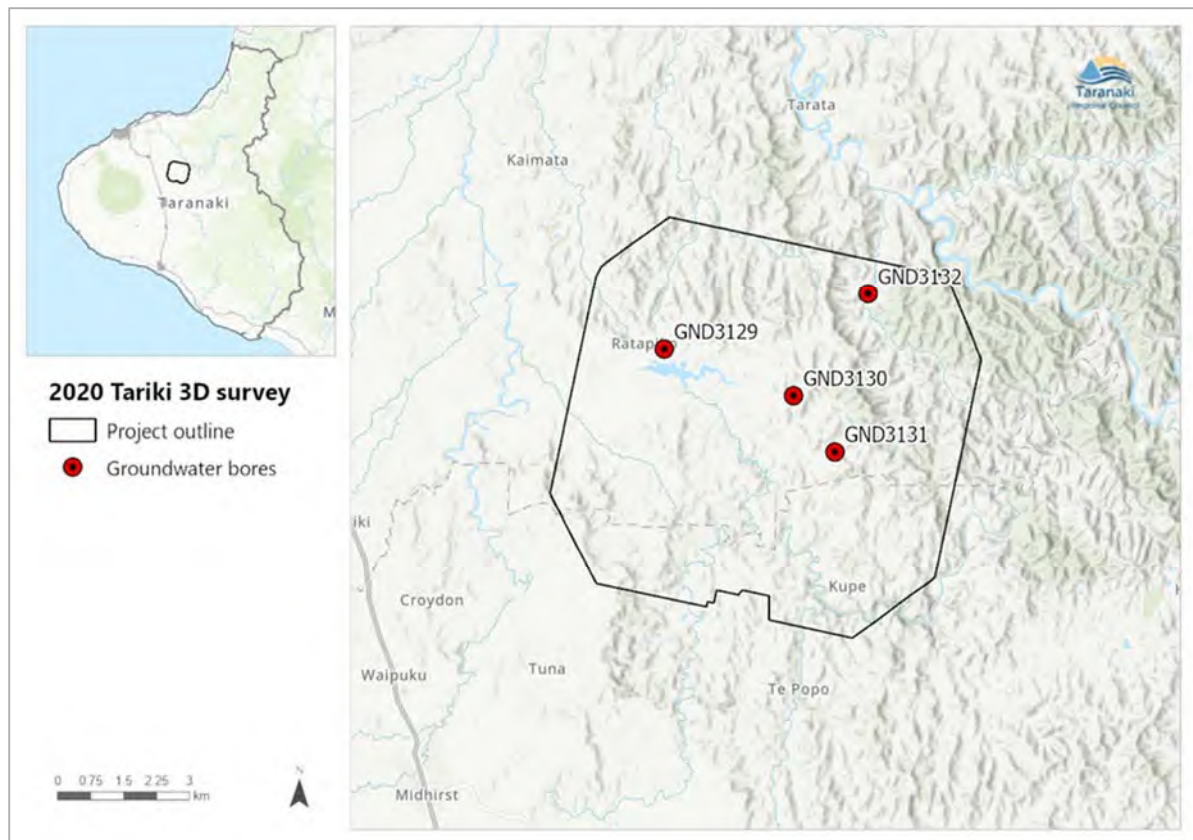


Figure 3 Tariki 3D seismic survey area and monitoring site locations

1.4 Monitoring programme

1.4.1 Introduction

Section 35 of the RMA sets obligations upon the Council to gather information, monitor and conduct research on the exercise of resource consents within the Taranaki region. The Council is also required to assess the effects arising from the exercising of these consents and report upon them.

The Council may therefore make and record measurements of physical and chemical parameters, take samples for analysis, carry out surveys and inspections, conduct investigations and seek information from consent holders.

The monitoring programme for the Company's seismic surveys consisted of five primary components.

1.4.2 Programme liaison and management

There is generally a significant investment of time and resources by the Council in:

- ongoing liaison with resource consent holders over consent conditions and their interpretation and application;
- discussion over monitoring requirements;
- preparation for any consent reviews, renewals or new consent applications;
- advice on the Council's environmental management strategies and content of regional plans; and
- consultation on associated matters.

1.4.3 Site selection

The criteria for site selection was the same between both surveys. There was a significant commitment to selecting and constructing monitoring bores prior to drilling of source points. This allowed the associated source point to be accurately drilled immediately up gradient of the monitoring bore, a feature that has not been previously undertaken in any onshore seismic surveys in Taranaki. This method was first used in the Turangi 3D seismic survey and applied to the Tariki 3D seismic survey. Site selection criteria is summarised below.

1.4.3.1 Turangi 3D seismic survey

The site selection guidance used ensured the monitoring sites were appropriate for the objectives of the monitoring programme. Sites selected included the following criteria:

- Located up-gradient of source points
- Estimation of groundwater travel times, hydraulic gradient and connectivity between the monitoring site and source point and its metabolites once activated
- Cover a range of geological units and land use types

Following completion of the survey a control bore outside the permit area, GND2770 adjacent to Kowhai A, was selected to be included in the monitoring programme.

1.4.3.2 Tariki 3D seismic survey

The site selection guidance uses ensured the monitoring sites were appropriate for the objectives of the monitoring programme. Sites selected included the following criteria:

- Located up-gradient of source points
- Estimation of groundwater travel times, hydraulic gradient and connectivity between the monitoring site and source point and its metabolites once activated
- Cover a range of geological units and land use types

1.4.4 Groundwater sampling

Five monitoring sites were included in the monitoring programme undertaken in relation to the Turangi 3D seismic survey. All sites were between 44 to 127m away from a source point.

Groundwater samples were obtained following drilling of the seismic holes and prior to detonation of the explosives. The main purpose of the monitoring programme was to monitor shallow groundwater resources across the seismic survey footprint to ensure that they remained suitable for current use.

Four monitoring sites were included in the monitoring programme undertaken in relation to the Tariki 3D seismic survey. All monitoring sites were located between 27 to 74m from a source point.

In addition to the primary purpose of the monitoring programme, which was to ensure groundwater resources remained suitable for their current use, the Turangi and Tariki 3D surveys also enabled the collection of water quality data in closer proximity to the discharges. To ascertain if any detectable contamination remained in the groundwater system following detonation of the explosives.

To enable the secondary purpose of the programme monitoring sites need to intercept groundwater flow, which moves both laterally and vertically under gravitational and locally induced hydraulic gradients, directly from the location of the detonated explosive charges. (Figure 4).

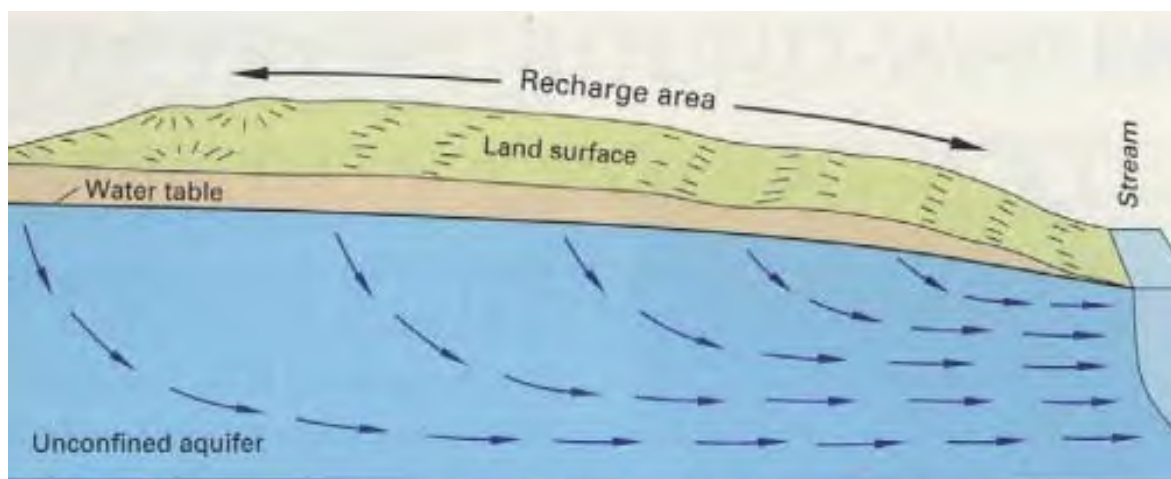


Figure 4 Image of the movement of a water through the groundwater system (USGS Graphic)

Details of the groundwater monitoring sites are listed below in Table 2. The location of each monitoring site in relation to the seismic survey footprint being monitored are illustrated in Figure 2 and Figure 3.

Table 2 Groundwater monitoring sites Turangi (blue) and Tariki 3D (purple)

Site code	NZTM (easting)	NZTM (northing)	Distance to closest source point	Interval (m)	Source point activation depth (m)
GND3111	17130009	5681060	127	28-40	29
GND3112	1712329	5683912	61	14.5-29.5	28
GND3113	1711800	5678557	44	19.3-28.8	28
GND3114	1720584	5681450	69	15-29	28
GND3115	1717106	5677847	105	2.7-11	10
GND3129	1714593	5660098	73	15-30	27.5
GND3130	1717538	5659039	27	12-21	20
GND3131	1718481	5657774	56	12-20	10
GND3132	1719263	5661366	37	6-13	16

Groundwater samples taken by BTW on behalf of the Company and by the Council were sent to Hill laboratories (Hills) and analysed for a range of parameters including the following:

- pH;
- alkalinity;
- ammonia;
- nitrate and nitrite;
- total hardness;
- free carbon dioxide;
- conductivity;
- total dissolved solids;
- magnesium, potassium, sodium, calcium, chloride and sulphate;
- dissolved boron, copper, iron, manganese, and zinc; and
- Escherichia coli (*E. coli*)

The parameters above are deemed sufficient to enable identification of any significant changes in groundwater quality related to a seismic survey.

1.4.5 Assessment of data submitted by the Company

A significant component of the monitoring programme was the assessment of consent holder submitted data. The Company is required to submit a wide range of data under the conditions of their discharge consents as follows:

- The locations and depths of each shot hole and explosive;
- The date that each charge was detonated;
- Details of any misfires; and
- The date and method of each hole abandonment.

As required by the conditions of each consent, the Company is also required to submit a groundwater monitoring programme for review that included:

- Water quality criteria for applicable existing uses;
- The location of each sampling point and the frequency of sampling;
- A list of the analysis to be undertaken for contaminants that could result from the discharges authorised; and

- How and when the results of monitoring will be reported to the Council.

Additional reports were also required at 6 monthly intervals for the first two years following completion of each groundwater sampling round. The groundwater monitoring programme was altered after two years, with groundwater sampling now occurring annually.

2. Results

2.1 Groundwater sampling

Groundwater sampling in relation to the activity was undertaken by BTW, on behalf of the Company.

Results were reported and discussed in the scheduled reports submitted by BTW on behalf of the Company. The baseline water quality sampling at each site and each post activity sampling round were compared to ascertain any trends. There was insufficient data available to undertake an additional robust statistical analysis.

Water quality results show there were no significant changes in groundwater composition attributable to the detonation of explosives, at any site monitored across the reporting period. This is demonstrated by the relatively narrow ranges between the pre-detonation and post-detonation results.

Turangi 3D monitoring sites

There were some anomalous results, considered to be unrelated to the seismic survey reported across the period. These results are summarised below:

- GND3114 measured an increase in *E. coli* in October 2022 due to excessive pugging and faecal matter around the bore stand at time of sampling.
- GND3112 reported the presence of *E. coli* in November 2021. This bore sustained serious damage from farm equipment. The bore had been reinstated by the Company the following day and when resampled within the week, recorded *E. coli* within normal limits.
- Nitrate could be seen increasing and decreasing at various times throughout the sampling regime in GND 3112, likely an indicator of impacts from local agricultural use.
- GND3112 reported an increase in carbon dioxide following detonation. Although GND3114 also showed an increase in November 2021 so these concentrations are also likely a result of local activities, rather than a result of a more widespread decrease in water quality.
- Most monitoring sites exhibited fluctuations in some parameters but none of the sites exhibited any significant decrease in water quality that would result in it becoming unsuitable for its current use.

Table 3 Turangi 3D monitoring site type, primary purpose and number of samples used in assessment

Site code	Type	Primary purpose	Samples (n)
GND3111/ GND2567	Purpose built bore	Residue from exploded charges and water quality changes over time	6
GND3112	Purpose built bore	Residue from exploded charges and water quality changes over time	6
GND3113	Purpose built bore	Residue from exploded charges and water quality changes over time	6
GND3114	Purpose built bore	Residue from exploded charges and water quality changes over time	6
GND3115	Purpose built bore	Residue from exploded charges and water quality changes over time	6

Tariki 3D monitoring sites

There were some anomalous results, considered to be unrelated to the seismic survey reported across the period. These results are summarised below:

- There was a significant amount of *E. coli* found in GND3129 in December 2023, despite previous samples indicating no presence of *E. coli*. The bore is located beside a paddock that contained pigs at the time of sampling. The area around the bore was pugged with faecal matter present.
- *E. coli* was recorded in the purpose built monitoring bore GND3131 during the baseline sampling round undertaken in June 2021 indicating these bores had not been adequately airlifted following installation. The bore was sampled again in July 2021 post detonation and there was no *E. coli* present.
- There was an increase in nitrate in GND3131 over time which relates to the impact of local agricultural use.
- Most monitoring sites exhibited fluctuations in some parameters but none of the sites exhibited any significant decrease in water quality that would result in it becoming unsuitable for its current use.

Table 4 Tariki 3D monitoring site type, primary purpose and number of samples used in assessment

Site code	Type	Primary purpose	Samples (n)
GND3129	Purpose built bore	Residue from exploded charges and water quality changes over time	5
GND3130	Purpose built bore	Residue from exploded charges and water quality changes over time	5
GND3131	Purpose built bore	Residue from exploded charges and water quality changes over time	5
GND3132	Purpose built bore	Residue from exploded charges and water quality changes over time	5

A summary of the results for the Turangi monitoring programme are included below in Table 5 and Table 6 and for the Tariki monitoring programme Table 7 and Table 8. The complete suite of sampling results for Turangi 3D are included as Appendix III. The complete set of sampling results for Tariki 3D are included as Appendix IV.

Table 5 Minimum and maximum results compared to baseline GND3111/GND2657 and GND3112

Bore id		GND3111/GND2657			GND3112		
Sample range		Baseline	Minimum	Maximum	Baseline	Minimum	Maximum
Date		25/03/2021	2021-2023		18/03/2021	2021-2023	
pH	-	6.9	6.8	6.9	7.0	6.7	7.0
Alkalinity	g/m ³ CaCO ₃	71	50	71	42	40	44
Free carbon dioxide	g/m ³ @25°C	16.7	12.7	21	9.3	8.8	17.9
Total hardness	CaCO ₃	68	43	68	58	52	60
Electrical conductivity	µS/cm	215	169	215	277	275	288
Total dissolved solids	g/m ³	144	113	144	186	185	193
Boron	g/m ³	0.015	0.013	0.015	0.018	0.018	0.02
Calcium	g/m ³	14.8	8.9	14.8	12.7	11	12.7
Magnesium	g/m ³	7.5	4.3	7.5	6.3	5.9	6.7
Potassium	g/m ³	4.6	3.1	4.6	2.4	2.3	2.5
Sodium	g/m ³	12.5	10.6	14.6	33	31	34
Chloride	g/m ³	18.1	17.7	18.7	41	40	44
Manganese	g/m ³	0.63	0.37	0.63	0.0013	<0.0005	0.0013
Dissolved Copper	g/m ³	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Dissolved Iron	g/m ³	2.8	2.1	3.5	<0.02	<0.02	<0.02
Dissolved zinc	g/m ³	0.0015	<0.0010	0.144	<0.0010	<0.0010	0.0165
Ammoniacal nitrogen	g/m ³	1.84	0.56	1.84	<0.010	<0.010	<0.010
Nitrite	g/m ³ N	<0.002	<0.002	0.004	<0.002	<0.002	<0.002
Nitrate	g/m ³ N	<0.002	<0.002	<0.002	5.4	4.8	5.6
Nitrite and nitrate	g/m ³ N	<0.002	<0.002	0.004	5.4	4.8	5.6
Sulphate	g/m ³	4.6	0.9	4.6	4.8	4.4	4.8
<i>E. coli</i>	MPN/100mL	<1	<1	<1	<1	<1	71

Table 6 Range of results compared to baseline GND3113, GND3114 and GND3115

Bore id		GND3114			GND3114			GND3115		
		Baseline	Minimum	Maximum	Baseline	Minimum	Maximum	Baseline	Minimum	Maximum
Date		02/11/2021	2021-2023		04/03/2021	2021-2023		04/03/2021	2021-2023	
pH	-	6.5	6.5	6.5	6.5	6.1	6.5	7.2	7.2	7.5
Alkalinity	g/m ³ CaCO ₃	340	300	340	42	15	42	200	178	200
Free carbon Dioxide	g/m ³ @25°C	197	164	220	25	19.3	29	25	10.8	26
Total hardness	CaCO ₃	198	198	280	33	15.9	33	160	152	165
Electrical conductivity	µS/cm	614	614	704	134	74	134	412	363	412
Total dissolved solids	g/m ³	410	410	470	90	50	90	280	240	280
Boron	g/m ³	0.016	0.012	0.024	0.019	0.014	0.022	0.033	0.033	0.043
Calcium	g/m ³	39	39	54	8.7	3.3	8.7	42	39	43
Magnesium	g/m ³	24	24	35	2.7	1.85	2.7	13.5	12.4	13.7
Potassium	g/m ³	6.4	6.4	14.8	1.87	1.24	2.3	5.8	5.6	5.9
Sodium	g/m ³	28	23	28	10.6	7.5	11.2	21	18.6	21
Chloride	g/m ³	21	16.8	21	9.4	8.4	11	12.4	11.7	12.4
Manganese	g/m ³	0.83	0.083	1.32	0.59	0.0065	0.59	13.5	12.4	13.7
Dissolved Copper	g/m ³	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0007	<0.0005	<0.0005	<0.0005
Dissolved Iron	g/m ³	1.94	1.94	36	2.9	<0.02	2.9	0.3	0.3	4.2
Dissolved zinc	g/m ³	0.0016	0.0016	0.103	0.0022	0.0022	0.079	<0.0010	<0.0010	0.0045
Ammoniacal nitrogen	g/m ³	9.3	8.9	13.5	0.054	<0.010	0.054	3.1	2.4	3.1
Nitrite	g/m ³ N	<0.02	<0.02	<0.1	0.004	<0.002	0.004	0.006	<0.002	<0.02
Nitrate	g/m ³ N	0.006	0.006	<0.1	0.029	0.029	0.24	<0.002	<0.002	0.009
Nitrite and nitrate	g/m ³ N	0.067	<0.02	<0.1	0.032	0.032	0.24	0.004	<0.002	<0.011
Sulphate	g/m ³	9.8	0.9	9.8	6.9	3.8	6.9	<0.5	<0.5	<0.5
<i>E. coli</i>	MPN/100mL	<1	<1	1	<1	<1	1	<1	<1	1

Table 7 Range of results compared to baseline GND3129 and GND3130

Bore id		GND3129			GND3130		
		Baseline	Minimum	Maximum	Baseline	Minimum	Maximum
Date		23/06/2021	2021-2023		23/06/2021	2021-2023	
pH	-	6.6	6.3	6.9	6.4	6.4	7.5
Alkalinity	g/m ³ CaCO ₃	70	34	82	73	52	73
Free carbon Dioxide	g/m ³ @25°C	38	8.1	74	52	3.7	52
Total hardness	CaCO ₃	45	37	50	42	39	46
Electrical conductivity	µS/cm	180	115	182	150	119	150
Total dissolved solids	g/m ³	120	77	122	100	80	100
Boron	g/m ³	0.019	0.016	0.019	0.01	0.009	0.011
Calcium	g/m ³	11	10	12.6	9.9	9.1	11
Magnesium	g/m ³	4.4	2.9	4.8	4.1	3.5	4.4
Potassium	g/m ³	4.8	4.4	4.8	1.62	1.2	1.62
Sodium	g/m ³	12.5	6.4	12.8	14.5	10.7	14.5
Chloride	g/m ³	11.4	8.2	11.4	6.7	5.4	6.7
Manganese	g/m ³	0.33	0.092	0.36	0.095	0.037	0.11
Dissolved Copper	g/m ³	<0.0005	<0.0005	0.0018	<0.0005	<0.0005	0.0006
Dissolved Iron	g/m ³	6.8	0.02	6.8	0.47	0.04	0.47
Dissolved zinc	g/m ³	0.024	0.0041	0.0024	0.0121	<0.0010-	0.0121
Ammoniacal nitrogen	g/m ³	0.49	0.053	0.61	0.063	<0.010	0.064
Nitrite	g/m ³ N	0.003	<0.002	0.003	0.003	<0.002	0.004
Nitrate	g/m ³ N	0.014	0.004	0.021	0.107	0.026	0.185
Nitrite and nitrate	g/m ³ N	0.017	0.006	0.021	0.11	0.03	0.185
Sulphate	g/m ³	3.6	2.1	8.1	2.2	2.1	3
<i>E. coli</i>	MPN/100mL	<1	<1	41	11	<1	1

Table 8 Range of results compared to baseline GND3131 and GND3132

Bore id		GND3131			GND3132		
		Baseline	Minimum	Maximum	Baseline	Minimum	Maximum
Date		21/06/2021	2021-2023		21/06/2021	2021-2023	
pH	-	7.7	7.3	8.0	7.3	6.9	7.8
Alkalinity	g/m ³ CaCO ₃	159	96	159	134	38	199
Free carbon Dioxide	g/m ³ @25°C	5.9	1.9	12.1	12.1	5.9	15.7
Total hardness	CaCO ₃	75	61	90	62	40	62
Electrical conductivity	µS/cm	256	187	256	334	130	433
Total dissolved solids	g/m ³	171	125	171	220	87	290
Boron	g/m ³	0.067	0.019	0.068	0.065	0.017	0.076
Calcium	g/m ³	20	15.5	22	15.4	10.1	16.1
Magnesium	g/m ³	6	5.5	8.4	5.7	3.6	5.7
Potassium	g/m ³	2.4	2.1	2.4	7.1	1.76	7.2
Sodium	g/m ³	27	12	27	48	11.3	61
Chloride	g/m ³	6.3	6.1	6.5	10.6	7.4	10.6
Manganese	g/m ³	0.33	0.16	0.33	0.46	0.0005	0.57
Dissolved Copper	g/m ³	0.0007	<0.0005	0.0023	0.0014	<0.0005	0.0017
Dissolved Iron	g/m ³	<0.02	0.04	0.36	<0.02	<0.02	0.86
Dissolved zinc	g/m ³	<0.0010	<0.0010	0.0013	0.001	<0.0010	0.0158
Ammoniacal nitrogen	g/m ³	0.086	0.085	0.153	0.57	0.49	0.66
Nitrite	g/m ³ N	0.003	0.002	0.007	0.007	<0.002	0.011
Nitrate	g/m ³ N	0.013	0.002	0.154	0.012	0.012	1.75
Nitrite and nitrate	g/m ³ N	0.016	0.003	0.157	0.019	0.019	1.75
Sulphate	g/m ³	5.8	0.7	5.8	23	5.6	23
<i>E. coli</i>	MPN/100mL	2	<1	2	<1	<1	<1

2.2 Provision of consent holder data

2.2.1 Turangi 3D

The Turangi 3D seismic survey comprised of >2,100 GEOPRIME dbx charges that were detonated at depths between 10m and 29m below ground. A summary of the programme is as follows:

- Holes were drilled between 11 February and 19 April 2021;
- Charges detonated between 21 April and 6 May 2021;
- Holes were all backfilled between 22 April and 26 May 2021;
- All holes were backfilled within 30 days of detonation;
- 8 misfires were recorded; and
- Only 1 shot could not be detonated due to a charge being removed by a third party.

All of the monitoring sites included in the programme were sampled prior to commencement of detonation and the first sample collected from each site was considered the baseline.

All holes were backfilled and capped with a bentonite plug. Abandonment of all shot holes was undertaken between 22 April and 6 May 2021.

The date each hole was drilled, the shot was placed and detonated and the day each holes was backfilled and abandoned were all provided.

Specific monitoring of the effects of unexploded charges on groundwater quality were undertaken following installation of a purpose built bore.

A monitoring programme was provided and additional reports were also submitted following the analysis of each scheduled interim water quality sampling round.

2.2.2 Tariki 3D

The Tariki 3D seismic survey comprised of >1,000 GEOPRIME dbx charges that were detonated at depths between 10m and 29m below ground. A summary of the programme is as follows:

- Holes were drilled between 14 May and 23 June 2021;
- Charges were detonated between 24 and 29 June 2021;
- Holes were all backfilled between 2 to 25 July 2021;
- All holes were backfilled within 30 days of detonation;
- No misfires were recorded;
- All shots were detonated

As required by the conditions of their consent, the Company also submitted a groundwater monitoring programme which included details of the location and frequency of sampling. A list of the analysis to be undertaken, and how and when the results of monitoring would be reported to the Council.

Specific monitoring of the effects of unexploded charges on groundwater quality was not required as all charges were successfully detonated.

All charges were detonated between 24 and 29 June 2021. There were no misfires reported, and no undetonated charges remaining in the ground following the survey. The method and date of abandonment for each shot hole was also provided. Holes were backfilled with bentonite plug in place to prevent surface water ingress. Abandonment of all shot holes was undertaken between 2 to 25 July 2021.

All data was provided within the required timeframes.

A summary of the data provided is included in Table 9 below.

Table 9 A summary of data provided under consent conditions

Survey	Survey area (m ²)	Number of shots set	Drilled depths (range m)	Shot depths (range m)	Shots that were not detonated	Abandonment within 30 days (% shots)
Turangi 3D	72.5	2,131	10-29	10-29	8	>99.9
Tariki 3D	71.2	1,002	10-29	10-28	0	100

2.3 Incidents, investigations, and interventions

The monitoring programme for the year was based on what was considered to be an appropriate level of monitoring, review of data, and liaison with the Company. During the year matters may arise which require additional activity by the Council, for example provision of advice and information, or investigation of potential or actual causes of non-compliance or failure to maintain good practices. A pro-active approach, that in the first instance avoids issues occurring, is favoured.

For all significant compliance issues, as well as complaints from the public, the Council maintains a database record. The record includes events where the individual/organisation concerned has itself notified the Council. Details of any investigation and corrective action taken are recorded for non-compliant events.

Complaints may be alleged to be associated with a particular site. If there is potentially an issue of legal liability, the Council must be able to prove by investigation that the identified individual/organisation is indeed the source of the incident (or that the allegation cannot be proven).

In the 2023/2024 period, the Council was not required to undertake significant additional investigations and interventions, or record incidents, in association with the Company's conditions in resource consents or provisions in Regional Plans.

3. Discussion

3.1 Discussion of site performance

Potential bi-products from the detonation of explosives include the release of carbon dioxide and, nitrogen gas which has the potential to convert to nitrate and ammonia.

Nitrate and ammonia results from all monitoring sites remained similar from pre-activity through to the final sampling round and there were no significant increases recorded in free carbon dioxide concentrations.

General ions and cations which are indicative of general water quality and local geology differed slightly between sites and fluctuated between sampling rounds.

The pre-detonation results indicated the presence of *E. coli* in some bores/wells which is generally indicative of poor wellhead protection and therefore also potentially surface water ingress. Although the presence of *E. coli* is not ideal, as due to the low volume of potential contaminants produced by a seismic survey any surface water infiltration could mask any potential effects from the activity. Due to the significant number of seismic holes that were drilled, which although not requiring consent for installation under the RFWP, do have the potential to provide a conduit directly into the aquifer. These sites were still considered of value and remained in the programme to assess any significant water quality changes in the aquifer over the longer term.

The significant portion of the holes were detonated successfully and all holes were abandoned within consented timeframes. There has been no evidence to suggest that the activities undertaken in relation to either seismic survey have had any adverse effect on local groundwater quality that could result in it becoming unsuitable for its current use.

Overall the seismic programmes were successfully undertaken with all of the explosives detonated, backfilled and abandoned within the agreed timeframes, resulting in the reduction of the risk of any potential adverse effects.

Although no adverse environmental effects have been recorded by the Council in relation to the monitored seismic surveys.

It is also important to note that due to the large scale (area and depth of the activities), the small scale of the associated monitoring programmes and the complicated groundwater system this does not provide tangible evidence that the activity provides no risk of environmental impact. Therefore a recommendation that groundwater monitoring remain an integral part of any future seismic survey activities has been included in this report.

In addition, due to the nature of gases in the groundwater system and the predominant land-uses across the region, which include intensive dairy, farming and oil and gas production the source of any significant changes in the concentrations of carbon-dioxide or nitrogen species if found, would be difficult to ascertain. Therefore a recommendation that any future programmes include the installation of purpose built bores under the supervision of an experienced and qualified hydrogeologist to ensure the monitoring sites are secure, has also been included in this report.

3.2 Environmental effects of exercise of consents

No adverse environmental effects have been recorded by the Council in relation to either of the seismic surveys.

The groundwater monitoring component of this programme included the collection, analysis and assessment of 30 samples from five monitoring sites in the vicinity of the Turangi seismic survey footprint

and 20 samples from four sites in the vicinity of the Tariki 3D seismic survey footprint. The results of the monitoring carried out show that the groundwater composition at each site was similar pre-detonation and post-detonation. Some minor fluctuations in analyte concentrations are attributable to standard sampling variability, and or likely a result of land-use and natural groundwater evolution over time. The presence of *E. coli* in some samples indicate that some sites may have received some surface water runoff, unrelated to the survey.

There is no evidence to suggest that activities undertaken by the Company during either seismic survey have had any adverse effect on local groundwater quality.

Compliance with the conditions of the Company's seismic survey related consents during the reporting period is summarised below in Section 3.3.

3.3 Evaluation of performance

A tabular summary of the consent holder's compliance record for the period under review is set out in Tables 10 to Table 14.

Table 10 Summary of performance for consent 10870-1

Purpose: To discharge contaminants to land where they may enter groundwater, including residues from detonation of explosive charges and degradation of unexploded charges, associated with undertaking a seismic survey		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Activity to be undertaken in accordance with the information provided in the application	Assessment of consent holder records and data	Yes
2. Discharge of contaminants to remain within the designated area	Receipt of final shot hole locations	Yes
3. No more than 1 charge per shot hole	Assessment of consent holder records and data	Yes
4. No detonations to occur after 30 April 2023	Receipt of data required by condition 5	Yes
5. Data is to be provided monthly and must include: <ul style="list-style-type: none"> • Shot hole locations; • Hole and explosive depths; • Amount of explosive in each hole; • The date of discharge; • Locations and details of misfires; and • The date each hole was appropriately abandoned 	Review of monthly reports	Yes
6. The consent holder shall minimise any effects on groundwater by; <ul style="list-style-type: none"> • Ensuring charge is placed and recapped on the same day; and • Holes are restored and abandoned within 30 working days of detonation 	Review of detonation and abandonment records	Yes
7. The consent holder shall not cause any change in water quality that would result in it being unsuitable for its current use	Assessment of groundwater quality data	Yes

Purpose: To discharge contaminants to land where they may enter groundwater, including residues from detonation of explosive charges and degradation of unexploded charges, associated with undertaking a seismic survey		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
8. The consent holder shall undertake a programme of sampling and testing (the 'Monitoring Programme') that monitors the effects of the exercise of this consent on fresh water resources	Monitoring Programme submitted to the Chief Executive, Taranaki Regional Council.	Yes
9. Sampling results to be provided within 30 days of sampling	Receipt of data, assess compliance with condition 7	Yes
10. Consent review provision	N/A	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

N/A = not applicable

Table 11 Summary of performance for consent 10871-1

Purpose: To discharge contaminants into land where they may enter groundwater from use of drilling muds associated with undertaking a seismic survey		
Condition requirement	Means of monitoring during period under	Compliance achieved?
1. Activity to be undertaken in accordance with information provided within the consent application	Receipt of satisfactory information	Yes
2. BPO condition	Receipt of satisfactory information	Yes
Overall assessment of consent compliance and environmental performance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

Table 12 Summary of performance for consent 10874-1

Purpose: To discharge contaminants to land where they may enter groundwater, including residues from detonation of explosive charges and degradation of unexploded charges, associated with undertaking a seismic survey		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Activity to be undertaken in accordance with the information provided in the application	Assessment of consent holder records and data	Yes
2. Discharge of contaminants to remain within the designated area	Receipt of final shot hole locations	Yes
3. No more than 1 charge per shot hole	Assessment of consent holder records and data	Yes
4. No detonations to occur after 1 June 2023	Receipt of data required by condition 5	Yes
5. Data is to be provided monthly and must include: <ul style="list-style-type: none"> Shot hole locations; Hole and explosive depths; Amount of explosive in each hole; The date of discharge; Locations and details of misfires; and The date each hole was appropriately abandoned 	Review of monthly reports.	Yes

Purpose: To discharge contaminants to land where they may enter groundwater, including residues from detonation of explosive charges and degradation of unexploded charges, associated with undertaking a seismic survey		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
6. The consent holder shall minimise any effects on groundwater by; <ul style="list-style-type: none"> Ensuring charge is placed and recapped on the same day; and Holes are restored and abandoned within 30 working days of detonation 	Review of detonation and abandonment records	Yes
7. The consent holder shall not cause any change in water quality that would result in it being unsuitable for its current use	Assessment of groundwater quality data	Yes
8. The consent holder shall undertake a programme of sampling and testing (the 'Monitoring Programme') that monitors the effects of the exercise of this consent on fresh water resources	Monitoring Programme submitted to the Chief Executive, Taranaki Regional Council.	Yes
9. Sampling results to be provided within 30 days of sampling.	Receipt of data, assess compliance with condition 7	Yes
10. No drilling or detonation within a distance of wetland, spring used for water supply	Receipt of final hole locations	Yes
11. Engage professional to review source points to ensure offset from sites of significance to Maori.	BTW engaged with TRC and NZ Surveys in site selection	Yes
12. If requested, consent holder to employ 'cultural monitor'	No sites of significance identified	N/A
13. Heritage NZ Accidental Discovery Protocol applied if a site of significance is discovered	N/A	N/A
14. Consent review provision	N/A	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

N/A = not applicable

Table 13 Summary of performance for consent 10875-1

Purpose: To discharge contaminants into land where they may enter groundwater from use of drilling muds associated with undertaking a seismic survey		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Activity to be undertaken in accordance with information provided within the consent application	Receipt of satisfactory information	Yes
2. BPO condition	Receipt of satisfactory information	Yes
Overall assessment of consent compliance and environmental performance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

During the period, the Company demonstrated a high level of environmental and high level of administrative performance with the resource consents as defined in Appendix I.

3.4 Alterations to future monitoring programmes

In designing and implementing the monitoring programmes for air/water discharges in the region, the Council has taken into account:

- the extent of information already made available through monitoring or other means to date;
- its relevance under the RMA;
- the Council's obligations to monitor consented activities and their effects under the RMA;
- the record of administrative and environmental performances of the consent holder; and
- reporting to the regional community.

The Council also takes into account the scope of assessments required at the time of renewal of permits, and the need to maintain a sound understanding of industrial processes within Taranaki exercising resource consents.

It is proposed that for any future programmes that the range of monitoring carried out during the Turangi and Tariki 3D seismic surveys be continued.

It should be noted that the proposed programme represents a reasonable and risk-based level of monitoring for the site(s) in question. The Council reserves the right to subsequently adjust the programme from that initially prepared, should the need arise if potential or actual non-compliance is determined at any time in the future.

4. Recommendations

1. THAT in the first instance, monitoring of consented activities for future programmes continue at the same level for these programmes; and
2. THAT future programmes include installation of fit for purpose site specific monitoring bores under the supervision of a qualified and experienced hydrogeologist following consultation with the Taranaki Regional council.
3. THAT should there be issues with environmental or administrative performance in future periods, monitoring may be adjusted to reflect any additional investigation or intervention as found necessary.

Glossary of common terms and abbreviations

The following abbreviations and terms may be used within this report:

Aquifer (freshwater)	A formation, or group or part of a formation that contains sufficient saturated permeable media to yield exploitable quantities of fresh water.
BPO	Best practicable option.
Conductivity	A measure of the level of dissolved salts in a sample. Usually measured at 25°C and expressed as microsiemens per metre ($\mu\text{S}/\text{cm}$ or as Total Dissolved Solids (g/m^3)).
Confining layer	A geological layer or rock unit that is impermeable to fluids.
Deep well injection (DWI)	Injection of fluids at depth for disposal or enhanced recovery.
Fracture gradient	A measure of how the pressure required to fracture rock in the earth's crust changes with depth. It is usually measured in units of "pounds per square inch per foot" (psi/ft) and varies with the type of rock and the strain of the rock.
g/m^3	Grams per cubic metre. A measure of concentration which is equivalent to milligrams per litre (mg/L), or parts per million (ppm).
Hydraulic fracturing (HF)	The process of increasing reservoir permeability by injecting fluids at pressures sufficient to fracture rock within the reservoir ("fracking").
Injectate	Fluid disposed of by deep well injection.
Incident	An event that is alleged or is found to have occurred that may have actual or potential environmental consequences or may involve non-compliance with a consent or rule in a regional plan. Registration of an incident by the Council does not automatically mean such an outcome had actually occurred.
Intervention	Action/s taken by Council to instruct or direct actions be taken to avoid or reduce the likelihood of an incident occurring.
Investigation	Action taken by Council to establish what were the circumstances/events surrounding an incident including any allegations of an incident.
IR	Unauthorised Incident Register – contains a list of events recorded by the Council on the basis that they may have the potential or actual environmental consequences that may represent a breach of a consent or provision in a Regional Plan.
L/s	Litres per second.
mBGL	Metres below ground level.
mBMP	Metres below measuring point.
$\mu\text{S}/\text{cm}$	Microsiemens per metre.
mS/m	Millisiemens per metre.
mTVD	Metres true vertical depth.
mTVDBGL	Metres true vertical depth below ground level.
m^3	Cubic metre.
N/A	Not applicable.
pH	Numerical system for measuring acidity in solutions, with 7 as neutral. Values lower than 7 are acidic and higher than 7 are alkaline. The scale is logarithmic i.e. a change of 1 represents a ten-fold change in strength. For example, a pH of 4 is ten times more acidic than a pH of 5.

Produced water	Water associated with oil and gas reservoirs that is produced along with the oil and gas. Typically highly saline with salt concentrations similar to seawater and containing low levels of hydrocarbons.
Resource consent	Refer Section 87 of the RMA. Resource consents include land use consents (refer Sections 9 and 13 of the RMA), coastal permits (Sections 12, 14 and 15), water permits (Section 14) and discharge permits (Section 15).
UI	Unauthorised Incident.
Water flooding	A method of thermal recovery in which hot water is injected into a reservoir through specially distributed injection wells. Hot water flooding reduces the viscosity of the crude oil, allowing it to move more easily toward production wells.

For further information on analytical methods, contact a manager within the Environment Quality Department.

Bibliography and references

Ministry for the Environment. 2018. Best Practice Guidelines for Compliance, Monitoring and Enforcement under the Resource Management Act 1991. Wellington: Ministry for the Environment.

Stevens G. (2001): Taranaki: In: *Groundwaters of New Zealand*, M.R. Rosen and P.A. White (eds). New Zealand Hydrological Society Inc., Wellington. P381-386.

BTW (2021): *Turangi 3D Seismic Groundwater Monitoring Programme with borelogs February 2021*. #2709065.

BTW (2021): *Turangi 3D Seismic Groundwater Monitoring Programme March 2021*. #2720967.

BTW (2021): *GPL Tariki 3D Seismic Survey Groundwater Monitoring Programme May 2021*. #2765755.

BTW (2023): *NZ Surveys Tariki 3D Groundwater Monitoring Programme April 2023*. #3243113.

GPL Turangi Seismic Condition 5 and 6 Data spreadsheet. Frodo #2789608.

NZEC Tariki 3D Seismic Condition 5 and 6 Data spreadsheet Frodo. #2835095.

Appendix I

Resource consents held by Greymouth Petroleum Limited

(For a copy of the signed resource consent
please contact the TRC Consents department)

Water abstraction permits

Section 14 of the RMA stipulates that no person may take, use, dam or divert any water, unless the activity is expressly allowed for by a resource consent or a rule in a regional plan, or it falls within some particular categories set out in Section 14. Permits authorising the abstraction of water are issued by the Council under Section 87(d) of the RMA.

Water discharge permits

Section 15(1)(a) of the RMA stipulates that no person may discharge any contaminant into water, unless the activity is expressly allowed for by a resource consent or a rule in a regional plan, or by national regulations. Permits authorising discharges to water are issued by the Council under Section 87(e) of the RMA.

Air discharge permits

Section 15(1)(c) of the RMA stipulates that no person may discharge any contaminant from any industrial or trade premises into air, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations. Permits authorising discharges to air are issued by the Council under Section 87(e) of the RMA.

Discharges of wastes to land

Sections 15(1)(b) and (d) of the RMA stipulate that no person may discharge any contaminant onto land if it may then enter water, or from any industrial or trade premises onto land under any circumstances, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations. Permits authorising the discharge of wastes to land are issued by the Council under Section 87(e) of the RMA.

Land use permits

Section 13(1)(a) of the RMA stipulates that no person may in relation to the bed of any lake or river use, erect, reconstruct, place, alter, extend, remove, or demolish any structure or part of any structure in, on, under, or over the bed, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations. Land use permits are issued by the Council under Section 87(a) of the RMA.

Coastal permits

Section 12(1)(b) of the RMA stipulates that no person may erect, reconstruct, place, alter, extend, remove, or demolish any structure that is fixed in, on, under, or over any foreshore or seabed, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations. Coastal permits are issued by the Council under Section 87(c) of the RMA.

Discharge Permit
Pursuant to the Resource Management Act 1991
a resource consent is hereby granted by the
Taranaki Regional Council

Name of
Consent Holder: NZ Surveys 2020 Limited
14 Connett Road West
Bell Block
New Plymouth 4312

Decision Date 3 December 2020

Commencement Date 3 December 2020

Conditions of Consent

Consent Granted: To discharge contaminants to land where they may enter groundwater, including residues from detonation of explosive charges and degradation of unexploded charges, associated with undertaking a seismic survey

Expiry Date: 1 June 2025

Review Date(s): In accordance with special condition 10

Site Location: Turangi 3D survey area (various locations in the Turangi Area)

Grid Reference (NZTM) Various

Catchment: Various

*For General, Standard and Special conditions
pertaining to this consent please see reverse side of this document*

General condition

- a. The consent holder shall pay to the Taranaki Regional Council all the administration, monitoring and supervision costs of this consent, fixed in accordance with section 36 of the Resource Management Act 1991.

Special conditions

1. The activity shall be undertaken in general accordance with the information provided in support of the application for this consent. Where there is conflict between the application and the consent conditions the conditions shall prevail.
2. This consent authorises the discharge of contaminants resulting from undertaking a seismic survey only within the area shown on the map attached (Appendix 1). The contaminants include:
 - (a) those arising from placing charges of Dyno Nobel Geoprime® dBX™ explosive, each no more than 1 kg, at depths between 10 and 30 metres below ground; and
 - (b) residues from detonating charges of Dyno Nobel Geoprime® dBX™ explosive, each no more than 1 kg, at depths between 10 and 30 metres below ground.
3. No more than one charge shall be placed in each shot hole unless it is necessary to address a misfire, in which case another charge of up to 1 kg may be added.
4. The discharges shall be from the progressive detonation of charges with no detonations occurring after 30 April 2023.
5. The consent holder shall report the following information to the Chief Executive, Taranaki Regional Council on the first day of each month, with the first monthly report to include information in relation to all previous activity:
 - (a) the NZTM grid reference of the location of each shot hole;
 - (b) the depth of each shot hole and depth of the explosive;
 - (c) the amount of explosive in each shot hole;
 - (d) the date that each charge was detonated;
 - (e) the location of shot holes where the charge misfired and details of any additional charge that may have been placed in the hole; and
 - (f) the date that each shot hole is abandoned and details of the method of abandonment.
6. To prevent any effects on groundwater all shot holes shall be:
 - (a) capped at surface to prevent the ingress of surface water on the same day that the charge is placed and re-capped on the same day as detonation and data acquisition occurs; and
 - (b) restored and abandoned within 30 working days of detonation.
7. The activity shall not cause any change in groundwater quality that results in it being unsuitable for its current use.

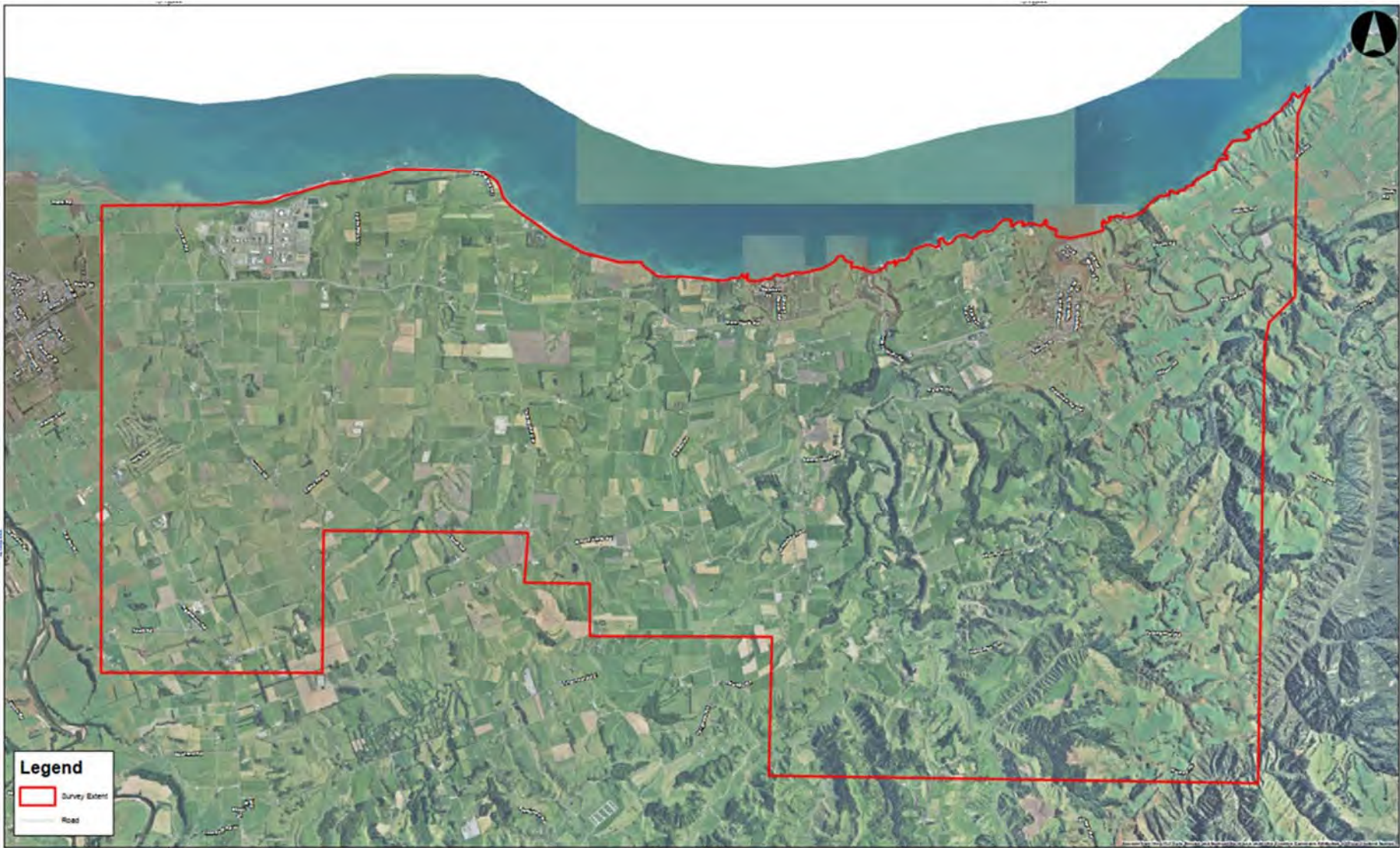
8. The consent holder shall undertake a programme of sampling and testing that identifies the effects of the exercise of this consent on groundwater resources over the duration of the consent (the 'Monitoring Programme'). The Monitoring Programme may be reviewed from time to time but at all times shall be certified by the Chief Executive, Taranaki Regional Council, and shall include:
- (a) water quality criteria for applicable existing uses;
 - (b) the location of each sampling point and the frequency of sampling;
 - (c) a listing of analyses to be undertaken for contaminants that could result from the discharges authorised;
 - (d) specific monitoring of the effects of unexploded charges on groundwater quality;
 - (e) details of how and when the results of monitoring will be reported to the Taranaki Regional Council; and
 - (f) an appropriate abandonment procedure.
9. All sampling and analysis shall be undertaken in accordance with a Sampling and Analysis Plan, which shall be certified by the Chief Executive, Taranaki Regional Council before the activity commences. The plan shall specify the use of standard protocols recognised to constitute good professional practice including quality control and assurance. An International Accreditation New Zealand (IANZ) accredited laboratory shall be used for all sample analysis. Results shall be provided to the Chief Executive within 30 days of sampling and shall include supporting quality control and assurance information. These results will be used to assess compliance with condition 7.
- Note: The Sampling and Analysis Plan may be combined with the Monitoring Programme required by condition 8.*
10. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review within 3 months of receiving a report in accordance with condition 5 and/or 8 above, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 3 December 2020

For and on behalf of
Taranaki Regional Council

A D McLay
Director - Resource Management

Appendix 1: Map of Turangi Seismic Survey Area



Discharge Permit
Pursuant to the Resource Management Act 1991
a resource consent is hereby granted by the
Taranaki Regional Council

Name of
Consent Holder: NZ Surveys 2020 Limited
14 Connett Road West
Bell Block
New Plymouth 4312

Decision Date 3 December 2020

Commencement Date 3 December 2020

Conditions of Consent

Consent Granted: To discharge contaminants into land where they may enter groundwater from use of drilling muds associated with undertaking a seismic survey

Expiry Date: 1 June 2025

Site Location: Turangi 3D survey area (various locations in the Turangi Area)

Grid Reference (NZTM) Various

Catchment: Various

*For General, Standard and Special conditions
pertaining to this consent please see reverse side of this document*

General condition

- a. The consent holder shall pay to the Taranaki Regional Council all the administration, monitoring and supervision costs of this consent, fixed in accordance with section 36 of the Resource Management Act 1991.

Special conditions

1. The activity shall be undertaken in general accordance with the information provided in support of the application for this consent. Where there is conflict between the application and the consent conditions, the conditions shall prevail.
2. The consent holder shall at all times adopt the best practicable option, as defined in Section 2 of the Resource Management Act 1991, to prevent or minimise any actual or likely adverse effect on the environment associated with the discharge of contaminants from the site, including but not limited to effects on any water body or soil.

Signed at Stratford on 3 December 2020

For and on behalf of
Taranaki Regional Council

A D McLay
Director - Resource Management

Discharge Permit
Pursuant to the Resource Management Act 1991
a resource consent is hereby granted by the
Taranaki Regional Council

Name of
Consent Holder: NZ Surveys 2020 Limited
14 Connett Road West
Bell Block
New Plymouth 4312

Decision Date 11 February 2021

Commencement Date 11 February 2021

Conditions of Consent

Consent Granted: To discharge contaminants to land where they may enter groundwater, including residues from detonation of explosive charges and degradation of unexploded charges, associated with undertaking a seismic survey

Expiry Date: 1 June 2025

Review Date(s): In accordance with special condition 15

Site Location: Tariki 3D Survey Area (various locations in the Tariki Area)

Grid Reference (NZTM) Various

Catchment: Various

*For General, Standard and Special conditions
pertaining to this consent please see reverse side of this document*

General condition

- a. The consent holder shall pay to the Taranaki Regional Council all the administration, monitoring and supervision costs of this consent, fixed in accordance with section 36 of the Resource Management Act 1991.

Special conditions

1. The activity shall be undertaken in general accordance with the information provided in support of the application for this consent. Where there is conflict between the application and the consent conditions the conditions shall prevail.
2. This consent authorises the discharge of contaminants resulting from undertaking a seismic survey only within the area shown on the map attached (Appendix 1). The contaminants include:
 - (a) those arising from placing charges of Dyno Nobel Geoprime® dBX™ explosive, each no more than 1 kg, at depths between 10 and 60 metres below ground; and
 - (b) residues from detonating charges of Dyno Nobel Geoprime® dBX™ explosive, each no more than 1 kg, at depths between 10 and 60 metres below ground.
3. No more than one charge shall be placed in each shot hole unless it is necessary to address a misfire, in which case another charge of up to 1 kg may be added.
4. The discharges shall be from the progressive detonation of charges with no detonations occurring after 1 June 2023.
5. The consent holder shall report the following information to the Chief Executive, Taranaki Regional Council on the first day of each month, with the first monthly report to include information in relation to all previous activity:
 - (a) the NZTM grid reference of the location of each shot hole;
 - (b) the depth of each shot hole and depth of the explosive;
 - (c) the amount of explosive in each shot hole;
 - (d) the date that each charge was detonated;
 - (e) the location of shot holes where the charge misfired and details of any additional charge that may have been placed in the hole; and
 - (f) the date that each shot hole is abandoned and details of the method of abandonment.
6. To prevent any effects on groundwater all shot holes shall be:
 - (a) capped at surface to prevent the ingress of surface water on the same day that the charge is placed and re-capped on the same day as detonation and data acquisition occurs; and
 - (b) restored and abandoned within 30 working days of detonation.
7. The activity shall not cause any change in groundwater quality that results in it being unsuitable for its current use.

8. The consent holder shall undertake a programme of sampling and testing that identifies the effects of the exercise of this consent on groundwater resources over the duration of the consent (the 'Monitoring Programme'). The Monitoring Programme may be reviewed from time to time but at all times shall be certified by the Chief Executive, Taranaki Regional Council, and shall include:
 - (a) water quality criteria for applicable existing uses;
 - (b) the location of each sampling point and the frequency of sampling;
 - (c) a listing of analyses to be undertaken for contaminants that could result from the discharges authorised;
 - (d) specific monitoring of the effects of unexploded charges on groundwater quality;
 - (e) details of how and when the results of monitoring will be reported to the Taranaki Regional Council; and
 - (f) an appropriate abandonment procedure.
9. All sampling and analysis shall be undertaken in accordance with a Sampling and Analysis Plan, which shall be certified by the Chief Executive, Taranaki Regional Council before the activity commences. The plan shall specify the use of standard protocols recognised to constitute good professional practice including quality control and assurance. An International Accreditation New Zealand (IANZ) accredited laboratory shall be used for all sample analysis. Results shall be provided to the Chief Executive within 30 days of sampling and shall include supporting quality control and assurance information. These results will be used to assess compliance with condition 7.

Note: The Sampling and Analysis Plan may be combined with the Monitoring Programme required by condition 8.
10. There shall be no drilling or detonation of explosive charges within:
 - (a) 20 metres of any wetland or surface water body;
 - (b) 100 metres of any bore, well or spring used for water supply; or
 - (c) any offset distance determined by the archaeologist in accordance with condition 11 below.
11. The consent holder shall engage a professional archaeologist to undertake a desktop review of all source points within the Tariki 3D Seismic Survey area to ensure they are adequately offset from any archaeological sites or sites of significance to Maori.
12. If requested by the iwi or hapu, the consent holder shall employ at least one person as a 'cultural monitor'. A cultural monitor is a person, who the iwi has agreed, has the ability to identify any previously unidentified sites of significance to Maori that may be encountered during drilling. Cultural monitors shall form part of the drilling crew.
13. The Heritage New Zealand Accidental Discovery Protocol shall apply to any archaeological site or site of significance to Maori that may be discovered while the work is being undertaken.

14. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review within 3 months of receiving a report in accordance with condition 5 and/or 8 above, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 11 February 2021

For and on behalf of
Taranaki Regional Council

A D McLay
Director - Resource Management

Discharge Permit
Pursuant to the Resource Management Act 1991
a resource consent is hereby granted by the
Taranaki Regional Council

Name of
Consent Holder: NZ Surveys 2020 Limited
14 Connett Road West
Bell Block
New Plymouth 4312

Decision Date 11 February 2021

Commencement Date 11 February 2021

Conditions of Consent

Consent Granted: To discharge contaminants into land where they may enter groundwater from use of drilling muds associated with undertaking a seismic survey

Expiry Date: 1 June 2025

Site Location: Tariki 3D Survey Area (various locations in the Tariki Area)

Grid Reference (NZTM) Various

Catchment: Various

*For General, Standard and Special conditions
pertaining to this consent please see reverse side of this document*

General condition

- a. The consent holder shall pay to the Taranaki Regional Council all the administration, monitoring and supervision costs of this consent, fixed in accordance with section 36 of the Resource Management Act 1991.

Special conditions

1. The activity shall be undertaken in general accordance with the information provided in support of the application for this consent. Where there is conflict between the application and the consent conditions, the conditions shall prevail.
2. The consent holder shall at all times adopt the best practicable option, as defined in Section 2 of the Resource Management Act 1991, to prevent or minimise any actual or likely adverse effect on the environment associated with the discharge of contaminants from the site, including but not limited to effects on any water body or soil.

Signed at Stratford on 11 February 2021

For and on behalf of
Taranaki Regional Council

A D McLay
Director - Resource Management

Appendix II

Categories used to evaluate environmental and administrative performance

Categories used to evaluate environmental and administrative performance

Environmental performance is concerned with actual or likely effects on the receiving environment from the activities during the monitoring year. Administrative performance is concerned with the Company's approach to demonstrating consent compliance in site operations and management including the timely provision of information to Council (such as contingency plans and water take data) in accordance with consent conditions.

Events that were beyond the control of the consent holder and unforeseeable (that is a defence under the provisions of the RMA can be established) may be excluded with regard to the performance rating applied. For example loss of data due to a flood destroying deployed field equipment.

The categories used by the Council for this monitoring period, and their interpretation, are as follows:

Environmental Performance

High: No or inconsequential (short-term duration, less than minor in severity) breaches of consent or regional plan parameters resulting from the activity; no adverse effects of significance noted or likely in the receiving environment. The Council did not record any verified unauthorised incidents involving environmental impacts and was not obliged to issue any abatement notices or infringement notices in relation to such impacts.

Good: Likely or actual adverse effects of activities on the receiving environment were negligible or minor at most. There were some such issues noted during monitoring, from self-reports, or during investigations of incidents reported to the Council by a third party but these items were not critical, and follow-up inspections showed they have been dealt with. These minor issues were resolved positively, co-operatively, and quickly. The Council was not obliged to issue any abatement notices or infringement notices in relation to the minor non-compliant effects however, abatement notices may have been issued to mitigate an identified potential for an environmental effect to occur.

For example:

- High suspended solid values recorded in discharge samples however, the discharge was to land or to receiving waters that were in high flow at the time;
- Strong odour beyond boundary but no residential properties or other recipient nearby.

Improvement required: Likely or actual adverse effects of activities on the receiving environment were more than minor, but not substantial. There were some issues noted during monitoring, from self-reports, or during investigations of incidents reported to the Council by a third party. Cumulative adverse effects of a persistent minor non-compliant activity could elevate a minor issue to this level. Abatement notices and infringement notices may have been issued in respect of effects.

Poor: Likely or actual adverse effects of activities on the receiving environment were significant. There were some items noted during monitoring, from self-reports, or during investigations of incidents reported to the Council by a third party. Cumulative adverse effects of a persistent moderate non-compliant activity could elevate an 'improvement required' issue to this level. Typically there were grounds for either a prosecution or an infringement notice in respect of effects.

Administrative performance

High: The administrative requirements of the resource consents were met, or any failure to do this had trivial consequences and were addressed promptly and co-operatively.

Good: Perhaps some administrative requirements of the resource consents were not met at a particular time however, this was addressed without repeated interventions from the Council staff. Alternatively adequate reason was provided for matters such as the no or late provision of information, interpretation of 'best practical option' for avoiding potential effects, etc.

Improvement required: Repeated interventions to meet the administrative requirements of the resource consents were made by Council staff. These matters took some time to resolve, or remained unresolved at the end of the period under review. The Council may have issued an abatement notice to attain compliance.

Poor: Material failings to meet the administrative requirements of the resource consents. Significant intervention by the Council was required. Typically there were grounds for an infringement notice.

Appendix III

Turangi 3D seismic survey groundwater sampling results



Certificate of Analysis

Page 1 of 1

Client:	BTW Company Limited	Lab No:	2496535	SPv1
Contact:	Greg Larkin	Date Received:	18-Dec-2020	
	C/- BTW Company Limited	Date Reported:	20-Dec-2020	
	PO Box 551	Quote No:	71869	
	New Plymouth 4340	Order No:		
		Client Reference:	190694.01	
		Submitted By:	Greg Larkin	

Sample Type: Aqueous

Sample Name:	Onaero Bore 17-Dec-2020 12:00 pm	Kowhai C Bore 17-Dec-2020 2:10 pm			
Lab Number:	2496535.1	2496535.2			
Escherichia coli	cfu / 100mL	29	24,000	-	-

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Escherichia coli	Membrane filtration, Count on mFC agar, Incubated at 44.5°C for 22 hours, MUG Confirmation. APHA 9222 I 23 rd ed. 2017.	1 cfu / 100mL	1-2

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed on 20-Dec-2020. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.

Priya Babu DipTech (Science)
Laboratory Technician - Microbiology



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Certificate of Analysis

Page 1 of 1

Client:	BTW Company Limited	Lab No:	2495639	SPv1
Contact:	Greg Larkin	Date Received:	17-Dec-2020	
	C/- BTW Company Limited	Date Reported:	19-Dec-2020	
	PO Box 551	Quote No:	71869	
	New Plymouth 4340	Order No:		
		Client Reference:		
		Submitted By:	Greg Larkin	

Sample Type: Aqueous

Sample Name:	Turangi H Bore 16-Dec-2020 12:30 pm	Halcombe Bore 16-Dec-2020 4:00 pm			
Lab Number:	2495639.1	2495639.2			
Escherichia coli	cfu / 100mL	20 #1	20	-	-

Analyst's Comments

#1 Statistically estimated count based on the theoretical countable range for the stated method.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Escherichia coli	Membrane filtration, Count on mFC agar, Incubated at 44.5°C for 22 hours, MUG Confirmation. APHA 9222 I 23 rd ed. 2017.	1 cfu / 100mL	1-2

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed on 19-Dec-2020. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Kevin Wang MSc
Laboratory Technician - Microbiology



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Certificate of Analysis

Page 1 of 1

Client:	BTW Company Limited	Lab No:	2789659	SPV1
Contact:	Greg Larkin	Date Received:	04-Dec-2021	
	C/- BTW Company Limited	Date Reported:	06-Dec-2021	
	PO Box 551	Quote No:	71869	
	New Plymouth 4340	Order No:		
		Client Reference:	190694	
		Submitted By:	Greg Larkin	

Sample Type: Aqueous

Sample Name:	GND3112				
	03-Dec-2021 2:30 pm				
Lab Number:	2789659.1				
Escherichia coli	MPN / 100mL	< 1	-	-	-

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Escherichia coli	MPN count using Colilert 18 (Incubated at 35°C for 18 hours) and 97 wells. APHA 9223 B 23 rd ed. 2017.	1 MPN / 100mL	1

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed on 05-Dec-2021. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Shobhna Ram BSc
Operations Support - Microbiology



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Certificate of Analysis

Page 1 of 2

Client:	BTW Company Limited	Lab No:	2560979	SPv2
Contact:	Greg Larkin	Date Received:	19-Mar-2021	
	C/- BTW Company Limited	Date Reported:	25-Mar-2021	
	PO Box 551	Quote No:	110132	
	New Plymouth 4340	Order No:		
		Client Reference:	Turangi 3D	
		Submitted By:	Angela Smith	

Sample Type: Aqueous

Sample Name:		GND03113 18-Mar-2021 1:40 pm	GND03112 18-Mar-2021 9:55 am			
Lab Number:		2560979.1	2560979.2			
pH	pH Units	6.5	7.0	-	-	-
Total Alkalinity	g/m ³ as CaCO ₃	340	42	-	-	-
Free Carbon Dioxide	g/m ³ at 25°C	197	9.3	-	-	-
Total Hardness	g/m ³ as CaCO ₃	198	58	-	-	-
Electrical Conductivity (EC)	mS/m	61.4	27.7	-	-	-
Approx Total Dissolved Salts	g/m ³	410	186	-	-	-
Dissolved Boron	g/m ³	0.016	0.018	-	-	-
Dissolved Calcium	g/m ³	39	12.7	-	-	-
Dissolved Copper	g/m ³	< 0.0005	< 0.0005	-	-	-
Dissolved Iron	g/m ³	1.94	< 0.02	-	-	-
Dissolved Magnesium	g/m ³	24	6.3	-	-	-
Dissolved Manganese	g/m ³	0.83	0.0013	-	-	-
Dissolved Potassium	g/m ³	6.4	2.4	-	-	-
Dissolved Sodium	g/m ³	28	33	-	-	-
Dissolved Zinc	g/m ³	0.0016	< 0.0010	-	-	-
Chloride	g/m ³	21	41	-	-	-
Total Ammoniacal-N	g/m ³	9.3	< 0.010	-	-	-
Nitrite-N	g/m ³	0.061	< 0.002	-	-	-
Nitrate-N	g/m ³	0.006	5.4	-	-	-
Nitrate-N + Nitrite-N	g/m ³	0.067	5.4	-	-	-
Sulphate	g/m ³	9.8	4.8	-	-	-
Escherichia coli	MPN / 100mL	< 10	< 1	-	-	-

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-2
pH	pH meter. APHA 4500-H+ B 23 rd ed. 2017. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-2
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (modified for Alkalinity <20) 23 rd ed. 2017.	1.0 g/m ³ as CaCO ₃	1-2



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Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Free Carbon Dioxide	Calculation: from alkalinity and pH, valid where TDS is not >500 mg/L and alkalinity is almost entirely due to hydroxides, carbonates or bicarbonates. APHA 4500-CO ₂ D 23 rd ed. 2017.	1.0 g/m ³ at 25°C	1-2
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 23 rd ed. 2017.	1.0 g/m ³ as CaCO ₃	1-2
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 23 rd ed. 2017.	0.1 mS/m	1-2
Approx Total Dissolved Salts	Calculation: from Electrical Conductivity.	2 g/m ³	1-2
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23 rd ed. 2017.	-	1-2
Dissolved Boron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.005 g/m ³	1-2
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.05 g/m ³	1-2
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0005 g/m ³	1-2
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-2
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-2
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0005 g/m ³	1-2
Dissolved Potassium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.05 g/m ³	1-2
Dissolved Sodium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-2
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0010 g/m ³	1-2
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23 rd ed. 2017.	0.5 g/m ³	1-2
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH ₄ -N = NH ₄ ⁺ -N + NH ₃ -N). APHA 4500-NH ₃ H (modified) 23 rd ed. 2017.	0.010 g/m ³	1-2
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO ₃ ⁻ I (modified) 23 rd ed. 2017.	0.002 g/m ³	1-2
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO ₂ N. In-House.	0.0010 g/m ³	1-2
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO ₃ ⁻ I (modified) 23 rd ed. 2017.	0.002 g/m ³	1-2
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23 rd ed. 2017.	0.5 g/m ³	1-2
Escherichia coli	MPN count using Colilert (Incubated at 35°C for 24 hours) and 97 wells. APHA 9223 B 23 rd ed. 2017.	1 MPN / 100mL	1-2

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 19-Mar-2021 and 25-Mar-2021. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Graham Corban MSc Tech (Hons)
Client Services Manager - Environmental



Certificate of Analysis

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Client:	BTW Company Limited	Lab No:	2547393	SPv2
Contact:	Greg Larkin	Date Received:	05-Mar-2021	
	C/- BTW Company Limited	Date Reported:	12-Mar-2021	
	PO Box 551	Quote No:	110132	
	New Plymouth 4340	Order No:		
		Client Reference:	Groundwater testing	
		Submitted By:	Angela Smith	

Sample Type: Aqueous

Sample Name:		GND3115 04-Mar-2021 2:45 pm	GND3114 04-Mar-2021 12:40 pm			
Lab Number:		2547393.1	2547393.2			
pH	pH Units	7.2	6.5	-	-	-
Total Alkalinity	g/m ³ as CaCO ₃	200	42	-	-	-
Free Carbon Dioxide	g/m ³ at 25°C	25	25	-	-	-
Total Hardness	g/m ³ as CaCO ₃	160	33	-	-	-
Electrical Conductivity (EC)	mS/m	41.2	13.4	-	-	-
Approx Total Dissolved Salts	g/m ³	280	90	-	-	-
Dissolved Boron	g/m ³	0.033	0.019	-	-	-
Dissolved Calcium	g/m ³	42	8.7	-	-	-
Dissolved Copper	g/m ³	< 0.0005	< 0.0005	-	-	-
Dissolved Iron	g/m ³	0.30	2.9	-	-	-
Dissolved Magnesium	g/m ³	13.5	2.7	-	-	-
Dissolved Manganese	g/m ³	0.25	0.59	-	-	-
Dissolved Potassium	g/m ³	5.8	1.87	-	-	-
Dissolved Sodium	g/m ³	21	10.6	-	-	-
Dissolved Zinc	g/m ³	< 0.0010	0.0022	-	-	-
Chloride	g/m ³	12.4	9.4	-	-	-
Total Ammoniacal-N	g/m ³	3.1	0.054	-	-	-
Nitrite-N	g/m ³	0.006 #1	0.004	-	-	-
Nitrate-N	g/m ³	< 0.002	0.029	-	-	-
Nitrate-N + Nitrite-N	g/m ³	0.004 #1	0.032	-	-	-
Sulphate	g/m ³	< 0.5	6.9	-	-	-
Escherichia coli	MPN / 100mL	< 1	< 1	-	-	-

Analyst's Comments

#1 It has been noted that the result for Nitrite-N was greater than that for Nitrate-N + Nitrite-N, but within the analytical variation of these methods.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-2



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Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
pH	pH meter. APHA 4500-H ⁺ B 23 rd ed. 2017. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-2
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (modified for Alkalinity <20) 23 rd ed. 2017.	1.0 g/m ³ as CaCO ₃	1-2
Free Carbon Dioxide	Calculation: from alkalinity and pH, valid where TDS is not >500 mg/L and alkalinity is almost entirely due to hydroxides, carbonates or bicarbonates. APHA 4500-CO ₂ D 23 rd ed. 2017.	1.0 g/m ³ at 25°C	1-2
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 23 rd ed. 2017.	1.0 g/m ³ as CaCO ₃	1-2
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 23 rd ed. 2017.	0.1 mS/m	1-2
Approx Total Dissolved Salts	Calculation: from Electrical Conductivity.	2 g/m ³	1-2
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23 rd ed. 2017.	-	1-2
Dissolved Boron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.005 g/m ³	1-2
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.05 g/m ³	1-2
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0005 g/m ³	1-2
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-2
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-2
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0005 g/m ³	1-2
Dissolved Potassium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.05 g/m ³	1-2
Dissolved Sodium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-2
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0010 g/m ³	1-2
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23 rd ed. 2017.	0.5 g/m ³	1-2
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH ₄ ⁺ -N + NH ₃ -N). APHA 4500-NH ₃ H (modified) 23 rd ed. 2017.	0.010 g/m ³	1-2
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO ₂ ⁻ I (modified) 23 rd ed. 2017.	0.002 g/m ³	1-2
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO ₂ N. In-House.	0.0010 g/m ³	1-2
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO ₃ ⁻ I (modified) 23 rd ed. 2017.	0.002 g/m ³	1-2
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23 rd ed. 2017.	0.5 g/m ³	1-2
Escherichia coli	MPN count using Colilert (Incubated at 35°C for 24 hours) and 97 wells. APHA 9223 B 23 rd ed. 2017.	1 MPN / 100mL	1-2

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 06-Mar-2021 and 12-Mar-2021. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Ara Heron BSc (Tech)
Client Services Manager - Environmental



Certificate of Analysis

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Client:	BTW Company Limited	Lab No:	2568326	SPv2
Contact:	Greg Larkin	Date Received:	26-Mar-2021	
	C/- BTW Company Limited	Date Reported:	30-Mar-2021	
	PO Box 551	Quote No:	110132	
	New Plymouth 4340	Order No:		
		Client Reference:	Groundwater testing	
		Submitted By:	Greg Larkin	

Sample Type: Aqueous

Sample Name:		GMD3111 25-Mar-2021 11:45 am	GMD2770 25-Mar-2021 1:05 pm			
Lab Number:		2568326.1	2568326.2			
pH	pH Units	6.9	6.3	-	-	-
Total Alkalinity	g/m ³ as CaCO ₃	71	25	-	-	-
Free Carbon Dioxide	g/m ³ at 25°C	16.7	23	-	-	-
Total Hardness	g/m ³ as CaCO ₃	68	43	-	-	-
Electrical Conductivity (EC)	mS/m	21.5	17.9	-	-	-
Approx Total Dissolved Salts	g/m ³	144	120	-	-	-
Dissolved Boron	g/m ³	0.015	0.013	-	-	-
Dissolved Calcium	g/m ³	14.8	9.1	-	-	-
Dissolved Copper	g/m ³	< 0.0005	0.0010	-	-	-
Dissolved Iron	g/m ³	2.8	0.06	-	-	-
Dissolved Magnesium	g/m ³	7.5	4.9	-	-	-
Dissolved Manganese	g/m ³	0.63	0.0058	-	-	-
Dissolved Potassium	g/m ³	4.6	1.65	-	-	-
Dissolved Sodium	g/m ³	12.5	16.7	-	-	-
Dissolved Zinc	g/m ³	0.0015	0.031	-	-	-
Chloride	g/m ³	18.1	32	-	-	-
Total Ammoniacal-N	g/m ³	1.84	< 0.010	-	-	-
Nitrite-N	g/m ³	< 0.002	< 0.002	-	-	-
Nitrate-N	g/m ³	< 0.002	1.36	-	-	-
Nitrate-N + Nitrite-N	g/m ³	< 0.002	1.36	-	-	-
Sulphate	g/m ³	4.6	2.1	-	-	-
Escherichia coli	MPN / 100mL	< 1	< 1	-	-	-

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-2
pH	pH meter. APHA 4500-H ⁺ B 23 rd ed. 2017. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-2
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (modified for Alkalinity <20) 23 rd ed. 2017.	1.0 g/m ³ as CaCO ₃	1-2



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Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Free Carbon Dioxide	Calculation: from alkalinity and pH, valid where TDS is not >500 mg/L and alkalinity is almost entirely due to hydroxides, carbonates or bicarbonates. APHA 4500-CO ₂ D 23 rd ed. 2017.	1.0 g/m ³ at 25°C	1-2
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 23 rd ed. 2017.	1.0 g/m ³ as CaCO ₃	1-2
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 23 rd ed. 2017.	0.1 mS/m	1-2
Approx Total Dissolved Salts	Calculation: from Electrical Conductivity.	2 g/m ³	1-2
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23 rd ed. 2017.	-	1-2
Dissolved Boron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.005 g/m ³	1-2
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.05 g/m ³	1-2
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0005 g/m ³	1-2
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-2
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-2
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0005 g/m ³	1-2
Dissolved Potassium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.05 g/m ³	1-2
Dissolved Sodium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-2
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0010 g/m ³	1-2
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23 rd ed. 2017.	0.5 g/m ³	1-2
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH ₄ -N = NH ₄ ⁺ -N + NH ₃ -N). APHA 4500-NH ₃ H (modified) 23 rd ed. 2017.	0.010 g/m ³	1-2
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO ₃ I (modified) 23 rd ed. 2017.	0.002 g/m ³	1-2
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO ₂ N. In-House.	0.0010 g/m ³	1-2
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO ₃ I (modified) 23 rd ed. 2017.	0.002 g/m ³	1-2
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23 rd ed. 2017.	0.5 g/m ³	1-2
Escherichia coli	MPN count using Colilert (Incubated at 35°C for 24 hours) and 97 wells. APHA 9223 B 23 rd ed. 2017.	1 MPN / 100mL	1-2

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 27-Mar-2021 and 30-Mar-2021. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Kim Harrison MSc
Client Services Manager - Environmental



Certificate of Analysis

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Client:	BTW Company Limited	Lab No:	2560979	SPv1
Contact:	Greg Larkin C/- BTW Company Limited PO Box 551 New Plymouth 4340	Date Received:	19-Mar-2021	
		Date Reported:	23-Mar-2021	
		Quote No:	110132	
		Order No:		
		Client Reference:	Turangi 3D	
		Submitted By:	Angela Smith	

Interim Report

This is an interim report, prepared before all test results are completed. As all final Q.C. checks may not have been possible, it is not regarded as an official certificate of analysis. The final, official report will be issued upon completion of all tests.

Sample Type: Aqueous						
Sample Name:		GND03113 18-Mar-2021 1:40 pm	GND03112 18-Mar-2021 9:55 am			
Lab Number:		2560979.1	2560979.2			
pH	pH Units	6.5	7.0	-	-	-
Total Alkalinity	g/m ³ as CaCO ₃	In Progress	42	-	-	-
Free Carbon Dioxide	g/m ³ at 25°C	In Progress	9.3	-	-	-
Total Hardness	g/m ³ as CaCO ₃	In Progress	In Progress	-	-	-
Electrical Conductivity (EC)	mS/m	61.4	27.7	-	-	-
Approx Total Dissolved Salts	g/m ³	410	186	-	-	-
Dissolved Boron	g/m ³	In Progress	In Progress	-	-	-
Dissolved Calcium	g/m ³	In Progress	In Progress	-	-	-
Dissolved Copper	g/m ³	In Progress	In Progress	-	-	-
Dissolved Iron	g/m ³	In Progress	In Progress	-	-	-
Dissolved Magnesium	g/m ³	In Progress	In Progress	-	-	-
Dissolved Manganese	g/m ³	In Progress	In Progress	-	-	-
Dissolved Potassium	g/m ³	In Progress	In Progress	-	-	-
Dissolved Sodium	g/m ³	In Progress	In Progress	-	-	-
Dissolved Zinc	g/m ³	In Progress	In Progress	-	-	-
Chloride	g/m ³	21	41	-	-	-
Total Ammoniacal-N	g/m ³	9.3	< 0.010	-	-	-
Nitrite-N	g/m ³	0.061	< 0.002	-	-	-
Nitrate-N	g/m ³	0.006	5.4	-	-	-
Nitrate-N + Nitrite-N	g/m ³	0.067	5.4	-	-	-
Sulphate	g/m ³	9.8	4.8	-	-	-
Escherichia coli	MPN / 100mL	< 10	< 1	-	-	-

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-2
pH	pH meter. APHA 4500-H ⁺ B 23 rd ed. 2017. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-2
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (modified for Alkalinity <20) 23 rd ed. 2017.	1.0 g/m ³ as CaCO ₃	1-2

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Free Carbon Dioxide	Calculation: from alkalinity and pH, valid where TDS is not >500 mg/L and alkalinity is almost entirely due to hydroxides, carbonates or bicarbonates. APHA 4500-CO ₂ D 23 rd ed. 2017.	1.0 g/m ³ at 25°C	1-2
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 23 rd ed. 2017.	1.0 g/m ³ as CaCO ₃	1-2
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 23 rd ed. 2017.	0.1 mS/m	1-2
Approx Total Dissolved Salts	Calculation: from Electrical Conductivity.	2 g/m ³	1-2
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23 rd ed. 2017.	-	1-2
Dissolved Boron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.005 g/m ³	1-2
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.05 g/m ³	1-2
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0005 g/m ³	1-2
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-2
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-2
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0005 g/m ³	1-2
Dissolved Potassium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.05 g/m ³	1-2
Dissolved Sodium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-2
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0010 g/m ³	1-2
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23 rd ed. 2017.	0.5 g/m ³	1-2
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH ₄ -N = NH ₄ ⁺ -N + NH ₃ -N). APHA 4500-NH ₃ H (modified) 23 rd ed. 2017.	0.010 g/m ³	1-2
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO ₃ ⁻ I (modified) 23 rd ed. 2017.	0.002 g/m ³	1-2
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO ₂ N. In-House.	0.0010 g/m ³	1-2
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO ₃ ⁻ I (modified) 23 rd ed. 2017.	0.002 g/m ³	1-2
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23 rd ed. 2017.	0.5 g/m ³	1-2
Escherichia coli	MPN count using Colilert (Incubated at 35°C for 24 hours) and 97 wells. APHA 9223 B 23 rd ed. 2017.	1 MPN / 100mL	1-2

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 19-Mar-2021 and 22-Mar-2021. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Martin Cowell - BSc
Client Services Manager - Environmental



Certificate of Analysis

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Client:	BTW Company Limited	Lab No:	2763275	SPv1
Contact:	Greg Larkin	Date Received:	11-Nov-2021	
	C/- BTW Company Limited	Date Reported:	17-Nov-2021	
	PO Box 551	Quote No:	110132	
	New Plymouth 4340	Order No:		
		Client Reference:	190694.02	
		Submitted By:	Greg Larkin	

Sample Type: Aqueous

Sample Name:		GND3114 10-Nov-2021 12:30 pm	GND3115 10-Nov-2021 1:50 pm	GND3112 10-Nov-2021 3:30 pm		
Lab Number:		2763275.1	2763275.2	2763275.3		
pH	pH Units	6.2	7.2	6.7	-	-
Total Alkalinity	g/m ³ as CaCO ₃	21	192	43	-	-
Free Carbon Dioxide	g/m ³ at 25°C	29	26	17.9	-	-
Total Hardness	g/m ³ as CaCO ₃	18.4	160	55	-	-
Electrical Conductivity (EC)	mS/m	8.3	38.9	28.0	-	-
Approx Total Dissolved Salts	g/m ³	56	260	188	-	-
Dissolved Boron	g/m ³	0.015	0.040	0.020	-	-
Dissolved Calcium	g/m ³	4.2	43	12.1	-	-
Dissolved Copper	g/m ³	< 0.0005	< 0.0005	< 0.0005	-	-
Dissolved Iron	g/m ³	< 0.02	3.2	< 0.02	-	-
Dissolved Magnesium	g/m ³	1.94	13.1	6.0	-	-
Dissolved Manganese	g/m ³	0.032	0.27	0.0012	-	-
Dissolved Potassium	g/m ³	1.40	5.9	2.5	-	-
Dissolved Sodium	g/m ³	8.7	18.8	34	-	-
Dissolved Zinc	g/m ³	0.079	0.0045	0.0165	-	-
Chloride	g/m ³	8.9	12.4	43	-	-
Total Ammoniacal-N	g/m ³	< 0.010	2.6	< 0.010	-	-
Nitrite-N	g/m ³	< 0.002	< 0.02 #1	< 0.002	-	-
Nitrate-N	g/m ³	0.169	< 0.02	5.6	-	-
Nitrate-N + Nitrite-N	g/m ³	0.169	< 0.02 #1	5.6	-	-
Sulphate	g/m ³	4.4	< 0.5	4.8	-	-
Escherichia coli	MPN / 100mL	< 1	< 1	71	-	-

Analyst's Comments

#1 Severe matrix interferences required that a dilution be performed prior to analysis, resulting in a detection limit higher than that normally achieved for the NOxN /NO2N analysis.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples where insufficient sample is available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-3



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Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
pH	pH meter. APHA 4500-H ⁺ B 23 rd ed. 2017. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-3
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (modified for Alkalinity <20) 23 rd ed. 2017.	1.0 g/m ³ as CaCO ₃	1-3
Free Carbon Dioxide	Calculation: from alkalinity and pH, valid where TDS is not >500 mg/L and alkalinity is almost entirely due to hydroxides, carbonates or bicarbonates. APHA 4500-CO ₂ D 23 rd ed. 2017.	1.0 g/m ³ at 25°C	1-3
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 23 rd ed. 2017.	1.0 g/m ³ as CaCO ₃	1-3
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 23 rd ed. 2017.	0.1 mS/m	1-3
Approx Total Dissolved Salts	Calculation: from Electrical Conductivity.	2 g/m ³	1-3
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23 rd ed. 2017.	-	1-3
Dissolved Boron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.005 g/m ³	1-3
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.05 g/m ³	1-3
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0005 g/m ³	1-3
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-3
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-3
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0005 g/m ³	1-3
Dissolved Potassium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.05 g/m ³	1-3
Dissolved Sodium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-3
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0010 g/m ³	1-3
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23 rd ed. 2017.	0.5 g/m ³	1-3
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH ₄ ⁺ -N + NH ₃ -N). APHA 4500-NH ₃ H (modified) 23 rd ed. 2017.	0.010 g/m ³	1-3
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO ₃ ⁻ I (modified) 23 rd ed. 2017.	0.002 g/m ³	1-3
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO ₂ N. In-House.	0.0010 g/m ³	1-3
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO ₃ ⁻ I (modified) 23 rd ed. 2017.	0.002 g/m ³	1-3
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23 rd ed. 2017.	0.5 g/m ³	1-3
Escherichia coli	MPN count using Colilert (Incubated at 35°C for 24 hours) and 97 wells. APHA 9223 B 23 rd ed. 2017.	1 MPN / 100mL	1-3

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 12-Nov-2021 and 17-Nov-2021. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Martin Cowell - BSc
Client Services Manager - Environmental



Certificate of Analysis

Page 1 of 2

Client:	BTW Company Limited	Lab No:	2960878	SPv1
Contact:	Greg Larkin	Date Received:	20-Apr-2022	
	C/- BTW Company Limited	Date Reported:	28-Apr-2022	
	PO Box 551	Quote No:	110132	
	New Plymouth 4340	Order No:	190694	
		Client Reference:	190694	
		Submitted By:	Campbell Graham	

Sample Type: Aqueous

Sample Name:	GND3112				
	19-Apr-2022				
	12:15 pm				
Lab Number:	2960878.1				
pH	pH Units	6.8	-	-	-
Total Alkalinity	g/m ³ as CaCO ₃	43	-	-	-
Free Carbon Dioxide	g/m ³ at 25°C	12.3	-	-	-
Total Hardness	g/m ³ as CaCO ₃	60	-	-	-
Electrical Conductivity (EC)	mS/m	27.6	-	-	-
Approx Total Dissolved Salts	g/m ³	185	-	-	-
Dissolved Boron	g/m ³	0.019	-	-	-
Dissolved Calcium	g/m ³	12.7	-	-	-
Dissolved Copper	g/m ³	< 0.0005	-	-	-
Dissolved Iron	g/m ³	< 0.02	-	-	-
Dissolved Magnesium	g/m ³	6.7	-	-	-
Dissolved Manganese	g/m ³	0.0008	-	-	-
Dissolved Potassium	g/m ³	2.4	-	-	-
Dissolved Sodium	g/m ³	31	-	-	-
Dissolved Zinc	g/m ³	0.0037	-	-	-
Chloride	g/m ³	40	-	-	-
Total Ammoniacal-N	g/m ³	< 0.010	-	-	-
Nitrite-N	g/m ³	< 0.002	-	-	-
Nitrate-N	g/m ³	4.8	-	-	-
Nitrate-N + Nitrite-N	g/m ³	4.8	-	-	-
Sulphate	g/m ³	4.7	-	-	-
Escherichia coli	MPN / 100mL	< 1 #1	-	-	-

Analyst's Comments

#1 Please interpret this result with caution as the sample was > 10 °C on receipt at the lab. The sample temperature is recommended by the laboratory's reference methods to be less than 10 °C on receipt at the laboratory (but not frozen). However, it is acknowledged that samples that are transported quickly to the laboratory after sampling, may not have been cooled to this temperature.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1



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Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
pH	pH meter. APHA 4500-H ⁺ B 23 rd ed. 2017. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (modified for Alkalinity <20) 23 rd ed. 2017.	1.0 g/m ³ as CaCO ₃	1
Free Carbon Dioxide	Calculation: from alkalinity and pH, valid where TDS is not >500 mg/L and alkalinity is almost entirely due to hydroxides, carbonates or bicarbonates. APHA 4500-CO ₂ D 23 rd ed. 2017.	1.0 g/m ³ at 25°C	1
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 23 rd ed. 2017.	1.0 g/m ³ as CaCO ₃	1
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 23 rd ed. 2017.	0.1 mS/m	1
Approx Total Dissolved Salts	Calculation: from Electrical Conductivity.	2 g/m ³	1
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23 rd ed. 2017.	-	1
Dissolved Boron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.005 g/m ³	1
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.05 g/m ³	1
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0005 g/m ³	1
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0005 g/m ³	1
Dissolved Potassium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.05 g/m ³	1
Dissolved Sodium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0010 g/m ³	1
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23 rd ed. 2017.	0.5 g/m ³	1
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH ₄ ⁺ -N + NH ₃ -N). APHA 4500-NH ₃ H (modified) 23 rd ed. 2017.	0.010 g/m ³	1
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO ₂ ⁻ I (modified) 23 rd ed. 2017.	0.002 g/m ³	1
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO ₂ N. In-House.	0.0010 g/m ³	1
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO ₃ ⁻ I (modified) 23 rd ed. 2017.	0.002 g/m ³	1
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23 rd ed. 2017.	0.5 g/m ³	1
Escherichia coli	MPN count using Colilert (Incubated at 35°C for 24 hours) and 97 wells. APHA 9223 B 23 rd ed. 2017.	1 MPN / 100mL	1

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 20-Apr-2022 and 28-Apr-2022. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Ara Heron BSc (Tech)
Client Services Manager - Environmental



Certificate of Analysis

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Client:	BTW Company Limited	Lab No:	2949630	SPV1
Contact:	Greg Larkin	Date Received:	08-Apr-2022	
	C/- BTW Company Limited	Date Reported:	14-Apr-2022	
	PO Box 551	Quote No:	110132	
	New Plymouth 4340	Order No:		
		Client Reference:	190694	
		Submitted By:	Greg Larkin	

Sample Type: Aqueous

Sample Name:		GND 3113 07-Apr-2022 12:55 pm	GND 3115 07-Apr-2022 2:00 pm			
Lab Number:		2949630.1	2949630.2			
pH	pH Units	6.5	7.2	-	-	-
Total Alkalinity	g/m ³ as CaCO ₃	340	193	-	-	-
Free Carbon Dioxide	g/m ³ at 25°C	220	26	-	-	-
Total Hardness	g/m ³ as CaCO ₃	280	165	-	-	-
Electrical Conductivity (EC)	mS/m	70.0	39.5	-	-	-
Approx Total Dissolved Salts	g/m ³	470	260	-	-	-
Dissolved Boron	g/m ³	0.016	0.043	-	-	-
Dissolved Calcium	g/m ³	54	43	-	-	-
Dissolved Copper	g/m ³	< 0.0005	< 0.0005	-	-	-
Dissolved Iron	g/m ³	36	4.2	-	-	-
Dissolved Magnesium	g/m ³	35	13.7	-	-	-
Dissolved Manganese	g/m ³	1.01	0.25	-	-	-
Dissolved Potassium	g/m ³	7.4	5.7	-	-	-
Dissolved Sodium	g/m ³	23	19.3	-	-	-
Dissolved Zinc	g/m ³	0.0044	< 0.0010	-	-	-
Chloride	g/m ³	16.8	11.8	-	-	-
Total Ammoniacal-N	g/m ³	13.5	2.6	-	-	-
Nitrite-N	g/m ³	< 0.02 #1	< 0.02 #1	-	-	-
Nitrate-N	g/m ³	< 0.02	< 0.02	-	-	-
Nitrate-N + Nitrite-N	g/m ³	< 0.02 #1	< 0.02 #1	-	-	-
Sulphate	g/m ³	1.3	< 0.5	-	-	-
Escherichia coli	MPN / 100mL	< 1	< 1	-	-	-

Analyst's Comments

#1 Severe matrix interferences required that a dilution be performed prior to analysis of this sample, resulting in a detection limit higher than that normally achieved for the NO₂N, NO₃N and NO_xN analysis.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples where insufficient sample is available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-2



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Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
pH	pH meter. APHA 4500-H ⁺ B 23 rd ed. 2017. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-2
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (modified for Alkalinity <20) 23 rd ed. 2017.	1.0 g/m ³ as CaCO ₃	1-2
Free Carbon Dioxide	Calculation: from alkalinity and pH, valid where TDS is not >500 mg/L and alkalinity is almost entirely due to hydroxides, carbonates or bicarbonates. APHA 4500-CO ₂ D 23 rd ed. 2017.	1.0 g/m ³ at 25°C	1-2
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 23 rd ed. 2017.	1.0 g/m ³ as CaCO ₃	1-2
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 23 rd ed. 2017.	0.1 mS/m	1-2
Approx Total Dissolved Salts	Calculation: from Electrical Conductivity.	2 g/m ³	1-2
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23 rd ed. 2017.	-	1-2
Dissolved Boron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.005 g/m ³	1-2
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.05 g/m ³	1-2
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0005 g/m ³	1-2
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-2
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-2
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0005 g/m ³	1-2
Dissolved Potassium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.05 g/m ³	1-2
Dissolved Sodium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-2
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0010 g/m ³	1-2
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23 rd ed. 2017.	0.5 g/m ³	1-2
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH ₄ ⁺ -N + NH ₃ -N). APHA 4500-NH ₃ H (modified) 23 rd ed. 2017.	0.010 g/m ³	1-2
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO ₂ ⁻ I (modified) 23 rd ed. 2017.	0.002 g/m ³	1-2
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO ₂ N. In-House.	0.0010 g/m ³	1-2
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO ₃ ⁻ I (modified) 23 rd ed. 2017.	0.002 g/m ³	1-2
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23 rd ed. 2017.	0.5 g/m ³	1-2
Escherichia coli	MPN count using Colilert (Incubated at 35°C for 24 hours) and 97 wells. APHA 9223 B 23 rd ed. 2017.	1 MPN / 100mL	1-2

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 09-Apr-2022 and 14-Apr-2022. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Kim Harrison MSc
Client Services Manager - Environmental



Certificate of Analysis

Page 1 of 2

Client:	BTW Company Limited	Lab No:	2955164	SPV1
Contact:	Greg Larkin	Date Received:	13-Apr-2022	
	C/- BTW Company Limited	Date Reported:	22-Apr-2022	
	PO Box 551	Quote No:	110132	
	New Plymouth 4340	Order No:		
		Client Reference:	190694	
		Submitted By:	Greg Larkin	

Sample Type: Aqueous

Sample Name:		GND 3111 12-Apr-2022 1:20 pm	GDN 3114 12-Apr-2022 11:10 am	Trip Blank 12-Apr-2022 11:30 am		
Lab Number:		2955164.1	2955164.2	2955164.3		
pH	pH Units	6.9	6.4	-	-	-
Total Alkalinity	g/m ³ as CaCO ₃	52	30	-	-	-
Free Carbon Dioxide	g/m ³ at 25°C	14.5	25	-	-	-
Total Hardness	g/m ³ as CaCO ₃	56	24	-	-	-
Electrical Conductivity (EC)	mS/m	17.8	10.5	-	-	-
Approx Total Dissolved Salts	g/m ³	119	70	-	-	-
Dissolved Boron	g/m ³	0.013	0.022	-	-	-
Dissolved Calcium	g/m ³	11.5	5.4	-	-	-
Dissolved Copper	g/m ³	< 0.0005	< 0.0005	-	-	-
Dissolved Iron	g/m ³	3.5	0.49	-	-	-
Dissolved Magnesium	g/m ³	6.6	2.7	-	-	-
Dissolved Manganese	g/m ³	0.48	0.082	-	-	-
Dissolved Potassium	g/m ³	3.7	1.25	-	-	-
Dissolved Sodium	g/m ³	11.3	9.4	-	-	-
Dissolved Zinc	g/m ³	< 0.0010	0.0044	-	-	-
Chloride	g/m ³	18.5	11.0	-	-	-
Total Ammoniacal-N	g/m ³	1.14	0.015	-	-	-
Nitrite-N	g/m ³	0.003 #1	< 0.002	-	-	-
Nitrate-N	g/m ³	< 0.002	0.111	-	-	-
Nitrate-N + Nitrite-N	g/m ³	< 0.002 #1	0.113	-	-	-
Sulphate	g/m ³	4.1	4.9	-	-	-
Escherichia coli	MPN / 100mL	< 1	< 1	< 1	-	-

Analyst's Comments

#1 It has been noted that the result for Nitrite-N was greater than that for Nitrate-N + Nitrite-N, but within the analytical variation of these methods.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples where insufficient sample is available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-2



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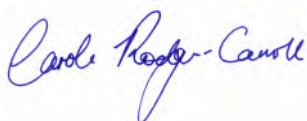
Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
pH	pH meter. APHA 4500-H ⁺ B 23 rd ed. 2017. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-2
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (modified for Alkalinity <20) 23 rd ed. 2017.	1.0 g/m ³ as CaCO ₃	1-2
Free Carbon Dioxide	Calculation: from alkalinity and pH, valid where TDS is not >500 mg/L and alkalinity is almost entirely due to hydroxides, carbonates or bicarbonates. APHA 4500-CO ₂ D 23 rd ed. 2017.	1.0 g/m ³ at 25°C	1-2
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 23 rd ed. 2017.	1.0 g/m ³ as CaCO ₃	1-2
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 23 rd ed. 2017.	0.1 mS/m	1-2
Approx Total Dissolved Salts	Calculation: from Electrical Conductivity.	2 g/m ³	1-2
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23 rd ed. 2017.	-	1-2
Dissolved Boron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.005 g/m ³	1-2
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.05 g/m ³	1-2
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0005 g/m ³	1-2
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-2
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-2
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0005 g/m ³	1-2
Dissolved Potassium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.05 g/m ³	1-2
Dissolved Sodium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-2
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0010 g/m ³	1-2
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23 rd ed. 2017.	0.5 g/m ³	1-2
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH ₄ ⁺ -N + NH ₃ -N). APHA 4500-NH ₃ H (modified) 23 rd ed. 2017.	0.010 g/m ³	1-2
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO ₂ ⁻ I (modified) 23 rd ed. 2017.	0.002 g/m ³	1-2
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO ₂ N. In-House.	0.0010 g/m ³	1-2
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO ₃ ⁻ I (modified) 23 rd ed. 2017.	0.002 g/m ³	1-2
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23 rd ed. 2017.	0.5 g/m ³	1-2
Escherichia coli	MPN count using Colilert (Incubated at 35°C for 24 hours) and 97 wells. APHA 9223 B 23 rd ed. 2017.	1 MPN / 100mL	1-3

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 16-Apr-2022 and 22-Apr-2022. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Carole Rodgers-Carroll BA, NZCS
Client Services Manager - Environmental



Certificate of Analysis

Page 1 of 2

Client:	BTW Company Limited	Lab No:	3095147	SPV1
Contact:	Greg Larkin	Date Received:	13-Oct-2022	
	C/- BTW Company Limited	Date Reported:	19-Oct-2022	
	PO Box 551	Quote No:	110132	
	New Plymouth 4340	Order No:		
		Client Reference:	190694	
		Submitted By:	Grace Sommerville	

Sample Type: Aqueous

Sample Name:		GND3114 12-Oct-2022 3:40 pm	GND2567 12-Oct-2022 1:20 pm	GND3115 12-Oct-2022 11:22 am
Lab Number:		3095147.1	3095147.2	3095147.3
pH	pH Units	6.2	6.9	7.5
Total Alkalinity	g/m ³ as CaCO ₃	16.2	50	190
Free Carbon Dioxide	g/m ³ at 25°C	19.3	12.7	10.8
Total Hardness	g/m ³ as CaCO ₃	15.9	43	152
Electrical Conductivity (EC)	mS/m	7.6	16.9	39.9
Approx Total Dissolved Salts	g/m ³	51	113	270
Dissolved Boron	g/m ³	0.014	0.014	0.039
Dissolved Calcium	g/m ³	3.3	8.9	39
Dissolved Copper	g/m ³	< 0.0005	< 0.0005	< 0.0005
Dissolved Iron	g/m ³	< 0.02	3.5	0.92
Dissolved Magnesium	g/m ³	1.85	5.2	13.2
Dissolved Manganese	g/m ³	0.0065	0.38	0.24
Dissolved Potassium	g/m ³	1.24	3.1	5.6
Dissolved Sodium	g/m ³	7.7	10.6	19.6
Dissolved Zinc	g/m ³	0.0060	0.0013	< 0.0010
Chloride	g/m ³	8.7	18.7	12.3
Total Ammoniacal-N	g/m ³	< 0.010	0.94	2.7
Nitrite-N	g/m ³	< 0.002	0.003	< 0.002
Nitrate-N	g/m ³	0.24	< 0.002	< 0.002
Nitrate-N + Nitrite-N	g/m ³	0.24	< 0.002	< 0.002
Sulphate	g/m ³	3.8	3.4	< 0.5
Escherichia coli	MPN / 100mL	1	< 1	< 1

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-3
pH	pH meter. APHA 4500-H ⁺ B 23 rd ed. 2017. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-3
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (modified for Alkalinity <20) 23 rd ed. 2017.	1.0 g/m ³ as CaCO ₃	1-3
Free Carbon Dioxide	Calculation: from alkalinity and pH, valid where TDS is not >500 mg/L and alkalinity is almost entirely due to hydroxides, carbonates or bicarbonates. APHA 4500-CO ₂ D 23 rd ed. 2017.	1.0 g/m ³ at 25°C	1-3



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Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 23 rd ed. 2017.	1.0 g/m ³ as CaCO ₃	1-3
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 23 rd ed. 2017.	0.1 mS/m	1-3
Approx Total Dissolved Salts	Calculation: from Electrical Conductivity.	2 g/m ³	1-3
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23 rd ed. 2017.	-	1-3
Dissolved Boron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.005 g/m ³	1-3
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.05 g/m ³	1-3
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0005 g/m ³	1-3
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-3
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-3
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0005 g/m ³	1-3
Dissolved Potassium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.05 g/m ³	1-3
Dissolved Sodium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-3
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0010 g/m ³	1-3
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23 rd ed. 2017.	0.5 g/m ³	1-3
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH ₄ -N = NH ₄ ⁺ -N + NH ₃ -N). APHA 4500-NH ₃ H (modified) 23 rd ed. 2017.	0.010 g/m ³	1-3
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO ₃ ⁻ I (modified) 23 rd ed. 2017.	0.002 g/m ³	1-3
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO ₂ N. In-House.	0.0010 g/m ³	1-3
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO ₃ ⁻ I (modified) 23 rd ed. 2017.	0.002 g/m ³	1-3
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23 rd ed. 2017.	0.5 g/m ³	1-3
Escherichia coli	MPN count using Colilert (Incubated at 35°C for 24 hours) and 97 wells. APHA 9223 B 23 rd ed. 2017.	1 MPN / 100mL	1-3

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 14-Oct-2022 and 19-Oct-2022. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Graham Corban MSc Tech (Hons)
Client Services Manager - Environmental



Certificate of Analysis

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Client:	BTW Company Limited	Lab No:	3096169	SPv2
Contact:	Greg Larkin	Date Received:	14-Oct-2022	
	C/- BTW Company Limited	Date Reported:	21-Oct-2022	
	PO Box 551	Quote No:	110132	
	New Plymouth 4340	Order No:		
		Client Reference:	Groundwater testing	
		Submitted By:	Grace Sommerville	

Sample Type: Aqueous

Sample Name:		GND3112 13-Oct-2022 10:05 am	GND3113 13-Oct-2022 11:30 am	GMP-GW 13-Oct-2022 11:30 am
Lab Number:		3096169.2	3096169.3	3096169.4
pH	pH Units	7.0	6.6	-
Total Alkalinity	g/m ³ as CaCO ₃	42	300	-
Free Carbon Dioxide	g/m ³ at 25°C	8.8	164	-
Total Hardness	g/m ³ as CaCO ₃	56	198	-
Electrical Conductivity (EC)	mS/m	27.9	64.8	-
Approx Total Dissolved Salts	g/m ³	187	430	-
Dissolved Boron	g/m ³	0.019	0.024	-
Dissolved Calcium	g/m ³	11.9	39	-
Dissolved Copper	g/m ³	< 0.0005	< 0.0005	-
Dissolved Iron	g/m ³	< 0.02	22	-
Dissolved Magnesium	g/m ³	6.5	25	-
Dissolved Manganese	g/m ³	< 0.0005	1.03	-
Dissolved Potassium	g/m ³	2.3	14.8	-
Dissolved Sodium	g/m ³	31	28	-
Dissolved Zinc	g/m ³	< 0.0010	0.0041	-
Chloride	g/m ³	42	20	-
Total Ammoniacal-N	g/m ³	< 0.010	9.4	-
Nitrite-N	g/m ³	< 0.002	< 0.02 #1	-
Nitrate-N	g/m ³	4.8	< 0.02	-
Nitrate-N + Nitrite-N	g/m ³	4.8	< 0.02 #1	-
Sulphate	g/m ³	4.8	1.0	-
Escherichia coli	MPN / 100mL	< 1	< 1	< 1

Analyst's Comments

#1 Severe matrix interferences required that a dilution be performed prior to analysis, resulting in a detection limit higher than that normally achieved for the NOxN /NO2N analysis.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	2-3
pH	pH meter. APHA 4500-H+ B 23 rd ed. 2017. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	2-3



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Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (modified for Alkalinity <20) 23 rd ed. 2017.	1.0 g/m ³ as CaCO ₃	2-3
Free Carbon Dioxide	Calculation: from alkalinity and pH, valid where TDS is not >500 mg/L and alkalinity is almost entirely due to hydroxides, carbonates or bicarbonates. APHA 4500-CO ₂ D 23 rd ed. 2017.	1.0 g/m ³ at 25°C	2-3
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 23 rd ed. 2017.	1.0 g/m ³ as CaCO ₃	2-3
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 23 rd ed. 2017.	0.1 mS/m	2-3
Approx Total Dissolved Salts	Calculation: from Electrical Conductivity.	2 g/m ³	2-3
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23 rd ed. 2017.	-	2-3
Dissolved Boron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.005 g/m ³	2-3
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.05 g/m ³	2-3
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0005 g/m ³	2-3
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	2-3
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	2-3
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0005 g/m ³	2-3
Dissolved Potassium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.05 g/m ³	2-3
Dissolved Sodium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	2-3
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0010 g/m ³	2-3
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23 rd ed. 2017.	0.5 g/m ³	2-3
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH ₄ -N = NH ₄ ⁺ -N + NH ₃ -N). APHA 4500-NH ₃ H (modified) 23 rd ed. 2017.	0.010 g/m ³	2-3
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO ₃ ⁻ I (modified) 23 rd ed. 2017.	0.002 g/m ³	2-3
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO ₂ N. In-House.	0.0010 g/m ³	2-3
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO ₃ ⁻ I (modified) 23 rd ed. 2017.	0.002 g/m ³	2-3
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23 rd ed. 2017.	0.5 g/m ³	2-3
Escherichia coli	MPN count using Colilert (Incubated at 35°C for 24 hours) and 97 wells. APHA 9223 B 23 rd ed. 2017.	1 MPN / 100mL	2-4

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 15-Oct-2022 and 21-Oct-2022. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Kim Harrison MSc
Client Services Manager - Environmental

Certificate of Analysis

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Client:	BTW Company Limited	Lab No:	3383879	SPV1
Contact:	Greg Larkin	Date Received:	12-Oct-2023	
	C/- BTW Company Limited	Date Reported:	17-Oct-2023	
	PO Box 551	Quote No:	110132	
	New Plymouth 4340	Order No:		
		Client Reference:	Groundwater testing	
		Submitted By:	Greg Larkin	

Sample Type: Aqueous

Sample Name:		GND2567 11-Oct-2023 9:35 am	GND3112 11-Oct-2023 1:35 pm	GND3113 11-Oct-2023 3:15 pm	GND3114 11-Oct-2023 12:10 pm	GND3115 11-Oct-2023 10:55 am
Lab Number:		3383879.1	3383879.2	3383879.3	3383879.4	3383879.5
pH	pH Units	6.8	6.9	6.5	6.1	7.2
Total Alkalinity	g/m ³ as CaCO ₃	56	40	340	15.0	192
Free Carbon Dioxide	g/m ³ at 25°C	16.4	10.2	220	23	22
Total Hardness	g/m ³ as CaCO ₃	44	56	260	16.0	158
Electrical Conductivity (EC)	mS/m	17.9	28.8	70.4	7.4	39.8
Approx Total Dissolved Salts	g/m ³	120	193	470	50	270
Dissolved Boron	g/m ³	0.015	0.020	0.012	0.014	0.041
Dissolved Calcium	g/m ³	10.3	12.2	52	3.3	42
Dissolved Copper	g/m ³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dissolved Iron	g/m ³	2.1	< 0.02	33	< 0.02	1.27
Dissolved Magnesium	g/m ³	4.3	6.2	31	1.91	12.8
Dissolved Manganese	g/m ³	0.37	< 0.0005	1.00	0.0073	0.24
Dissolved Potassium	g/m ³	3.3	2.5	8.0	1.32	5.8
Dissolved Sodium	g/m ³	14.6	32	23	7.5	18.6
Dissolved Zinc	g/m ³	< 0.0010	< 0.0010	0.0026	0.0067	< 0.0010
Chloride	g/m ³	18.7	44	17.0	8.4	12.1
Total Ammoniacal-N	g/m ³	0.56	< 0.010	13.3	< 0.010	2.7
Nitrite-N	g/m ³	< 0.002	< 0.002	< 0.02 #1	< 0.002	< 0.002
Nitrate-N	g/m ³	< 0.002	4.9	< 0.02	0.22	< 0.002
Nitrate-N + Nitrite-N	g/m ³	< 0.002	4.9	< 0.02 #1	0.22	< 0.002
Sulphate	g/m ³	0.9	4.4	0.9	4.0	< 0.5
Escherichia coli	MPN / 100mL	< 1	< 1	< 1	< 1	< 1

Analyst's Comments

#1 Severe matrix interferences required that a dilution be performed prior to analysis of this sample, resulting in a detection limit higher than that normally achieved for the NO₂N, NO₃N and NO_xN analysis.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-5



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Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
pH	pH meter. APHA 4500-H ⁺ B (modified) : Online Edition. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-5
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (modified for Alkalinity <20) : Online Edition.	1.0 g/m ³ as CaCO ₃	1-5
Free Carbon Dioxide	Calculation: from alkalinity and pH, valid where TDS is not >500 mg/L and alkalinity is almost entirely due to hydroxides, carbonates or bicarbonates. APHA 4500-CO ₂ D : Online Edition.	1.0 g/m ³ at 25°C	1-5
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B : Online Edition.	1.0 g/m ³ as CaCO ₃	1-5
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	0.1 mS/m	1-5
Approx Total Dissolved Salts	Calculation: from Electrical Conductivity.	2 g/m ³	1-5
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B : Online Edition.	-	1-5
Dissolved Boron	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.005 g/m ³	1-5
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.05 g/m ³	1-5
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m ³	1-5
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.02 g/m ³	1-5
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.02 g/m ³	1-5
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m ³	1-5
Dissolved Potassium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.05 g/m ³	1-5
Dissolved Sodium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.02 g/m ³	1-5
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0010 g/m ³	1-5
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m ³	1-5
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH ₄ ⁺ -N + NH ₃ -N). APHA 4500-NH ₃ H (modified) : Online Edition.	0.010 g/m ³	1-5
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO ₃ ⁻ I (modified) : Online Edition.	0.002 g/m ³	1-5
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - Nitrite-N. In-House.	0.0010 g/m ³	1-5
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO ₃ ⁻ I (modified) : Online Edition.	0.002 g/m ³	1-5
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m ³	1-5
Escherichia coli	MPN count using Colilert (Incubated at 35°C for 24 hours) and 97 wells. APHA 9223 B : Online Edition.	1 MPN / 100mL	1-5

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 12-Oct-2023 and 17-Oct-2023. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Graham Corban MSc Tech (Hons)
Client Services Manager - Environmental

Appendix IV

Tariki 3D seismic survey groundwater sampling results



Certificate of Analysis

Page 1 of 2

Client:	BTW Company Limited	Lab No:	2796858	SPV1
Contact:	Greg Larkin	Date Received:	11-Dec-2021	
	C/- BTW Company Limited	Date Reported:	17-Dec-2021	
	PO Box 551	Quote No:	110132	
	New Plymouth 4340	Order No:		
		Client Reference:	200160	
		Submitted By:	Greg Larkin	

Sample Type: Aqueous

Sample Name:		GND 3131 10-Dec-2021 2:00 pm	GND 3132 10-Dec-2021 12:20 pm			
Lab Number:		2796858.1	2796858.2			
pH	pH Units	7.4	7.3	-	-	-
Total Alkalinity	g/m ³ as CaCO ₃	124	148	-	-	-
Free Carbon Dioxide	g/m ³ at 25°C	9.3	15.7	-	-	-
Total Hardness	g/m ³ as CaCO ₃	66	61	-	-	-
Electrical Conductivity (EC)	mS/m	22.7	30.6	-	-	-
Approx Total Dissolved Salts	g/m ³	152	210	-	-	-
Dissolved Boron	g/m ³	0.068	0.062	-	-	-
Dissolved Calcium	g/m ³	17.3	16.1	-	-	-
Dissolved Copper	g/m ³	0.0023	0.0013	-	-	-
Dissolved Iron	g/m ³	0.04	0.62	-	-	-
Dissolved Magnesium	g/m ³	5.6	5.0	-	-	-
Dissolved Manganese	g/m ³	0.198	0.48	-	-	-
Dissolved Potassium	g/m ³	2.3	5.1	-	-	-
Dissolved Sodium	g/m ³	25	49	-	-	-
Dissolved Zinc	g/m ³	< 0.0010	0.0085	-	-	-
Chloride	g/m ³	6.4	8.3	-	-	-
Total Ammoniacal-N	g/m ³	0.085	0.49	-	-	-
Nitrite-N	g/m ³	0.007	0.006	-	-	-
Nitrate-N	g/m ³	0.024	0.57	-	-	-
Nitrate-N + Nitrite-N	g/m ³	0.031	0.57	-	-	-
Sulphate	g/m ³	3.0	5.9	-	-	-
Escherichia coli	MPN / 100mL	< 1 #1	< 1 #1	-	-	-

Analyst's Comments

#1 Please interpret this result with caution as the sample was > 10 °C on receipt at the lab. The sample temperature is recommended by the laboratory's reference methods to be less than 10 °C on receipt at the laboratory (but not frozen). However, it is acknowledged that samples that are transported quickly to the laboratory after sampling, may not have been cooled to this temperature.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-2



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Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
pH	pH meter. APHA 4500-H ⁺ B 23 rd ed. 2017. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-2
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (modified for Alkalinity <20) 23 rd ed. 2017.	1.0 g/m ³ as CaCO ₃	1-2
Free Carbon Dioxide	Calculation: from alkalinity and pH, valid where TDS is not >500 mg/L and alkalinity is almost entirely due to hydroxides, carbonates or bicarbonates. APHA 4500-CO ₂ D 23 rd ed. 2017.	1.0 g/m ³ at 25°C	1-2
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 23 rd ed. 2017.	1.0 g/m ³ as CaCO ₃	1-2
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 23 rd ed. 2017.	0.1 mS/m	1-2
Approx Total Dissolved Salts	Calculation: from Electrical Conductivity.	2 g/m ³	1-2
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23 rd ed. 2017.	-	1-2
Dissolved Boron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.005 g/m ³	1-2
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.05 g/m ³	1-2
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0005 g/m ³	1-2
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-2
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-2
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0005 g/m ³	1-2
Dissolved Potassium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.05 g/m ³	1-2
Dissolved Sodium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-2
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0010 g/m ³	1-2
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23 rd ed. 2017.	0.5 g/m ³	1-2
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH ₄ ⁺ -N + NH ₃ -N). APHA 4500-NH ₃ H (modified) 23 rd ed. 2017.	0.010 g/m ³	1-2
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO ₂ ⁻ I (modified) 23 rd ed. 2017.	0.002 g/m ³	1-2
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO ₂ N. In-House.	0.0010 g/m ³	1-2
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO ₃ ⁻ I (modified) 23 rd ed. 2017.	0.002 g/m ³	1-2
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23 rd ed. 2017.	0.5 g/m ³	1-2
Escherichia coli	MPN count using Colilert 18 (Incubated at 35°C for 18 hours) and 97 wells. APHA 9223 B 23 rd ed. 2017.	1 MPN / 100mL	1-2

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 12-Dec-2021 and 17-Dec-2021. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Ara Heron BSc (Tech)
Client Services Manager - Environmental



Certificate of Analysis

Page 1 of 2

Client:	BTW Company Limited	Lab No:	2640365	SPv1
Contact:	Greg Larkin	Date Received:	22-Jun-2021	
	C/- BTW Company Limited	Date Reported:	29-Jun-2021	
	PO Box 551	Quote No:	110132	
	New Plymouth 4340	Order No:		
		Client Reference:	Groundwater testing	
		Submitted By:	Greg Larkin	

Sample Type: Aqueous

Sample Name:		GND3131 21-Jun-2021 1:30 pm	GND3131 21-Jun-2021 1:15 pm	GND3132 21-Jun-2021 12:00 pm	GND3131 21-Jun-2021 12:30 pm	
Lab Number:		2640365.1	2640365.2	2640365.3	2640365.4	
pH	pH Units	7.7	7.6	7.3	-	-
Total Alkalinity	g/m ³ as CaCO ₃	159	-	134	-	-
Free Carbon Dioxide	g/m ³ at 25°C	5.9	-	12.1	-	-
Total Hardness	g/m ³ as CaCO ₃	75	-	62	-	-
Electrical Conductivity (EC)	mS/m	25.6	24.1	33.4	-	-
Approx Total Dissolved Salts	g/m ³	171	-	220	-	-
Dissolved Boron	g/m ³	0.067	-	0.065	-	-
Dissolved Calcium	g/m ³	20	-	15.4	-	-
Dissolved Copper	g/m ³	0.0007	-	0.0014	-	-
Dissolved Iron	g/m ³	< 0.02	-	< 0.02	-	-
Dissolved Magnesium	g/m ³	6.0	-	5.7	-	-
Dissolved Manganese	g/m ³	0.33	-	0.46	-	-
Dissolved Potassium	g/m ³	2.4	-	7.1	-	-
Dissolved Sodium	g/m ³	27	-	48	-	-
Dissolved Zinc	g/m ³	< 0.0010	-	0.0010	-	-
Chloride	g/m ³	6.3	6.2	10.6	-	-
Total Ammoniacal-N	g/m ³	0.086	-	0.57	-	-
Nitrite-N	g/m ³	0.003	-	0.007	-	-
Nitrate-N	g/m ³	0.013	-	0.012	-	-
Nitrate-N + Nitrite-N	g/m ³	0.016	-	0.019	-	-
Sulphate	g/m ³	5.8	-	23	-	-
Escherichia coli	MPN / 100mL	2	-	10	< 1 #1	-

Analyst's Comments

#1 Please interpret this microbiological result with caution as the sample was > 24 hours old at the time of testing in the laboratory. The sample was receipted by the laboratory within 24 hrs of sample collection, but due to processing delays it was not processed within the required time frame. An investigation has been instigated.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-3



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Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
pH	pH meter. APHA 4500-H ⁺ B 23 rd ed. 2017. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-3
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (modified for Alkalinity <20) 23 rd ed. 2017.	1.0 g/m ³ as CaCO ₃	1, 3
Free Carbon Dioxide	Calculation: from alkalinity and pH, valid where TDS is not >500 mg/L and alkalinity is almost entirely due to hydroxides, carbonates or bicarbonates. APHA 4500-CO ₂ D 23 rd ed. 2017.	1.0 g/m ³ at 25°C	1, 3
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 23 rd ed. 2017.	1.0 g/m ³ as CaCO ₃	1, 3
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 23 rd ed. 2017.	0.1 mS/m	1-3
Approx Total Dissolved Salts	Calculation: from Electrical Conductivity.	2 g/m ³	1, 3
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23 rd ed. 2017.	-	1, 3
Dissolved Boron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.005 g/m ³	1, 3
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.05 g/m ³	1, 3
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0005 g/m ³	1, 3
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1, 3
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1, 3
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0005 g/m ³	1, 3
Dissolved Potassium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.05 g/m ³	1, 3
Dissolved Sodium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1, 3
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0010 g/m ³	1, 3
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23 rd ed. 2017.	0.5 g/m ³	1-3
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH ₄ ⁺ -N + NH ₃ -N). APHA 4500-NH ₃ H (modified) 23 rd ed. 2017.	0.010 g/m ³	1, 3
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO ₂ ⁻ I (modified) 23 rd ed. 2017.	0.002 g/m ³	1, 3
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO ₂ N. In-House.	0.0010 g/m ³	1, 3
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO ₃ ⁻ I (modified) 23 rd ed. 2017.	0.002 g/m ³	1, 3
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23 rd ed. 2017.	0.5 g/m ³	1, 3
Escherichia coli	MPN count using Colilert 18 (Incubated at 35°C for 18 hours) and 97 wells. APHA 9223 B 23 rd ed. 2017.	1 MPN / 100mL	4
Escherichia coli	MPN count using Colilert (Incubated at 35°C for 24 hours) and 97 wells. APHA 9223 B 23 rd ed. 2017.	1 MPN / 100mL	1, 3

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 22-Jun-2021 and 29-Jun-2021. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Graham Corban MSc Tech (Hons)
Client Services Manager - Environmental



Certificate of Analysis

Page 1 of 2

Client:	BTW Company Limited	Lab No:	2642345	SPV1
Contact:	Greg Larkin	Date Received:	24-Jun-2021	
	C/- BTW Company Limited	Date Reported:	29-Jun-2021	
	PO Box 551	Quote No:	110132	
	New Plymouth 4340	Order No:	200160	
		Client Reference:	Tariki Pre-det	
		Submitted By:	Angela Smith	

Sample Type: Aqueous

Sample Name:		GND 3129 23-Jun-2021 11:30 am	GND 3130 23-Jun-2021 11:40 am			
Lab Number:		2642345.1	2642345.2			
pH	pH Units	6.6	6.4	-	-	-
Total Alkalinity	g/m ³ as CaCO ₃	70	73	-	-	-
Free Carbon Dioxide	g/m ³ at 25°C	38	52	-	-	-
Total Hardness	g/m ³ as CaCO ₃	45	42	-	-	-
Electrical Conductivity (EC)	mS/m	18.0	15.0	-	-	-
Approx Total Dissolved Salts	g/m ³	120	100	-	-	-
Dissolved Boron	g/m ³	0.019	0.010	-	-	-
Dissolved Calcium	g/m ³	11.0	9.9	-	-	-
Dissolved Copper	g/m ³	< 0.0005	< 0.0005	-	-	-
Dissolved Iron	g/m ³	6.8	0.47	-	-	-
Dissolved Magnesium	g/m ³	4.4	4.1	-	-	-
Dissolved Manganese	g/m ³	0.33	0.095	-	-	-
Dissolved Potassium	g/m ³	4.8	1.62	-	-	-
Dissolved Sodium	g/m ³	12.5	14.5	-	-	-
Dissolved Zinc	g/m ³	0.024	0.0121	-	-	-
Chloride	g/m ³	11.4	6.7	-	-	-
Total Ammoniacal-N	g/m ³	0.49	0.063	-	-	-
Nitrite-N	g/m ³	0.003	0.003	-	-	-
Nitrate-N	g/m ³	0.014	0.107	-	-	-
Nitrate-N + Nitrite-N	g/m ³	0.017	0.110	-	-	-
Sulphate	g/m ³	3.6	2.2	-	-	-
Escherichia coli	MPN / 100mL	< 1	1	-	-	-

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-2
pH	pH meter. APHA 4500-H ⁺ B 23 rd ed. 2017. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-2
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (modified for Alkalinity <20) 23 rd ed. 2017.	1.0 g/m ³ as CaCO ₃	1-2



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Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Free Carbon Dioxide	Calculation: from alkalinity and pH, valid where TDS is not >500 mg/L and alkalinity is almost entirely due to hydroxides, carbonates or bicarbonates. APHA 4500-CO ₂ D 23 rd ed. 2017.	1.0 g/m ³ at 25°C	1-2
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 23 rd ed. 2017.	1.0 g/m ³ as CaCO ₃	1-2
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 23 rd ed. 2017.	0.1 mS/m	1-2
Approx Total Dissolved Salts	Calculation: from Electrical Conductivity.	2 g/m ³	1-2
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23 rd ed. 2017.	-	1-2
Dissolved Boron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.005 g/m ³	1-2
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.05 g/m ³	1-2
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0005 g/m ³	1-2
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-2
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-2
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0005 g/m ³	1-2
Dissolved Potassium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.05 g/m ³	1-2
Dissolved Sodium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-2
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0010 g/m ³	1-2
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23 rd ed. 2017.	0.5 g/m ³	1-2
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH ₄ -N = NH ₄ ⁺ -N + NH ₃ -N). APHA 4500-NH ₃ H (modified) 23 rd ed. 2017.	0.010 g/m ³	1-2
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO ₃ I (modified) 23 rd ed. 2017.	0.002 g/m ³	1-2
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO ₂ N. In-House.	0.0010 g/m ³	1-2
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO ₃ I (modified) 23 rd ed. 2017.	0.002 g/m ³	1-2
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23 rd ed. 2017.	0.5 g/m ³	1-2
Escherichia coli	MPN count using Colilert (Incubated at 35°C for 24 hours) and 97 wells. APHA 9223 B 23 rd ed. 2017.	1 MPN / 100mL	1-2

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 24-Jun-2021 and 28-Jun-2021. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Graham Corban MSc Tech (Hons)
Client Services Manager - Environmental



Certificate of Analysis

Page 1 of 2

Client:	BTW Company Limited	Lab No:	2656982	SPV1
Contact:	Greg Larkin	Date Received:	15-Jul-2021	
	C/- BTW Company Limited	Date Reported:	20-Jul-2021	
	PO Box 551	Quote No:	110132	
	New Plymouth 4340	Order No:		
		Client Reference:	Tariki 3D Post-Det	
		Submitted By:	Greg Larkin	

Sample Type: Aqueous

Sample Name:		GND3129 14-Jul-2021 11:40 am	GND3130 14-Jul-2021 2:10 pm	GND3131 14-Jul-2021 12:40 pm	GND3132 14-Jul-2021 10:30 am	
Lab Number:		2656982.1	2656982.2	2656982.3	2656982.4	
pH	pH Units	6.7	6.8	7.3	7.8	-
Total Alkalinity	g/m ³ as CaCO ₃	73	66	115	199	-
Free Carbon Dioxide	g/m ³ at 25°C	31	19.6	12.1	5.9	-
Total Hardness	g/m ³ as CaCO ₃	50	39	61	57	-
Electrical Conductivity (EC)	mS/m	18.2	14.0	21.1	43.3	-
Approx Total Dissolved Salts	g/m ³	122	94	142	290	-
Dissolved Boron	g/m ³	0.017	0.011	0.042	0.076	-
Dissolved Calcium	g/m ³	12.6	9.9	15.5	15.0	-
Dissolved Copper	g/m ³	< 0.0005	0.0006	< 0.0005	0.0017	-
Dissolved Iron	g/m ³	3.9	0.16	< 0.02	0.86	-
Dissolved Magnesium	g/m ³	4.5	3.5	5.5	4.7	-
Dissolved Manganese	g/m ³	0.36	0.110	0.32	0.57	-
Dissolved Potassium	g/m ³	4.4	1.50	2.1	7.2	-
Dissolved Sodium	g/m ³	12.8	11.9	16.7	61	-
Dissolved Zinc	g/m ³	0.0162	0.0043	0.0011	0.0158	-
Chloride	g/m ³	10.4	6.5	6.1	10.1	-
Total Ammoniacal-N	g/m ³	0.61	0.064	0.153	0.66	-
Nitrite-N	g/m ³	0.002	0.003	< 0.002	0.011	-
Nitrate-N	g/m ³	0.004	0.090	0.002	0.027	-
Nitrate-N + Nitrite-N	g/m ³	0.006	0.093	0.003	0.038	-
Sulphate	g/m ³	2.1	2.1	3.1	13.2	-
Escherichia coli	MPN / 100mL	< 10	< 10	< 10	< 10	-

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-4
pH	pH meter. APHA 4500-H ⁺ B 23 rd ed. 2017. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-4
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (modified for Alkalinity <20) 23 rd ed. 2017.	1.0 g/m ³ as CaCO ₃	1-4



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Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Free Carbon Dioxide	Calculation: from alkalinity and pH, valid where TDS is not >500 mg/L and alkalinity is almost entirely due to hydroxides, carbonates or bicarbonates. APHA 4500-CO ₂ D 23 rd ed. 2017.	1.0 g/m ³ at 25°C	1-4
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 23 rd ed. 2017.	1.0 g/m ³ as CaCO ₃	1-4
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 23 rd ed. 2017.	0.1 mS/m	1-4
Approx Total Dissolved Salts	Calculation: from Electrical Conductivity.	2 g/m ³	1-4
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23 rd ed. 2017.	-	1-4
Dissolved Boron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.005 g/m ³	1-4
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.05 g/m ³	1-4
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0005 g/m ³	1-4
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-4
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-4
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0005 g/m ³	1-4
Dissolved Potassium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.05 g/m ³	1-4
Dissolved Sodium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-4
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0010 g/m ³	1-4
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23 rd ed. 2017.	0.5 g/m ³	1-4
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH ₄ -N = NH ₄ ⁺ -N + NH ₃ -N). APHA 4500-NH ₃ H (modified) 23 rd ed. 2017.	0.010 g/m ³	1-4
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO ₃ I (modified) 23 rd ed. 2017.	0.002 g/m ³	1-4
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO ₂ N. In-House.	0.0010 g/m ³	1-4
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO ₃ I (modified) 23 rd ed. 2017.	0.002 g/m ³	1-4
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23 rd ed. 2017.	0.5 g/m ³	1-4
Escherichia coli	MPN count using Colilert (Incubated at 35°C for 24 hours) and 97 wells. APHA 9223 B 23 rd ed. 2017.	1 MPN / 100mL	1-4

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 16-Jul-2021 and 20-Jul-2021. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Graham Corban MSc Tech (Hons)
Client Services Manager - Environmental



Certificate of Analysis

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Client:	BTW Company Limited	Lab No:	2825708	SPV1
Contact:	Greg Larkin	Date Received:	13-Jan-2022	
	C/- BTW Company Limited	Date Reported:	20-Jan-2022	
	PO Box 551	Quote No:	110132	
	New Plymouth 4340	Order No:		
		Client Reference:	Groundwater testing/ 200160	
		Submitted By:	Greg Larkin	

Sample Type: Aqueous

Sample Name:	GND 3129				
	12-Jan-2022				
	11:00 am				
Lab Number:	2825708.1				
pH	pH Units	6.3	-	-	-
Total Alkalinity	g/m ³ as CaCO ₃	82	-	-	-
Free Carbon Dioxide	g/m ³ at 25°C	74	-	-	-
Total Hardness	g/m ³ as CaCO ₃	49	-	-	-
Electrical Conductivity (EC)	mS/m	15.5	-	-	-
Approx Total Dissolved Salts	g/m ³	104	-	-	-
Dissolved Boron	g/m ³	0.016	-	-	-
Dissolved Calcium	g/m ³	11.6	-	-	-
Dissolved Copper	g/m ³	0.0008	-	-	-
Dissolved Iron	g/m ³	0.42	-	-	-
Dissolved Magnesium	g/m ³	4.8	-	-	-
Dissolved Manganese	g/m ³	0.24	-	-	-
Dissolved Potassium	g/m ³	4.5	-	-	-
Dissolved Sodium	g/m ³	10.4	-	-	-
Dissolved Zinc	g/m ³	0.0041	-	-	-
Chloride	g/m ³	10.6	-	-	-
Total Ammoniacal-N	g/m ³	0.41	-	-	-
Nitrite-N	g/m ³	< 0.002	-	-	-
Nitrate-N	g/m ³	< 0.002	-	-	-
Nitrate-N + Nitrite-N	g/m ³	< 0.002	-	-	-
Sulphate	g/m ³	2.7	-	-	-
Escherichia coli	MPN / 100mL	11	-	-	-

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1
pH	pH meter. APHA 4500-H ⁺ B 23 rd ed. 2017. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (modified for Alkalinity <20) 23 rd ed. 2017.	1.0 g/m ³ as CaCO ₃	1



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Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Free Carbon Dioxide	Calculation: from alkalinity and pH, valid where TDS is not >500 mg/L and alkalinity is almost entirely due to hydroxides, carbonates or bicarbonates. APHA 4500-CO ₂ D 23 rd ed. 2017.	1.0 g/m ³ at 25°C	1
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 23 rd ed. 2017.	1.0 g/m ³ as CaCO ₃	1
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 23 rd ed. 2017.	0.1 mS/m	1
Approx Total Dissolved Salts	Calculation: from Electrical Conductivity.	2 g/m ³	1
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23 rd ed. 2017.	-	1
Dissolved Boron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.005 g/m ³	1
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.05 g/m ³	1
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0005 g/m ³	1
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0005 g/m ³	1
Dissolved Potassium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.05 g/m ³	1
Dissolved Sodium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0010 g/m ³	1
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23 rd ed. 2017.	0.5 g/m ³	1
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH ₄ -N = NH ₄ ⁺ -N + NH ₃ -N). APHA 4500-NH ₃ H (modified) 23 rd ed. 2017.	0.010 g/m ³	1
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO ₃ ⁻ I (modified) 23 rd ed. 2017.	0.002 g/m ³	1
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO ₂ N. In-House.	0.0010 g/m ³	1
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO ₃ ⁻ I (modified) 23 rd ed. 2017.	0.002 g/m ³	1
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23 rd ed. 2017.	0.5 g/m ³	1
Escherichia coli	MPN count using Colilert (Incubated at 35°C for 24 hours) and 97 wells. APHA 9223 B 23 rd ed. 2017.	1 MPN / 100mL	1

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 14-Jan-2022 and 20-Jan-2022. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Ara Heron BSc (Tech)
Client Services Manager - Environmental



Certificate of Analysis

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Client:	BTW Company Limited	Lab No:	2836242	SPV1
Contact:	Greg Larkin	Date Received:	22-Jan-2022	
	C/- BTW Company Limited	Date Reported:	23-Jan-2022	
	PO Box 551	Quote No:	71869	
	New Plymouth 4340	Order No:		
		Client Reference:	200160	
		Submitted By:	Greg Larkin	

Sample Type: Aqueous

Sample Name:	GND 3129				
	21-Jan-2022				
	12:00 pm				
Lab Number:	2836242.1				
Escherichia coli	MPN / 100mL	3	-	-	-

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Escherichia coli	MPN count using Colilert (Incubated at 35°C for 24 hours) and 97 wells. APHA 9223 B 23 rd ed. 2017.	1 MPN / 100mL	1

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed on 23-Jan-2022. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Priya Babu DipTech (Science)
Laboratory Technician - Microbiology



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Client:	BTW Company Limited	Lab No:	3017886	SPV1
Contact:	Greg Larkin	Date Received:	21-Jun-2022	
	C/- BTW Company Limited	Date Reported:	27-Jun-2022	
	PO Box 551	Quote No:	110132	
	New Plymouth 4340	Order No:		
		Client Reference:	200160	
		Submitted By:	Greg Larkin	

Sample Type: Aqueous

Sample Name:		GND3130 20-Jun-2022 1:00 pm	GND3132 20-Jun-2022 10:45 am			
Lab Number:		3017886.1	3017886.2			
pH	pH Units	6.9	7.4	-	-	-
Total Alkalinity	g/m ³ as CaCO ₃	58	146	-	-	-
Free Carbon Dioxide	g/m ³ at 25°C	14.4	10.9	-	-	-
Total Hardness	g/m ³ as CaCO ₃	45	73	-	-	-
Electrical Conductivity (EC)	mS/m	12.9	29.9	-	-	-
Approx Total Dissolved Salts	g/m ³	86	200	-	-	-
Dissolved Boron	g/m ³	0.013	0.068	-	-	-
Dissolved Calcium	g/m ³	10.6	18.2	-	-	-
Dissolved Copper	g/m ³	< 0.0005	0.0014	-	-	-
Dissolved Iron	g/m ³	0.24	0.10	-	-	-
Dissolved Magnesium	g/m ³	4.5	6.6	-	-	-
Dissolved Manganese	g/m ³	0.064	0.44	-	-	-
Dissolved Potassium	g/m ³	1.35	5.3	-	-	-
Dissolved Sodium	g/m ³	11.6	49	-	-	-
Dissolved Zinc	g/m ³	0.0024	0.0019	-	-	-
Chloride	g/m ³	6.3	8.1	-	-	-
Total Ammoniacal-N	g/m ³	< 0.010	0.43	-	-	-
Nitrite-N	g/m ³	< 0.002	< 0.002	-	-	-
Nitrate-N	g/m ³	0.076	0.082	-	-	-
Nitrate-N + Nitrite-N	g/m ³	0.077	0.083	-	-	-
Sulphate	g/m ³	2.1	5.0	-	-	-
Escherichia coli	MPN / 100mL	< 1	< 1	-	-	-

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-2
pH	pH meter. APHA 4500-H ⁺ B 23 rd ed. 2017. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-2
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (modified for Alkalinity <20) 23 rd ed. 2017.	1.0 g/m ³ as CaCO ₃	1-2



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Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Free Carbon Dioxide	Calculation: from alkalinity and pH, valid where TDS is not >500 mg/L and alkalinity is almost entirely due to hydroxides, carbonates or bicarbonates. APHA 4500-CO ₂ D 23 rd ed. 2017.	1.0 g/m ³ at 25°C	1-2
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 23 rd ed. 2017.	1.0 g/m ³ as CaCO ₃	1-2
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 23 rd ed. 2017.	0.1 mS/m	1-2
Approx Total Dissolved Salts	Calculation: from Electrical Conductivity.	2 g/m ³	1-2
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23 rd ed. 2017.	-	1-2
Dissolved Boron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.005 g/m ³	1-2
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.05 g/m ³	1-2
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0005 g/m ³	1-2
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-2
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-2
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0005 g/m ³	1-2
Dissolved Potassium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.05 g/m ³	1-2
Dissolved Sodium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-2
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0010 g/m ³	1-2
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23 rd ed. 2017.	0.5 g/m ³	1-2
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH ₄ -N = NH ₄ ⁺ -N + NH ₃ -N). APHA 4500-NH ₃ H (modified) 23 rd ed. 2017.	0.010 g/m ³	1-2
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO ₃ I (modified) 23 rd ed. 2017.	0.002 g/m ³	1-2
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO ₂ N. In-House.	0.0010 g/m ³	1-2
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO ₃ I (modified) 23 rd ed. 2017.	0.002 g/m ³	1-2
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23 rd ed. 2017.	0.5 g/m ³	1-2
Escherichia coli	MPN count using Colilert (Incubated at 35°C for 24 hours) and 97 wells. APHA 9223 B 23 rd ed. 2017.	1 MPN / 100mL	1-2

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 22-Jun-2022 and 27-Jun-2022. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Martin Cowell - BSc
Client Services Manager - Environmental



Certificate of Analysis

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Client:	BTW Company Limited	Lab No:	3020826	SPv2
Contact:	Greg Larkin	Date Received:	25-Jun-2022	
	C/- BTW Company Limited	Date Reported:	01-Jul-2022	
	PO Box 551	Quote No:	110132	
	New Plymouth 4340	Order No:		
		Client Reference:	200160	
		Submitted By:	Campbell Graham	

Sample Type: Aqueous

Sample Name:		GND3129 23-Jun-2022 12:10 pm	GND3131 23-Jun-2022 2:40 pm	D1 23-Jun-2022 2:50 pm		
Lab Number:		3020826.1	3020826.2	3020826.3		
pH	pH Units	6.3	7.3	7.3	-	-
Total Alkalinity	g/m ³ as CaCO ₃	47	115	114	-	-
Free Carbon Dioxide	g/m ³ at 25°C	43	11.3	11.7	-	-
Total Hardness	g/m ³ as CaCO ₃	35	72	73	-	-
Electrical Conductivity (EC)	mS/m	12.4	19.0	19.1	-	-
Approx Total Dissolved Salts	g/m ³	83	127	128	-	-
Dissolved Boron	g/m ³	0.018	0.027	0.027	-	-
Dissolved Calcium	g/m ³	9.5	16.9	17.1	-	-
Dissolved Copper	g/m ³	0.0018	0.0017	0.0019	-	-
Dissolved Iron	g/m ³	0.10	0.07	0.11	-	-
Dissolved Magnesium	g/m ³	2.9	7.3	7.3	-	-
Dissolved Manganese	g/m ³	0.046	0.104	0.105	-	-
Dissolved Potassium	g/m ³	5.2	2.0	2.0	-	-
Dissolved Sodium	g/m ³	7.4	14.8	14.8	-	-
Dissolved Zinc	g/m ³	0.0030	< 0.0010	< 0.0010	-	-
Chloride	g/m ³	9.6	6.1	6.5	-	-
Total Ammoniacal-N	g/m ³	0.056	0.168	0.152	-	-
Nitrite-N	g/m ³	< 0.002	< 0.002	< 0.002	-	-
Nitrate-N	g/m ³	0.37	0.002	< 0.002	-	-
Nitrate-N + Nitrite-N	g/m ³	0.37	0.002	0.003	-	-
Sulphate	g/m ³	8.7	1.3	1.0	-	-
Escherichia coli	MPN / 100mL	488 #1	< 1 #1	-	-	-

Analyst's Comments

#1 Please interpret this microbiological result with caution as the sample was >24 hours old on receipt at the lab. The sample is required to reach the laboratory with sufficient time to allow testing to commence within 24 hours of sampling.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples where insufficient sample is available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-3



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Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
pH	pH meter. APHA 4500-H ⁺ B 23 rd ed. 2017. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-3
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (modified for Alkalinity <20) 23 rd ed. 2017.	1.0 g/m ³ as CaCO ₃	1-3
Free Carbon Dioxide	Calculation: from alkalinity and pH, valid where TDS is not >500 mg/L and alkalinity is almost entirely due to hydroxides, carbonates or bicarbonates. APHA 4500-CO ₂ D 23 rd ed. 2017.	1.0 g/m ³ at 25°C	1-3
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 23 rd ed. 2017.	1.0 g/m ³ as CaCO ₃	1-3
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 23 rd ed. 2017.	0.1 mS/m	1-3
Approx Total Dissolved Salts	Calculation: from Electrical Conductivity.	2 g/m ³	1-3
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23 rd ed. 2017.	-	1-3
Dissolved Boron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.005 g/m ³	1-3
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.05 g/m ³	1-3
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0005 g/m ³	1-3
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-3
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-3
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0005 g/m ³	1-3
Dissolved Potassium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.05 g/m ³	1-3
Dissolved Sodium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.02 g/m ³	1-3
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 23 rd ed. 2017.	0.0010 g/m ³	1-3
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23 rd ed. 2017.	0.5 g/m ³	1-3
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH ₄ ⁺ -N + NH ₃ -N). APHA 4500-NH ₃ H (modified) 23 rd ed. 2017.	0.010 g/m ³	1-3
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO ₂ ⁻ I (modified) 23 rd ed. 2017.	0.002 g/m ³	1-3
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO ₂ N. In-House.	0.0010 g/m ³	1-3
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO ₃ ⁻ I (modified) 23 rd ed. 2017.	0.002 g/m ³	1-3
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23 rd ed. 2017.	0.5 g/m ³	1-3
Escherichia coli	MPN count using Colilert (Incubated at 35°C for 24 hours) and 97 wells. APHA 9223 B 23 rd ed. 2017.	1 MPN / 100mL	1-2

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 27-Jun-2022 and 01-Jul-2022. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Graham Corban MSc Tech (Hons)
Client Services Manager - Environmental

Certificate of Analysis

Page 1 of 2

Client:	BTW Company Limited	Lab No:	3433484	SPV1
Contact:	Greg Larkin	Date Received:	20-Dec-2023	
	C/- BTW Company Limited	Date Reported:	28-Dec-2023	
	PO Box 551	Quote No:	110132	
	New Plymouth 4340	Order No:		
		Client Reference:	Groundwater testing	
		Submitted By:	Greg Larkin	

Sample Type: Aqueous

Sample Name:		GND3129 19-Dec-2023 10:30 am	GND3130 19-Dec-2023 12:35 pm	GND3131 19-Dec-2023 11:30 am	GND3132 19-Dec-2023 9:15 am	GND1007 19-Dec-2023 12:15 pm
Lab Number:		3433484.1	3433484.2	3433484.3	3433484.4	3433484.5
pH	pH Units	6.9	7.5	8.0	6.9	-
Total Alkalinity	g/m ³ as CaCO ₃	34	59	100	38	-
Free Carbon Dioxide	g/m ³ at 25°C	8.1	3.7	1.9	8.7	-
Total Hardness	g/m ³ as CaCO ₃	37	46	90	40	-
Electrical Conductivity (EC)	mS/m	11.5	13.2	20.9	13.0	-
Approx Total Dissolved Salts	g/m ³	77	89	140	87	-
Dissolved Boron	g/m ³	0.019	0.011	0.028	0.017	-
Dissolved Calcium	g/m ³	10.0	11.0	22	10.1	-
Dissolved Copper	g/m ³	0.0017	< 0.0005	< 0.0005	< 0.0005	-
Dissolved Iron	g/m ³	0.09	0.21	0.36	< 0.02	-
Dissolved Magnesium	g/m ³	3.0	4.4	8.4	3.6	-
Dissolved Manganese	g/m ³	0.092	0.063	0.160	0.0005	-
Dissolved Potassium	g/m ³	4.6	1.35	2.2	1.76	-
Dissolved Sodium	g/m ³	6.4	12.3	14.0	11.3	-
Dissolved Zinc	g/m ³	0.0079	< 0.0010	0.0013	< 0.0010	-
Chloride	g/m ³	8.2	5.7	6.5	7.4	-
Total Ammoniacal-N	g/m ³	0.053	0.011	0.102	< 0.010	-
Nitrite-N	g/m ³	< 0.002	0.004	0.003	< 0.002	-
Nitrate-N	g/m ³	0.005	0.026	0.154	1.75	-
Nitrate-N + Nitrite-N	g/m ³	0.006	0.030	0.157	1.75	-
Sulphate	g/m ³	6.7	2.6	1.7	5.6	-
Escherichia coli	MPN / 100mL	41	< 1	< 1	< 1	< 1

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-4
pH	pH meter. APHA 4500-H+ B (modified) : Online Edition. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-4
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (modified for Alkalinity <20) : Online Edition.	1.0 g/m ³ as CaCO ₃	1-4



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Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Free Carbon Dioxide	Calculation: from alkalinity and pH, valid where TDS is not >500 mg/L and alkalinity is almost entirely due to hydroxides, carbonates or bicarbonates. APHA 4500-CO ₂ D : Online Edition.	1.0 g/m ³ at 25°C	1-4
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B : Online Edition.	1.0 g/m ³ as CaCO ₃	1-4
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	0.1 mS/m	1-4
Approx Total Dissolved Salts	Calculation: from Electrical Conductivity.	2 g/m ³	1-4
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B : Online Edition.	-	1-4
Dissolved Boron	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.005 g/m ³	1-4
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.05 g/m ³	1-4
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m ³	1-4
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.02 g/m ³	1-4
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.02 g/m ³	1-4
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m ³	1-4
Dissolved Potassium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.05 g/m ³	1-4
Dissolved Sodium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.02 g/m ³	1-4
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0010 g/m ³	1-4
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m ³	1-4
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH ₄ -N = NH ₄ ⁺ -N + NH ₃ -N). APHA 4500-NH ₃ H (modified) : Online Edition.	0.010 g/m ³	1-4
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO ₃ ⁻ I (modified) : Online Edition.	0.002 g/m ³	1-4
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - Nitrite-N. In-House.	0.0010 g/m ³	1-4
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO ₃ ⁻ I (modified) : Online Edition.	0.002 g/m ³	1-4
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m ³	1-4
Escherichia coli	MPN count using Colilert (Incubated at 35°C for 24 hours) and 97 wells. APHA 9223 B : Online Edition.	1 MPN / 100mL	1-5

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 20-Dec-2023 and 28-Dec-2023. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Kim Harrison MSc
Client Services Manager - Environmental