Greymouth Petroleum Turangi Ltd Turangi-A Hydraulic Fracturing

Monitoring Programme Annual Report 2022/23

Technical Report 2024-64

Taranaki Regional Council

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Annual Report
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Executive summary

Greymouth Petroleum Turangi Ltd (the Company) operates the Turangi-A hydrocarbon exploration site located on Turangi Road, Motunui. This site is located in the Parahaki Catchment. This report outlines and discusses the results of the monitoring programme implemented by the Council in relation to hydraulic fracturing activities conducted by the Company at the wellsite over the period 9 June 2022 to 12 April 2023. The report also details the results of the monitoring undertaken and assesses the environmental effects of the Company's activities.

The programme of hydraulic fracturing undertaken by the Company at the Turangi-A wellsite included the hydraulic fracturing of two wells. The wells targeted for stimulation were Turangi-15 and Turangi-2 wells.

During the monitoring period, the Company demonstrated an overall high level of environmental and a high level of administrative performance.

The programme of monitoring implemented by the Council in relation to these hydraulic fracturing activities spanned the 2022/23 monitoring year. Monitoring included pre and post-discharge groundwater sampling. Two biomonitoring surveys were also carried out on a tributary of the Parahaki Stream in relation to the hydraulic fracturing programme, and three further samples taken as part of the Turangi Production Station monitoring programme. Samples of hydraulic fracturing fluids, and fluids returning to the wellhead post-fracturing, were also obtained for physicochemical analysis in order to characterise the discharges and to determine compliance with consent conditions.

This is the third monitoring report produced by the Council in relation to the hydraulic fracturing activities at the Turangi-A wellsite.

The monitoring carried out by the Council indicates that the hydraulic fracturing activities undertaken by the Company had no significant adverse effects on local groundwater or surface water resources. There were no unauthorised incidents recording non-compliance in respect of the resource consent held by the Company in relation to these activities or provisions in regional plans, during the period under review.

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 consent holder over the last several years, this report shows that the consent holder's performance remains at a high level in the year under review.

This report includes recommendations for the future monitoring of any hydraulic fracturing activities at the Turangi-A wellsite.

This report includes recommendations for the 2024/25 year, including a recommendation relating to an optional review of Consent 10000-2 due in June 2025.

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1. Introduction

1.1 Compliance monitoring programme reports and the Resource Management Act 1991

1.1.1 Introduction

This report outlines and discusses the results of the monitoring programme implemented by Taranaki Regional Council (the Council) in relation to the programme of hydraulic fracturing undertaken by Greymouth Petroleum Turangi Limited (the Company) at the Turangi-A wellsite, over the period 9 June 2022 to 12 April 2023. The report also assesses the Company's level of environmental performance and compliance with the resource consent held in relation to the activity.

The programme of hydraulic fracturing undertaken by the Company at the Turangi-A wellsite included the hydraulic fracturing of two wells. The wells targeted for stimulation were Turangi-15 and Turangi-2 wells.

The programme of monitoring implemented by the Council in relation to these hydraulic fracturing activities spanned the 2022/23 monitoring year. Monitoring included a mixture of groundwater, surface water and discharge monitoring components. This is the third monitoring report produced by the Council in relation to hydraulic fracturing activities at the Turangi-A wellsite. The second covered hydraulic fracturing activities related to the Turangi-7 well during the 2019/20 monitoring year.

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 the monitoring consented sites;
- the resource consents held by the Company;
- the nature of the monitoring programme in place for the period under review; and
- a description of the activities and operations conducted at the Turangi-A wellsite.

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 for the future monitoring of any hydraulic fracturing activities at the Turangi-A wellsite.

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 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]

1.2 Process description

1.2.1 Hydraulic fracturing

Hydraulic fracturing is a reservoir stimulation technique used to increase the flow of hydrocarbons to the surface. The primary objective of hydraulic fracturing is to increase the permeability of the target reservoir by creating numerous small, interconnected fractures, thus increasing the flow of hydrocarbons from the formation to a given well. The process of hydraulic fracturing has enabled companies to produce hydrocarbons at economically viable rates from extremely low permeability reservoirs and those that have become depleted using conventional production techniques.

The process of hydraulic fracturing involves the pumping of fluids and a proppant (medium-grained sand or small ceramic pellets) down a well, through a perforated section of the well casing, and into the target reservoir. The fluid mixture is pumped at a pressure that exceeds the fracture strength of the reservoir rock in order to create fractures. Once fractures have been initiated, pumping continues in order to force the

[1] The Council has used these compliance grading criteria for more than 21 years. They align closely with the 4 compliance grades in the MfE Best Practice Guidelines for Compliance, Monitoring and Enforcement, 2018

fluid and proppant into the fractures created. The proppant is designed to keep the fractures open when the pumping is stopped. The placement of proppant into the fractures can be assisted by the use of cross-linked gels (gel fracturing), turbulent flow (slick-water fracturing) or the use of nitrogen gas.

1.2.1.1 Gel fracturing

Gel fracturing utilises cross-linked gel solutions, which are liquid at the surface but, when mixed, form long-chain polymer bonds and thus become viscous gels. These gels are used to transport the proppant into the formation. Once in the formation they 'break' back with time, temperature and the aid of gel breaking chemicals into a liquid state and are flowed back to surface, without disturbing the proppant which remains in place and enhances the flow of hydrocarbons back to the surface.

1.2.1.2 Slick water fracturing

Slick water fracturing utilises water based fracturing fluids with friction-reducing additives. The addition of the friction reducers allows the fracturing fluids and proppant to be pumped to the target zone at higher rates and reduced pressures, than when using water alone. The higher rate creates turbulence within the fluid column holding the proppant and enabling its placement into the open fractures and enhancing the flow of hydrocarbons back to the surface.[2]

1.2.1.3 Nitrogen gas fracturing

Nitrogen gas assisted fracturing involves replacing some of the fluid used in the fracturing process with nitrogen gas, which can fracture rock at high pressures much like water. While nitrogen (N_2) is a gas at room temperature, it can be maintained in a liquid state through cooling and pressurisation. Nitrogen assisted fracturing is extremely beneficial from a production standpoint as inevitably during the fracturing process some of the water pumped down the well remains underground in the rock formation, which can block some of the small pores, inhibiting hydrocarbon recovery. Nitrogen gas achieves the same purpose as water but returns more easily to the surface.[3] Additionally, a reduction in the volume of water used also reduces the total concentration of chemical additives required and the volume of water returning to the surface that requires subsequent disposal.[2]

1.2.2 The Turangi-A wellsite and hydraulic fracturing activities

The Turangi-A wellsite is located on Turangi Road, Motonui and lies within the Parahaki Catchment. An unnamed tributary of the Parahaki Stream is located approximately 80m to the east of the wellsite and the main channel of the Parahaki Stream is located approximately 50m to the west of the wellsite. The location of the wellsite is illustrated in Figure 1. A summary of the hydraulic fracturing activities carried out by the Company in the Turangi-15 and Turangi-2 wells at the Turangi-A wellsite during the period being reported is provided below in Table 1.

2 *http://geology.com/energy/hydraulic-fracturing-fluids*
3 *http://frackwire.com/nitrogen-gas-fracking*

Table 1 Summary of hydraulic fracturing details

Well	Bore id.	Date	Treatment	Injection zone (m TVDss)	Formation
Turangi-15	GND3177	09/02/2022	1	4383.6-4393.1	Kaimiro/ Mangahewa
		18/06/2022	2	3954.6-3973.1	
		25/06/2022	3	3592-3598	
		08/07/2022	4	3458.6-3468.1	
		18/07/2022	5	3437.6-3443.6	
		09/08/2022	6	3437.6-3443.6	
		17/08/2022	7	3411.6-3421.1	
		31/08/2022	8	3358.6-3370.6	
Turangi-2	GND3197	23/02/2023	1	4095.4-4101.2	Kaimiro/ Mangahewa
		02/03/2023	2	3977-3981	
		08/03/2023	3	3842.4-3851.7	
		15/03/2023	4	3769.2-3778.5	
		23/03/2023	5	3597-3600.1	
		02/04/2023	6	3469-3478.1	
		12/04/2023	7	3443.2-3448.9	

1.3 Resource consents

The Company holds one resource consent the details of which are summarised in Table 2 below. Summaries of the conditions attached to the permit are set out in Section 3 of this report.

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

Table 2 Resource consent held by the Company during the period under review

Consent number	Purpose of consent	Granted	Next review	Expires
10000-1	To discharge water based hydraulic fracturing fluids into land at depths greater than 3,350m TVDss beneath the Turangi-A wellsite	30 Oct 2014	N/A	replaced
10000-2	To discharge water based hydraulic fracturing fluids into land at depths greater than 3,200m TVDss beneath the Turangi-A wellsite	22 Oct 2020	2025 (June annually)	1 Jun 2039

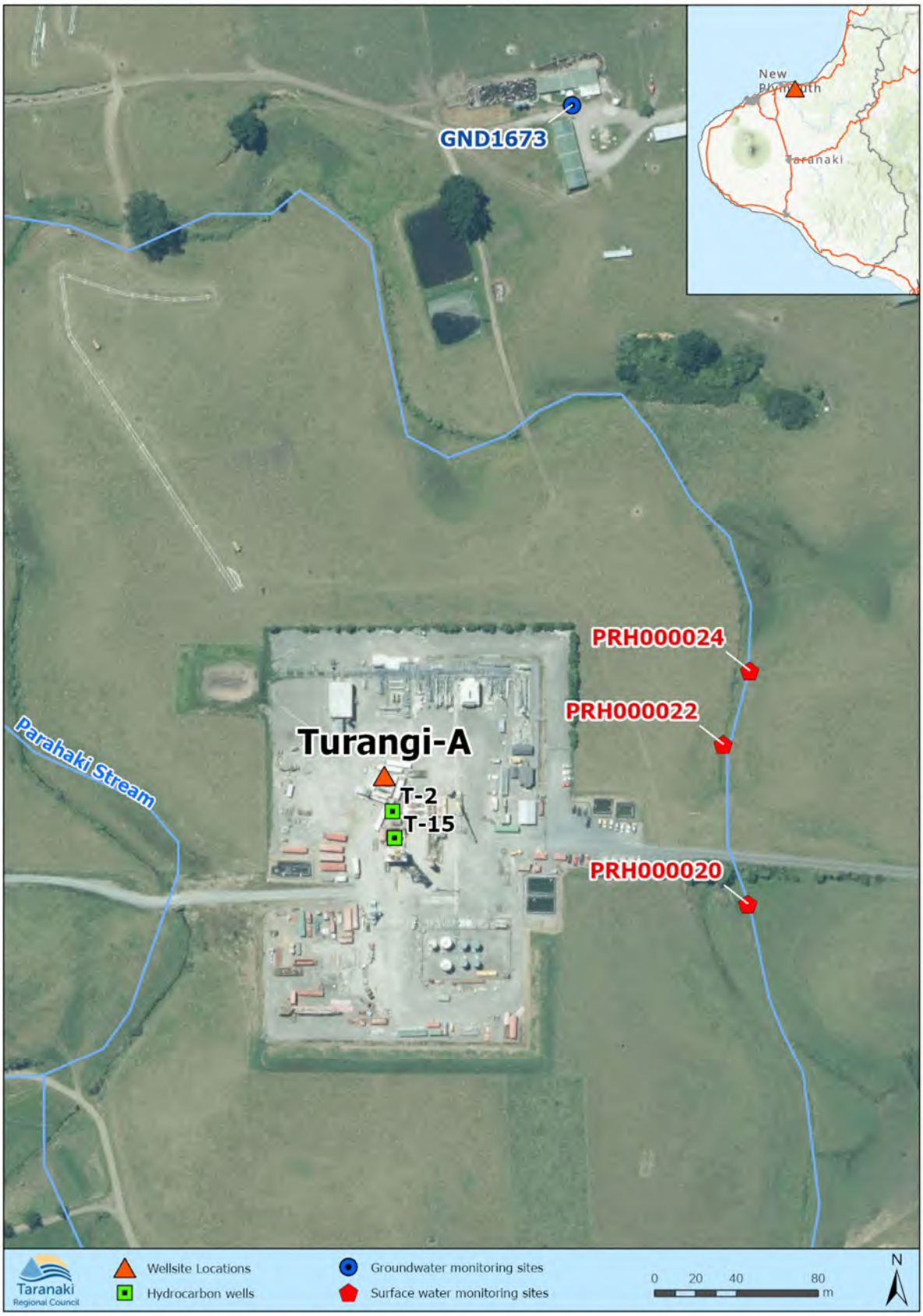

Figure 1 Location map

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 Turangi-A wellsite consisted of four 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;
- in 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 Assessment of data submitted by the consent holder

As required by the conditions of the Consent the Company submitted pre and post-fracturing discharge reports to the Council for the well fractured during the period under review. Pre-fracturing discharge reports provide an outline of the proposed fracturing operations in relation to each well, while post-fracturing reports confirm details of what actually occurred. The specific range of information required in each report is stipulated in the conditions of the consent.

1.4.4 Physicochemical sampling

1.4.4.1 Groundwater

As a generally accepted rule, all existing bores or wells within a 1 km radius of the proposed hydraulic fracturing activity are assessed for their suitability for sampling (or otherwise) in the monitoring programme. Two groundwater monitoring sites (GND2232 and GND1673) were found within 1km of the wellsite. One of the sites identified (GND1673) was deemed suitable for inclusion in the groundwater monitoring programme. The other (GND2232) was excluded from the programme as the well is very shallow (~2.5m deep) and up-gradient of the surface water drainage from the site. Groundwater quality at this site is also already regularly monitored by the Council as part of the Company's deep well injection monitoring programme. The location of these groundwater monitoring sites is displayed in Figure 1.

Bore details for GND1673, the only groundwater monitoring site included in the Turangi-A Hydraulic Fracturing monitoring programme, are summarised in Table 3.

Table 3 Details of groundwater sites included in the monitoring programme

Monitoring site	Easting	Northing	Distance from wellsite (m)	Total depth (m)	Screened/open interval (m)	Aquifer
GND1673	5681723	1713925	285	42	26-42	Marine terraces

Samples of groundwater were obtained pre-fracturing to provide a baseline reference of groundwater composition, with further rounds of sampling carried out at various scheduled intervals during and after the commencement of activities.

1.4.4.2 Hydraulic fracturing and return fluids

In addition to the sampling of local groundwater, representative samples of the hydraulic fracturing fluid and reservoir fluids produced back to the wellhead immediately following each fracturing event (return fluids) were obtained for analysis.

Samples of return fluids were collected at regular intervals during the flow-back period. Return fluids are comprised of a mixture of hydraulic fracturing fluids and formation fluids produced from the target reservoir, following the completion of the hydraulic fracturing process. The relative concentrations of each contributing fluid type change as the volume of fluid produced from the well increases. Immediately following the opening of the well post-fracturing, a high proportion of the fluid returning to the wellhead is fluid injected during the hydraulic fracturing process. As the volume of fluid produced from the well increases, the proportion of hydraulic fracturing fluid reduces in relation to formation fluids. The individual samples of return fluid are generally combined in a composite sample for laboratory analysis. Composites are designed to provide a representative sample of fluids returning to the wellhead over the entire flow-back period.

All samples were transported to Hill laboratories (Hills) for analysis following standard chain of custody procedures.

1.4.5 Surface water quality monitoring

An unnamed tributary of the Parahaki Stream is located 80m east of the site and the main channel of the Parahaki Stream is located 50m to the west of the site (Figure 1).

Monitoring sites have been selected to monitor upstream and downstream of the estimated location of groundwater/subsurface drainage from the wellsite. Details of the three sites monitored on the unnamed tributary are included in Table 4. The locations are illustrated on Figure 1.

Table 4 Surface water monitoring site details

Monitoring site	Description	Location	Eastings	Northings
PRH000020	Unnamed tributary of the Parahaki Stream	188m downstream of GND2106	1714011	5681322
PRH000022	Unnamed tributary of the Parahaki Stream	30m downstream of PRH00020	1714002	5681392
PRH000024	Unnamed tributary of the Parahaki Stream	37m downstream of PRH00022	1714012	5681446

1.4.5.1 Biomonitoring surveys

Biomonitoring surveys are undertaken to determine whether stormwater discharges from the wellsite have had any detrimental impacts on the macroinvertebrate communities of the unnamed tributary of the Parahaki Stream. Samples are processed to provide number of taxa (richness), MCI and $SQMCI_S$ scores, and EPT taxa for each site.

The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of organic pollution in stony streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to environmental conditions. The $SQMCI_S$ takes into account taxa abundance as well as sensitivity to pollution and may reveal more subtle changes in communities. It may be the more appropriate index if non-organic impacts are occurring.

Significant differences in either the MCI or the $SQMCI_S$ between sites indicate the degree of adverse effects (if any) of the discharges being monitored.

One macroinvertebrate survey was carried out prior to commencement of fracturing the Turangi-15 and Turangi-2 wells on 8 November 2021. One macroinvertebrate survey was also carried out after completion of the hydraulic fracturing programme on 3 November 2023. Additional surveys were carried out on 19 August, 27 October 2022, and 20 February 2023 as part of the Company's Production Station monitoring programme.

2. Results

2.1 Consent holder submitted data

2.1.1 Turangi-15 post-fracturing discharge report

The conclusions from the Turangi-15 well post-fracturing discharge report are summarised as follows:

- A total of seven intervals were fractured during eight stimulation events, with one interval receiving two treatments, over the period 9 June to 31 August 2022 at depths between 3411m to 4393m TVDss.
- A total of 14,618bbls (2,324m^3) of liquid was discharged across the seven fractured zones. The total proppant weight was 303 tonnes (669,821lbs).
- The Turangi-15 well was opened for flow-back following the completion of fracturing operations. In total 13,496bbls (2,145m^3) of fluid was returned from the well over the initial flow-back period.
- Zones two to seven returned all pumped fluid, with only a minor amount left underground from zone one and zone eight. Any fluid remaining underground flowed to surface once all zones are comingled and the well begins producing.
- A total of 303 tonnes (669,8219lbs) of proppant was estimated to have remained within the formation following flow-back.
- No screen outs occurred during the hydraulic fracturing of the Turangi-15 well.
- All return fluid from the Turangi-15 well fracturing operations was disposed of by deep well injection at the Kaimiro-G wellsite under Consent 9470-1.
- Pressure testing was undertaken of all surface equipment, including flow lines and the wellhead, prior to injection.
- There was no escape of fluids during hydraulic fracturing operations.
- It is considered that the mitigation measures implemented by the Company were effective in reducing the potential for adverse environmental effects associated with fracturing operations.

2.1.2 Turangi-2 post fracturing discharge report

- A total of seven zones were fractured over the period 23 February to 12 April 2023 at mid-point depths between 3443m to 4657m TVDss.
- A total of 11,499bbls (1826.1m^3) of liquid was discharged across the seven fractured units. The total proppant weight was 257.1 tonnes (566,858lbs).
- Almost all fluid injected was returned from the well over the flow-back period. Any fluid remaining underground flowed to surface once all zones are commingled and the well begins producing.
- A total of 257.1 tonnes (566,858lbs) of proppant was estimated to have remained within the formation following flow-back.
- No screen outs occurred during hydraulic fracturing of the Turangi-2 well.
- All return fluid from the Turangi-2 fracturing operations were disposed of at the Company's Kaimiro-G wellsite under the Company's deep well injection consent.
- Pressure testing was undertaken of all surface equipment, including flow lines and the wellhead, prior to injection.
- There was no escape of fluids during hydraulic fracturing operations.

2.2 Physicochemical sampling

2.2.1 Groundwater

Hydraulic fracturing activities commenced at the Turangi-A wellsite on 9 June 2022 and continued until 12 April 2023. A pre-fracturing baseline sample was collected on 27 April 2022. Post-fracturing groundwater samples were collected three months, and 12 months following commencement of the activities on 20 October 2022, and 17 June 2024 respectively.

Methane concentrations >1g/m^3 were reported in all samples both pre and post-hydraulic fracturing activities and can occur as a result of biogenic processes in sulphate depleted groundwater systems. To determine whether the source of the methane was biogenic or thermogenic, during this campaign only one sample was sent to Geological and Nuclear Sciences (GNS) for carbon 13 isotope analysis. The presence of carbon 13 isotopes at concentrations less than -50‰ indicate a thermogenic deep gas source and concentrations greater than -50‰ a shallow biogenic gas source. Carbon 13 concentrations were -67.7‰ indicating the source of methane was predominantly biogenic and within the expected range for shallow groundwater across Taranaki.

Overall, samples demonstrate relatively narrow ranges between analyte concentrations over time. The subtle variation in analyte concentrations at each site are a result of natural seasonal fluctuation and sampling variability. The results of the laboratory analysis indicate there have been no significant changes in groundwater composition over the period monitored.

A summary of the results for groundwater samples taken in relation to the hydraulic fracturing activities compared to baseline is included in Table 5. The certificates of analysis for the review period are included in Appendix III.

Table 5 Results of groundwater sampling carried out in relation to the Turangi-15 and Turangi-2 fracturing event

Parameter	Bore id	GND1673		
	Unit	pre-fracturing	3mth post frac	1 Year Post frac
Sample date	-	27/04/2022	20/10/2022	17/06/2024
Lab number (Hill)	-	TRC226320	TRC228439	TRC2418925
pH	pH	7.6	7.7	7.4
Total alkalinity	g/m^3 $CaCO^3$	148	136	152
Bicarbonate	g/m^3 HCO_3	180	165	184
Total hardness	g/m^3 $CaCO_3$	97	84	97
Electrical conductivity	mS/m	31.7	30.4	32.9
Total dissolved solids	g/m^3	210	210	230
Dissolved calcium	g/m^3	20	17.1	21
Chloride	g/m^3	15.2	15.8	14.8
Dissolved magnesium	g/m^3	11.1	9.9	10.8
Dissolved potassium	g/m^3	5.6	4.8	5.6
Dissolved sodium	g/m^3	30	27	32
Nitrite nitrogen	g/m^3 N	0.002	<0.002	<0.002
Nitrate nitrogen	g/m^3 N	<0.002	<0.002	0.010
Nitrate & nitrite nitrogen	g/m^3 N	0.003	0.002	0.011
Sulphate	g/m^3	<0.5	<0.5	<0.5
Dissolved barium	mg/kg	0.022	0.011	0.023
Bromide	g/m^3	0.08	0.08	0.07

Parameter	Bore id	GND1673		
	Unit	pre-fracturing	3mth post frac	1 Year Post frac
Sample date	-	27/04/2022	20/10/2022	17/06/2024
Lab number (Hill)	-	TRC226320	TRC228439	TRC2418925
Dissolved copper	g/m^3	<0.0005	<0.0005	0.0016
Dissolved iron	g/m^3	7.9	0.9	7
Dissolved manganese	g/m^3	0.195	9.9	0.194
Dissolved mercury	g/m^3	<0.00008	<0.00008	<0.00008
Dissolved nickel	mg/kg	<0.0005	<0.0005	0.0063
Dissolved zinc	g/m^3	0.0166	0.0015	0.07
Ethylene glycol	g/m^3	<4	<4	<4
Propylene glycol	g/m^3	<4	<4	<4
Methanol	g/m^3	<2	<2	<2
Benzene	g/m^3	<0.0010	<0.0010	<0.0010
Toluene	g/m^3	<0.0010	<0.0010	<0.0010
Ethylbenzene	g/m^3	<0.0010	<0.0010	<0.0010
m-Xylene	g/m^3	<0.002	<0.002	<0.002
o-Xylene	g/m^3	<0.0010	<0.0010	<0.0010
Formaldehyde	g/m^3	<0.02	<0.02	<0.02
Ethane	g/m^3	<0.003	<0.003	<0.001
Ethylene	g/m^3	<0.003	<0.004	<0.001
Methane	g/m^3	7.5	1.19	3.68
C7-C9	g/m^3	<0.10	<0.10	<0.10
C10-C14	g/m^3	<0.2	<0.2	<0.2
C15-C36	g/m^3	<0.4	<0.4	<0.4
Total hydrocarbons	g/m^3	<0.7	<0.7	<0.7
δ13C value*	‰ (-)	not analysed	-67.7	not analysed

2.2.2 Hydraulic fracturing and return fluids

The results of the analyses carried out on samples of the hydraulic fracturing fluid used in the treatment of the Turangi-15 and Turangi-2 wells are shown below in Table 6 and Table 7. The certificates of analysis are included in Appendix IV.

The results of the analyses carried out on the return fluid samples obtained following the hydraulic fracturing of the Turangi-15 and Turangi-2 wells are summarised below in Table 8 and Table 9 and certificates of analysis are included in Appendix IV.

The results demonstrate the variability of groundwater composition and hydrocarbon concentrations with depth. The relatively high levels of chloride, sodium and hydrocarbons in each sample indicate that the composite samples prepared contained a greater proportion of reservoir fluids than hydraulic fracturing fluids introduced during the fracturing activities, which are comprised predominantly of freshwater.

Table 6 Results of hydraulic fracturing fluid sampling – Turangi-15 well

Parameter	Well id	GND3177 (Turangi-15 well)							
Interval/treatment	-	1/1	2/2	3/3	4/4	5/5	5/6	6/7	7/8
Sample date	Unit	09/06/2022	18/06/2022	25/06/2022	08/07/2022	18/07/2022	09/08/2022	17/08/2022	31/08/2022
Lab number	Hill	3012873	3017905	3025837	3032722	3038181	3054061	3060497	3069579
Ethylene glycol*	g/m^3	670	550	700	930	630	470	590	640
Propylene glycol*	g/m^3	<2	<2	<2	<2	<2	<2	<2	<20
Methanol*	g/m^3	<2	<2	<2	<2	<2	<2	<2	<2
Benzene	g/m^3	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0042	<0.010
Toluene	g/m^3	0.0011	0.0013	<0.0010	<0.0010	<0.0010	0.0019	0.032	0.0033
Ethylbenzene	g/m^3	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0049	<0.010
m-Xylene	g/m^3	<0.002	<0.002	<0.002	<0.002	<0.002	0.003	0.027	0.003
o-Xylene	g/m^3	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0104	0.0013
C7-C9	g/m^3	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
C10-C14	g/m^3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
C15-C36	g/m^3	<2	<2	<2	<2	<2	6	<2	<2
Total hydrocarbons	g/m^3	<4	<4	<4	<4	<4	6	<4	<4

Table 7 Results of hydraulic fracturing fluid sampling – Turangi-2 well

Parameter	Well id	GND3197 (Turangi-2 well)						
Interval/treatment	-	1	2	3	4	5	6	7
Sample date	Unit	23-02-23	02-03-23	08-03-23	15-03-23	23-03-23	02-04-23	12-04-23
Lab number	Hill	3195105	3195136	3196732	3204349	3217768	3228062	3242322
Ethylene glycol*	g/m^3	98	93	97	110	80	98	85
Propylene glycol*	g/m^3	<2	<2	<2	<2	<20	<2	<4
Methanol*	g/m^3	<2	<2	<2	<2	<20	<2	<2
Benzene	g/m^3	0.0016	0.0035	0.0064	0.0020	0.0015	<0.0010	0.0013
Toluene	g/m^3	0.0075	0.0165	0.052	0.0108	0.0061	0.0026	0.0026
Ethylbenzene	g/m^3	0.0011	0.0021	0.0063	0.0017	0.0013	<0.0010	<0.0010
m-Xylene	g/m^3	0.007	0.015	0.040	0.009	0.006	0.003	0.003

Parameter	Well id	GND3197 (Turangi-2 well)						
Interval/treatment	-	1	2	3	4	5	6	7
Sample date	Unit	23-02-23	02-03-23	08-03-23	15-03-23	23-03-23	02-04-23	12-04-23
Lab number	Hill	3195105	3195136	3196732	3204349	3217768	3228062	3242322
o-Xylene	g/m^3	0.0024	0.0059	0.0121	0.0038	0.0027	0.0017	0.0014
C7-C9	g/m^3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
C10-C14	g/m^3	<1.0	<1	1.5	<1.0	<1.0	<1.0	<1
C15-C36	g/m^3	<2	2	10	4	2	<2	<2
Total hydrocarbons	g/m^3	<4	<4	11	4	<4	<4	<4

Table 8 Results of hydraulic fracturing return fluid sampling – Turangi-15 well

Parameter	Well id	GND3177 (Turangi-15 well)							
Sample date**	-	09/06/2022	02/07/2022	02/07/2022	27/07/2022	28/07/2022	01/09/2022	01/09/2022	07/09/2022
Interval/treatment	Unit	1/1	2/2	3/3	4/4	5/5	5/6	6/7	7/8
Lab number	Hill	3025847	3025489	3025848	3041751	3042620	3066311	3066312	3070579
pH	pH	6.9	6.8	7.1	7.0	7.4	6.9	7.0	7.3
Total alkalinity	g/m^3 $CaCO_3$	400	570	1,800	2,400	2,600	2,100	1,980	2,100
Total hardness	g/m^3 $CaCO_3$	159	420	230	198	125	164	145	163
Electrical conductivity	mS/m	851	1,779	1,833	1,226	991	846	826	934
Total dissolved solids	g/m^3	4,800	12,200	13,400	9,400	7,700	7,200	7,200	7,200
Total barium	g/m^3	8.5	25	49	35	7.9	5.3	3.2	2.1
Total bromine	g/m^3	5.6	16.6	18.4	11.7	10.7	8.9	9.7	9.9
Dissolved calcium	g/m^3	51	134	75	54	39	51	47	56
Total copper	g/m^3	0.006	0.021	0.006	0.009	0.006	0.019	0.012	0.014
Total iron	g/m^3	17.1	5.1	1.44	1.78	1.37	8.4	2.9	2.7
Dissolved magnesium	g/m^3	8	22	12	8	6	9	7	6
Total manganese	g/m^3	2.9	2.0	1.74	1.23	0.63	2.1	1.60	1.04
Total nickel	g/m^3	0.24	0.182	0.045	<0.032	<0.032	0.086	0.047	0.036
Total potassium	g/m^3	67	119	120	97	68	66	68	61
Total sodium	g/m^3	1,590	3,400	3,900	2,900	2,400	1,970	1,920	2,000

Parameter	Well id	GND3177 (Turangi-15 well)							
Sample date**	-	09/06/2022	02/07/2022	02/07/2022	27/07/2022	28/07/2022	01/09/2022	01/09/2022	07/09/2022
Interval/treatment	Unit	1/1	2/2	3/3	4/4	5/5	5/6	6/7	7/8
Lab number	Hill	3025847	3025489	3025848	3041751	3042620	3066311	3066312	3070579
Total sulphur	g/m^3	10	11	7	10	12	11	12	15
Total zinc	g/m^3	0.180	0.185	0.071	0.170	0.042	0.032	0.093	0.029
Chloride	g/m^3	2,500	5,700	5,200	2,800	1,950	1,510	1,640	1,790
Nitrite nitrogen*	g/m^3 N	<0.010	0.021	0.136	<0.10	<0.05	<0.10	<0.10	0.0174
Nitrate nitrogen*	g/m^3 N	<0.010	0.152	<0.010	<0.10	<0.05	<0.10	<0.10	0.156
Nitrate & nitrite nitrogen*	g/m^3 N	<0.010	0.173	0.129	<0.10	<0.05	<0.10	0.10	0.173
Sulphate	g/m^3	30	32	22	31	37	33	36	46
Ethylene glycol*	g/m^3	<20	44	83	38	98	<20	<20	210
Propylene glycol*	g/m^3	<20	<20	<20	<20	<20	<20	<20	<20
Methanol*	g/m^3	<20	<20	<20	<20	<20	<20	<20	<20
Benzene	g/m^3	6.0	40	9.9	7.1	11.8	18.3	5.6	17.3
Toluene	g/m^3	6.6	25	19.9	7.4	11.6	21	4.2	15.9
Ethylbenzene	g/m^3	0.42	1.65	1.65	0.47	0.99	2.1	0.35	1.02
m-Xylene	g/m^3	2.4	10	13.4	2.8	5.5	11.1	1.84	5.7
o-Xylene	g/m^3	0.95	3.1	3.3	0.96	1.94	3.8	0.72	2.0
Formaldehyde	g/m^3	<0.15	0.37	<0.15	0.22	<0.15	<1.5	<1.5	0.54
C7-C9	g/m^3	6.3	240	138	32	63	250	22	30
C10-C14	g/m^3	6.1	300	176	81	109	490	108	59
C15-C36	g/m^3	4.1	550	186	188	210	780	173	77
Total hydrocarbons	g/m^3	16.4	1,080	500	300	380	1,520	300	165

*Note * Depending on the viscosity of the sample received at the laboratory, samples may require dilution prior to analysis which results in higher detection limits. ** Date sample received in lab*

Table 9 Results of hydraulic fracturing return fluid sampling – Turangi-2 well

Parameter	Well id	GND3197 (Turangi-2 well)						
Sample date**	-	16/03/2023	16/03/2023	16/03/2023	28/03/2023	01/04/2023	15/04/2023	09/05/2023
Interval/treatment	Unit	1	2	3	4	5	6	7
Lab number	Hill	3202731	3202729	3202730	3217781	3224591	3242323	3270610
pH	pH	6.8	6.5	6.7	6.6	6.8	6.1	6.3
Total alkalinity	g/m^3 $CaCO_3$	830	870	600	790	780	370	50
Total hardness	g/m^3 $CaCO_3$	350	410	420	320	181	2,200	104
Electrical conductivity	mS/m	1,410	2,400	1,825	1,641	913	1,489	95.9
Total dissolved solids	g/m^3	9,600	15,400	12,400	10,600	7,100	11,000	3,500
Total barium	g/m^3	28	66	38	31	9.4	12.6	0.128
Total bromine	g/m^3	12.8	24	17.4	18.3	8.4	10.6	<0.5
Dissolved calcium	g/m^3	120	140	137	105	55	840	31
Total copper	g/m^3	0.021	0.041	0.008	<0.005	0.061	0.015	0.01
Total iron	g/m^3	12.4	11.9	2.6	4.0	4.1	25	2.7
Dissolved magnesium	g/m^3	11	14	19	15	11	17	6
Total manganese	g/m^3	2.5	3.1	1.35	1.76	0.21	1.00	0.21
Total nickel	g/m^3	0.30	0.188	0.082	0.136	0.086	0.20	0.141
Total potassium	g/m^3	158	260	188	195	104	108	11.6
Total sodium	g/m^3	2,900	5,300	3,800	3,300	1,850	2,100	20
Total sulphur	g/m^3	7.1	6.4	7.1	8	10	8	8
Total zinc	g/m^3	0.44	0.117	0.090	0.159	0.22	0.157	0.29
Chloride	g/m^3	4,300	7,700	6,000	5,200	2,500	5,100	230
Nitrite nitrogen*	g/m^3 N	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Nitrate nitrogen*	g/m^3 N	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Nitrate & nitrite nitrogen*	g/m^3 N	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sulphate	g/m^3	21	19	21	24	31	24	24
Ethylene glycol*	g/m^3	47	46	<30	<20	<20	<20	<20
Propylene glycol*	g/m^3	<20	<20	<20	<20	<20	<20	<20
Methanol*	g/m^3	<20	<20	<20	<20	<20	<1,100	<20

Parameter	Well id	GND3197 (Turangi-2 well)						
Sample date**	-	16/03/2023	16/03/2023	16/03/2023	28/03/2023	01/04/2023	15/04/2023	09/05/2023
Interval/treatment	Unit	1	2	3	4	5	6	7
Lab number	Hill	3202731	3202729	3202730	3217781	3224591	3242323	3270610
Benzene	g/m^3	3.7	7.6	5.3	5.3	17.5	21	0.24
Toluene	g/m^3	2.1	3.9	3.4	3.2	32	17.7	0.51
Ethylbenzene	g/m^3	0.082	0.131	0.129	0.15	4.3	2.6	0.067
m-Xylene	g/m^3	0.44	0.62	0.52	0.6	24	6.1	0.25
o-Xylene	g/m^3	0.183	0.29	0.26	0.32	7.2	3.3	0.133
Formaldehyde	g/m^3	<0.15	<1.5	<0.15	<0.15	<0.15	<0.15	0.53
C7-C9	g/m^3	8.7	12.6	11.0	8.0	660	540	3.7
C10-C14	g/m^3	18.3	49	28	22	1,210	610	35
C15-C36	g/m^3	250	97	70	56	1,420	560	89
Total hydrocarbons	g/m^3	270	158	109	86	3,300	1,720	1

*Note * Depending on the viscosity of the sample received at the laboratory, samples may require dilution prior to analysis which results in higher detection limits. ** Date sample received in lab.*

2.3 Biomonitoring surveys

A macroinvertebrate survey was carried out at three sites in an unnamed tributary of the Parahaki Stream located approximately 80m east of the Turangi-A wellsite prior to the commencement of hydraulic fracturing activities. Following completion of hydraulic fracturing at the Turangi-A wellsite another survey was undertaken to determine if discharges from the Turangi-A wellsite had had any detrimental effects on the stream macroinvertebrate communities.

A pre-fracturing survey undertaken 8 November 2021 recorded relatively poor macroinvertebrate communities that were typical for the three sites. Taxa richnesses were lower than usual but were similar to the preceding survey. MCI and SQMCI scores were highest at site 2, the 'primary impact' site, which would be expected to be affected the most by any discharges from the Turangi-A wellsite.

A post-hydraulic fracturing survey undertaken 3 November 2023 recorded SQMCI scores of 'very poor' macroinvertebrate health at site 1 and 'poor' macroinvertebrate health at sites 2 and 3. MCI scores decreased in a downstream direction and the most downstream site 3 recorded an MCI score significantly less than sites 1 and 2. Compared to previous surveys, current macroinvertebrate metrics of sites 1 and 2 indicated better macroinvertebrate community health, while current results at site 3 were similar to previous surveys.

The results of these surveys indicate that the discharges from the Turangi-A wellsite had not caused any recent significant detrimental impacts on the macroinvertebrate communities of the unnamed tributary of the Parahaki Stream.

Copies of the biomonitoring reports for the site are available from the Council upon request.

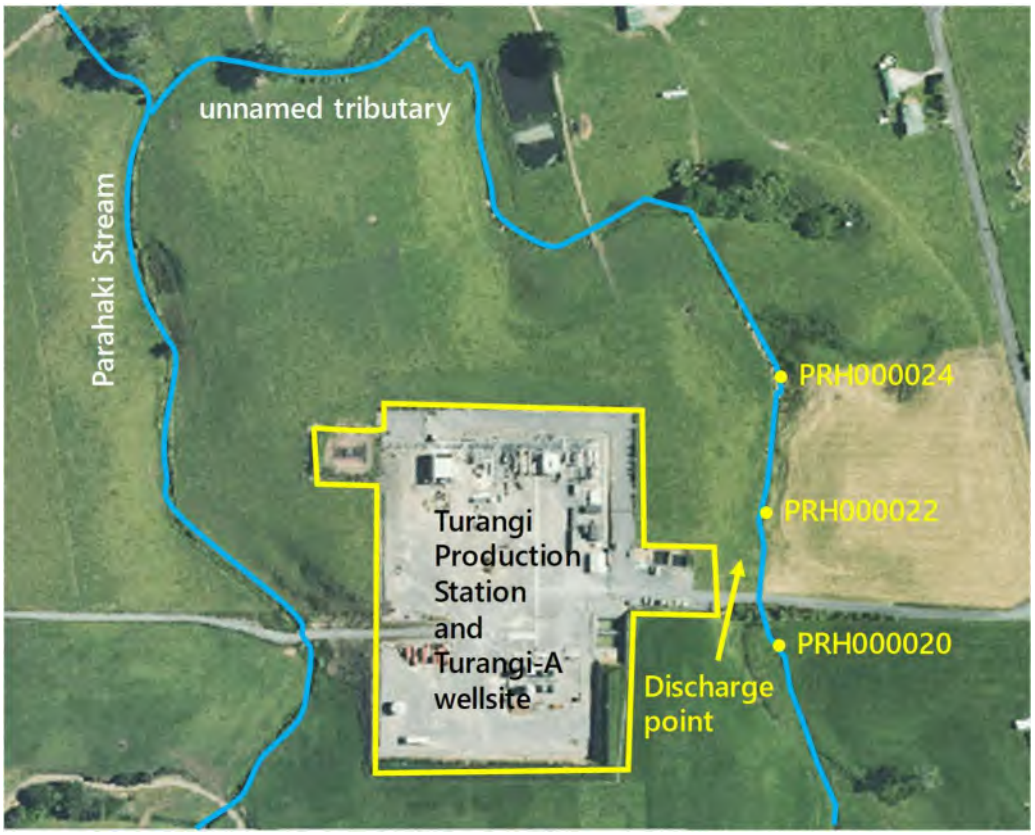

Figure 2 Location of biomonitoring sites in relation to the Turangi-A wellsite

2.4 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 2022/23 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 Environmental effects of exercise of consents

Two wells (Turangi-15 and Turangi-2) were stimulated by hydraulic fracturing at the Turangi-A wellsite during the period 9 June 2022 to 12 April 2023.

The monitoring programme carried out by the Council in relation to the fracturing events undertaken included both groundwater and surface water monitoring components.

The groundwater monitoring component incorporated pre and post-fracturing sampling at one groundwater monitoring site located to the north of the Turangi-A wellsite. The results of post-fracturing groundwater sampling carried out showed only very minor variations in water composition in comparison to baseline results. The minor variations in analytes are a result of natural variations in water composition.

The surface water monitoring component of the programme comprised of two biomonitoring surveys of an unnamed tributary of the Parahaki Catchment pre and post-fracturing of the Turangi-15 and Turangi-2 wells. The results of the biomonitoring surveys undertaken in relation to the fracturing event indicate that the site activities had no adverse effects on the invertebrate communities within the stream.

In summary, the monitoring carried out by the Council during the period being reported indicated that the hydraulic fracturing activities undertaken by the Company at the Turangi-A wellsite has had no significant adverse effects on local groundwater or surface water resources.

3.2 Evaluation of performance

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

Table 10 Summary of performance for Consent 10000-2

Purpose: To discharge water based hydraulic fracturing fluids into land at depths greater than 3,200m TVDss beneath the Turangi-A wellsite		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Any discharge shall occur below 3,200m TVDss	Assessment of consent holder submitted data	Yes
2. No discharge shall occur after 1 June 2034	Assessment of consent holder submitted data	N/A
3. Monitoring and reporting of seismic events within 5km of any discharge	Notification and post fracturing report	Yes
4. Actions to be taken following the occurrence of any events described in condition 3	Notification under condition 3	Yes
5. Exercise of consent shall not result in any contaminants reaching any useable freshwater	Results of groundwater monitoring	Yes
6. Consent holder shall undertake sampling programme	Development and certification of a monitoring programme	Yes
7. If no suitable bores exist with 500m of the wellsite, a monitoring bore may need to be installed	Inspection of bores	Yes
8. Sampling programme shall follow recognised field procedures and be analysed for a specific range of chemical parameters	Development and certification of monitoring programme and assessment of results	Yes

Purpose: To discharge water based hydraulic fracturing fluids into land at depths greater than 3,200m TVDss beneath the Turangi-A wellsite		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
9. All sampling to be carried out in according with a certified Sampling and Analysis Plan	Development and certification of a Sampling and Analysis Plan	Yes
10. Well and equipment pressure testing to be carried out prior to any hydraulic fracturing programme commencing	Assessment of consent holder submitted data	Yes
11. A pre-fracturing discharge report is to be provided to the Council 14 days prior to discharge	Pre-fracturing discharge report received	Yes
12. Consent holder shall notify the Council of hydraulic fracturing discharge	Notification received	Yes
13. A post-fracturing discharge report is to be provided to the Council 14 days prior to discharge	Post fracturing discharge report received	Yes
14. For programme including multiple hydraulic fracturing discharges, more than one "Post fracturing discharge report' may be required	Reports received via email	Yes
15. The reports outlined in conditions 11 and 13 must be emailed to consents@trc.govt.nz	Reports received via email	Yes
16. The consent holder shall provide sample results of hydraulic fracturing fluids and return fluids to Council	Assessment of consent holder submitted data	Yes
17. Consent holder to adopt best practicable options at all times.	Site inspections, sampling and assessment of consent holder submitted data	Yes
18. The fracture fluid shall be comprised of no less than 95% water and proppant by volume	Assessment of consent holder submitted data	Yes
19. Lapse clause	Received notice of exercise of consent	Yes
20. Review condition	Next opportunity for review June 2025	N/A
Overall assessment of environmental performance and compliance in respect of this consent		**High**
Overall assessment of administrative performance and compliance in respect of this consent		**High**

N/A = not applicable

During the year, the Company demonstrated a high level of environmental and high level of administrative performance with the resource consent as defined in Appendix II. An evaluation of environmental performance over time is set out below in Table 11.

Table 11 Evaluation of environmental performance over time

Year	Consent number	High	Good	Improvement req	Poor
2017-2018	10000-1	1			
2018-2021	10000-2	1			
2022-2023	10000-2	1			

3.3 Recommendations from the 2018-2021 Triennial Report

In the 2018-2021 Triennial Report, it was recommended:

1. THAT in the first instance, the range of monitoring carried out during the reporting period in relation to the Company's hydraulic fracturing activities be replicated for any future fracturing events at the Turangi-A wellsite.
2. 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.
3. THAT the option for a review of resource consent in June 2022 as set out in condition 20 of the consent not be exercised.

3.4 Alterations to monitoring programmes of future hydraulic fracturing events

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 the range of monitoring carried out in relation to the hydraulic fracturing activities undertaken by the Company be replicated for any future fracturing events at the Turangi-A wellsite.

Recommendations to this effect are included in Section 4 of this report.

It should be noted that the proposed programme represents a reasonable and risk-based level of monitoring for the site 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 during future monitoring periods.

3.5 Exercise of optional review of consent

Resource Consent 10000-2.0 provides for an optional review of the consent in June annually. Condition 20 allows the Council to review the consent, for the purpose of:

a. ensuring that the conditions are adequate to deal with any significant adverse effects on the environment arising from the exercise of this 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; and/or
b. further specifying the best practicable option as required by condition 17; and/or
c. ensuring hydraulic fracturing operations appropriately take into account any best practice guidance published by a recognised industry association or environmental regulator.

Based on the results of monitoring in the year under review, it is considered that there are no grounds that require a review to be pursued or grounds to exercise the review option.

4. Recommendations

1. THAT in the first instance, the range of monitoring carried out during the reporting period in relation to the Company's hydraulic fracturing activities be replicated for any future fracturing events at the Turangi-A wellsite.
2. 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.
3. THAT the option for a review of resource consent in June 2025 as set out in condition 20 of the consent not be exercised.

Glossary of common terms and abbreviations

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

Biomonitoring	Assessing the health of the environment using aquatic organisms.
bbls	Barrel. Unit of measure used in the oil and gas industry (equivalent to approximately 159 litres).
Conductivity	Conductivity, an indication of the level of dissolved salts in a sample, usually measured at 25°C and expressed in µS/cm.
DO	Dissolved oxygen.
E.coli	Escherichia coli, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre sample.
EPT	Ephemeroptera (mayfly), Plecoptera (stonefly) and Trichoptera (caddisfly) which are macroinvertebrates sensitive to pollution.
Fresh	Elevated flow in a stream, such as after heavy rainfall.
g/m^3	Grams per cubic metre, and equivalent to milligrams per litre (mg/L). In water, this is also equivalent to parts per million (ppm), but the same does not apply to gaseous mixtures.
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 the circumstances/events surrounding an incident including any allegations of an incident.
L/s	Litres per second.
Macroinvertebrate	An invertebrate that is large enough to be seen without the use of a microscope.
masl	Metres above sea level.
MCI	Macroinvertebrate community index; a numerical indication of the state of biological life in a stream that takes into account the sensitivity of the taxa present to organic pollution in stony habitats.
mS/m	Millisiemens per metre.
m^3	Cubic metre (1,000 litres).
NZTM	New Zealand Transverse Mercator coordinates.
pH	A numerical system for measuring acidity in solutions, with 7 as neutral. Numbers lower than 7 are increasingly acidic and higher than 7 are increasingly alkaline.
Physicochemical	Measurement of both physical properties (e.g. temperature, clarity, density) and chemical determinants (e.g. metals and nutrients) to characterise the state of an environment.
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).
RMA	Resource Management Act 1991 and including all subsequent amendments.

Screen Out	A condition that occurs when the solids carried in a treatment fluid, such as proppant in a fracture fluid, create a bridge across the perforations or similar restricted flow area. This creates a sudden and significant restriction to fluid flow that causes a rapid rise in pump pressure.
SQMCI	Semi quantitative macroinvertebrate community index.
TVDss	True vertical depth sub-sea.
µS/cm	Microsiemens per centimetre.
Workover	The repair or stimulation of an existing production well for the purpose of restoring, prolonging or enhancing the production of hydrocarbons.

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

Bibliography and references

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Appendix I

Resource consents held by Greymouth Petroleum Turangi Ltd

(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:	Greymouth Petroleum Turangi Limited PO Box 3394 Fitzroy New Plymouth 4341
Decision Date	22 October 2020
Commencement Date	22 October 2020

Conditions of Consent

Consent Granted:	To discharge water based hydraulic fracturing fluids into land at depths greater than 3,200 mTVDss beneath the Turangi-A Production Station
Expiry Date:	1 June 2039
Review Date(s):	June annually
Site Location:	Turangi-A Production Station, 126 Turangi Road, Motunui
Grid Reference (NZTM)	1713843E-5681398N
Catchment:	Parahaki

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 discharge point shall be deeper than 3,200 mTVDss.

   Note: mTVDss = metres true vertical depth subsea i.e., the true vertical depth in metres below sea level.

2. There shall be no discharge of hydraulic fracturing fluids after 1 June 2034.

3. If the Geonet seismic monitoring network records a seismic event higher than a Modified Mercalli intensity of Magnitude 3 within 5 km of the geographical position (in 3 dimensions) of any hydraulic fracturing discharge then;

   (a) If hydraulic fracturing discharge is currently being undertaken it shall cease immediately and not recommence; or
   (b) If a hydraulic fracturing discharge has occurred within the previous 72 hours no further hydraulic fracturing discharges shall occur.

4. Following the occurrence of any seismic event described in special condition 3 the consent holder shall immediately notify the Chief Executive, Taranaki Regional Council and investigate and report on the likelihood of the seismic event being induced by the exercise of this consent. Hydraulic fracturing discharges may only then continue once the Chief Executive, Taranaki Regional Council has considered the report and concluded that the environmental risk of recommencing hydraulic fracturing is acceptable and has advised the consent holder accordingly.

5. The consent holder shall ensure that the exercise of this consent does not result in contaminants reaching any useable fresh water (groundwater or surface water). Usable fresh groundwater is defined as any groundwater having a Total Dissolved Solids concentration of less than 1,000 mg/l.

6. The consent holder shall undertake a programme of sampling and testing that monitors the effects of the exercise of this consent on fresh water resources to assess compliance with condition 5 (the 'Monitoring Programme'). The Monitoring Programme shall be certified by the Chief Executive, Taranaki Regional Council ('the Chief Executive'), before this consent is exercised, and shall include:

   (a) the location of the discharge point(s);
   (b) the location of sampling sites; and
   (c) sampling frequency with reference to a hydraulic fracturing programme.

7. Representative groundwater sampling is required to be undertaken at a minimum of one suitable site within 500 metres of the wellsite. If no suitable groundwater monitoring sites can be identified it will be necessary to install at least one monitoring bore of a depth, location and design determined after consultation with the Chief Executive, Taranaki Regional Council and installed in accordance with NZS 4411:2001.

8. All water samples taken for monitoring purposes shall be taken in accordance with recognised field procedures and analysed for:

   (a) pH;
   (b) conductivity;
   (c) total dissolved solids;
   (d) major ions (Ca, Mg, K, Na, total alkalinity, bromide, chloride, nitrate-nitrogen, and sulphate);
   (e) trace metals (barium, copper, iron, manganese, nickel, and zinc);
   (f) total petroleum hydrocarbons;
   (g) formaldehyde;
   (h) dissolved methane and ethane gas;
   (i) methanol;
   (j) glycols;
   (k) benzene, toluene, ethylbenzene, and xylenes (BTEX); and
   (l) carbon-13 composition of any dissolved methane gas discovered (13C-CH4).

   Note: The samples required, under conditions of this consent could be taken and analysed by the Taranaki Regional Council or other contracted party on behalf of the consent holder.

9. All sampling and analysis shall be undertaken in accordance with a Sampling and Analysis Plan, which shall be submitted to the Chief Executive, Taranaki Regional Council for review and certification before the first sampling is undertaken. 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 5.

   Note: The Sampling and Analysis Plan may be combined with the Monitoring Programme required by condition 6.

10. The consent holder shall undertake well and equipment pressure testing prior to any hydraulic fracture programme on a given well to ensure any discharge will not affect the integrity of the well and hydraulic fracturing equipment.

11. Any hydraulic fracture discharge shall only occur after the consent holder has provided a comprehensive 'Pre-fracturing Discharge Report' to the Chief Executive, Taranaki Regional Council. The report shall be provided at least 14 days before the discharge is proposed to commence and shall detail the hydraulic fracturing programme proposed, including as a minimum:

    (a) the specific well in which each discharge is to occur, the intended fracture interval(s) ('fracture interval' is the discrete subsurface zone to receive a hydraulic fracture treatment), and the duration of the hydraulic fracturing programme;
    (b) the number of discharges proposed and the geographical position (i.e. depth and lateral position) of each intended discharge point;
    (c) the total volume of fracture fluid planned to be pumped down the well, including mini-fracture treatments, and their intended composition, including a list of all contaminants and Material Safety Data Sheets for all the chemicals to be used;
    (d) the monitoring techniques to be used to determine the fate of discharged material;
    (e) the results of the reviews required by condition 17;
    (f) results of modelling showing an assessment of the likely extent and dimensions of the fractures that will be generated by the discharge;
    (g) the preventative and mitigation measures to be in place to ensure the discharge does not cause adverse environmental effects and complies with condition 5;
    (h) the extent and permeability characteristics of the geology above the discharge point to the surface;
    (i) an annotated seismic profile showing the locations of any interpreted faults (active or inactive) within 2 km if available of the surface discharge location, and a discussion regarding the potential for adverse effects due to the presence of any identified faults.
    (j) an assessment of the integrity of the well.
    (k) the burst pressure of the well casing and the anticipated maximum well and discharge pressures and the duration of the pressures; and
    (l) details of the disposal of any returned fluids, including any consents that are relied on to authorise the disposal; and
    (m) details of the contaminants in the discharge and the monitoring techniques used to comply with condition 17.

    Note: If seismic data is not available within 2 km of the subsurface discharge location the pre-fracturing report shall include a seismic profile to the distance that the data is available and a map showing any identified faults within the modelled fracture length plus a margin of 50%.

    For further information regarding the level of detail required to adequately comply with the requirements of the pre- fracturing report contact Taranaki Regional Council.

12. The consent holder shall notify the Taranaki Regional Council of the date that each discharge is intended to commence. Notification also shall identify the 'Pre-fracturing Discharge Report', required by condition 11, which details the discharge and be given no less than 3 days before the intended discharge date. If any discharge occurs more than 30 days after the notification date, additional notification as specified in this condition is required. Unless the Chief Executive advises that an alternative method is required this notice shall be served by completing and submitting the 'Notification of work' form on the Council's website (http://bit.ly/TRCWorkNotificationForm).

    Note: For clarification the notification date is the date that the Chief Executive, Taranaki Regional Council received notification in accordance with this condition, not the intended discharge date.

13. Subject to condition 14, within 90 days of any commencement date as advised under condition 12, the consent holder shall submit a comprehensive 'Post-fracturing Discharge Report' to the Chief Executive. The report shall, as a minimum, contain:

    (a) date and time of discharge;
    (b) confirmation of the interval(s) where fracturing occurred for that programme, and the geographical position (i.e., depth and lateral position) of the discharge point for each fracture interval;
    (c) the contaminant volumes and composition of fluid discharged into each fracture interval;
    (d) the volume of return fluids from each fracture interval;
    (e) an analysis for the constituents set out in conditions 1(a) to 1(k), in a return fluid sample taken within the first two hours of flow back, for each fracture interval if flowed back individually, or for the well if flowed back with all intervals comingled;
    (f) an estimate of the volume of fluids (and proppant) remaining underground;
    (g) the volume of water produced with the hydrocarbons (produced water) over the period beginning at the start of the hydraulic fracturing programme and ending 30 days after the programme is completed or after that period of production;
    (h) an assessment of the extent and dimensions of the fractures that were generated by the discharge, based on modelling undertaken after the discharge has occurred and other diagnostic techniques, including production analysis, available to determine fracture length, height and containment;
    (i) the results of seismic monitoring required by conditions 3.
    (j) the results of pressure testing required by condition 10 and the top-hole pressure (psi), slurry rate (bpm), surface proppant concentration (lb/gal), bottom hole proppant concentration (lb/gal), and calculated bottom hole pressure (psi), as well as predicted values for each of these parameters; prior to, during and after each hydraulic fracture treatment;
    (k) details of the disposal of any returned fluids, including any consents that are relied on to authorise the disposal;
    (l) details of any incidents where hydraulic fracture fluid is unable to pass through the well perforations (screen outs) that occurred, their likely cause and implications for compliance with conditions 1 and 5; and
    (m) results of the monitoring referred to in condition 11(d);
    (n) an assessment of the effectiveness of the mitigation measures in place with specific reference to those described in the application for this consent.

    Note: Further information regarding the level of detail required to adequately comply with the requirements of the post- fracturing report can be found on the Taranaki Regional Council website.

14. For programs including multiple hydraulic fracturing discharges, more than one 'Post-fracturing discharge report' may be required in order to meet the specified 90 day deadline from each commencement date. In these situations the consent holder shall submit a subsequent 'Post-fracturing Discharge Report' to the Chief Executive within 90 days of the previous report submitted.

15. Unless the Chief Executive advises that an alternative method is required, the reports required by conditions 11 and 13 shall be provided by completing and submitting the 'Notification of work' form on the Council's website (http://bit.ly/TRCWorkNotificationForm).

16. The consent holder shall provide access to a location where the Taranaki Regional Council officers can obtain a sample of the hydraulic fracturing fluids and the return fluids.

17. 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 of the activity on the environment by, as a minimum, ensuring that:

    (a) the discharge is contained within the fracture interval;
    (b) regular reviews of monitoring techniques used to ensure the discharge does not cause adverse environmental effects are undertaken;
    (c) regular reviews are undertaken of the preventative and mitigation measures adopted to ensure the discharge does not cause adverse environmental effects; and
    (d) regular reviews of the chemicals used are undertaken with a view to reducing the toxicity of the chemicals used.

18. The fracture fluid shall be comprised of no less than 95% water and proppant by volume.

19. This consent lapses 5 years after its date of commencement, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991.

20. The Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review;

    (a) during the month of June each year, and/or,
    (b) within 30 days of receiving any investigation and report in accordance with special condition 4 above;

    For the purpose of:

    (a) ensuring that the conditions are adequate to deal with any significant adverse effects on the environment arising from the exercise of this 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; and/or
    (b) further specifying the best practicable option as required by condition 17; and/or
    (c) ensuring hydraulic fracturing operations appropriately take into account any best practice guidance published by a recognised industry association or environmental regulator.

Signed at Stratford on 22 October 2020

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

Certificates of analysis (groundwater)

R J Hill Laboratories Limited
28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand

0508 HILL LAB (44 555 22)
+64 7 858 2000
mail@hill-labs.co.nz
www.hill-labs.co.nz

Certificate of Analysis

Client:	Taranaki Regional Council	**Lab No:**	3608254 SPv1
Contact:	Elizabeth Fynan C/- Taranaki Regional Council Private Bag 713 Stratford 4352	**Date Received:**	18-Jun-2024
		Date Reported:	15-Jul-2024
		Quote No:	47915
		Order No:	300852
		Client Reference:	#9556 - Turangi-A pre frac groundwater June 2024
		Submitted By:	Ben Pearson

Sample Type: Aqueous

Sample Name:		TRC2418925 17-Jun-2024 2:50 pm
Lab Number:		3608254.1
Individual Tests		
Gases in Ground Water*‡		See attached report
Sum of Anions	meq/L	3.4
Sum of Cations	meq/L	3.7
pH	pH Units	7.4
Total Alkalinity	g/m³ as $CaCO_3$	152
Bicarbonate	g/m³ at 25°C	184
Total Hardness	g/m³ as $CaCO_3$	97
Electrical Conductivity (EC)	mS/m	32.9
Total Dissolved Solids (TDS)	g/m³	230
Sample Temperature*†	°C	15.6
Dissolved Barium	g/m³	0.023
Dissolved Calcium	g/m³	21
Dissolved Copper	g/m³	0.0016
Dissolved Iron	g/m³	7.0
Dissolved Magnesium	g/m³	10.8
Dissolved Manganese	g/m³	0.194
Dissolved Mercury	g/m³	< 0.00008
Dissolved Nickel	g/m³	0.0063
Dissolved Potassium	g/m³	5.6
Dissolved Sodium	g/m³	30
Dissolved Zinc	g/m³	0.050
Bromide	g/m³	0.07
Chloride	g/m³	14.8
Nitrite-N	g/m³	< 0.002
Nitrate-N	g/m³	0.010
Nitrate-N + Nitrite-N	g/m³	0.011
Sulphate	g/m³	< 0.5
Ethylene Glycol in Water*		
Ethylene glycol*	g/m³	< 4
Propylene Glycol in Water*		
Propylene glycol*	g/m³	< 4
Methanol in Water - Aqueous Solvents*		
Methanol*	g/m³	< 2

Sample Type: Aqueous		
Sample Name:		TRC2418925 17-Jun-2024 2:50 pm
Lab Number:		3608254.1
BTEX in Water by Headspace GC-MS		
Benzene	g/m³	< 0.0010
Toluene	g/m³	< 0.0010
Ethylbenzene	g/m³	< 0.0010
m&p-Xylene	g/m³	< 0.002
o-Xylene	g/m³	< 0.0010
Formaldehyde in Water by DNPH & LCMSMS		
Formaldehyde	g/m³	< 0.02
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m³	< 0.10
C10 - C14	g/m³	< 0.2
C15 - C36	g/m³	< 0.4
Total hydrocarbons (C7 - C36)	g/m³	< 0.7

Analyst's Comments

† Customer supplied data. Please note: Hill Labs cannot be held responsible for the validity of this customer supplied data, or any subsequent calculations that rely on this information.

‡ Analysis subcontracted to an external provider. Refer to the Summary of Methods section for more details.

Appendix No.1 - ALS Report

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.

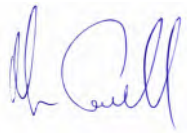
Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
Gases in Ground Water*	See attached report. Subcontracted to ALS Environmental - Brisbane.	-	1
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1
Total anions for anion/cation balance check	Calculation: sum of anions as mEquiv/L calculated from Alkalinity (bicarbonate), Chloride and Sulphate. Nitrate-N, Nitrite-N. Fluoride, Dissolved Reactive Phosphorus and Cyanide also included in calculation if available. APHA 1030 E : Online Edition.	0.07 meq/L	1
Total cations for anion/cation balance check	Sum of cations as mEquiv/L calculated from Sodium, Potassium, Calcium and Magnesium. Iron, Manganese, Aluminium, Zinc, Copper, Lithium, Total Ammoniacal-N and pH (H^+) also included in calculation if available. APHA 1030 E : Online Edition.	0.05 meq/L	1
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
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (modified for Alkalinity <20) : Online Edition.	1.0 g/m³ as $CaCO_3$	1
Bicarbonate	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/m³ at 25°C	1
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B : Online Edition.	1.0 g/m³ as $CaCO_3$	1
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	0.1 mS/m	1
Total Dissolved Solids (TDS)	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) : Online Edition.	10 g/m³	1
Sample Temperature*	Temperature of the sample at the time of sampling, supplied by customer.	0.1 °C	1

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Dissolved Barium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.005 g/m³	1
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.05 g/m³	1
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.02 g/m³	1
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.02 g/m³	1
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1
Dissolved Mercury	0.45µm filtration, bromine oxidation followed by atomic fluorescence. US EPA Method 245.7, Feb 2005.	0.00008 g/m³	1
Dissolved Nickel	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0005 g/m³	1
Dissolved Potassium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.05 g/m³	1
Dissolved Sodium	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.02 g/m³	1
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0010 g/m³	1
Bromide	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.05 g/m³	1
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m³	1
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) : Online Edition.	0.002 g/m³	1
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - Nitrite-N. In-House.	0.0010 g/m³	1
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO_3^- I (modified) : Online Edition.	0.002 g/m³	1
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m³	1
Ethylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	1
Propylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	1
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	1
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	1
Formaldehyde in Water by DNPH & LCMSMS	Derivatisation, SPE extraction, LC-MS/MS analysis. In-house based on US EPA 8315A.	0.02 g/m³	1
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	1
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	1
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	1
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	1

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

Testing was completed between 20-Jun-2024 and 15-Jul-2024. 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.



Martin Cowell - BSc
Client Services Manager - Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB2422219**	Page	: 1 of 2
Amendment	: **2**		
Client	: **ANALYTICA LABORATORIES LIMITED**	Laboratory	: Environmental Division Brisbane
Contact	: Default reports	Contact	: Customer Services EB
Address	: RUAKURA RESEARCH CENTRE 10 Bisley Road HAMILTON WAIKATO, NZ 3240	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61-7-3243 7222
Project	: 24- 19870	Date Samples Received	: 28-Jun-2024 13:29
Order number	: ----	Date Analysis Commenced	: 09-Jul-2024
C-O-C number	: ----	Issue Date	: 15-Jul-2024 11:43
Sampler	: ----		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 1		
No. of samples analysed	: 1		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW

Page	:	2 of 2
Work Order	:	EB2422219 Amendment 2
Client	:	ANALYTICA LABORATORIES LIMITED
Project	:	24- 19870

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- **Analysis is conducted by ALS Environmental, Sydney, NATA accreditation no. 825, Site No. 10911 (Micro site no. 14913).**
- Amendment (11.07.2024): This report has been amended as a result of a request to change sample identification numbers (IDs) received from Charlene Ragas on 11.7.24. All analysis results are as per the previous report.
- Amendment (15/07/2024): This report has been amended as a result of a request to change sample identification numbers (IDs) received from Tamaryn Cronje on 15/07/2024. All analysis results are as per the previous report.

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)				Sample ID	**3608254.1**	----	----	----	----
				Sampling date / time	[17-Jun-2024]	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*		**EB2422219-001**	--------	--------	--------	--------
					Result	----	----	----	----
EP033: C1 - C4 Hydrocarbon Gases									
Methane	74-82-8	1	µg/L		**3680**	----	----	----	----
Ethene	74-85-1	1	µg/L		<1	----	----	----	----
Ethane	74-84-0	1	µg/L		<1	----	----	----	----
Propene	115-07-1	1	µg/L		<1	----	----	----	----
Propane	74-98-6	1	µg/L		<1	----	----	----	----
Butene	25167-67-3	1	µg/L		<1	----	----	----	----
Butane	106-97-8	1	µg/L		<1	----	----	----	----

Inter-Laboratory Testing

Analysis conducted by ALS Sydney, NATA accreditation no. 825, site no. 10911.

(WATER) EP033: C1 - C4 Hydrocarbon Gases

Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
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Private Bag 3205
Hamilton 3240 New Zealand

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T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Certificate of Analysis

Client:	Taranaki Regional Council	**Lab No:**	3100533 SPv1
Contact:	Jane Harvey C/- Taranaki Regional Council Private Bag 713 Stratford 4352	**Date Received:**	21-Oct-2022
		Date Reported:	28-Oct-2022
		Quote No:	47915
		Order No:	4500002828
		Client Reference:	#7908 - HF interim GW Turangi-A
		Submitted By:	Josh Dowsing

Sample Type: Aqueous

Sample Name:		TRC228439 (GND1673) 20-Oct-2022 12:40 pm
Lab Number:		3100533.1
Individual Tests		
Sum of Anions	meq/L	3.2
Sum of Cations	meq/L	3.0
pH	pH Units	7.7
Total Alkalinity	g/m³ as $CaCO_3$	136
Bicarbonate	g/m³ at 25°C	165
Total Hardness	g/m³ as $CaCO_3$	84
Electrical Conductivity (EC)	mS/m	30.4
Total Dissolved Solids (TDS)	g/m³	210
Sample Temperature*†	°C	15.5
Dissolved Barium	g/m³	0.011
Dissolved Calcium	g/m³	17.1
Dissolved Copper	g/m³	< 0.0005
Dissolved Iron	g/m³	0.90
Dissolved Magnesium	g/m³	9.9
Dissolved Manganese	g/m³	0.158
Dissolved Mercury	g/m³	< 0.00008
Dissolved Nickel	g/m³	< 0.0005
Dissolved Potassium	g/m³	4.8
Dissolved Sodium	g/m³	27
Dissolved Zinc	g/m³	0.0015
Bromide	g/m³	0.08
Chloride	g/m³	15.8
Nitrite-N	g/m³	< 0.002
Nitrate-N	g/m³	< 0.002
Nitrate-N + Nitrite-N	g/m³	0.002
Sulphate	g/m³	< 0.5
Ethylene Glycol in Water*		
Ethylene glycol*	g/m³	< 4
Propylene Glycol in Water*		
Propylene glycol*	g/m³	< 4
Methanol in Water - Aqueous Solvents*		
Methanol*	g/m³	< 2
BTEX in Water by Headspace GC-MS		
Benzene	g/m³	< 0.0010
Toluene	g/m³	< 0.0010
Ethylbenzene	g/m³	< 0.0010
m&p-Xylene	g/m³	< 0.002
o-Xylene	g/m³	< 0.0010

Sample Type: Aqueous		
Sample Name:		TRC228439 (GND1673) 20-Oct-2022 12:40 pm
Lab Number:		3100533.1
Formaldehyde in Water by DNPH & LCMSMS		
Formaldehyde	g/m³	< 0.02
Gases in groundwater		
Ethane	g/m³	< 0.003
Ethylene	g/m³	< 0.004
Methane	g/m³	1.19
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m³	< 0.10
C10 - C14	g/m³	< 0.2
C15 - C36	g/m³	< 0.4
Total hydrocarbons (C7 - C36)	g/m³	< 0.7

Analyst's Comments

† Customer supplied data. Please note: Hill Laboratories cannot be held responsible for the validity of this customer supplied data, or any subsequent calculations that rely on this information.

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**
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1
Total anions for anion/cation balance check	Calculation: sum of anions as mEquiv/L calculated from Alkalinity (bicarbonate), Chloride and Sulphate. Nitrate-N, Nitrite-N. Fluoride, Dissolved Reactive Phosphorus and Cyanide also included in calculation if available. APHA 1030 E 23rd ed. 2017.	0.07 meq/L	1
Total cations for anion/cation balance check	Sum of cations as mEquiv/L calculated from Sodium, Potassium, Calcium and Magnesium. Iron, Manganese, Aluminium, Zinc, Copper, Lithium, Total Ammoniacal-N and pH (H^+) also included in calculation if available. APHA 1030 E 23rd ed. 2017.	0.05 meq/L	1
pH	pH meter. APHA 4500-H^+ B 23rd 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) 23rd ed. 2017.	1.0 g/m³ as $CaCO_3$	1
Bicarbonate	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 23rd ed. 2017.	1.0 g/m³ at 25°C	1
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 23rd ed. 2017.	1.0 g/m³ as $CaCO_3$	1
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 23rd ed. 2017.	0.1 mS/m	1
Total Dissolved Solids (TDS)	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) 23rd ed. 2017.	10 g/m³	1
Sample Temperature*	Temperature of the sample at the time of sampling, supplied by customer.	0.1 °C	1
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23rd ed. 2017.	-	1
Dissolved Barium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.005 g/m³	1
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.05 g/m³	1
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.0005 g/m³	1
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.02 g/m³	1

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.02 g/m³	1
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.0005 g/m³	1
Dissolved Mercury	0.45µm filtration, bromine oxidation followed by atomic fluorescence. US EPA Method 245.7, Feb 2005.	0.00008 g/m³	1
Dissolved Nickel	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.0005 g/m³	1
Dissolved Potassium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.05 g/m³	1
Dissolved Sodium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.02 g/m³	1
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.0010 g/m³	1
Bromide	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23rd ed. 2017.	0.05 g/m³	1
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23rd ed. 2017.	0.5 g/m³	1
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.002 g/m³	1
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO2N. In-House.	0.0010 g/m³	1
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.002 g/m³	1
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23rd ed. 2017.	0.5 g/m³	1
Ethylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	1
Propylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	1
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	1
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	1
Formaldehyde in Water by DNPH & LCMSMS	Derivatisation, SPE extraction, LC-MS/MS analysis. In-house based on US EPA 8315A.	0.02 g/m³	1
Gases in groundwater	Headspace GC-FID analysis. In-house.	0.002 - 0.003 g/m³	1
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	1
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	1
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	1
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	1

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

Testing was completed between 22-Oct-2022 and 28-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.

Ara Heron BSc (Tech)
Client Services Manager - Environmental

Hill Laboratories
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Certificate of Analysis

Client:	Taranaki Regional Council	**Lab No:**	2969176 SPv1
Contact:	Jane Harvey	**Date Received:**	28-Apr-2022
	C/- Taranaki Regional Council	**Date Reported:**	05-May-2022
	Private Bag 713	**Quote No:**	47915
	Stratford 4352	**Order No:**	4500002828
		Client Reference:	#7540 - Greymouth Turangi-A Pre-Frac GW
		Submitted By:	Sarah Avery

Sample Type: Aqueous

Sample Name:		TRC226320 (GND1673) 27-Apr-2022 12:20 pm				
Lab Number:		2969176.1				
Individual Tests						
Sum of Anions	meq/L	3.4	-	-	-	-
Sum of Cations	meq/L	3.7	-	-	-	-
pH	pH Units	7.6	-	-	-	-
Total Alkalinity	g/m³ as $CaCO_3$	148	-	-	-	-
Bicarbonate	g/m³ at 25°C	180	-	-	-	-
Total Hardness	g/m³ as $CaCO_3$	97	-	-	-	-
Electrical Conductivity (EC)	mS/m	31.7	-	-	-	-
Total Dissolved Solids (TDS)	g/m³	210	-	-	-	-
Sample Temperature*†	°C	15.6	-	-	-	-
Dissolved Barium	g/m³	0.022	-	-	-	-
Dissolved Calcium	g/m³	20	-	-	-	-
Dissolved Copper	g/m³	< 0.0005	-	-	-	-
Dissolved Iron	g/m³	7.9	-	-	-	-
Dissolved Magnesium	g/m³	11.1	-	-	-	-
Dissolved Manganese	g/m³	0.195	-	-	-	-
Dissolved Mercury	g/m³	< 0.00008	-	-	-	-
Dissolved Nickel	g/m³	< 0.0005	-	-	-	-
Dissolved Potassium	g/m³	5.6	-	-	-	-
Dissolved Sodium	g/m³	30	-	-	-	-
Dissolved Zinc	g/m³	0.0166	-	-	-	-
Bromide	g/m³	0.08	-	-	-	-
Chloride	g/m³	15.2	-	-	-	-
Nitrite-N	g/m³	0.002	-	-	-	-
Nitrate-N	g/m³	< 0.002	-	-	-	-
Nitrate-N + Nitrite-N	g/m³	0.003	-	-	-	-
Sulphate	g/m³	< 0.5	-	-	-	-
Ethylene Glycol in Water*						
Ethylene glycol*	g/m³	< 4	-	-	-	-
Propylene Glycol in Water*						
Propylene glycol*	g/m³	< 4	-	-	-	-
Methanol in Water - Aqueous Solvents*						
Methanol*	g/m³	< 2	-	-	-	-

Sample Type: Aqueous						
Sample Name:		TRC226320 (GND1673) 27-Apr-2022 12:20 pm				
Lab Number:		2969176.1				
BTEX in Water by Headspace GC-MS						
Benzene	g/m³	< 0.0010	-	-	-	-
Toluene	g/m³	< 0.0010	-	-	-	-
Ethylbenzene	g/m³	< 0.0010	-	-	-	-
m&p-Xylene	g/m³	< 0.002	-	-	-	-
o-Xylene	g/m³	< 0.0010	-	-	-	-
Formaldehyde in Water by DNPH & LCMSMS						
Formaldehyde	g/m³	< 0.02	-	-	-	-
Gases in groundwater						
Ethane	g/m³	< 0.003	-	-	-	-
Ethylene	g/m³	< 0.003	-	-	-	-
Methane	g/m³	7.5	-	-	-	-
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m³	< 0.10	-	-	-	-
C10 - C14	g/m³	< 0.2	-	-	-	-
C15 - C36	g/m³	< 0.4	-	-	-	-
Total hydrocarbons (C7 - C36)	g/m³	< 0.7	-	-	-	-

Analyst's Comments

† Customer supplied data. Please note: Hill Laboratories cannot be held responsible for the validity of this customer supplied data, or any subsequent calculations that rely on this information.

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**
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1
Total anions for anion/cation balance check	Calculation: sum of anions as mEquiv/L calculated from Alkalinity (bicarbonate), Chloride and Sulphate. Nitrate-N, Nitrite-N. Fluoride, Dissolved Reactive Phosphorus and Cyanide also included in calculation if available. APHA 1030 E 23rd ed. 2017.	0.07 meq/L	1
Total cations for anion/cation balance check	Sum of cations as mEquiv/L calculated from Sodium, Potassium, Calcium and Magnesium. Iron, Manganese, Aluminium, Zinc, Copper, Lithium, Total Ammoniacal-N and pH (H^+) also included in calculation if available. APHA 1030 E 23rd ed. 2017.	0.05 meq/L	1
pH	pH meter. APHA 4500-H^+ B 23rd 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) 23rd ed. 2017.	1.0 g/m³ as $CaCO_3$	1
Bicarbonate	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 23rd ed. 2017.	1.0 g/m³ at 25°C	1
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 23rd ed. 2017.	1.0 g/m³ as $CaCO_3$	1
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 23rd ed. 2017.	0.1 mS/m	1
Total Dissolved Solids (TDS)	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) 23rd ed. 2017.	10 g/m³	1
Sample Temperature*	Temperature of the sample at the time of sampling, supplied by customer.	0.1 °C	1

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Dissolved Barium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.005 g/m³	1
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.05 g/m³	1
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.0005 g/m³	1
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.02 g/m³	1
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.02 g/m³	1
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.0005 g/m³	1
Dissolved Mercury	0.45µm filtration, bromine oxidation followed by atomic fluorescence. US EPA Method 245.7, Feb 2005.	0.00008 g/m³	1
Dissolved Nickel	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.0005 g/m³	1
Dissolved Potassium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.05 g/m³	1
Dissolved Sodium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.02 g/m³	1
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.0010 g/m³	1
Bromide	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23rd ed. 2017.	0.05 g/m³	1
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23rd ed. 2017.	0.5 g/m³	1
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.002 g/m³	1
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO2N. In-House.	0.0010 g/m³	1
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.002 g/m³	1
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23rd ed. 2017.	0.5 g/m³	1
Ethylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	1
Propylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	1
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	1
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	1
Formaldehyde in Water by DNPH & LCMSMS	Derivatisation, SPE extraction, LC-MS/MS analysis. In-house based on US EPA 8315A.	0.02 g/m³	1
Gases in groundwater	Headspace GC-FID analysis. In-house.	0.002 - 0.003 g/m³	1
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	1
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	1
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	1
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	1

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

Testing was completed between 28-Apr-2022 and 05-May-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.

Kim Harrison MSc
Client Services Manager - Environmental

Appendix IV

Certificates of analysis (hydraulic fracturing fluids)

Hill Laboratories
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R J Hill Laboratories Limited
28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand

T 0508 HILL LAB (44 555 22)
T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3012873 SPv1
Contact:	Fiona Campbell	**Date Received:**	14-Jun-2022
	C/- Greymouth Petroleum Limited	**Date Reported:**	22-Jun-2022
	14 Connett Road West	**Quote No:**	85159
	Bell Block	**Order No:**	256091
	New Plymouth 4312	**Client Reference:**	Hydraulic fracturing fluid testing
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

Sample Name:		Turangi 15 Stim 1 Prepumped HF Fluid 09-Jun-2022				
Lab Number:		3012873.1				
Ethylene Glycol in Water*						
Ethylene glycol*	g/m³	670	-	-	-	-
Propylene Glycol in Water*						
Propylene glycol*	g/m³	< 20	-	-	-	-
Methanol in Water - Aqueous Solvents*						
Methanol*	g/m³	< 20	-	-	-	-
BTEX in Water by Headspace GC-MS						
Benzene	g/m³	< 0.0010	-	-	-	-
Toluene	g/m³	0.0011	-	-	-	-
Ethylbenzene	g/m³	< 0.0010	-	-	-	-
m&p-Xylene	g/m³	< 0.002	-	-	-	-
o-Xylene	g/m³	< 0.0010	-	-	-	-
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m³	< 0.4	-	-	-	-
C10 - C14	g/m³	< 1.0	-	-	-	-
C15 - C36	g/m³	< 2	-	-	-	-
Total hydrocarbons (C7 - C36)	g/m³	< 4	-	-	-	-

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
Individual Tests			
Ethylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	1
Propylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	1
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	1
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	1
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	1
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	1
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	1
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	1

This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

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

Testing was completed between 15-Jun-2022 and 22-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.

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

Martin Cowell - BSc
Client Services Manager - Environmental

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Hamilton 3240 New Zealand

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W www.hill-laboratories.com

Certificate of Analysis

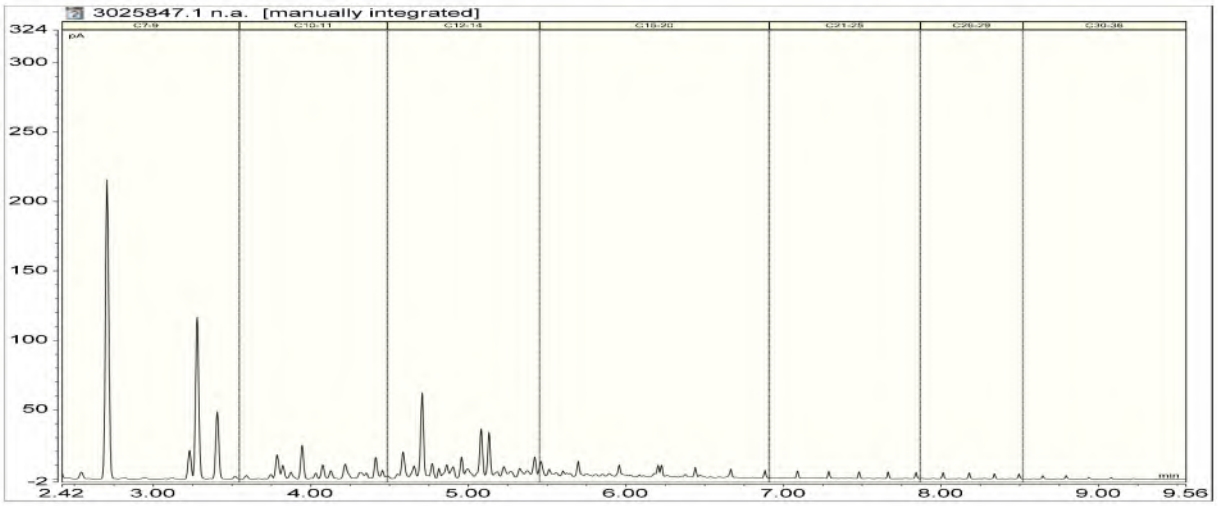
Client:	Greymouth Petroleum Limited	**Lab No:**	3025847 SPv1
Contact:	Fiona Campbell	**Date Received:**	02-Jul-2022
	C/- Greymouth Petroleum Limited	**Date Reported:**	13-Jul-2022
	14 Connett Road West	**Quote No:**	81870
	Bell Block	**Order No:**	256091
	New Plymouth 4312	**Client Reference:**	Return Fluid Composite
		Submitted By:	Fiona Campbell

Sample Type: Saline

Sample Name:		Turangi 15 Stim #1 Return HF Fluid Start 09-Jun-2022				
Lab Number:		3025847.1				
Individual Tests						
pH*	pH Units	6.9	-	-	-	-
Total Alkalinity*	g/m³ as $CaCO_3$	400	-	-	-	-
Total Hardness*	g/m³ as $CaCO_3$	159	-	-	-	-
Electrical Conductivity (EC)*	mS/m	851	-	-	-	-
Salinity*		4.7	-	-	-	-
Total Suspended Solids	g/m³	2,600	-	-	-	-
Total Dissolved Solids (TDS)*	g/m³	4,800	-	-	-	-
Dissolved Barium	g/m³	8.5	-	-	-	-
Dissolved Bromine	g/m³	5.6	-	-	-	-
Dissolved Calcium	g/m³	51	-	-	-	-
Dissolved Copper	g/m³	0.006	-	-	-	-
Dissolved Iron	g/m³	17.1	-	-	-	-
Dissolved Magnesium	g/m³	8	-	-	-	-
Dissolved Manganese	g/m³	2.9	-	-	-	-
Total Nickel	g/m³	0.24	-	-	-	-
Total Potassium	g/m³	67	-	-	-	-
Total Sodium	g/m³	1,590	-	-	-	-
Total Sulphur*	g/m³	10	-	-	-	-
Total Zinc	g/m³	0.180	-	-	-	-
Chloride*	g/m³	2,500	-	-	-	-
Nitrite-N	g/m³	< 0.010 #1	-	-	-	-
Nitrate-N	g/m³	< 0.010	-	-	-	-
Nitrate*	g/m³	< 0.05	-	-	-	-
Nitrate-N + Nitrite-N	g/m³	< 0.010 #1	-	-	-	-
Sulphate*	g/m³	30	-	-	-	-
Ethylene Glycol in Water*						
Ethylene glycol*	g/m³	< 20	-	-	-	-
Propylene Glycol in Water*						
Propylene glycol*	g/m³	< 20	-	-	-	-
Methanol in Water - Aqueous Solvents*						
Methanol*	g/m³	< 20	-	-	-	-

Sample Type: Saline						
Sample Name:		Turangi 15 Stim #1 Return HF Fluid Start 09-Jun-2022				
Lab Number:		3025847.1				
BTEX in Water by Headspace GC-MS*						
Benzene*	g/m³	6.0	-	-	-	-
Toluene*	g/m³	6.6	-	-	-	-
Ethylbenzene*	g/m³	0.42	-	-	-	-
m&p-Xylene*	g/m³	2.4	-	-	-	-
o-Xylene*	g/m³	0.95	-	-	-	-
Formaldehyde in Water by DNPH & LCMSMS*						
Formaldehyde*	g/m³	< 1.5	-	-	-	-
Total Petroleum Hydrocarbons in Water*						
C7 - C9*	g/m³	6.3	-	-	-	-
C10 - C14*	g/m³	6.1	-	-	-	-
C15 - C36*	g/m³	4.1	-	-	-	-
Total hydrocarbons (C7 - C36)*	g/m³	16.4	-	-	-	-

3025847.1
Turangi 15 Stim #1 Return HF Fluid Start 09-Jun-2022
Client Chromatogram for TPH by FID



Analyst's Comments

[#1] Due to the nature of this sample a dilution was performed prior to analysis, resulting in a detection limit higher than that normally achieved for the NO2N, NO3N and NOxN 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: Saline			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
Filtration, Unpreserved*	Sample filtration through 0.45µm membrane filter.	-	1
Total Digestion*	Boiling nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	1
Total Digestion of Saline Samples*	Nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	1
pH*	pH meter. APHA 4500-H^+ B 23rd 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

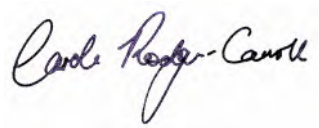
Sample Type: Saline			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Alkalinity*	Saline water, Titration to pH 4.5.	1.0 g/m³ as $CaCO_3$	1
Total Hardness*	Calculation from Calcium and Magnesium. APHA 2340 B 23rd ed. 2017.	1.0 g/m³ as $CaCO_3$	1
Electrical Conductivity (EC)*	Conductivity meter, 25°C. APHA 2510 B 23rd ed. 2017.	0.1 mS/m	1
Salinity*	Conductivity Meter (WTW Cond 340i with nonlinear temperature compensation according to EN 27 888). APHA 2520 B 23rd ed. 2017.	0.2	1
Total Suspended Solids	Saline sample. Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D (modified) 23rd ed. 2017.	3 g/m³	1
Total Dissolved Solids (TDS)*	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) 23rd ed. 2017.	50 g/m³	1
Filtration for dissolved metals analysis*	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23rd ed. 2017.	-	1
Dissolved Barium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.0006 g/m³	1
Dissolved Bromine	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.10 g/m³	1
Dissolved Calcium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	1.0 g/m³	1
Dissolved Copper	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0010 g/m³	1
Dissolved Iron	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 23rd ed. 2017.	0.004 g/m³	1
Dissolved Magnesium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.4 g/m³	1
Dissolved Manganese	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0010 g/m³	1
Total Nickel	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.0070 g/m³	1
Total Potassium	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	1.1 g/m³	1
Total Sodium	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.42 g/m³	1
Total Sulphur*	Nitric acid digestion, ICP-OES (method may not fully account for H_2S due to volatilisation during digestion). All forms of oxidised and organic sulphur will be determined by this method. APHA 3120 B 23rd ed. 2017.	0.5 g/m³	1
Total Zinc	Nitric acid digestion, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0042 g/m³	1
Chloride*	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23rd ed. 2017.	0.5 g/m³	1
Nitrite-N	Saline sample. Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.0010 g/m³	1
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO2N. In-House.	0.0010 g/m³	1
Nitrate*	Calculation from Nitrate-N.	0.005 g/m³	1
Nitrate-N + Nitrite-N	Saline sample. Total oxidised nitrogen. Automated cadmium reduction, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.0010 g/m³	1
Total Sulphate*	Calculation: from total sulphur.	2 g/m³	1
Ethylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	1
Propylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	1
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	1
BTEX in Water by Headspace GC-MS*	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	1
Formaldehyde in Water by DNPH & LCMSMS*	Derivatisation, SPE extraction, LC-MS/MS analysis. In-house based on US EPA 8315A.	0.02 g/m³	1
Total Petroleum Hydrocarbons in Water			
C7 - C9*	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	1
C10 - C14*	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	1
C15 - C36*	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	1

Sample Type: Saline			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total hydrocarbons (C7 - C36)*	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m^3	1

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

Testing was completed between 02-Jul-2022 and 13-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.



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

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Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3017905 SPv1
Contact:	Fiona Campbell	**Date Received:**	21-Jun-2022
	C/- Greymouth Petroleum Limited	**Date Reported:**	30-Jun-2022
	14 Connett Road West	**Quote No:**	85159
	Bell Block	**Order No:**	256283
	New Plymouth 4312	**Client Reference:**	Hydraulic fracturing fluid testing
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

Sample Name:		Turangi 15 Stim #2 Prepumped HF Fluid 18-Jun-2022				
Lab Number:		3017905.1				
Ethylene Glycol in Water*						
Ethylene glycol*	g/m³	550	-	-	-	-
Propylene Glycol in Water*						
Propylene glycol*	g/m³	< 20	-	-	-	-
Methanol in Water - Aqueous Solvents*						
Methanol*	g/m³	< 20	-	-	-	-
BTEX in Water by Headspace GC-MS						
Benzene	g/m³	< 0.0010	-	-	-	-
Toluene	g/m³	0.0013	-	-	-	-
Ethylbenzene	g/m³	< 0.0010	-	-	-	-
m&p-Xylene	g/m³	< 0.002	-	-	-	-
o-Xylene	g/m³	< 0.0010	-	-	-	-
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m³	< 0.4	-	-	-	-
C10 - C14	g/m³	< 1.0	-	-	-	-
C15 - C36	g/m³	< 2	-	-	-	-
Total hydrocarbons (C7 - C36)	g/m³	< 4	-	-	-	-

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
Individual Tests			
Ethylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	1
Propylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	1
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	1
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	1
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	1
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	1
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	1

This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised. The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m^3	1

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

Testing was completed between 23-Jun-2022 and 28-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.

Ara Heron BSc (Tech)
Client Services Manager - Environmental

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Certificate of Analysis

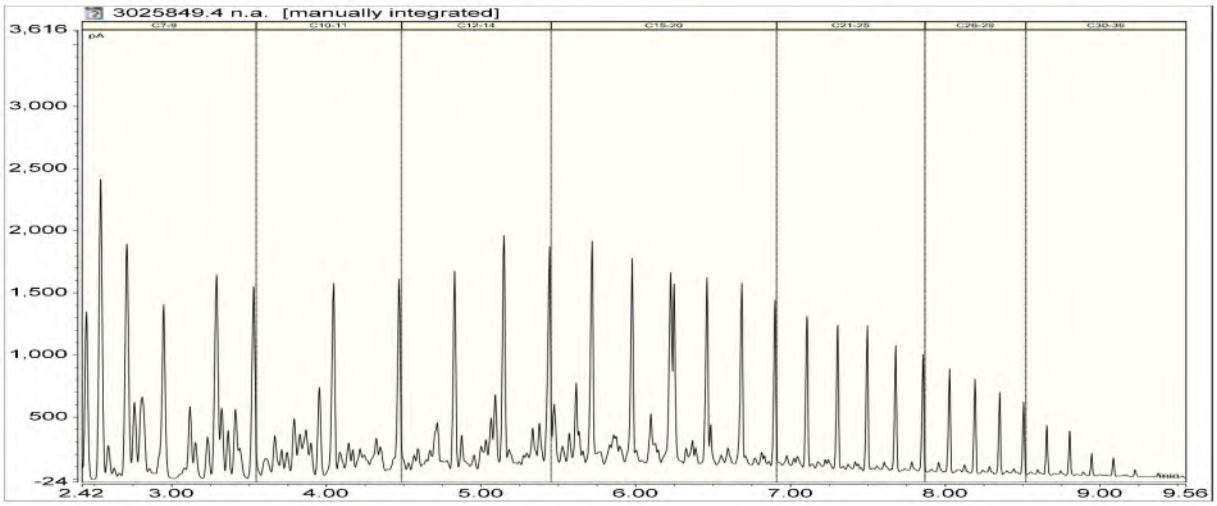
Client:	Greymouth Petroleum Limited	**Lab No:**	3025849 SPv1
Contact:	Fiona Campbell	**Date Received:**	02-Jul-2022
	C/- Greymouth Petroleum Limited	**Date Reported:**	13-Jul-2022
	14 Connett Road West	**Quote No:**	81870
	Bell Block	**Order No:**	256283
	New Plymouth 4312	**Client Reference:**	Return Fluid Composite
		Submitted By:	Fiona Campbell

Sample Type: Saline

	Sample Name:	Turangi 15 Stim #2 Return HF Fluid (Composite of Turangi 15 Stim #2 Return HF Fluid Start, Middle & End)				
	Lab Number:	3025849.4				
Individual Tests						
pH*	pH Units	6.8	-	-	-	-
Total Alkalinity*	g/m³ as $CaCO_3$	570	-	-	-	-
Total Hardness*	g/m³ as $CaCO_3$	420	-	-	-	-
Electrical Conductivity (EC)*	mS/m	1,779	-	-	-	-
Salinity*		10.5	-	-	-	-
Total Suspended Solids	g/m³	340	-	-	-	-
Total Dissolved Solids (TDS)*	g/m³	12,200	-	-	-	-
Dissolved Barium	g/m³	25	-	-	-	-
Dissolved Bromine	g/m³	16.6	-	-	-	-
Dissolved Calcium	g/m³	134	-	-	-	-
Dissolved Copper	g/m³	0.021	-	-	-	-
Dissolved Iron	g/m³	5.1	-	-	-	-
Dissolved Magnesium	g/m³	22	-	-	-	-
Dissolved Manganese	g/m³	2.0	-	-	-	-
Total Nickel	g/m³	0.182 #1	-	-	-	-
Total Potassium	g/m³	119	-	-	-	-
Total Sodium	g/m³	3,400	-	-	-	-
Total Sulphur*	g/m³	11	-	-	-	-
Total Zinc	g/m³	0.185	-	-	-	-
Chloride*	g/m³	5,700	-	-	-	-
Nitrite-N	g/m³	0.021 #2	-	-	-	-
Nitrate-N	g/m³	0.152	-	-	-	-
Nitrate*	g/m³	0.67	-	-	-	-
Nitrate-N + Nitrite-N	g/m³	0.173 #2	-	-	-	-
Sulphate*	g/m³	32	-	-	-	-
Ethylene Glycol in Water*						
Ethylene glycol*	g/m³	44	-	-	-	-
Propylene Glycol in Water*						
Propylene glycol*	g/m³	< 20	-	-	-	-

Sample Type: Saline						
Sample Name:	Turangi 15 Stim #2 Return HF Fluid (Composite of Turangi 15 Stim #2 Return HF Fluid Start, Middle & End)					
Lab Number:	3025849.4					
Methanol in Water - Aqueous Solvents*						
Methanol* g/m³	< 20	-	-	-	-	
BTEX in Water by Headspace GC-MS*						
Benzene* g/m³	40	-	-	-	-	
Toluene* g/m³	25	-	-	-	-	
Ethylbenzene* g/m³	1.65	-	-	-	-	
m&p-Xylene* g/m³	10.0	-	-	-	-	
o-Xylene* g/m³	3.1	-	-	-	-	
Formaldehyde in Water by DNPH & LCMSMS*						
Formaldehyde* g/m³	0.37	-	-	-	-	
Total Petroleum Hydrocarbons in Water*						
C7 - C9* g/m³	240	-	-	-	-	
C10 - C14* g/m³	300	-	-	-	-	
C15 - C36* g/m³	550	-	-	-	-	
Total hydrocarbons (C7 - C36)* g/m³	1,080	-	-	-	-	

3025849.4
Turangi 15 Stim #2 Return HF Fluid (Composite of Turangi 15 Stim #2 Return HF Fluid Start, Middle & End)
Client Chromatogram for TPH by FID



Analyst's Comments

#1 It should be noted that the replicate analyses performed on this sample as part of our in-house Quality Assurance procedures showed greater variation than would normally be expected. This may reflect the heterogeneity of the sample. The average of the results of the replicate analyses has been reported.

#2 Due to the nature of this sample a dilution was performed prior to analysis, resulting in a detection limit higher than that normally achieved for the NO2N, NO3N and NOxN 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: Saline			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
Filtration, Unpreserved*	Sample filtration through 0.45µm membrane filter.	-	4

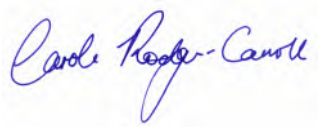
Sample Type: Saline			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Digestion*	Boiling nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	4
Total Digestion of Saline Samples*	Nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	4
pH*	pH meter. APHA 4500-H^+ B 23rd 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	4
Total Alkalinity*	Saline water, Titration to pH 4.5.	1.0 g/m^3 as $CaCO_3$	4
Total Hardness*	Calculation from Calcium and Magnesium. APHA 2340 B 23rd ed. 2017.	1.0 g/m^3 as $CaCO_3$	4
Electrical Conductivity (EC)*	Conductivity meter, 25°C. APHA 2510 B 23rd ed. 2017.	0.1 mS/m	4
Salinity*	Conductivity Meter (WTW Cond 340i with nonlinear temperature compensation according to EN 27 888). APHA 2520 B 23rd ed. 2017.	0.2	4
Total Suspended Solids	Saline sample. Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D (modified) 23rd ed. 2017.	3 g/m^3	4
Total Dissolved Solids (TDS)*	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) 23rd ed. 2017.	50 g/m^3	4
Filtration for dissolved metals analysis*	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23rd ed. 2017.	-	4
Dissolved Barium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.0006 g/m^3	4
Dissolved Bromine	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.10 g/m^3	4
Dissolved Calcium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	1.0 g/m^3	4
Dissolved Copper	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0010 g/m^3	4
Dissolved Iron	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 23rd ed. 2017.	0.004 g/m^3	4
Dissolved Magnesium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.4 g/m^3	4
Dissolved Manganese	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0010 g/m^3	4
Total Nickel	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.0070 g/m^3	4
Total Potassium	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	1.1 g/m^3	4
Total Sodium	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.42 g/m^3	4
Total Sulphur*	Nitric acid digestion, ICP-OES (method may not fully account for H_2S due to volatilisation during digestion). All forms of oxidised and organic sulphur will be determined by this method. APHA 3120 B 23rd ed. 2017.	0.5 g/m^3	4
Total Zinc	Nitric acid digestion, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0042 g/m^3	4
Chloride*	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23rd ed. 2017.	0.5 g/m^3	4
Nitrite-N	Saline sample. Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.0010 g/m^3	4
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO2N. In-House.	0.0010 g/m^3	4
Nitrate*	Calculation from Nitrate-N.	0.005 g/m^3	4
Nitrate-N + Nitrite-N	Saline sample. Total oxidised nitrogen. Automated cadmium reduction, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.0010 g/m^3	4
Total Sulphate*	Calculation: from total sulphur.	2 g/m^3	4
Ethylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m^3	4
Propylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m^3	4
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m^3	4
BTEX in Water by Headspace GC-MS*	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m^3	4

Sample Type: Saline			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Formaldehyde in Water by DNPH & LCMSMS*	Derivatisation, SPE extraction, LC-MS/MS analysis. In-house based on US EPA 8315A.	0.02 g/m^3	4
Total Petroleum Hydrocarbons in Water			
C7 - C9*	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m^3	4
C10 - C14*	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m^3	4
C15 - C36*	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m^3	4
Total hydrocarbons (C7 - C36)*	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m^3	4

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

Testing was completed between 05-Jul-2022 and 13-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.



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

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Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3025837 SPv1
Contact:	Fiona Campbell	**Date Received:**	02-Jul-2022
	C/- Greymouth Petroleum Limited	**Date Reported:**	14-Jul-2022
	14 Connett Road West	**Quote No:**	85159
	Bell Block	**Order No:**	256349
	New Plymouth 4312	**Client Reference:**	Hydraulic fracturing fluid testing
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

Sample Name:		Turangi 15 Stim 3 Prepumped HF Fluid 25-Jun-2022				
Lab Number:		3025837.1				
Ethylene Glycol in Water*						
Ethylene glycol*	g/m³	700	-	-	-	-
Propylene Glycol in Water*						
Propylene glycol*	g/m³	< 20	-	-	-	-
Methanol in Water - Aqueous Solvents*						
Methanol*	g/m³	< 20	-	-	-	-
BTEX in Water by Headspace GC-MS						
Benzene	g/m³	< 0.0010	-	-	-	-
Toluene	g/m³	< 0.0010	-	-	-	-
Ethylbenzene	g/m³	< 0.0010	-	-	-	-
m&p-Xylene	g/m³	< 0.002	-	-	-	-
o-Xylene	g/m³	< 0.0010	-	-	-	-
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m³	< 0.4	-	-	-	-
C10 - C14	g/m³	< 1.0	-	-	-	-
C15 - C36	g/m³	< 2	-	-	-	-
Total hydrocarbons (C7 - C36)	g/m³	< 4	-	-	-	-

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
Individual Tests			
Ethylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	1
Propylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	1
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	1
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	1
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	1
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	1
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	1
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	1

This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

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

Testing was completed between 05-Jul-2022 and 14-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.

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

Ara Heron BSc (Tech)
Client Services Manager - Environmental

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Certificate of Analysis

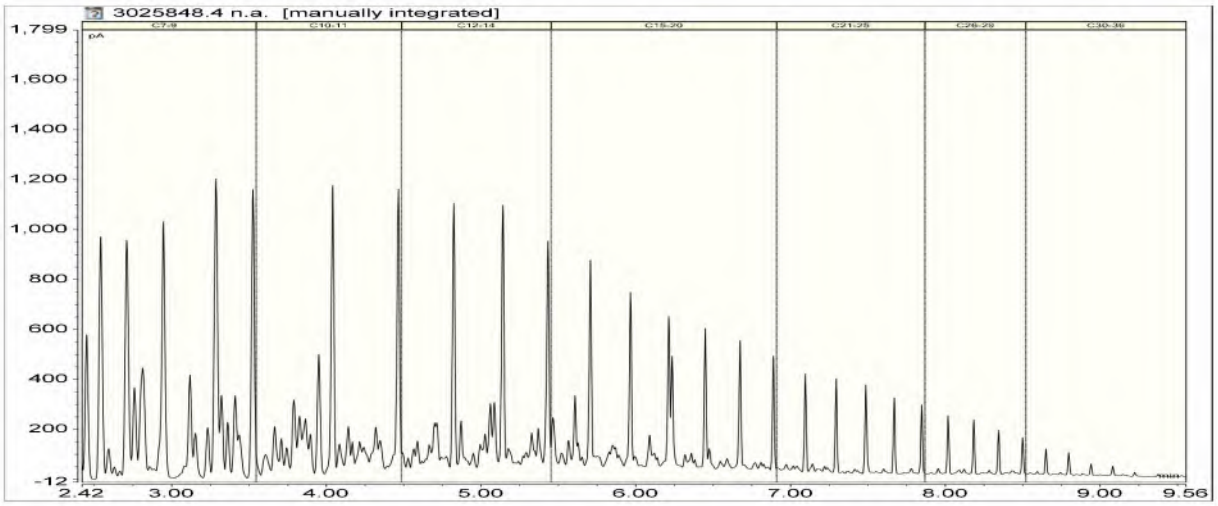
Client:	Greymouth Petroleum Limited	**Lab No:**	3025848 SPv1
Contact:	Fiona Campbell	**Date Received:**	02-Jul-2022
	C/- Greymouth Petroleum Limited	**Date Reported:**	13-Jul-2022
	14 Connett Road West	**Quote No:**	81870
	Bell Block	**Order No:**	256349
	New Plymouth 4312	**Client Reference:**	Return Fluid Composite
		Submitted By:	Fiona Campbell

Sample Type: Saline

	Sample Name:	Turangi 15 Stim #3 Return HF Fluid (Composite of Turangi 15 Stim #3 Return HF Fluid Start, Middle & End)				
	Lab Number:	3025848.4				
Individual Tests						
pH*	pH Units	7.1	-	-	-	-
Total Alkalinity*	g/m³ as $CaCO_3$	1,800	-	-	-	-
Total Hardness*	g/m³ as $CaCO_3$	230	-	-	-	-
Electrical Conductivity (EC)*	mS/m	1,833	-	-	-	-
Salinity*		10.9	-	-	-	-
Total Suspended Solids	g/m³	210	-	-	-	-
Total Dissolved Solids (TDS)*	g/m³	13,400	-	-	-	-
Dissolved Barium	g/m³	49	-	-	-	-
Dissolved Bromine	g/m³	18.4	-	-	-	-
Dissolved Calcium	g/m³	75	-	-	-	-
Dissolved Copper	g/m³	0.006	-	-	-	-
Dissolved Iron	g/m³	1.44	-	-	-	-
Dissolved Magnesium	g/m³	12	-	-	-	-
Dissolved Manganese	g/m³	1.74	-	-	-	-
Total Nickel	g/m³	0.045	-	-	-	-
Total Potassium	g/m³	120	-	-	-	-
Total Sodium	g/m³	3,900	-	-	-	-
Total Sulphur*	g/m³	7	-	-	-	-
Total Zinc	g/m³	0.071	-	-	-	-
Chloride*	g/m³	5,200	-	-	-	-
Nitrite-N	g/m³	0.136 #1	-	-	-	-
Nitrate-N	g/m³	< 0.010	-	-	-	-
Nitrate*	g/m³	< 0.05	-	-	-	-
Nitrate-N + Nitrite-N	g/m³	0.129 #1	-	-	-	-
Sulphate*	g/m³	22	-	-	-	-
Ethylene Glycol in Water*						
Ethylene glycol*	g/m³	83	-	-	-	-
Propylene Glycol in Water*						
Propylene glycol*	g/m³	< 20	-	-	-	-

Sample Type: Saline						
Sample Name:	Turangi 15 Stim #3 Return HF Fluid (Composite of Turangi 15 Stim #3 Return HF Fluid Start, Middle & End)					
Lab Number:	3025848.4					
Methanol in Water - Aqueous Solvents*						
Methanol* g/m³	< 20	-	-	-	-	
BTEX in Water by Headspace GC-MS*						
Benzene* g/m³	9.9	-	-	-	-	
Toluene* g/m³	19.9	-	-	-	-	
Ethylbenzene* g/m³	1.65	-	-	-	-	
m&p-Xylene* g/m³	13.4	-	-	-	-	
o-Xylene* g/m³	3.3	-	-	-	-	
Formaldehyde in Water by DNPH & LCMSMS*						
Formaldehyde* g/m³	< 1.5	-	-	-	-	
Total Petroleum Hydrocarbons in Water*						
C7 - C9* g/m³	138	-	-	-	-	
C10 - C14* g/m³	176	-	-	-	-	
C15 - C36* g/m³	186	-	-	-	-	
Total hydrocarbons (C7 - C36)* g/m³	500	-	-	-	-	

3025848.4
Turangi 15 Stim #3 Return HF Fluid (Composite of Turangi 15 Stim #3 Return HF Fluid Start, Middle & End)
Client Chromatogram for TPH by FID



Analyst's Comments

#1 Due to the nature of this sample a dilution was performed prior to analysis, resulting in a detection limit higher than that normally achieved for the NO2N, NO3N and NOxN analysis.

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: Saline			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
Filtration, Unpreserved*	Sample filtration through 0.45µm membrane filter.	-	4
Total Digestion*	Boiling nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	4

Sample Type: Saline			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Digestion of Saline Samples*	Nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	4
pH*	pH meter. APHA 4500-H^+ B 23rd 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	4
Total Alkalinity*	Saline water, Titration to pH 4.5.	1.0 g/m^3 as $CaCO_3$	4
Total Hardness*	Calculation from Calcium and Magnesium. APHA 2340 B 23rd ed. 2017.	1.0 g/m^3 as $CaCO_3$	4
Electrical Conductivity (EC)*	Conductivity meter, 25°C. APHA 2510 B 23rd ed. 2017.	0.1 mS/m	4
Salinity*	Conductivity Meter (WTW Cond 340i with nonlinear temperature compensation according to EN 27 888). APHA 2520 B 23rd ed. 2017.	0.2	4
Total Suspended Solids	Saline sample. Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D (modified) 23rd ed. 2017.	3 g/m^3	4
Total Dissolved Solids (TDS)*	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) 23rd ed. 2017.	50 g/m^3	4
Filtration for dissolved metals analysis*	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23rd ed. 2017.	-	4
Dissolved Barium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.0006 g/m^3	4
Dissolved Bromine	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.10 g/m^3	4
Dissolved Calcium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	1.0 g/m^3	4
Dissolved Copper	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0010 g/m^3	4
Dissolved Iron	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 23rd ed. 2017.	0.004 g/m^3	4
Dissolved Magnesium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.4 g/m^3	4
Dissolved Manganese	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0010 g/m^3	4
Total Nickel	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.0070 g/m^3	4
Total Potassium	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	1.1 g/m^3	4
Total Sodium	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.42 g/m^3	4
Total Sulphur*	Nitric acid digestion, ICP-OES (method may not fully account for H_2S due to volatilisation during digestion). All forms of oxidised and organic sulphur will be determined by this method. APHA 3120 B 23rd ed. 2017.	0.5 g/m^3	4
Total Zinc	Nitric acid digestion, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0042 g/m^3	4
Chloride*	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23rd ed. 2017.	0.5 g/m^3	4
Nitrite-N	Saline sample. Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.0010 g/m^3	4
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO2N. In-House.	0.0010 g/m^3	4
Nitrate*	Calculation from Nitrate-N.	0.005 g/m^3	4
Nitrate-N + Nitrite-N	Saline sample. Total oxidised nitrogen. Automated cadmium reduction, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.0010 g/m^3	4
Total Sulphate*	Calculation: from total sulphur.	2 g/m^3	4
Ethylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m^3	4
Propylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m^3	4
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m^3	4
BTEX in Water by Headspace GC-MS*	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m^3	4
Formaldehyde in Water by DNPH & LCMSMS*	Derivatisation, SPE extraction, LC-MS/MS analysis. In-house based on US EPA 8315A.	0.02 g/m^3	4

Sample Type: Saline			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Petroleum Hydrocarbons in Water			
C7 - C9*	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m^3	4
C10 - C14*	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m^3	4
C15 - C36*	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m^3	4
Total hydrocarbons (C7 - C36)*	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m^3	4

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

Testing was completed between 05-Jul-2022 and 13-Jul-2022. For completion dates of individual analyses please contact the laboratory.

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Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3032722 SPv1
Contact:	Fiona Campbell	**Date Received:**	13-Jul-2022
	C/- Greymouth Petroleum Limited	**Date Reported:**	22-Jul-2022
	14 Connett Road West	**Quote No:**	85159
	Bell Block	**Order No:**	256431
	New Plymouth 4312	**Client Reference:**	Hydraulic fracturing fluid testing
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

Sample Name:		Turangi 15 Stim 4 prepumped HF Fluid 08-Jul-2022
Lab Number:		3032722.1
Ethylene Glycol in Water*		
Ethylene glycol*	g/m³	930
Propylene Glycol in Water*		
Propylene glycol*	g/m³	< 20
Methanol in Water - Aqueous Solvents*		
Methanol*	g/m³	< 50
BTEX in Water by Headspace GC-MS		
Benzene	g/m³	< 0.0010
Toluene	g/m³	0.0019
Ethylbenzene	g/m³	< 0.0010
m&p-Xylene	g/m³	< 0.002
o-Xylene	g/m³	< 0.0010
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m³	< 0.4
C10 - C14	g/m³	< 1.0
C15 - C36	g/m³	< 2
Total hydrocarbons (C7 - C36)	g/m³	< 4

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
Individual Tests			
Ethylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	1
Propylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	1
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	1
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	1
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	1
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	1
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	1
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	1

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

Testing was completed between 14-Jul-2022 and 22-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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Client Services Manager - Environmental

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Certificate of Analysis

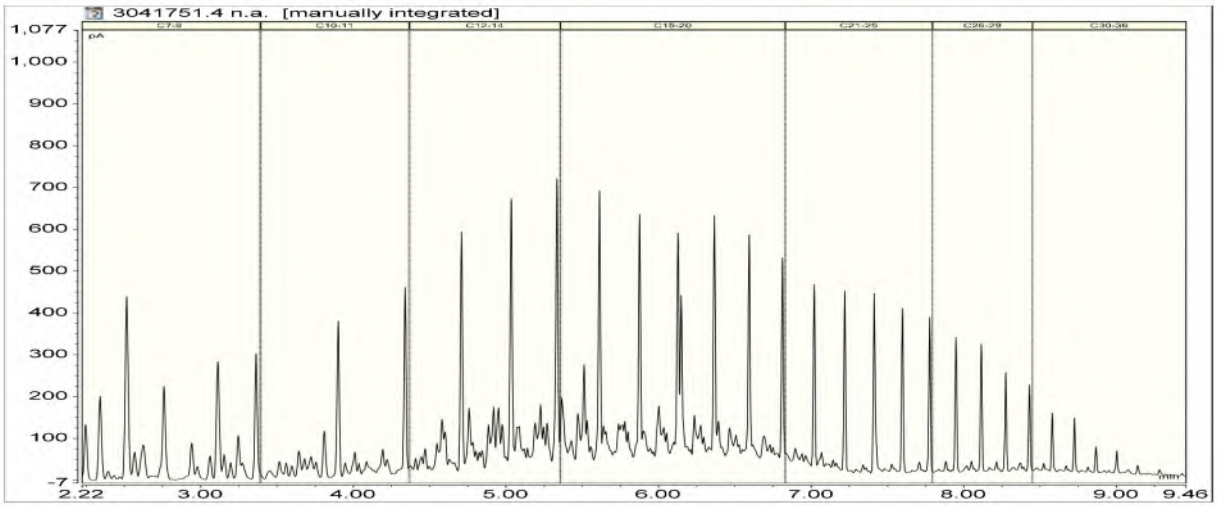
Client:	Greymouth Petroleum Limited	**Lab No:**	3041751 SPv1
Contact:	Fiona Campbell C/- Greymouth Petroleum Limited 14 Connett Road West Bell Block New Plymouth 4312	**Date Received:**	27-Jul-2022
		Date Reported:	03-Aug-2022
		Quote No:	81870
		Order No:	256431
		Client Reference:	Return Fluid Composite
		Submitted By:	Fiona Campbell

Sample Type: Saline

		Sample Name:	Turangi 15 Stim 4 Return HF Fluid (Composite of Turangi 15 Stim 4 Return HF Fluid Start, Middle & End)
		Lab Number:	3041751.4
Individual Tests			
pH*	pH Units		7.0
Total Alkalinity*	g/m³ as $CaCO_3$		2,400
Total Hardness*	g/m³ as $CaCO_3$		168
Electrical Conductivity (EC)*	mS/m		1,226
Salinity*			7.0
Total Suspended Solids	g/m³		270
Total Dissolved Solids (TDS)*	g/m³		9,400
Dissolved Barium	g/m³		35
Dissolved Bromine	g/m³		11.7
Dissolved Calcium	g/m³		54
Dissolved Copper	g/m³		0.009
Dissolved Iron	g/m³		1.78
Dissolved Magnesium	g/m³		8
Dissolved Manganese	g/m³		1.23
Total Nickel	g/m³		< 0.032
Total Potassium	g/m³		97
Total Sodium	g/m³		2,900
Total Sulphur*	g/m³		10
Total Zinc	g/m³		0.170 #1
Chloride*	g/m³		2,800
Nitrite-N	g/m³		< 0.10 #2
Nitrate-N	g/m³		< 0.10
Nitrate*	g/m³		< 0.5
Nitrate-N + Nitrite-N	g/m³		< 0.10 #2
Sulphate*	g/m³		31
Ethylene Glycol in Water*			
Ethylene glycol*	g/m³		38
Propylene Glycol in Water*			
Propylene glycol*	g/m³		< 20
Methanol in Water - Aqueous Solvents*			
Methanol*	g/m³		< 20
BTEX in Water by Headspace GC-MS*			
Benzene*	g/m³		7.1
Toluene*	g/m³		7.4
Ethylbenzene*	g/m³		0.47
m&p-Xylene*	g/m³		2.8
o-Xylene*	g/m³		0.96

Sample Type: Saline		
Sample Name:		Turangi 15 Stim 4 Return HF Fluid (Composite of Turangi 15 Stim 4 Return HF Fluid Start, Middle & End)
Lab Number:		3041751.4
Formaldehyde in Water by DNPH & LCMSMS*		
Formaldehyde*	g/m^3	0.22
Total Petroleum Hydrocarbons in Water*		
C7 - C9*	g/m^3	32
C10 - C14*	g/m^3	81
C15 - C36*	g/m^3	188
Total hydrocarbons (C7 - C36)*	g/m^3	300

3041751.4
Turangi 15 Stim 4 Return HF Fluid (Composite of Turangi 15 Stim 4 Return HF Fluid Start, Middle & End)
Client Chromatogram for TPH by FID



Analyst's Comments

#1 It should be noted that the replicate analyses performed on this sample as part of our in-house Quality Assurance procedures showed greater variation than would normally be expected. This may reflect the heterogeneity of the sample. The average of the results of the replicate analyses has been reported.

#2 Due to the nature of this sample a dilution was performed prior to analysis, resulting in a detection limit higher than that normally achieved for the NO2N, NO3N and NOxN 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: Saline			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
Filtration, Unpreserved*	Sample filtration through 0.45µm membrane filter.	-	4
Total Digestion*	Boiling nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	4
Total Digestion of Saline Samples*	Nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	4
pH*	pH meter. APHA 4500-H^+ B 23rd 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	4
Total Alkalinity*	Saline water, Titration to pH 4.5.	1.0 g/m^3 as $CaCO_3$	4
Total Hardness*	Calculation from Calcium and Magnesium. APHA 2340 B 23rd ed. 2017.	1.0 g/m^3 as $CaCO_3$	4
Electrical Conductivity (EC)*	Conductivity meter, 25°C. APHA 2510 B 23rd ed. 2017.	0.1 mS/m	4

Sample Type: Saline			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Salinity*	Conductivity Meter (WTW Cond 340i with nonlinear temperature compensation according to EN 27 888). APHA 2520 B 23rd ed. 2017.	0.2	4
Total Suspended Solids	Saline sample. Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D (modified) 23rd ed. 2017.	3 g/m³	4
Total Dissolved Solids (TDS)*	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) 23rd ed. 2017.	50 g/m³	4
Filtration for dissolved metals analysis*	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23rd ed. 2017.	-	4
Dissolved Barium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.0006 g/m³	4
Dissolved Bromine	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.10 g/m³	4
Dissolved Calcium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	1.0 g/m³	4
Dissolved Copper	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0010 g/m³	4
Dissolved Iron	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 23rd ed. 2017.	0.004 g/m³	4
Dissolved Magnesium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.4 g/m³	4
Dissolved Manganese	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0010 g/m³	4
Total Nickel	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.0070 g/m³	4
Total Potassium	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	1.1 g/m³	4
Total Sodium	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.42 g/m³	4
Total Sulphur*	Nitric acid digestion, ICP-OES (method may not fully account for H_2S due to volatilisation during digestion). All forms of oxidised and organic sulphur will be determined by this method. APHA 3120 B 23rd ed. 2017.	0.5 g/m³	4
Total Zinc	Nitric acid digestion, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0042 g/m³	4
Chloride*	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23rd ed. 2017.	0.5 g/m³	4
Nitrite-N	Saline sample. Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.0010 g/m³	4
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO2N. In-House.	0.0010 g/m³	4
Nitrate*	Calculation from Nitrate-N.	0.005 g/m³	4
Nitrate-N + Nitrite-N	Saline sample. Total oxidised nitrogen. Automated cadmium reduction, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.0010 g/m³	4
Total Sulphate*	Calculation: from total sulphur.	2 g/m³	4
Ethylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	4
Propylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	4
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	4
BTEX in Water by Headspace GC-MS*	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	4
Formaldehyde in Water by DNPH & LCMSMS*	Derivatisation, SPE extraction, LC-MS/MS analysis. In-house based on US EPA 8315A.	0.02 g/m³	4
Total Petroleum Hydrocarbons in Water			
C7 - C9*	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	4
C10 - C14*	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	4
C15 - C36*	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	4
Total hydrocarbons (C7 - C36)*	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	4

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

Testing was completed between 28-Jul-2022 and 03-Aug-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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Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3038181 SPv1
Contact:	Fiona Campbell	**Date Received:**	21-Jul-2022
	C/- Greymouth Petroleum Limited	**Date Reported:**	01-Aug-2022
	14 Connett Road West	**Quote No:**	85159
	Bell Block	**Order No:**	256636
	New Plymouth 4312	**Client Reference:**	Hydraulic fracturing fluid testing
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

Sample Name:		Turangi 15 STM #5 prepumped HF Fluid 18-Jul-2022
Lab Number:		3038181.1
Ethylene Glycol in Water*		
Ethylene glycol*	g/m³	630
Propylene Glycol in Water*		
Propylene glycol*	g/m³	< 20
Methanol in Water - Aqueous Solvents*		
Methanol*	g/m³	< 20
BTEX in Water by Headspace GC-MS		
Benzene	g/m³	< 0.0010
Toluene	g/m³	< 0.0010
Ethylbenzene	g/m³	< 0.0010
m&p-Xylene	g/m³	< 0.002
o-Xylene	g/m³	< 0.0010
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m³	< 0.4
C10 - C14	g/m³	< 1.0
C15 - C36	g/m³	< 2
Total hydrocarbons (C7 - C36)	g/m³	< 4

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
Individual Tests			
Ethylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	1
Propylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	1
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	1
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	1
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	1
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	1
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	1
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	1

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

Testing was completed between 25-Jul-2022 and 01-Aug-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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Certificate of Analysis

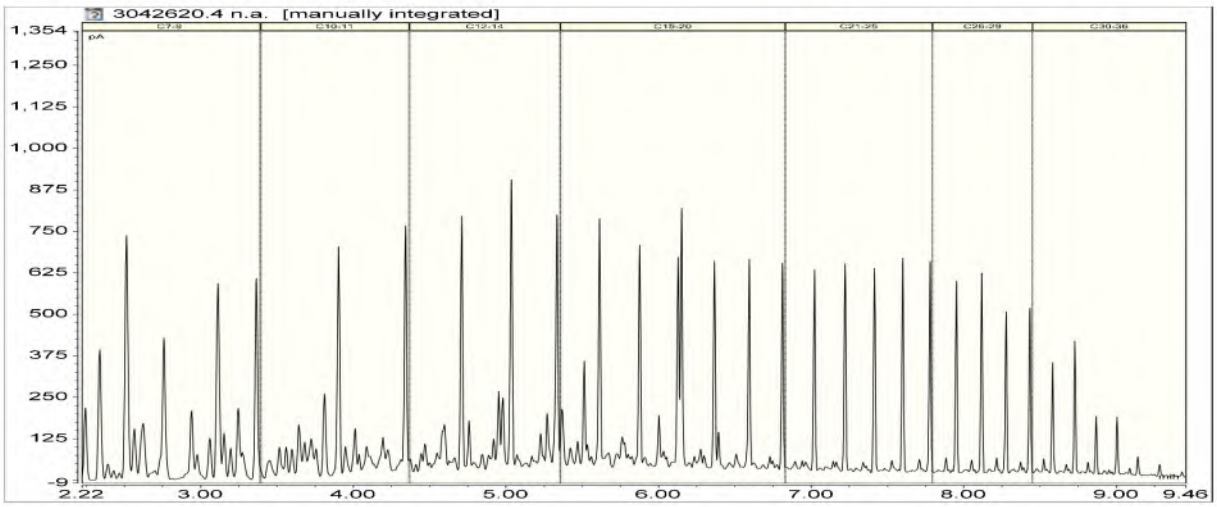
Client:	Greymouth Petroleum Limited	**Lab No:**	3042620 SPv1
Contact:	Fiona Campbell	**Date Received:**	28-Jul-2022
	C/- Greymouth Petroleum Limited	**Date Reported:**	05-Aug-2022
	14 Connett Road West	**Quote No:**	81870
	Bell Block	**Order No:**	256636
	New Plymouth 4312	**Client Reference:**	Return Fluid Composite
		Submitted By:	Fiona Campbell

Sample Type: Saline

		Sample Name:	Composite of Turangi 15 Stim 5 Return HF Fluid Start, Middle and End
		Lab Number:	3042620.4
Individual Tests			
pH*	pH Units		7.4
Total Alkalinity*	g/m³ as $CaCO_3$		2,600
Total Hardness*	g/m³ as $CaCO_3$		125
Electrical Conductivity (EC)*	mS/m		991
Salinity*			5.6
Total Suspended Solids	g/m³		200
Total Dissolved Solids (TDS)*	g/m³		7,700
Dissolved Barium	g/m³		7.9
Dissolved Bromine	g/m³		10.7
Dissolved Calcium	g/m³		39
Dissolved Copper	g/m³		0.006
Dissolved Iron	g/m³		1.37
Dissolved Magnesium	g/m³		6
Dissolved Manganese	g/m³		0.63
Total Nickel	g/m³		< 0.032
Total Potassium	g/m³		68
Total Sodium	g/m³		2,400
Total Sulphur*	g/m³		12
Total Zinc	g/m³		0.042
Chloride*	g/m³		1,950
Nitrite-N	g/m³		< 0.05 #1
Nitrate-N	g/m³		< 0.05
Nitrate*	g/m³		< 0.3
Nitrate-N + Nitrite-N	g/m³		< 0.05 #1
Sulphate*	g/m³		37
Ethylene Glycol in Water*			
Ethylene glycol*	g/m³		98
Propylene Glycol in Water*			
Propylene glycol*	g/m³		< 20
Methanol in Water - Aqueous Solvents*			
Methanol*	g/m³		< 20
BTEX in Water by Headspace GC-MS*			
Benzene*	g/m³		11.8
Toluene*	g/m³		11.6
Ethylbenzene*	g/m³		0.99
m&p-Xylene*	g/m³		5.5
o-Xylene*	g/m³		1.94

Sample Type: Saline		
Sample Name:		Composite of Turangi 15 Stim 5 Return HF Fluid Start, Middle and End
Lab Number:		3042620.4
Formaldehyde in Water by DNPH & LCMSMS*		
Formaldehyde*	g/m^3	< 0.15
Total Petroleum Hydrocarbons in Water*		
C7 - C9*	g/m^3	63
C10 - C14*	g/m^3	109
C15 - C36*	g/m^3	210
Total hydrocarbons (C7 - C36)*	g/m^3	380

3042620.4
Composite of Turangi 15 Stim 5 Return HF Fluid Start, Middle and End
Client Chromatogram for TPH by FID



Analyst's Comments

#1 Due to the nature of this sample a dilution was performed prior to analysis, resulting in a detection limit higher than that normally achieved for the NO2N, NO3N and NOxN 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: Saline			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
Filtration, Unpreserved*	Sample filtration through 0.45µm membrane filter.	-	4
Total Digestion*	Boiling nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	4
Total Digestion of Saline Samples*	Nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	4
pH*	pH meter. APHA 4500-H^+ B 23rd 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	4
Total Alkalinity*	Saline water, Titration to pH 4.5.	1.0 g/m^3 as $CaCO_3$	4
Total Hardness*	Calculation from Calcium and Magnesium. APHA 2340 B 23rd ed. 2017.	1.0 g/m^3 as $CaCO_3$	4
Electrical Conductivity (EC)*	Conductivity meter, 25°C. APHA 2510 B 23rd ed. 2017.	0.1 mS/m	4
Salinity*	Conductivity Meter (WTW Cond 340i with nonlinear temperature compensation according to EN 27 888). APHA 2520 B 23rd ed. 2017.	0.2	4
Total Suspended Solids	Saline sample. Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D (modified) 23rd ed. 2017.	3 g/m^3	4

Sample Type: Saline			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Dissolved Solids (TDS)*	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) 23rd ed. 2017.	50 g/m³	4
Filtration for dissolved metals analysis*	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23rd ed. 2017.	-	4
Dissolved Barium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.0006 g/m³	4
Dissolved Bromine	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.10 g/m³	4
Dissolved Calcium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	1.0 g/m³	4
Dissolved Copper	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0010 g/m³	4
Dissolved Iron	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 23rd ed. 2017.	0.004 g/m³	4
Dissolved Magnesium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.4 g/m³	4
Dissolved Manganese	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0010 g/m³	4
Total Nickel	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.0070 g/m³	4
Total Potassium	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	1.1 g/m³	4
Total Sodium	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.42 g/m³	4
Total Sulphur*	Nitric acid digestion, ICP-OES (method may not fully account for H_2S due to volatilisation during digestion). All forms of oxidised and organic sulphur will be determined by this method. APHA 3120 B 23rd ed. 2017.	0.5 g/m³	4
Total Zinc	Nitric acid digestion, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0042 g/m³	4
Chloride*	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23rd ed. 2017.	0.5 g/m³	4
Nitrite-N	Saline sample. Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.0010 g/m³	4
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO2N. In-House.	0.0010 g/m³	4
Nitrate*	Calculation from Nitrate-N.	0.005 g/m³	4
Nitrate-N + Nitrite-N	Saline sample. Total oxidised nitrogen. Automated cadmium reduction, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.0010 g/m³	4
Total Sulphate*	Calculation: from total sulphur.	2 g/m³	4
Ethylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	4
Propylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	4
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	4
BTEX in Water by Headspace GC-MS*	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	4
Formaldehyde in Water by DNPH & LCMSMS*	Derivatisation, SPE extraction, LC-MS/MS analysis. In-house based on US EPA 8315A.	0.02 g/m³	4
Total Petroleum Hydrocarbons in Water			
C7 - C9*	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	4
C10 - C14*	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	4
C15 - C36*	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	4
Total hydrocarbons (C7 - C36)*	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	4

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

Testing was completed between 30-Jul-2022 and 04-Aug-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

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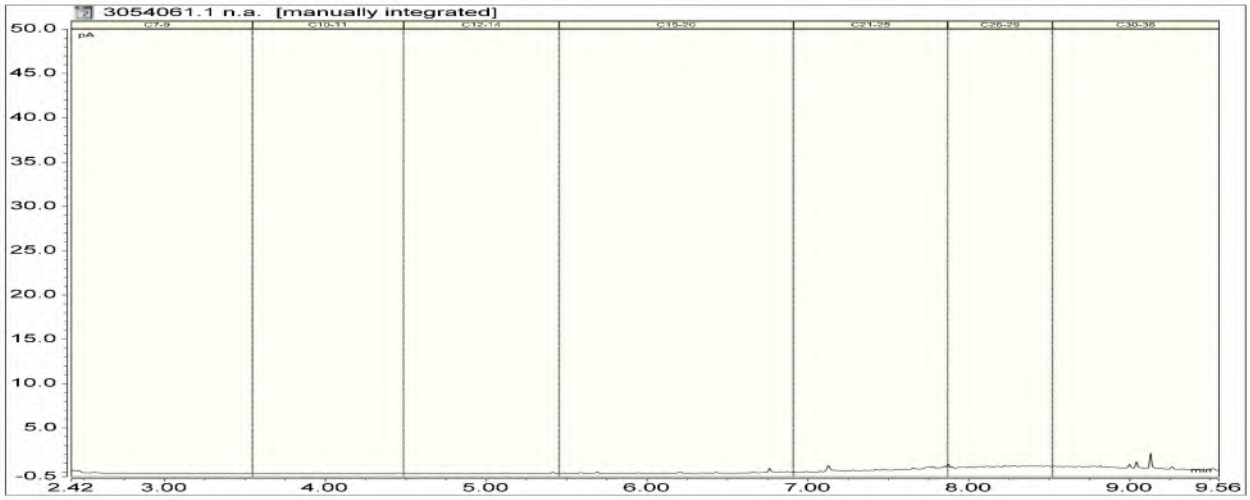
Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3054061 SPv1
Contact:	Fiona Campbell	**Date Received:**	13-Aug-2022
	C/- Greymouth Petroleum Limited	**Date Reported:**	26-Aug-2022
	14 Connett Road West	**Quote No:**	85159
	Bell Block	**Order No:**	256815
	New Plymouth 4312	**Client Reference:**	Hydraulic fracturing fluid testing
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

Sample Name:		Turangi 15 Stim6 Prepumped HF Fluid 09-Aug-2022
Lab Number:		3054061.1
Ethylene Glycol in Water*		
Ethylene glycol*	g/m³	470
Propylene Glycol in Water*		
Propylene glycol*	g/m³	< 20
Methanol in Water - Aqueous Solvents*		
Methanol*	g/m³	< 20
BTEX in Water by Headspace GC-MS		
Benzene	g/m³	< 0.0010
Toluene	g/m³	0.0019
Ethylbenzene	g/m³	< 0.0010
m&p-Xylene	g/m³	0.003
o-Xylene	g/m³	< 0.0010
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m³	< 0.4
C10 - C14	g/m³	< 1.0
C15 - C36	g/m³	6
Total hydrocarbons (C7 - C36)	g/m³	6

3054061.1
Turangi 15 Stim6 Prepumped HF Fluid 09-Aug-2022
Client Chromatogram for TPH by FID



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**
Individual Tests			
Ethylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m^3	1
Propylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m^3	1
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m^3	1
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m^3	1
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m^3	1
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m^3	1
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m^3	1
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m^3	1

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

Testing was completed between 17-Aug-2022 and 26-Aug-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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Client Services Manager - Environmental

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Certificate of Analysis

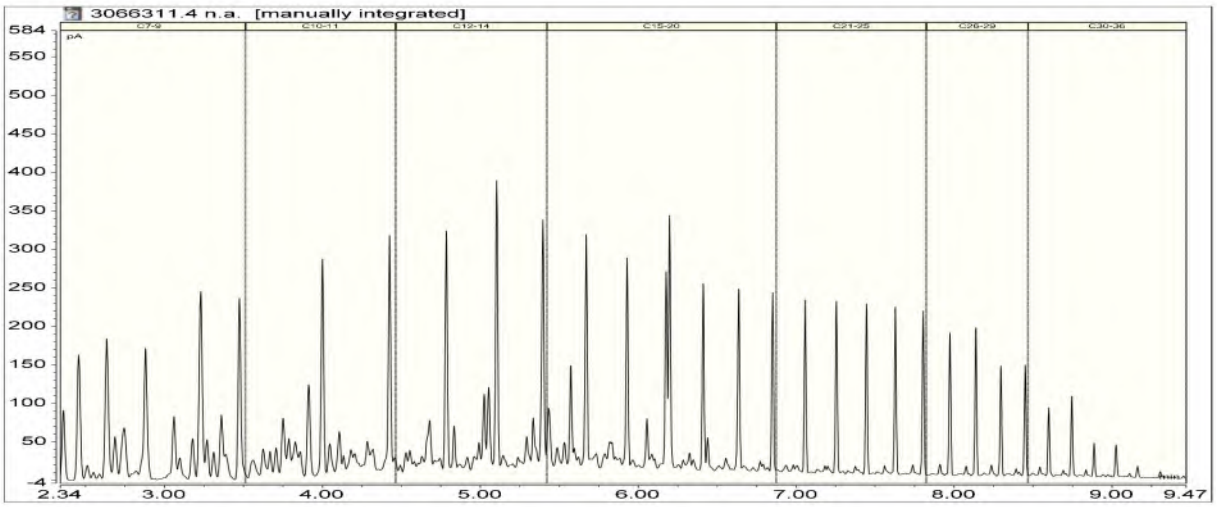
Client:	Greymouth Petroleum Limited	**Lab No:**	3066311 SPv1
Contact:	Fiona Campbell	**Date Received:**	01-Sep-2022
	C/- Greymouth Petroleum Limited	**Date Reported:**	08-Sep-2022
	14 Connett Road West	**Quote No:**	81870
	Bell Block	**Order No:**	256815
	New Plymouth 4312	**Client Reference:**	Return Fluid Composite
		Submitted By:	Fiona Campbell

Sample Type: Saline

	Sample Name:	Turangi 15 Stm#6 Return HF Fluid
	Lab Number:	3066311.4
Individual Tests		
pH*	pH Units	6.9
Total Alkalinity*	g/m³ as $CaCO_3$	2,100
Total Hardness*	g/m³ as $CaCO_3$	164
Electrical Conductivity (EC)*	mS/m	846
Salinity*		4.9
Total Suspended Solids	g/m³	750
Total Dissolved Solids (TDS)*	g/m³	7,200
Dissolved Barium	g/m³	5.3
Dissolved Bromine	g/m³	8.9
Dissolved Calcium	g/m³	51
Dissolved Copper	g/m³	0.019
Dissolved Iron	g/m³	8.4
Dissolved Magnesium	g/m³	9
Dissolved Manganese	g/m³	2.1
Total Nickel	g/m³	0.086
Total Potassium	g/m³	66
Total Sodium	g/m³	1,970
Total Sulphur*	g/m³	11
Total Zinc	g/m³	0.032
Chloride*	g/m³	1,510
Nitrite-N	g/m³	< 0.10 #1
Nitrate-N	g/m³	< 0.10
Nitrate*	g/m³	< 0.5
Nitrate-N + Nitrite-N	g/m³	< 0.10 #1
Sulphate*	g/m³	33
Ethylene Glycol in Water*		
Ethylene glycol*	g/m³	< 20
Propylene Glycol in Water*		
Propylene glycol*	g/m³	< 20
Methanol in Water - Aqueous Solvents*		
Methanol*	g/m³	< 20
BTEX in Water by Headspace GC-MS*		
Benzene*	g/m³	18.3
Toluene*	g/m³	21
Ethylbenzene*	g/m³	2.1
m&p-Xylene*	g/m³	11.1
o-Xylene*	g/m³	3.8

Sample Type: Saline		
Sample Name:		Turangi 15 Stm#6 Return HF Fluid
Lab Number:		3066311.4
Formaldehyde in Water by DNPH & LCMSMS*		
Formaldehyde*	g/m³	< 1.5
Total Petroleum Hydrocarbons in Water*		
C7 - C9*	g/m³	250
C10 - C14*	g/m³	490
C15 - C36*	g/m³	780
Total hydrocarbons (C7 - C36)*	g/m³	1,520

3066311.4
Turangi 15 Stm#6 Return HF Fluid
Client Chromatogram for TPH by FID



Analyst's Comments

#1 Due to the nature of this sample a dilution was performed prior to analysis, resulting in a detection limit higher than that normally achieved for the NO2N, NO3N and NOxN 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: Saline			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
Filtration, Unpreserved*	Sample filtration through 0.45µm membrane filter.	-	4
Total Digestion*	Boiling nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	4
Total Digestion of Saline Samples*	Nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	4
pH*	pH meter. APHA 4500-H^+ B 23rd 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	4
Total Alkalinity*	Saline water, Titration to pH 4.5.	1.0 g/m³ as $CaCO_3$	4
Total Hardness*	Calculation from Calcium and Magnesium. APHA 2340 B 23rd ed. 2017.	1.0 g/m³ as $CaCO_3$	4
Electrical Conductivity (EC)*	Conductivity meter, 25°C. APHA 2510 B 23rd ed. 2017.	0.1 mS/m	4
Salinity*	Conductivity Meter (WTW Cond 340i with nonlinear temperature compensation according to EN 27 888). APHA 2520 B 23rd ed. 2017.	0.2	4
Total Suspended Solids	Saline sample. Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D (modified) 23rd ed. 2017.	3 g/m³	4

Sample Type: Saline			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Dissolved Solids (TDS)*	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) 23rd ed. 2017.	50 g/m³	4
Filtration for dissolved metals analysis*	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23rd ed. 2017.	-	4
Dissolved Barium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.0006 g/m³	4
Dissolved Bromine	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.10 g/m³	4
Dissolved Calcium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	1.0 g/m³	4
Dissolved Copper	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0010 g/m³	4
Dissolved Iron	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 23rd ed. 2017.	0.004 g/m³	4
Dissolved Magnesium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.4 g/m³	4
Dissolved Manganese	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0010 g/m³	4
Total Nickel	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.0070 g/m³	4
Total Potassium	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	1.1 g/m³	4
Total Sodium	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.42 g/m³	4
Total Sulphur*	Nitric acid digestion, ICP-OES (method may not fully account for H_2S due to volatilisation during digestion). All forms of oxidised and organic sulphur will be determined by this method. APHA 3120 B 23rd ed. 2017.	0.5 g/m³	4
Total Zinc	Nitric acid digestion, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0042 g/m³	4
Chloride*	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23rd ed. 2017.	0.5 g/m³	4
Nitrite-N	Saline sample. Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.0010 g/m³	4
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO2N. In-House.	0.0010 g/m³	4
Nitrate*	Calculation from Nitrate-N.	0.005 g/m³	4
Nitrate-N + Nitrite-N	Saline sample. Total oxidised nitrogen. Automated cadmium reduction, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.0010 g/m³	4
Total Sulphate*	Calculation: from total sulphur.	2 g/m³	4
Ethylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	4
Propylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	4
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	4
BTEX in Water by Headspace GC-MS*	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	4
Formaldehyde in Water by DNPH & LCMSMS*	Derivatisation, SPE extraction, LC-MS/MS analysis. In-house based on US EPA 8315A.	0.02 g/m³	4
Total Petroleum Hydrocarbons in Water			
C7 - C9*	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	4
C10 - C14*	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	4
C15 - C36*	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	4
Total hydrocarbons (C7 - C36)*	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	4

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

Testing was completed between 02-Sep-2022 and 08-Sep-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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Client Services Manager - Environmental

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Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3060497 SPv1
Contact:	Fiona Campbell	**Date Received:**	24-Aug-2022
	C/- Greymouth Petroleum Limited	**Date Reported:**	07-Sep-2022
	14 Connett Road West	**Quote No:**	85159
	Bell Block	**Order No:**	256889
	New Plymouth 4312	**Client Reference:**	Hydraulic fracturing fluid testing
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

Sample Name:		Turangi 15 Stim 7 Prepumped HF Fluid 17-Aug-2022
Lab Number:		3060497.1
Ethylene Glycol in Water*		
Ethylene glycol*	g/m³	590
Propylene Glycol in Water*		
Propylene glycol*	g/m³	< 20
Methanol in Water - Aqueous Solvents*		
Methanol*	g/m³	< 20
BTEX in Water by Headspace GC-MS		
Benzene	g/m³	0.0042
Toluene	g/m³	0.032
Ethylbenzene	g/m³	0.0049
m&p-Xylene	g/m³	0.027
o-Xylene	g/m³	0.0104
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m³	< 0.4
C10 - C14	g/m³	< 1.0
C15 - C36	g/m³	< 2
Total hydrocarbons (C7 - C36)	g/m³	< 4

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
Individual Tests			
Ethylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	1
Propylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	1
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	1
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	1
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	1
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	1
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	1
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	1

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

Testing was completed between 29-Aug-2022 and 07-Sep-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

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Certificate of Analysis

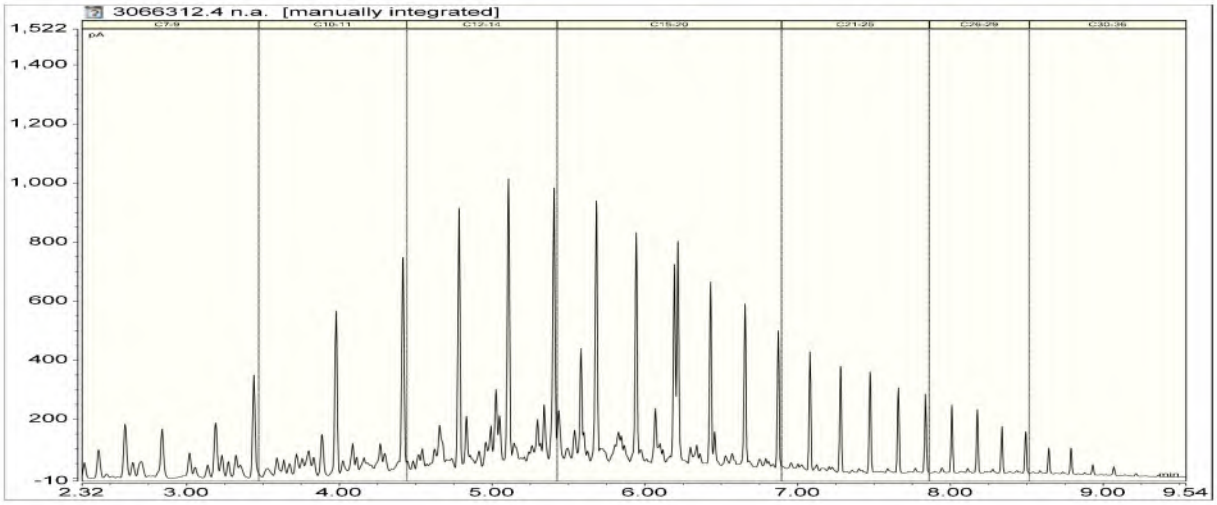
Client:	Greymouth Petroleum Limited	**Lab No:**	3066312 SPv1
Contact:	Fiona Campbell	**Date Received:**	01-Sep-2022
	C/- Greymouth Petroleum Limited	**Date Reported:**	08-Sep-2022
	14 Connett Road West	**Quote No:**	81870
	Bell Block	**Order No:**	256889
	New Plymouth 4312	**Client Reference:**	Return Fluid Composite
		Submitted By:	Fiona Campbell

Sample Type: Saline

	Sample Name:	Turangi 15 Stim #7 Return HF Fluid
	Lab Number:	3066312.4
Individual Tests		
pH*	pH Units	7.0
Total Alkalinity*	g/m³ as $CaCO_3$	1,980
Total Hardness*	g/m³ as $CaCO_3$	145
Electrical Conductivity (EC)*	mS/m	826
Salinity*		4.7
Total Suspended Solids	g/m³	240
Total Dissolved Solids (TDS)*	g/m³	7,200
Dissolved Barium	g/m³	3.2
Dissolved Bromine	g/m³	9.7
Dissolved Calcium	g/m³	47
Dissolved Copper	g/m³	0.012
Dissolved Iron	g/m³	2.9
Dissolved Magnesium	g/m³	7
Dissolved Manganese	g/m³	1.60
Total Nickel	g/m³	0.047
Total Potassium	g/m³	68
Total Sodium	g/m³	1,920
Total Sulphur*	g/m³	12
Total Zinc	g/m³	0.093 #1
Chloride*	g/m³	1,640
Nitrite-N	g/m³	< 0.10 #2
Nitrate-N	g/m³	< 0.10
Nitrate*	g/m³	< 0.5
Nitrate-N + Nitrite-N	g/m³	0.10 #2
Sulphate*	g/m³	36
Ethylene Glycol in Water*		
Ethylene glycol*	g/m³	< 20
Propylene Glycol in Water*		
Propylene glycol*	g/m³	< 20
Methanol in Water - Aqueous Solvents*		
Methanol*	g/m³	< 20
BTEX in Water by Headspace GC-MS*		
Benzene*	g/m³	5.6
Toluene*	g/m³	4.2
Ethylbenzene*	g/m³	0.35
m&p-Xylene*	g/m³	1.84
o-Xylene*	g/m³	0.72

Sample Type: Saline		
Sample Name:		Turangi 15 Stim #7 Return HF Fluid
Lab Number:		3066312.4
Formaldehyde in Water by DNPH & LCMSMS*		
Formaldehyde*	g/m³	< 1.5
Total Petroleum Hydrocarbons in Water*		
C7 - C9*	g/m³	22
C10 - C14*	g/m³	108
C15 - C36*	g/m³	173
Total hydrocarbons (C7 - C36)*	g/m³	300

3066312.4
Turangi 15 Stim #7 Return HF Fluid
Client Chromatogram for TPH by FID



Analyst's Comments

#1 It should be noted that the replicate analyses performed on this sample as part of our in-house Quality Assurance procedures showed greater variation than would normally be expected. This may reflect the heterogeneity of the sample. The average of the results of the replicate analyses has been reported.

#2 Due to the nature of this sample a dilution was performed prior to analysis, resulting in a detection limit higher than that normally achieved for the NO2N, NO3N and NOxN 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: Saline			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
Filtration, Unpreserved*	Sample filtration through 0.45µm membrane filter.	-	4
Total Digestion*	Boiling nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	4
Total Digestion of Saline Samples*	Nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	4
pH*	pH meter. APHA 4500-H^+ B 23rd 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	4
Total Alkalinity*	Saline water, Titration to pH 4.5.	1.0 g/m³ as $CaCO_3$	4
Total Hardness*	Calculation from Calcium and Magnesium. APHA 2340 B 23rd ed. 2017.	1.0 g/m³ as $CaCO_3$	4
Electrical Conductivity (EC)*	Conductivity meter, 25°C. APHA 2510 B 23rd ed. 2017.	0.1 mS/m	4
Salinity*	Conductivity Meter (WTW Cond 340i with nonlinear temperature compensation according to EN 27 888). APHA 2520 B 23rd ed. 2017.	0.2	4

Sample Type: Saline			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Suspended Solids	Saline sample. Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D (modified) 23rd ed. 2017.	3 g/m³	4
Total Dissolved Solids (TDS)*	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) 23rd ed. 2017.	50 g/m³	4
Filtration for dissolved metals analysis*	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23rd ed. 2017.	-	4
Dissolved Barium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.0006 g/m³	4
Dissolved Bromine	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.10 g/m³	4
Dissolved Calcium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	1.0 g/m³	4
Dissolved Copper	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0010 g/m³	4
Dissolved Iron	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 23rd ed. 2017.	0.004 g/m³	4
Dissolved Magnesium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.4 g/m³	4
Dissolved Manganese	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0010 g/m³	4
Total Nickel	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.0070 g/m³	4
Total Potassium	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	1.1 g/m³	4
Total Sodium	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.42 g/m³	4
Total Sulphur*	Nitric acid digestion, ICP-OES (method may not fully account for H_2S due to volatilisation during digestion). All forms of oxidised and organic sulphur will be determined by this method. APHA 3120 B 23rd ed. 2017.	0.5 g/m³	4
Total Zinc	Nitric acid digestion, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0042 g/m³	4
Chloride*	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23rd ed. 2017.	0.5 g/m³	4
Nitrite-N	Saline sample. Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.0010 g/m³	4
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO2N. In-House.	0.0010 g/m³	4
Nitrate*	Calculation from Nitrate-N.	0.005 g/m³	4
Nitrate-N + Nitrite-N	Saline sample. Total oxidised nitrogen. Automated cadmium reduction, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.0010 g/m³	4
Total Sulphate*	Calculation: from total sulphur.	2 g/m³	4
Ethylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	4
Propylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	4
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	4
BTEX in Water by Headspace GC-MS*	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	4
Formaldehyde in Water by DNPH & LCMSMS*	Derivatisation, SPE extraction, LC-MS/MS analysis. In-house based on US EPA 8315A.	0.02 g/m³	4
Total Petroleum Hydrocarbons in Water			
C7 - C9*	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	4
C10 - C14*	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	4
C15 - C36*	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	4
Total hydrocarbons (C7 - C36)*	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	4

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

Testing was completed between 02-Sep-2022 and 08-Sep-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

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Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3069579 SPv1
Contact:	Fiona Campbell	**Date Received:**	06-Sep-2022
	C/- Greymouth Petroleum Limited	**Date Reported:**	14-Sep-2022
	14 Connett Road West	**Quote No:**	85159
	Bell Block	**Order No:**	256932
	New Plymouth 4312	**Client Reference:**	Hydraulic fracturing fluid testing
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

Sample Name:		Turangi 15 Stim#8 Prepumed HF Fluid 31-Aug-2022
Lab Number:		3069579.1
Ethylene Glycol in Water*		
Ethylene glycol*	g/m³	640
Propylene Glycol in Water*		
Propylene glycol*	g/m³	< 20
Methanol in Water - Aqueous Solvents*		
Methanol*	g/m³	< 20
BTEX in Water by Headspace GC-MS		
Benzene	g/m³	< 0.0010
Toluene	g/m³	0.0033
Ethylbenzene	g/m³	< 0.0010
m&p-Xylene	g/m³	0.003
o-Xylene	g/m³	0.0013
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m³	< 0.4
C10 - C14	g/m³	< 1.0
C15 - C36	g/m³	< 2
Total hydrocarbons (C7 - C36)	g/m³	< 4

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
Individual Tests			
Ethylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	1
Propylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	1
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	1
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	1
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	1
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	1
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	1
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	1

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

Testing was completed between 07-Sep-2022 and 14-Sep-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

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Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3070579 SPv1
Contact:	Fiona Campbell	**Date Received:**	07-Sep-2022
	C/- Greymouth Petroleum Limited	**Date Reported:**	20-Sep-2022
	14 Connett Road West	**Quote No:**	81870
	Bell Block	**Order No:**	256932
	New Plymouth 4312	**Client Reference:**	Return Fluid Composite
		Submitted By:	Fiona Campbell

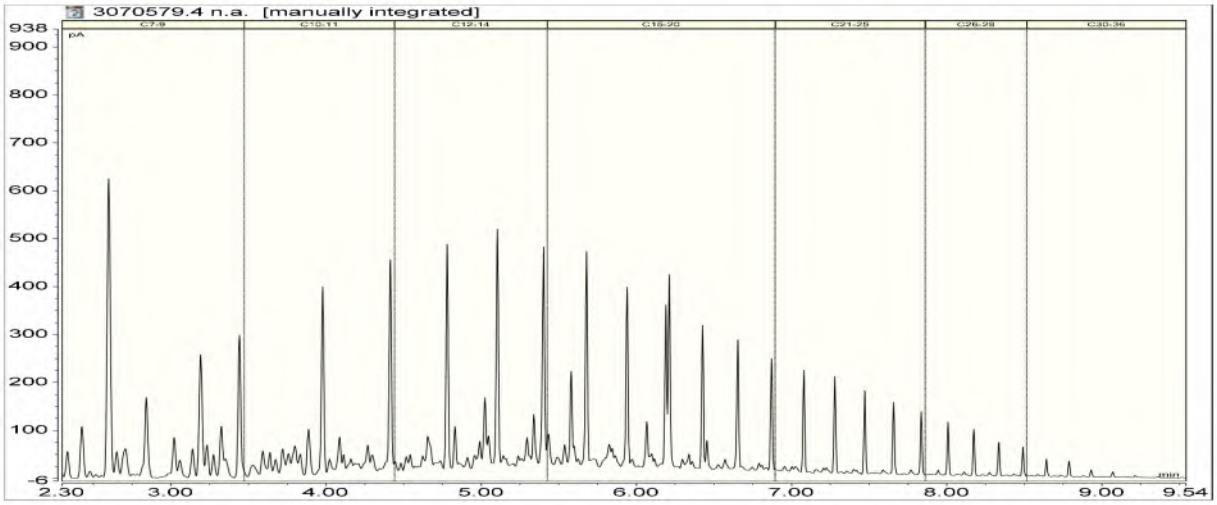
Sample Type: Aqueous

		Sample Name:	Composite of Turangi 15 Stim #8 Return HF Fluid
		Lab Number:	3070579.4
Individual Tests			
pH	pH Units		7.3
Total Alkalinity	g/m³ as $CaCO_3$		2,100
Total Hardness	g/m³ as $CaCO_3$		163
Electrical Conductivity (EC)	mS/m		934
Salinity*			5.0
Total Suspended Solids	g/m³		119
Total Dissolved Solids (TDS)	g/m³		7,200
Dissolved Barium	g/m³		2.1
Dissolved Bromine	g/m³		9.9
Dissolved Calcium	g/m³		56
Dissolved Copper	g/m³		0.041
Dissolved Iron	g/m³		2.7
Dissolved Magnesium	g/m³		6
Dissolved Manganese	g/m³		1.04
Total Nickel*	g/m³		0.036
Total Potassium*	g/m³		61
Total Sodium*	g/m³		2,000
Total Sulphur	g/m³		15
Total Zinc*	g/m³		0.029
Chloride	g/m³		1,790
Nitrite-N	g/m³		0.0174
Nitrate-N	g/m³		0.156
Nitrate	g/m³		0.69
Nitrate-N + Nitrite-N	g/m³		0.173
Sulphate*	g/m³		46
Ethylene Glycol in Water*			
Ethylene glycol*	g/m³		210
Propylene Glycol in Water*			
Propylene glycol*	g/m³		< 20
Methanol in Water - Aqueous Solvents*			
Methanol*	g/m³		< 20
BTEX in Water by Headspace GC-MS			
Benzene	g/m³		17.3
Toluene	g/m³		15.9
Ethylbenzene	g/m³		1.02
m&p-Xylene	g/m³		5.7
o-Xylene	g/m³		2.0

This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

Sample Type: Aqueous		
Sample Name:		Composite of Turangi 15 Stim #8 Return HF Fluid
Lab Number:		3070579.4
Formaldehyde in Water by DNPH & LCMSMS		
Formaldehyde	g/m³	0.54
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m³	30
C10 - C14	g/m³	59
C15 - C36	g/m³	77
Total hydrocarbons (C7 - C36)	g/m³	165

3070579.4
Composite of Turangi 15 Stim #8 Return HF Fluid
Client Chromatogram for TPH by FID



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**
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	4
Total Digestion	Boiling nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	4
Total Digestion of Saline Samples*	Nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	4
pH	pH meter. APHA 4500-H^+ B 23rd 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	4
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (modified for Alkalinity <20) 23rd ed. 2017.	1.0 g/m³ as $CaCO_3$	4
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 23rd ed. 2017.	1.0 g/m³ as $CaCO_3$	4
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 23rd ed. 2017.	0.1 mS/m	4
Salinity*	Conductivity Meter (WTW Cond 340i with nonlinear temperature compensation according to EN 27 888). APHA 2520 B 23rd ed. 2017.	0.2	4
Total Suspended Solids	Saline sample. Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D (modified) 23rd ed. 2017.	3 g/m³	4
Total Dissolved Solids (TDS)	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) 23rd ed. 2017.	50 g/m³	4

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23rd ed. 2017.	-	4
Dissolved Barium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.0006 g/m³	4
Dissolved Bromine	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.10 g/m³	4
Dissolved Calcium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	1.0 g/m³	4
Dissolved Copper	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0010 g/m³	4
Dissolved Iron	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 23rd ed. 2017.	0.004 g/m³	4
Dissolved Magnesium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.4 g/m³	4
Dissolved Manganese	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0010 g/m³	4
Total Nickel*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.0070 g/m³	4
Total Potassium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	1.1 g/m³	4
Total Sodium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.42 g/m³	4
Total Sulphur	Nitric acid digestion, ICP-OES (method may not fully account for H_2S due to volatilisation during digestion). All forms of oxidised and organic sulphur will be determined by this method. APHA 3120 B 23rd ed. 2017.	0.5 g/m³	4
Total Zinc*	Nitric acid digestion, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0042 g/m³	4
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23rd ed. 2017.	0.5 g/m³	4
Nitrite-N	Saline sample. Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.0010 g/m³	4
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO2N. In-House.	0.0010 g/m³	4
Nitrate	Calculation from Nitrate-N.	0.005 g/m³	4
Nitrate-N + Nitrite-N	Saline sample. Total oxidised nitrogen. Automated cadmium reduction, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.0010 g/m³	4
Total Sulphate*	Calculation: from total sulphur.	2 g/m³	4
Ethylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	4
Propylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	4
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	4
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	4
Formaldehyde in Water by DNPH & LCMSMS	Derivatisation, SPE extraction, LC-MS/MS analysis. In-house based on US EPA 8315A.	0.02 g/m³	4
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	4
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	4
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	4
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	4

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

Testing was completed between 09-Sep-2022 and 20-Sep-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

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Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3195105 SPv1
Contact:	Fiona Campbell	**Date Received:**	09-Mar-2023
	C/- Greymouth Petroleum Limited	**Date Reported:**	24-Mar-2023
	14 Connett Road West	**Quote No:**	85159
	Bell Block	**Order No:**	259750
	New Plymouth 4312	**Client Reference:**	Hydraulic fracturing fluid testing
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

Sample Name:		Turangi 2 Stim 1 Prepumped HF Fluid 23-Feb-2023
Lab Number:		3195105.1
Ethylene Glycol in Water*		
Ethylene glycol*	g/m³	98
Propylene Glycol in Water*		
Propylene glycol*	g/m³	< 20
Methanol in Water - Aqueous Solvents*		
Methanol*	g/m³	< 20
BTEX in Water by Headspace GC-MS		
Benzene	g/m³	0.0016
Toluene	g/m³	0.0075
Ethylbenzene	g/m³	0.0011
m&p-Xylene	g/m³	0.007
o-Xylene	g/m³	0.0024
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m³	< 0.5
C10 - C14	g/m³	< 1.0
C15 - C36	g/m³	< 2
Total hydrocarbons (C7 - C36)	g/m³	< 4

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
Individual Tests			
Ethylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	1
Propylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	1
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	1
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	1
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	1
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	1
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	1
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	1

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

Testing was completed between 10-Mar-2023 and 24-Mar-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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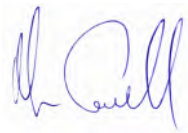

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Client Services Manager - Environmental

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Certificate of Analysis

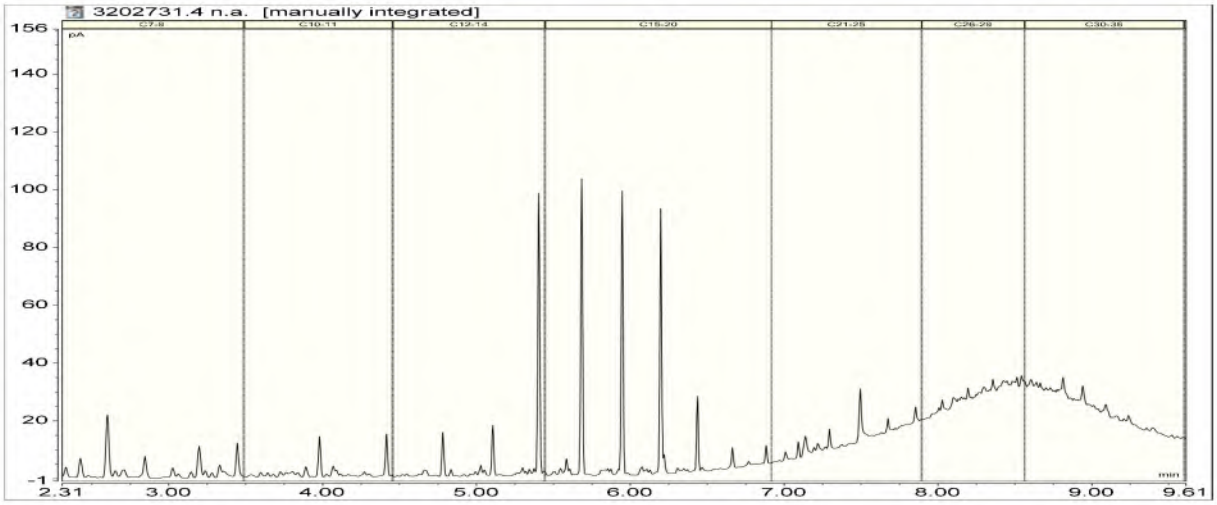
Client:	Greymouth Petroleum Limited	**Lab No:**	3202731 SPv1
Contact:	Fiona Campbell C/- Greymouth Petroleum Limited 14 Connett Road West Bell Block New Plymouth 4312	**Date Received:**	16-Mar-2023
		Date Reported:	30-Mar-2023
		Quote No:	81870
		Order No:	259750
		Client Reference:	Return Fluid Composite
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

		Sample Name:	Composite of Turagi 2 Stim 1 Return HF Fluid
		Lab Number:	3202731.4
Individual Tests			
pH	pH Units		6.8
Total Alkalinity	g/m³ as $CaCO_3$		830
Total Hardness	g/m³ as $CaCO_3$		350
Electrical Conductivity (EC)	mS/m		1,410
Salinity*			8.4
Total Suspended Solids	g/m³		710
Total Dissolved Solids (TDS)	g/m³		9,600
Dissolved Barium	g/m³		28
Dissolved Bromine	g/m³		12.8
Dissolved Calcium	g/m³		120
Dissolved Copper	g/m³		0.021
Dissolved Iron	g/m³		12.4
Dissolved Magnesium	g/m³		11
Dissolved Manganese	g/m³		2.5
Total Nickel*	g/m³		0.30
Total Potassium*	g/m³		158
Total Sodium*	g/m³		2,900
Total Sulphur	g/m³		7.1
Total Zinc*	g/m³		0.44
Chloride	g/m³		4,300
Nitrite-N	g/m³		< 0.10 #1
Nitrate-N	g/m³		< 0.10
Nitrate	g/m³		< 0.5
Nitrate-N + Nitrite-N	g/m³		< 0.10 #1
Sulphate*	g/m³		21
Ethylene Glycol in Water*			
Ethylene glycol*	g/m³		47
Propylene Glycol in Water*			
Propylene glycol*	g/m³		< 20
Methanol in Water - Aqueous Solvents*			
Methanol*	g/m³		< 20
BTEX in Water by Headspace GC-MS			
Benzene	g/m³		3.7
Toluene	g/m³		2.1
Ethylbenzene	g/m³		0.082
m&p-Xylene	g/m³		0.44
o-Xylene	g/m³		0.183

Sample Type: Aqueous		
Sample Name:		Composite of Turagi 2 Stim 1 Return HF Fluid
Lab Number:		3202731.4
Formaldehyde in Water by DNPH & LCMSMS		
Formaldehyde	g/m^3	< 0.15
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m^3	8.7
C10 - C14	g/m^3	18.3
C15 - C36	g/m^3	250
Total hydrocarbons (C7 - C36)	g/m^3	270

3202731.4
Composite of Turagi 2 Stim 1 Return HF Fluid
Client Chromatogram for TPH by FID



Analyst's Comments

#1 Due to the nature of this sample a dilution was performed prior to analysis, resulting in a detection limit higher than that normally achieved for the NO2N, NO3N and NOxN 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**
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	4
Total Digestion	Boiling nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	4
Total Digestion of Saline Samples*	Nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	4
pH	pH meter. APHA 4500-H^+ B 23rd 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	4
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (modified for Alkalinity <20) 23rd ed. 2017.	1.0 g/m^3 as $CaCO_3$	4
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 23rd ed. 2017.	1.0 g/m^3 as $CaCO_3$	4
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 23rd ed. 2017.	0.1 mS/m	4
Salinity*	Conductivity Meter (WTW Cond 340i with nonlinear temperature compensation according to EN 27 888). APHA 2520 B 23rd ed. 2017.	0.2	4

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Suspended Solids	Saline sample. Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D (modified) 23rd ed. 2017.	3 g/m³	4
Total Dissolved Solids (TDS)	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) 23rd ed. 2017.	50 g/m³	4
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23rd ed. 2017.	-	4
Dissolved Barium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.0006 g/m³	4
Dissolved Bromine	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.10 g/m³	4
Dissolved Calcium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	1.0 g/m³	4
Dissolved Copper	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0010 g/m³	4
Dissolved Iron	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 23rd ed. 2017.	0.004 g/m³	4
Dissolved Magnesium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.4 g/m³	4
Dissolved Manganese	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0010 g/m³	4
Total Nickel*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.0070 g/m³	4
Total Potassium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	1.1 g/m³	4
Total Sodium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.42 g/m³	4
Total Sulphur	Nitric acid digestion, ICP-OES (method may not fully account for H_2S due to volatilisation during digestion). All forms of oxidised and organic sulphur will be determined by this method. APHA 3120 B 23rd ed. 2017.	0.5 g/m³	4
Total Zinc*	Nitric acid digestion, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0042 g/m³	4
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23rd ed. 2017.	0.5 g/m³	4
Nitrite-N	Saline sample. Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.0010 g/m³	4
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO2N. In-House.	0.0010 g/m³	4
Nitrate	Calculation from Nitrate-N.	0.005 g/m³	4
Nitrate-N + Nitrite-N	Saline sample. Total oxidised nitrogen. Automated cadmium reduction, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.0010 g/m³	4
Total Sulphate*	Calculation: from total sulphur.	2 g/m³	4
Ethylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	4
Propylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	4
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	4
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	4
Formaldehyde in Water by DNPH & LCMSMS	Derivatisation, SPE extraction, LC-MS/MS analysis. In-house based on US EPA 8315A.	0.02 g/m³	4
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	4
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	4
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	4
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	4

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

Testing was completed between 21-Mar-2023 and 30-Mar-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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Client Services Manager - Environmental

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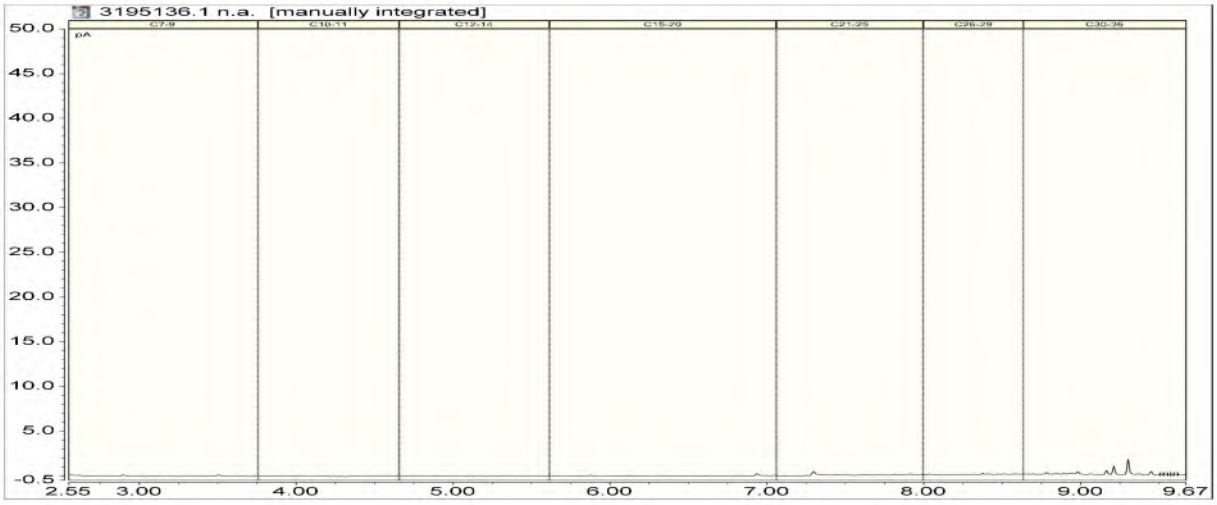
Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3195136 SPv1
Contact:	Fiona Campbell	**Date Received:**	09-Mar-2023
	C/- Greymouth Petroleum Limited	**Date Reported:**	20-Mar-2023
	14 Connett Road West	**Quote No:**	85159
	Bell Block	**Order No:**	259882
	New Plymouth 4312	**Client Reference:**	Hydraulic fracturing fluid testing
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

Sample Name:		Turangi 2 Stim 2 Prepumped HF Fluid 02-Mar-2023
Lab Number:		3195136.1
Ethylene Glycol in Water*		
Ethylene glycol*	g/m³	93
Propylene Glycol in Water*		
Propylene glycol*	g/m³	< 20
Methanol in Water - Aqueous Solvents*		
Methanol*	g/m³	< 20
BTEX in Water by Headspace GC-MS		
Benzene	g/m³	0.0035
Toluene	g/m³	0.0165
Ethylbenzene	g/m³	0.0021
m&p-Xylene	g/m³	0.015
o-Xylene	g/m³	0.0059
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m³	< 0.5
C10 - C14	g/m³	< 1.0
C15 - C36	g/m³	2
Total hydrocarbons (C7 - C36)	g/m³	< 4

3195136.1
Turangi 2 Stim 2 Prepumped HF Fluid 02-Mar-2023
Client Chromatogram for TPH by FID



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**
Individual Tests			
Ethylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m^3	1
Propylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m^3	1
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m^3	1
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m^3	1
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m^3	1
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m^3	1
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m^3	1
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m^3	1

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

Testing was completed between 10-Mar-2023 and 20-Mar-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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Certificate of Analysis

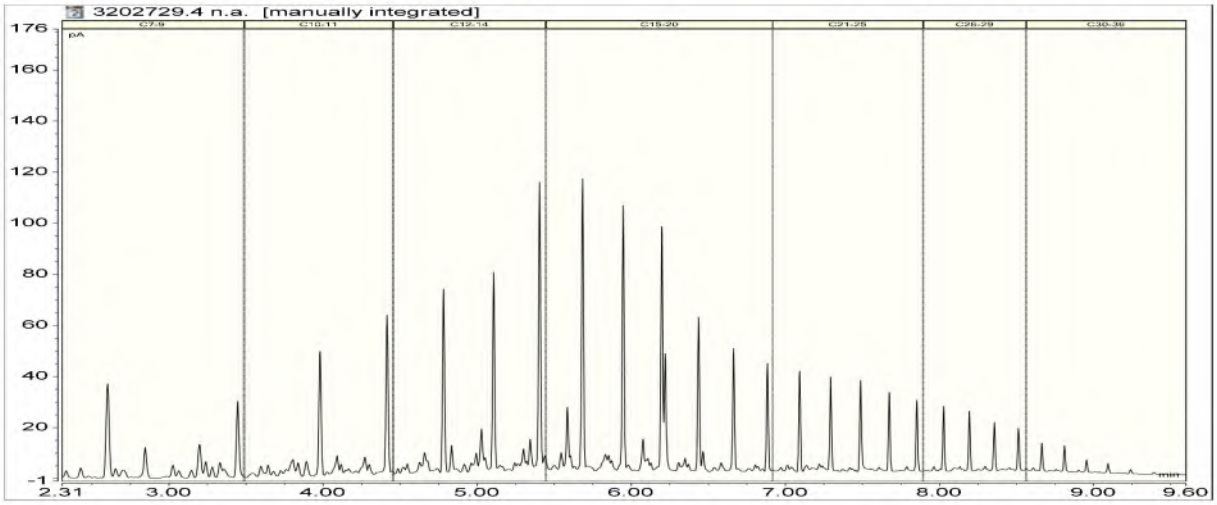
Client:	Greymouth Petroleum Limited	**Lab No:**	3202729 SPv1
Contact:	Fiona Campbell	**Date Received:**	16-Mar-2023
	C/- Greymouth Petroleum Limited	**Date Reported:**	29-Mar-2023
	14 Connett Road West	**Quote No:**	81870
	Bell Block	**Order No:**	259882
	New Plymouth 4312	**Client Reference:**	Return Fluid Composite
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

		Sample Name:	Composite of Turangi 2 Stim 2 Return HF Fluid
		Lab Number:	3202729.4
Individual Tests			
pH	pH Units		6.5
Total Alkalinity	g/m³ as $CaCO_3$		870
Total Hardness	g/m³ as $CaCO_3$		410
Electrical Conductivity (EC)	mS/m		2,400
Salinity*			14.8
Total Suspended Solids	g/m³		121
Total Dissolved Solids (TDS)	g/m³		15,400
Dissolved Barium	g/m³		66
Dissolved Bromine	g/m³		24
Dissolved Calcium	g/m³		140
Dissolved Copper	g/m³		0.041
Dissolved Iron	g/m³		11.9
Dissolved Magnesium	g/m³		14
Dissolved Manganese	g/m³		3.1
Total Nickel*	g/m³		0.188
Total Potassium*	g/m³		260
Total Sodium*	g/m³		5,300
Total Sulphur	g/m³		6.4
Total Zinc*	g/m³		0.117
Chloride	g/m³		7,700
Nitrite-N	g/m³		< 0.10 #1
Nitrate-N	g/m³		< 0.10
Nitrate	g/m³		< 0.5
Nitrate-N + Nitrite-N	g/m³		< 0.10 #1
Sulphate*	g/m³		19
Ethylene Glycol in Water*			
Ethylene glycol*	g/m³		46
Propylene Glycol in Water*			
Propylene glycol*	g/m³		< 20
Methanol in Water - Aqueous Solvents*			
Methanol*	g/m³		< 20
BTEX in Water by Headspace GC-MS			
Benzene	g/m³		7.6
Toluene	g/m³		3.9
Ethylbenzene	g/m³		0.131
m&p-Xylene	g/m³		0.62
o-Xylene	g/m³		0.29

Sample Type: Aqueous		
Sample Name:		Composite of Turangi 2 Stim 2 Return HF Fluid
Lab Number:		3202729.4
Formaldehyde in Water by DNPH & LCMSMS		
Formaldehyde	g/m³	< 1.5
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m³	12.6
C10 - C14	g/m³	49
C15 - C36	g/m³	97
Total hydrocarbons (C7 - C36)	g/m³	158

3202729.4
Composite of Turangi 2 Stim 2 Return HF Fluid
Client Chromatogram for TPH by FID



Analyst's Comments

#1 Due to the nature of this sample a dilution was performed prior to analysis, resulting in a detection limit higher than that normally achieved for the NO2N, NO3N and NOxN 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**
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	4
Total Digestion	Boiling nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	4
Total Digestion of Saline Samples*	Nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	4
pH	pH meter. APHA 4500-H^+ B 23rd 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	4
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (modified for Alkalinity <20) 23rd ed. 2017.	1.0 g/m³ as $CaCO_3$	4
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 23rd ed. 2017.	1.0 g/m³ as $CaCO_3$	4
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 23rd ed. 2017.	0.1 mS/m	4
Salinity*	Conductivity Meter (WTW Cond 340i with nonlinear temperature compensation according to EN 27 888). APHA 2520 B 23rd ed. 2017.	0.2	4

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Suspended Solids	Saline sample. Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D (modified) 23rd ed. 2017.	3 g/m³	4
Total Dissolved Solids (TDS)	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) 23rd ed. 2017.	50 g/m³	4
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23rd ed. 2017.	-	4
Dissolved Barium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.0006 g/m³	4
Dissolved Bromine	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.10 g/m³	4
Dissolved Calcium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	1.0 g/m³	4
Dissolved Copper	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0010 g/m³	4
Dissolved Iron	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 23rd ed. 2017.	0.004 g/m³	4
Dissolved Magnesium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.4 g/m³	4
Dissolved Manganese	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0010 g/m³	4
Total Nickel*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.0070 g/m³	4
Total Potassium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	1.1 g/m³	4
Total Sodium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.42 g/m³	4
Total Sulphur	Nitric acid digestion, ICP-OES (method may not fully account for H_2S due to volatilisation during digestion). All forms of oxidised and organic sulphur will be determined by this method. APHA 3120 B 23rd ed. 2017.	0.5 g/m³	4
Total Zinc*	Nitric acid digestion, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0042 g/m³	4
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23rd ed. 2017.	0.5 g/m³	4
Nitrite-N	Saline sample. Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.0010 g/m³	4
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO2N. In-House.	0.0010 g/m³	4
Nitrate	Calculation from Nitrate-N.	0.005 g/m³	4
Nitrate-N + Nitrite-N	Saline sample. Total oxidised nitrogen. Automated cadmium reduction, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.0010 g/m³	4
Total Sulphate*	Calculation: from total sulphur.	2 g/m³	4
Ethylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	4
Propylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	4
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	4
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	4
Formaldehyde in Water by DNPH & LCMSMS	Derivatisation, SPE extraction, LC-MS/MS analysis. In-house based on US EPA 8315A.	0.02 g/m³	4
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	4
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	4
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	4
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	4

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

Testing was completed between 21-Mar-2023 and 29-Mar-2023. For completion dates of individual analyses please contact the laboratory.

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

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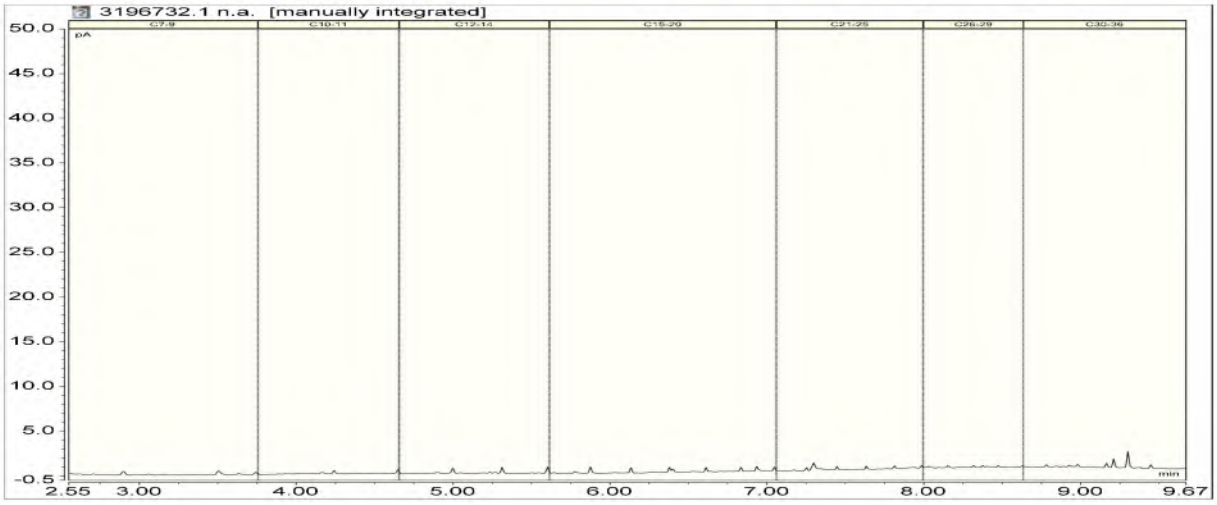
Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3196732 SPv1
Contact:	Fiona Campbell	**Date Received:**	10-Mar-2023
	C/- Greymouth Petroleum Limited	**Date Reported:**	24-Mar-2023
	14 Connett Road West	**Quote No:**	85159
	Bell Block	**Order No:**	259944
	New Plymouth 4312	**Client Reference:**	Hydraulic fracturing fluid testing
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

Sample Name:		Turangi 2 Stim 3 prepumped HF Fluid 08-Mar-2023
Lab Number:		3196732.1
Ethylene Glycol in Water*		
Ethylene glycol*	g/m³	97
Propylene Glycol in Water*		
Propylene glycol*	g/m³	< 20
Methanol in Water - Aqueous Solvents*		
Methanol*	g/m³	< 20
BTEX in Water by Headspace GC-MS		
Benzene	g/m³	0.0064
Toluene	g/m³	0.052
Ethylbenzene	g/m³	0.0063
m&p-Xylene	g/m³	0.040
o-Xylene	g/m³	0.0121
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m³	< 0.5
C10 - C14	g/m³	1.5
C15 - C36	g/m³	10
Total hydrocarbons (C7 - C36)	g/m³	11

3196732.1
Turangi 2 Stim 3 prepumped HF Fluid 08-Mar-2023
Client Chromatogram for TPH by FID



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**
Individual Tests			
Ethylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m^3	1
Propylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m^3	1
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m^3	1
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m^3	1
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m^3	1
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m^3	1
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m^3	1
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m^3	1

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

Testing was completed between 14-Mar-2023 and 24-Mar-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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Certificate of Analysis

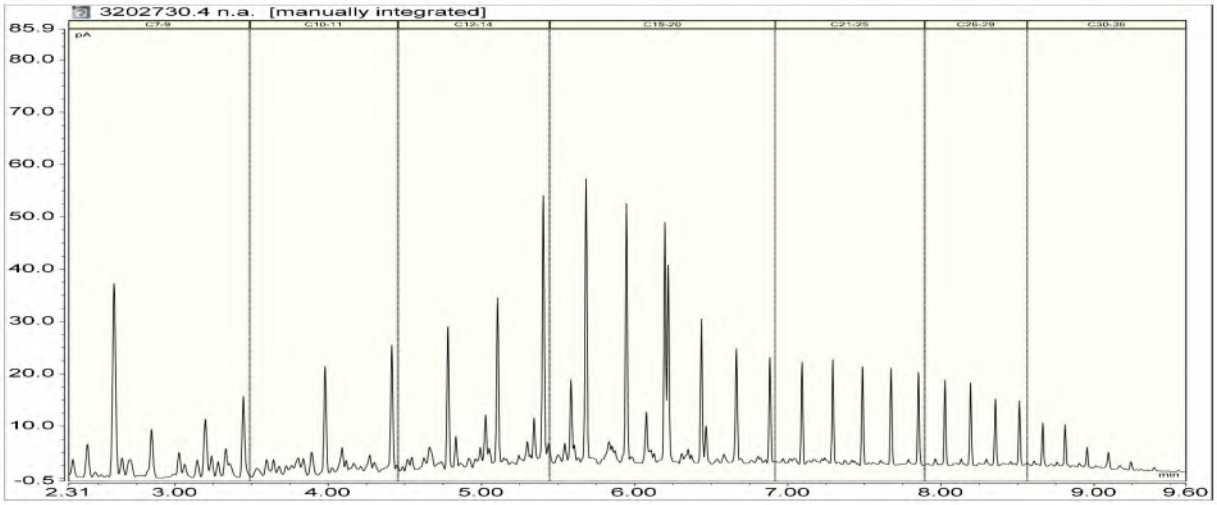
Client:	Greymouth Petroleum Limited	**Lab No:**	3202730 SPv1
Contact:	Fiona Campbell	**Date Received:**	16-Mar-2023
	C/- Greymouth Petroleum Limited	**Date Reported:**	29-Mar-2023
	14 Connett Road West	**Quote No:**	81870
	Bell Block	**Order No:**	259944
	New Plymouth 4312	**Client Reference:**	Return Fluid Composite
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

Sample Name:		Composite of Turangi 2 Stim 3 Return HF Fluid
Lab Number:		3202730.4
Individual Tests		
pH	pH Units	6.7
Total Alkalinity	g/m³ as $CaCO_3$	600
Total Hardness	g/m³ as $CaCO_3$	420
Electrical Conductivity (EC)	mS/m	1,825
Salinity*		11.0
Total Suspended Solids	g/m³	126
Total Dissolved Solids (TDS)	g/m³	12,400
Dissolved Barium	g/m³	38
Dissolved Bromine	g/m³	17.4
Dissolved Calcium	g/m³	137
Dissolved Copper	g/m³	0.008
Dissolved Iron	g/m³	2.6
Dissolved Magnesium	g/m³	19
Dissolved Manganese	g/m³	1.35
Total Nickel*	g/m³	0.082
Total Potassium*	g/m³	188
Total Sodium*	g/m³	3,800
Total Sulphur	g/m³	7.1
Total Zinc*	g/m³	0.090
Chloride	g/m³	6,000
Nitrite-N	g/m³	< 0.10 #2
Nitrate-N	g/m³	< 0.10
Nitrate	g/m³	< 0.5
Nitrate-N + Nitrite-N	g/m³	< 0.10 #2
Sulphate*	g/m³	21
Ethylene Glycol in Water*		
Ethylene glycol*	g/m³	< 30 #1
Propylene Glycol in Water*		
Propylene glycol*	g/m³	< 20
Methanol in Water - Aqueous Solvents*		
Methanol*	g/m³	< 20
BTEX in Water by Headspace GC-MS		
Benzene	g/m³	5.3
Toluene	g/m³	3.4
Ethylbenzene	g/m³	0.129
m&p-Xylene	g/m³	0.52
o-Xylene	g/m³	0.26

Sample Type: Aqueous		
Sample Name:		Composite of Turangi 2 Stim 3 Return HF Fluid
Lab Number:		3202730.4
Formaldehyde in Water by DNPH & LCMSMS		
Formaldehyde	g/m³	< 0.15
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m³	11.0
C10 - C14	g/m³	28
C15 - C36	g/m³	70
Total hydrocarbons (C7 - C36)	g/m³	109

3202730.4
Composite of Turangi 2 Stim 3 Return HF Fluid
Client Chromatogram for TPH by FID



Analyst's Comments

#1 Due to some interference found in the chromatography, the detection limit was raised. Hence the higher detection limit reported.

#2 Due to the nature of this sample a dilution was performed prior to analysis, resulting in a detection limit higher than that normally achieved for the NO2N, NO3N and NOxN 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**
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	4
Total Digestion	Boiling nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	4
Total Digestion of Saline Samples*	Nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	4
pH	pH meter. APHA 4500-H^+ B 23rd 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	4
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (modified for Alkalinity <20) 23rd ed. 2017.	1.0 g/m³ as $CaCO_3$	4
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 23rd ed. 2017.	1.0 g/m³ as $CaCO_3$	4
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 23rd ed. 2017.	0.1 mS/m	4
Salinity*	Conductivity Meter (WTW Cond 340i with nonlinear temperature compensation according to EN 27 888). APHA 2520 B 23rd ed. 2017.	0.2	4

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Suspended Solids	Saline sample. Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D (modified) 23rd ed. 2017.	3 g/m³	4
Total Dissolved Solids (TDS)	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) 23rd ed. 2017.	50 g/m³	4
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23rd ed. 2017.	-	4
Dissolved Barium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.0006 g/m³	4
Dissolved Bromine	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.10 g/m³	4
Dissolved Calcium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	1.0 g/m³	4
Dissolved Copper	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0010 g/m³	4
Dissolved Iron	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 23rd ed. 2017.	0.004 g/m³	4
Dissolved Magnesium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.4 g/m³	4
Dissolved Manganese	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0010 g/m³	4
Total Nickel*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.0070 g/m³	4
Total Potassium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	1.1 g/m³	4
Total Sodium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.42 g/m³	4
Total Sulphur	Nitric acid digestion, ICP-OES (method may not fully account for H_2S due to volatilisation during digestion). All forms of oxidised and organic sulphur will be determined by this method. APHA 3120 B 23rd ed. 2017.	0.5 g/m³	4
Total Zinc*	Nitric acid digestion, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0042 g/m³	4
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23rd ed. 2017.	0.5 g/m³	4
Nitrite-N	Saline sample. Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.0010 g/m³	4
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO2N. In-House.	0.0010 g/m³	4
Nitrate	Calculation from Nitrate-N.	0.005 g/m³	4
Nitrate-N + Nitrite-N	Saline sample. Total oxidised nitrogen. Automated cadmium reduction, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.0010 g/m³	4
Total Sulphate*	Calculation: from total sulphur.	2 g/m³	4
Ethylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	4
Propylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	4
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	4
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	4
Formaldehyde in Water by DNPH & LCMSMS	Derivatisation, SPE extraction, LC-MS/MS analysis. In-house based on US EPA 8315A.	0.02 g/m³	4
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	4
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	4
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	4
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	4

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

Testing was completed between 21-Mar-2023 and 29-Mar-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.

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

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

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W www.hill-laboratories.com

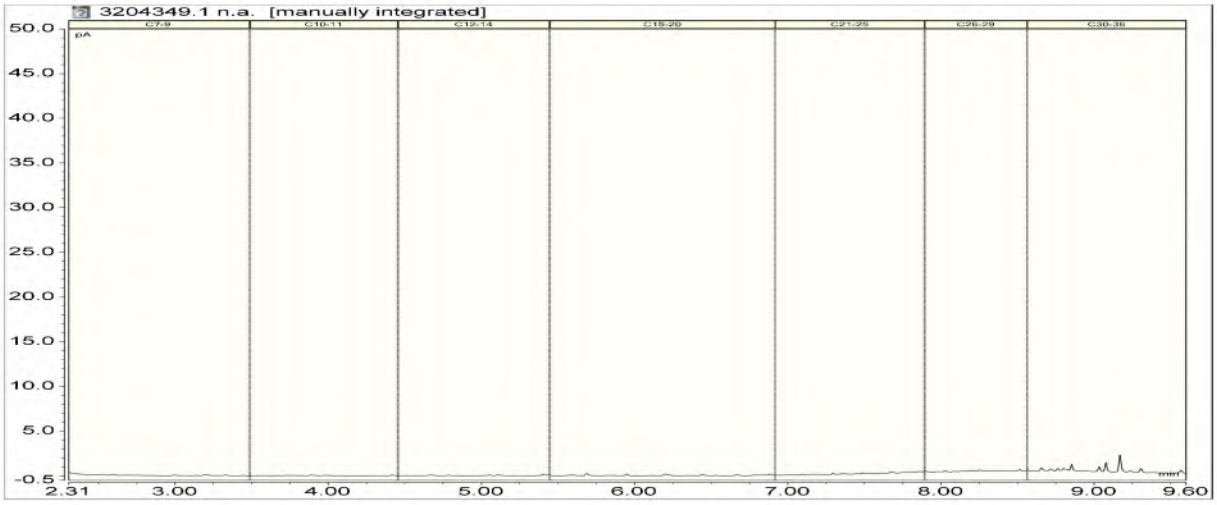
Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3204349 SPv1
Contact:	Fiona Campbell	**Date Received:**	17-Mar-2023
	C/- Greymouth Petroleum Limited	**Date Reported:**	27-Mar-2023
	14 Connett Road West	**Quote No:**	85159
	Bell Block	**Order No:**	260042
	New Plymouth 4312	**Client Reference:**	Hydraulic fracturing fluid testing
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

Sample Name:		Turangi 2 Stim 4 Prepumped HF Fluid 15-Mar-2023
Lab Number:		3204349.1
Ethylene Glycol in Water*		
Ethylene glycol*	g/m³	110
Propylene Glycol in Water*		
Propylene glycol*	g/m³	< 20
Methanol in Water - Aqueous Solvents*		
Methanol*	g/m³	< 20
BTEX in Water by Headspace GC-MS		
Benzene	g/m³	0.0020
Toluene	g/m³	0.0108
Ethylbenzene	g/m³	0.0017
m&p-Xylene	g/m³	0.009
o-Xylene	g/m³	0.0038
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m³	< 0.5
C10 - C14	g/m³	< 1.0
C15 - C36	g/m³	4
Total hydrocarbons (C7 - C36)	g/m³	4

3204349.1
Turangi 2 Stim 4 Prepumped HF Fluid 15-Mar-2023
Client Chromatogram for TPH by FID



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**
Individual Tests			
Ethylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m^3	1
Propylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m^3	1
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m^3	1
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m^3	1
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m^3	1
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m^3	1
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m^3	1
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m^3	1

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

Testing was completed between 22-Mar-2023 and 27-Mar-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.

Martin Cowell - BSc
Client Services Manager - Environmental

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Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3217781 SPv1
Contact:	Fiona Campbell C/- Greymouth Petroleum Limited 14 Connett Road West Bell Block New Plymouth 4312	**Date Received:**	28-Mar-2023
		Date Reported:	12-Apr-2023
		Quote No:	81870
		Order No:	260042
		Client Reference:	Return Fluid Composite
		Submitted By:	Fiona Campbell

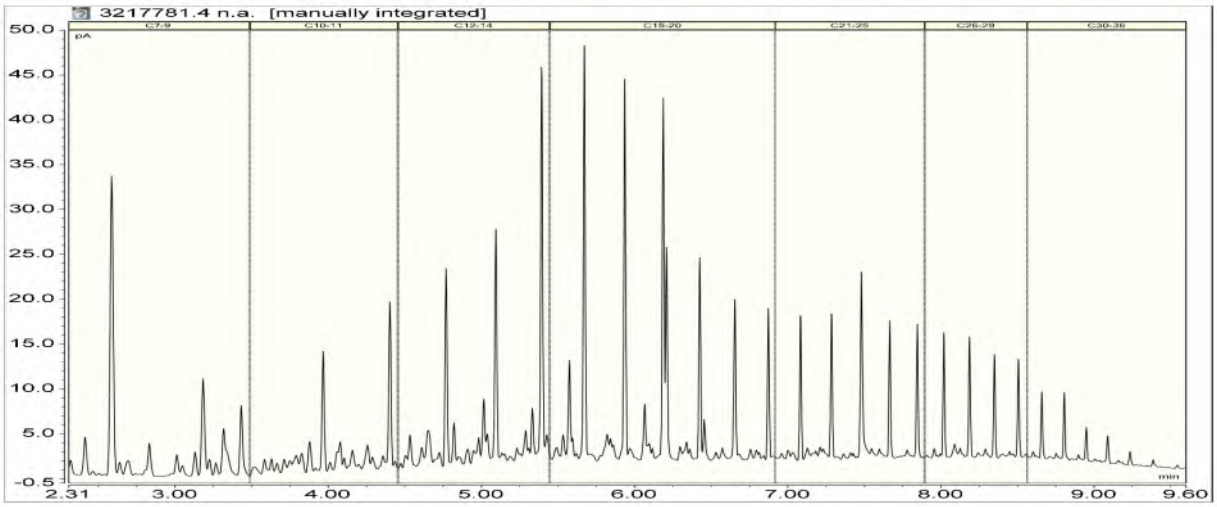
Sample Type: Aqueous

		Sample Name:	Composite of Turangi 2 Stim4 Return HF Fluid Start, Turangi 2 Stim4 Return HF Fluid Middle, Turangi 2 Stim4 Return HF Fluid Finish
		Lab Number:	3217781.4
Individual Tests			
pH	pH Units		6.6
Total Alkalinity	g/m³ as $CaCO_3$		790
Total Hardness	g/m³ as $CaCO_3$		320
Electrical Conductivity (EC)	mS/m		1,641
Salinity*			9.9
Total Suspended Solids	g/m³		220
Total Dissolved Solids (TDS)	g/m³		10,600
Dissolved Barium	g/m³		31
Dissolved Bromine	g/m³		18.3
Dissolved Calcium	g/m³		105
Dissolved Copper	g/m³		< 0.005
Dissolved Iron	g/m³		4.0
Dissolved Magnesium	g/m³		15
Dissolved Manganese	g/m³		1.76
Total Nickel*	g/m³		0.136
Total Potassium*	g/m³		195
Total Sodium*	g/m³		3,300
Total Sulphur	g/m³		8
Total Zinc*	g/m³		0.159
Chloride	g/m³		5,200
Nitrite-N	g/m³		< 0.10 #1
Nitrate-N	g/m³		< 0.10
Nitrate	g/m³		< 0.5
Nitrate-N + Nitrite-N	g/m³		< 0.10 #1
Sulphate*	g/m³		24
Ethylene Glycol in Water*			
Ethylene glycol*	g/m³		< 20
Propylene Glycol in Water*			
Propylene glycol*	g/m³		< 20
Methanol in Water - Aqueous Solvents*			
Methanol*	g/m³		< 20
BTEX in Water by Headspace GC-MS			
Benzene	g/m³		5.3
Toluene	g/m³		3.2
Ethylbenzene	g/m³		0.15
m&p-Xylene	g/m³		0.6
o-Xylene	g/m³		0.32

This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

Sample Type: Aqueous		
Sample Name:		Composite of Turangi 2 Stim4 Return HF Fluid Start, Turangi 2 Stim4 Return HF Fluid Middle, Turangi 2 Stim4 Return HF Fluid Finish
Lab Number:		3217781.4
Formaldehyde in Water by DNPH & LCMSMS		
Formaldehyde	g/m^3	< 0.15
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m^3	8.0
C10 - C14	g/m^3	22
C15 - C36	g/m^3	56
Total hydrocarbons (C7 - C36)	g/m^3	86

3217781.4
Composite of Turangi 2 Stim4 Return HF Fluid Start, Turangi 2 Stim4 Return HF Fluid Middle, Turangi 2 Stim4 Return HF Fluid Finish
Client Chromatogram for TPH by FID



Analyst's Comments

#1 Due to the nature of this sample a dilution was performed prior to analysis, resulting in a detection limit higher than that normally achieved for the NO2N, NO3N and NOxN 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**
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	4
Total Digestion	Boiling nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	4
Total Digestion of Saline Samples*	Nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	4
pH	pH meter. APHA 4500-H^+ B 23rd 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	4
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (modified for Alkalinity <20) 23rd ed. 2017.	1.0 g/m^3 as $CaCO_3$	4
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 23rd ed. 2017.	1.0 g/m^3 as $CaCO_3$	4
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 23rd ed. 2017.	0.1 mS/m	4
Salinity*	Conductivity Meter (WTW Cond 340i with nonlinear temperature compensation according to EN 27 888). APHA 2520 B 23rd ed. 2017.	0.2	4

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Suspended Solids	Saline sample. Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D (modified) 23rd ed. 2017.	3 g/m³	4
Total Dissolved Solids (TDS)	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) 23rd ed. 2017.	50 g/m³	4
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23rd ed. 2017.	-	4
Dissolved Barium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.0006 g/m³	4
Dissolved Bromine	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.10 g/m³	4
Dissolved Calcium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	1.0 g/m³	4
Dissolved Copper	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0010 g/m³	4
Dissolved Iron	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 23rd ed. 2017.	0.004 g/m³	4
Dissolved Magnesium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.4 g/m³	4
Dissolved Manganese	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0010 g/m³	4
Total Nickel*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.0070 g/m³	4
Total Potassium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	1.1 g/m³	4
Total Sodium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.42 g/m³	4
Total Sulphur	Nitric acid digestion, ICP-OES (method may not fully account for H_2S due to volatilisation during digestion). All forms of oxidised and organic sulphur will be determined by this method. APHA 3120 B 23rd ed. 2017.	0.5 g/m³	4
Total Zinc*	Nitric acid digestion, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0042 g/m³	4
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23rd ed. 2017.	0.5 g/m³	4
Nitrite-N	Saline sample. Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.0010 g/m³	4
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO2N. In-House.	0.0010 g/m³	4
Nitrate	Calculation from Nitrate-N.	0.005 g/m³	4
Nitrate-N + Nitrite-N	Saline sample. Total oxidised nitrogen. Automated cadmium reduction, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.0010 g/m³	4
Total Sulphate*	Calculation: from total sulphur.	2 g/m³	4
Ethylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	4
Propylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	4
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	4
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	4
Formaldehyde in Water by DNPH & LCMSMS	Derivatisation, SPE extraction, LC-MS/MS analysis. In-house based on US EPA 8315A.	0.02 g/m³	4
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	4
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	4
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	4
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	4

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

Testing was completed between 31-Mar-2023 and 12-Apr-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.

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

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

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W www.hill-laboratories.com

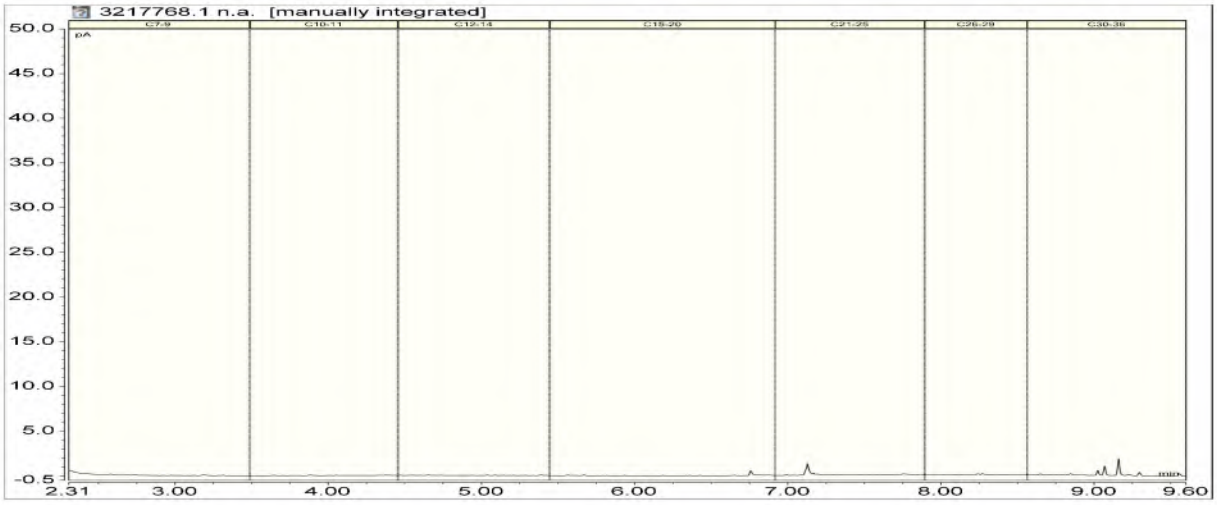
Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3217768 SPv1
Contact:	Fiona Campbell	**Date Received:**	28-Mar-2023
	C/- Greymouth Petroleum Limited	**Date Reported:**	06-Apr-2023
	14 Connett Road West	**Quote No:**	85159
	Bell Block	**Order No:**	260130
	New Plymouth 4312	**Client Reference:**	Hydraulic fracturing fluid testing
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

Sample Name:		Turangi 2 Stim 5 Prepumped HF Fluid 23-Mar-2023
Lab Number:		3217768.1
Ethylene Glycol in Water*		
Ethylene glycol*	g/m³	80
Propylene Glycol in Water*		
Propylene glycol*	g/m³	< 20
Methanol in Water - Aqueous Solvents*		
Methanol*	g/m³	< 20
BTEX in Water by Headspace GC-MS		
Benzene	g/m³	0.0015
Toluene	g/m³	0.0061
Ethylbenzene	g/m³	0.0013
m&p-Xylene	g/m³	0.006
o-Xylene	g/m³	0.0027
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m³	< 0.5
C10 - C14	g/m³	< 1.0
C15 - C36	g/m³	2
Total hydrocarbons (C7 - C36)	g/m³	< 4

3217768.1
Turangi 2 Stim 5 Prepumped HF Fluid 23-Mar-2023
Client Chromatogram for TPH by FID



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**
Individual Tests			
Ethylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m^3	1
Propylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m^3	1
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m^3	1
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m^3	1
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m^3	1
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m^3	1
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m^3	1
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m^3	1

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

Testing was completed between 03-Apr-2023 and 06-Apr-2023. For completion dates of individual analyses please contact the laboratory.

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Kim Harrison MSc
Client Services Manager - Environmental

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Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3224591 SPv1
Contact:	Fiona Campbell	**Date Received:**	01-Apr-2023
	C/- Greymouth Petroleum Limited	**Date Reported:**	17-Apr-2023
	14 Connett Road West	**Quote No:**	81870
	Bell Block	**Order No:**	260130
	New Plymouth 4312	**Client Reference:**	Return Fluid Composite
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

Sample Name:		Turangi 2 Stim5 Return HF Fluid Composite
Lab Number:		3224591.3
Individual Tests		
pH	pH Units	6.8
Total Alkalinity	g/m³ as $CaCO_3$	780
Total Hardness	g/m³ as $CaCO_3$	181
Electrical Conductivity (EC)	mS/m	913
Salinity*		5.2
Total Suspended Solids	g/m³	680
Total Dissolved Solids (TDS)	g/m³	7,100
Dissolved Barium	g/m³	9.4
Dissolved Bromine	g/m³	8.4
Dissolved Calcium	g/m³	55
Dissolved Copper	g/m³	0.061
Dissolved Iron	g/m³	4.1
Dissolved Magnesium	g/m³	11
Dissolved Manganese	g/m³	0.21
Total Nickel*	g/m³	0.086
Total Potassium*	g/m³	104
Total Sodium*	g/m³	1,850
Total Sulphur	g/m³	10
Total Zinc*	g/m³	0.22
Chloride	g/m³	2,500
Nitrite-N	g/m³	< 0.10 #1
Nitrate-N	g/m³	< 0.10
Nitrate	g/m³	< 0.5
Nitrate-N + Nitrite-N	g/m³	< 0.10 #1
Sulphate*	g/m³	31
Ethylene Glycol in Water*		
Ethylene glycol*	g/m³	< 20
Propylene Glycol in Water*		
Propylene glycol*	g/m³	< 20
Methanol in Water - Aqueous Solvents*		
Methanol*	g/m³	< 20
BTEX in Water by Headspace GC-MS		
Benzene	g/m³	17.5
Toluene	g/m³	32
Ethylbenzene	g/m³	4.3
m&p-Xylene	g/m³	24
o-Xylene	g/m³	7.2

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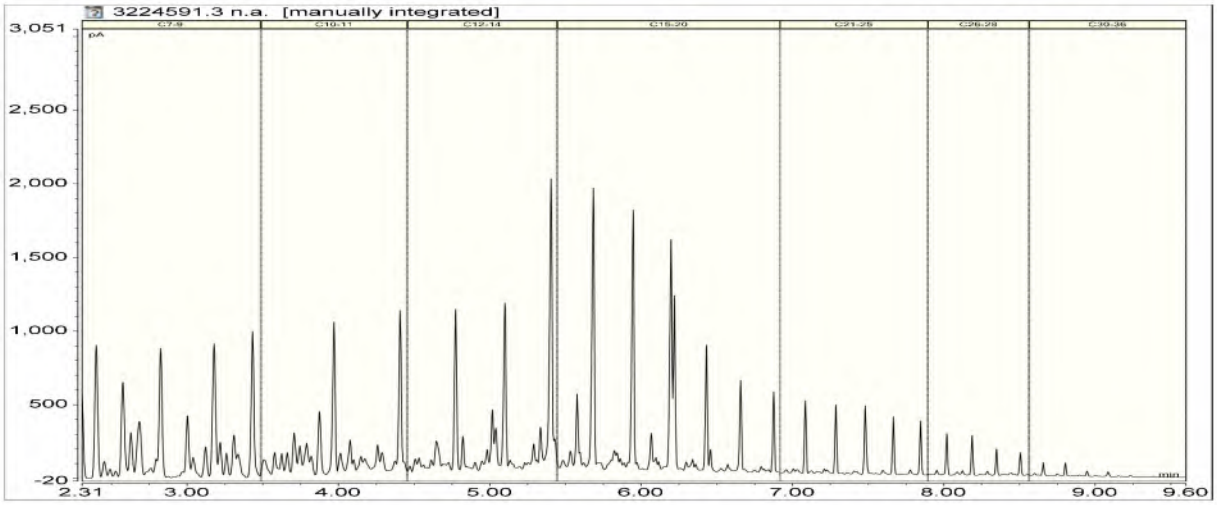
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

Sample Type: Aqueous		
Sample Name:		Turangi 2 Stim5 Return HF Fluid Composite
Lab Number:		3224591.3
Formaldehyde in Water by DNPH & LCMSMS		
Formaldehyde	g/m³	< 0.15
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m³	660
C10 - C14	g/m³	1,210
C15 - C36	g/m³	1,420
Total hydrocarbons (C7 - C36)	g/m³	3,300

3224591.3
Turangi 2 Stim5 Return HF Fluid Composite
Client Chromatogram for TPH by FID



Analyst's Comments

#1 Due to the nature of this sample a dilution was performed prior to analysis, resulting in a detection limit higher than that normally achieved for the NO2N, NO3N and NOxN 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**
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	3
Total Digestion	Boiling nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	3
Total Digestion of Saline Samples*	Nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	3
pH	pH meter. APHA 4500-H^+ B 23rd 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	3
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (modified for Alkalinity <20) 23rd ed. 2017.	1.0 g/m³ as $CaCO_3$	3
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 23rd ed. 2017.	1.0 g/m³ as $CaCO_3$	3
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 23rd ed. 2017.	0.1 mS/m	3
Salinity*	Conductivity Meter (WTW Cond 340i with nonlinear temperature compensation according to EN 27 888). APHA 2520 B 23rd ed. 2017.	0.2	3

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Suspended Solids	Saline sample. Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D (modified) 23rd ed. 2017.	3 g/m³	3
Total Dissolved Solids (TDS)	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) 23rd ed. 2017.	50 g/m³	3
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23rd ed. 2017.	-	3
Dissolved Barium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.0006 g/m³	3
Dissolved Bromine	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.10 g/m³	3
Dissolved Calcium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	1.0 g/m³	3
Dissolved Copper	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0010 g/m³	3
Dissolved Iron	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 23rd ed. 2017.	0.004 g/m³	3
Dissolved Magnesium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.4 g/m³	3
Dissolved Manganese	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0010 g/m³	3
Total Nickel*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.0070 g/m³	3
Total Potassium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	1.1 g/m³	3
Total Sodium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.42 g/m³	3
Total Sulphur	Nitric acid digestion, ICP-OES (method may not fully account for H_2S due to volatilisation during digestion). All forms of oxidised and organic sulphur will be determined by this method. APHA 3120 B 23rd ed. 2017.	0.5 g/m³	3
Total Zinc*	Nitric acid digestion, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0042 g/m³	3
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23rd ed. 2017.	0.5 g/m³	3
Nitrite-N	Saline sample. Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.0010 g/m³	3
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO2N. In-House.	0.0010 g/m³	3
Nitrate	Calculation from Nitrate-N.	0.005 g/m³	3
Nitrate-N + Nitrite-N	Saline sample. Total oxidised nitrogen. Automated cadmium reduction, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.0010 g/m³	3
Total Sulphate*	Calculation: from total sulphur.	2 g/m³	3
Ethylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	3
Propylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	3
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	3
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	3
Formaldehyde in Water by DNPH & LCMSMS	Derivatisation, SPE extraction, LC-MS/MS analysis. In-house based on US EPA 8315A.	0.02 g/m³	3
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	3
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	3
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	3
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	3

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

Testing was completed between 05-Apr-2023 and 17-Apr-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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Client Services Manager - Environmental

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Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3228062 SPv1
Contact:	Fiona Campbell	**Date Received:**	04-Apr-2023
	C/- Greymouth Petroleum Limited	**Date Reported:**	18-Apr-2023
	14 Connett Road West	**Quote No:**	85159
	Bell Block	**Order No:**	260172
	New Plymouth 4312	**Client Reference:**	Hydraulic fracturing fluid testing
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

Sample Name:		Turangi 2 stim 6 prepumped HF fluid 02-Apr-2023
Lab Number:		3228062.1
Ethylene Glycol in Water*		
Ethylene glycol*	g/m³	98
Propylene Glycol in Water*		
Propylene glycol*	g/m³	< 20
Methanol in Water - Aqueous Solvents*		
Methanol*	g/m³	< 20
BTEX in Water by Headspace GC-MS		
Benzene	g/m³	< 0.0010
Toluene	g/m³	0.0026
Ethylbenzene	g/m³	< 0.0010
m&p-Xylene	g/m³	0.003
o-Xylene	g/m³	0.0017
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m³	< 0.5
C10 - C14	g/m³	< 1.0
C15 - C36	g/m³	< 2
Total hydrocarbons (C7 - C36)	g/m³	< 4

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
Individual Tests			
Ethylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	1
Propylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	1
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	1
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	1
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	1
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	1
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	1
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	1

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Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3242323 SPv1
Contact:	Fiona Campbell	**Date Received:**	15-Apr-2023
	C/- Greymouth Petroleum Limited	**Date Reported:**	26-Apr-2023
	14 Connett Road West	**Quote No:**	81870
	Bell Block	**Order No:**	260172
	New Plymouth 4312	**Client Reference:**	Return Fluid Composite
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

		Sample Name:	composite of Turangi 2 Stim6 Return HF Fluid Start, Turangi 2 Stim6 Return HF Fluid Middle
		Lab Number:	3242323.3
Individual Tests			
pH	pH Units		6.1
Total Alkalinity	g/m³ as $CaCO_3$		370
Total Hardness	g/m³ as $CaCO_3$		2,200
Electrical Conductivity (EC)	mS/m		1,489
Salinity*			9.0
Total Suspended Solids	g/m³		330
Total Dissolved Solids (TDS)	g/m³		11,000
Dissolved Barium	g/m³		12.6
Dissolved Bromine	g/m³		10.6
Dissolved Calcium	g/m³		840
Dissolved Copper	g/m³		0.015
Dissolved Iron	g/m³		25
Dissolved Magnesium	g/m³		17
Dissolved Manganese	g/m³		1.00
Total Nickel*	g/m³		0.20
Total Potassium*	g/m³		108
Total Sodium*	g/m³		2,100
Total Sulphur	g/m³		8
Total Zinc*	g/m³		0.157
Chloride	g/m³		5,100
Nitrite-N	g/m³		< 0.10
Nitrate-N	g/m³		< 0.10
Nitrate	g/m³		< 0.5
Nitrate-N + Nitrite-N	g/m³		< 0.10
Sulphate*	g/m³		24
Ethylene Glycol in Water*			
Ethylene glycol*	g/m³		< 20
Propylene Glycol in Water*			
Propylene glycol*	g/m³		< 20
Methanol in Water - Aqueous Solvents*			
Methanol*	g/m³		< 1,100
BTEX in Water by Headspace GC-MS			
Benzene	g/m³		21
Toluene	g/m³		17.7
Ethylbenzene	g/m³		2.6
m&p-Xylene	g/m³		6.1
o-Xylene	g/m³		3.3

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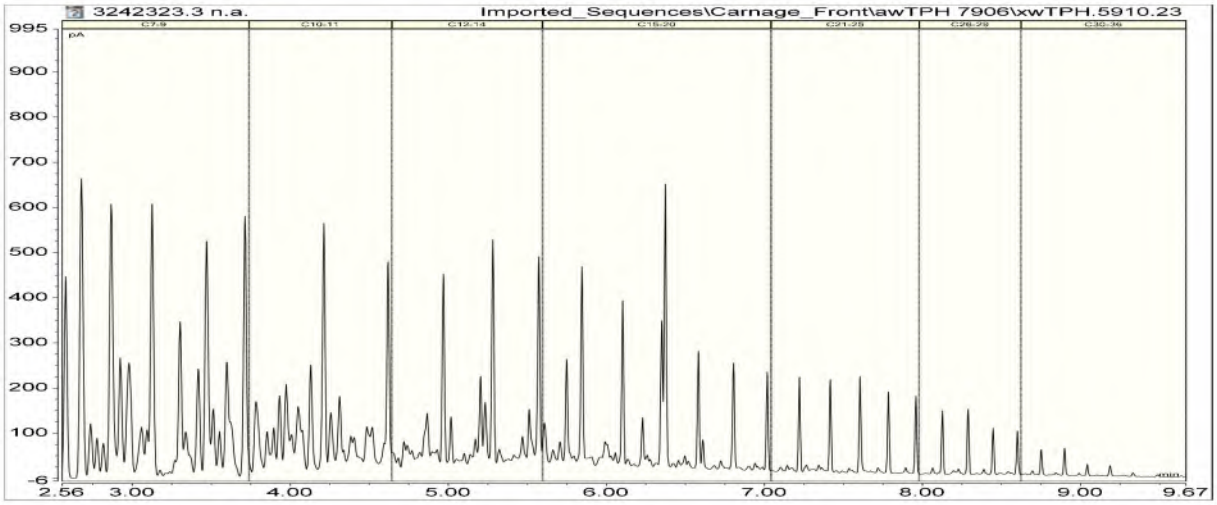
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

Sample Type: Aqueous		
Sample Name:		composite of Turangi 2 Stim6 Return HF Fluid Start, Turangi 2 Stim6 Return HF Fluid Middle
Lab Number:		3242323.3
Formaldehyde in Water by DNPH & LCMSMS		
Formaldehyde	g/m^3	< 0.15
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m^3	540
C10 - C14	g/m^3	610
C15 - C36	g/m^3	560
Total hydrocarbons (C7 - C36)	g/m^3	1,720

3242323.3
composite of Turangi 2 Stim6 Return HF Fluid Start, Turangi 2 Stim6 Return HF Fluid Middle
Client Chromatogram for TPH by FID



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**
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	3
Total Digestion	Boiling nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	3
Total Digestion of Saline Samples*	Nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	3
pH	pH meter. APHA 4500-H^+ B 23rd 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	3
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (modified for Alkalinity <20) 23rd ed. 2017.	1.0 g/m^3 as $CaCO_3$	3
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 23rd ed. 2017.	1.0 g/m^3 as $CaCO_3$	3
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 23rd ed. 2017.	0.1 mS/m	3
Salinity*	Conductivity Meter (WTW Cond 340i with nonlinear temperature compensation according to EN 27 888). APHA 2520 B 23rd ed. 2017.	0.2	3
Total Suspended Solids	Saline sample. Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D (modified) 23rd ed. 2017.	3 g/m^3	3
Total Dissolved Solids (TDS)	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) 23rd ed. 2017.	50 g/m^3	3

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23rd ed. 2017.	-	3
Dissolved Barium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.0006 g/m³	3
Dissolved Bromine	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.10 g/m³	3
Dissolved Calcium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	1.0 g/m³	3
Dissolved Copper	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0010 g/m³	3
Dissolved Iron	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 23rd ed. 2017.	0.004 g/m³	3
Dissolved Magnesium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.4 g/m³	3
Dissolved Manganese	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0010 g/m³	3
Total Nickel*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.0070 g/m³	3
Total Potassium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	1.1 g/m³	3
Total Sodium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.42 g/m³	3
Total Sulphur	Nitric acid digestion, ICP-OES (method may not fully account for H_2S due to volatilisation during digestion). All forms of oxidised and organic sulphur will be determined by this method. APHA 3120 B 23rd ed. 2017.	0.5 g/m³	3
Total Zinc*	Nitric acid digestion, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0042 g/m³	3
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23rd ed. 2017.	0.5 g/m³	3
Nitrite-N	Saline sample. Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.0010 g/m³	3
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO2N. In-House.	0.0010 g/m³	3
Nitrate	Calculation from Nitrate-N.	0.005 g/m³	3
Nitrate-N + Nitrite-N	Saline sample. Total oxidised nitrogen. Automated cadmium reduction, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.0010 g/m³	3
Total Sulphate*	Calculation: from total sulphur.	2 g/m³	3
Ethylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	3
Propylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	3
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	3
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	3
Formaldehyde in Water by DNPH & LCMSMS	Derivatisation, SPE extraction, LC-MS/MS analysis. In-house based on US EPA 8315A.	0.02 g/m³	3
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	3
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	3
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	3
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	3

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

Testing was completed between 19-Apr-2023 and 26-Apr-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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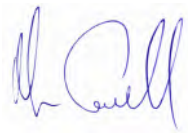

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Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3242322 SPv1
Contact:	Fiona Campbell	**Date Received:**	15-Apr-2023
	C/- Greymouth Petroleum Limited	**Date Reported:**	03-May-2023
	14 Connett Road West	**Quote No:**	85159
	Bell Block	**Order No:**	260308
	New Plymouth 4312	**Client Reference:**	Hydraulic fracturing fluid testing
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

Sample Name:		Turangi 2 Stim 7 Prepumped HF Fluid 12-Apr-2023
Lab Number:		3242322.1
Ethylene Glycol in Water*		
Ethylene glycol*	g/m³	85
Propylene Glycol in Water*		
Propylene glycol*	g/m³	< 4
Methanol in Water - Aqueous Solvents*		
Methanol*	g/m³	< 2
BTEX in Water by Headspace GC-MS		
Benzene	g/m³	0.0013
Toluene	g/m³	0.0026
Ethylbenzene	g/m³	< 0.0010
m&p-Xylene	g/m³	0.003
o-Xylene	g/m³	0.0014
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m³	< 0.5
C10 - C14	g/m³	< 1.0
C15 - C36	g/m³	< 2
Total hydrocarbons (C7 - C36)	g/m³	< 4

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
Individual Tests			
Ethylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	1
Propylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	1
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	1
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	1
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	1
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	1
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	1
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	1

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

Testing was completed between 20-Apr-2023 and 03-May-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

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Certificate of Analysis

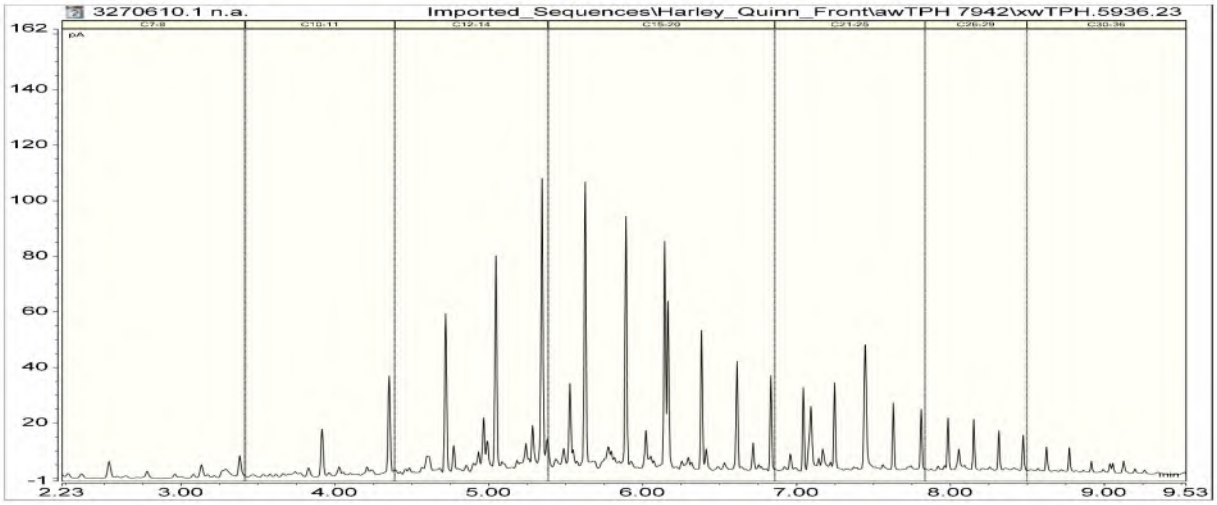
Client:	Greymouth Petroleum Limited	**Lab No:**	3270610 SPv1
Contact:	Fiona Campbell	**Date Received:**	09-May-2023
	C/- Greymouth Petroleum Limited	**Date Reported:**	18-May-2023
	14 Connett Road West	**Quote No:**	81870
	Bell Block	**Order No:**	260308
	New Plymouth 4312	**Client Reference:**	Return Fluid Composite
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

Sample Name:		Turangi 2 Stim 7 Return HF Fluid 12-Apr-2023
Lab Number:		3270610.1
Individual Tests		
pH	pH Units	6.3
Total Alkalinity	g/m³ as $CaCO_3$	50
Total Hardness	g/m³ as $CaCO_3$	104
Electrical Conductivity (EC)	mS/m	95.9
Salinity*		0.2
Total Suspended Solids	g/m³	510
Total Dissolved Solids (TDS)	g/m³	3,500
Dissolved Barium	g/m³	0.128
Dissolved Bromine	g/m³	< 0.5
Dissolved Calcium	g/m³	31
Dissolved Copper	g/m³	0.010
Dissolved Iron	g/m³	2.7
Dissolved Magnesium	g/m³	6
Dissolved Manganese	g/m³	0.21
Total Nickel*	g/m³	0.141
Total Potassium*	g/m³	11.6
Total Sodium*	g/m³	20
Total Sulphur	g/m³	8
Total Zinc*	g/m³	0.29
Chloride	g/m³	230
Nitrite-N	g/m³	< 0.10 #1
Nitrate-N	g/m³	< 0.10
Nitrate	g/m³	< 0.5
Nitrate-N + Nitrite-N	g/m³	< 0.10 #1
Sulphate*	g/m³	24
Ethylene Glycol in Water*		
Ethylene glycol*	g/m³	< 20
Propylene Glycol in Water*		
Propylene glycol*	g/m³	< 20
Methanol in Water - Aqueous Solvents*		
Methanol*	g/m³	< 20
BTEX in Water by Headspace GC-MS		
Benzene	g/m³	0.24
Toluene	g/m³	0.51
Ethylbenzene	g/m³	0.067
m&p-Xylene	g/m³	0.25
o-Xylene	g/m³	0.133

Sample Type: Aqueous		
Sample Name:		Turangi 2 Stim 7 Return HF Fluid 12-Apr-2023
Lab Number:		3270610.1
Formaldehyde in Water by DNPH & LCMSMS		
Formaldehyde	g/m³	0.53
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m³	3.7
C10 - C14	g/m³	35
C15 - C36	g/m³	89
Total hydrocarbons (C7 - C36)	g/m³	128

3270610.1
Turangi 2 Stim 7 Return HF Fluid 12-Apr-2023
Client Chromatogram for TPH by FID



Analyst's Comments

#1 Due to the nature of this sample a dilution was performed prior to analysis, resulting in a detection limit higher than that normally achieved for the NO2Nsal, NO3Nsal and NOxNsal 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.

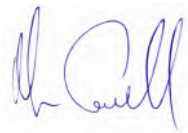
Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1
Total Digestion	Boiling nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	1
Total Digestion of Saline Samples*	Nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	1
pH	pH meter. APHA 4500-H^+ B 23rd 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) 23rd ed. 2017.	1.0 g/m³ as $CaCO_3$	1
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 23rd ed. 2017.	1.0 g/m³ as $CaCO_3$	1
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 23rd ed. 2017.	0.1 mS/m	1
Salinity*	Conductivity Meter (WTW Cond 340i with nonlinear temperature compensation according to EN 27 888). APHA 2520 B 23rd ed. 2017.	0.2	1

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Suspended Solids	Saline sample. Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D (modified) 23rd ed. 2017.	3 g/m³	1
Total Dissolved Solids (TDS)	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) 23rd ed. 2017.	50 g/m³	1
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23rd ed. 2017.	-	1
Dissolved Barium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.0006 g/m³	1
Dissolved Bromine	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.10 g/m³	1
Dissolved Calcium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	1.0 g/m³	1
Dissolved Copper	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0010 g/m³	1
Dissolved Iron	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 23rd ed. 2017.	0.004 g/m³	1
Dissolved Magnesium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.4 g/m³	1
Dissolved Manganese	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0010 g/m³	1
Total Nickel*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.0070 g/m³	1
Total Potassium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	1.1 g/m³	1
Total Sodium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 23rd ed. 2017.	0.42 g/m³	1
Total Sulphur	Nitric acid digestion, ICP-OES (method may not fully account for H_2S due to volatilisation during digestion). All forms of oxidised and organic sulphur will be determined by this method. APHA 3120 B 23rd ed. 2017.	0.5 g/m³	1
Total Zinc*	Nitric acid digestion, ICP-MS, ultratrace. APHA 3125 B 23rd ed. 2017.	0.0042 g/m³	1
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23rd ed. 2017.	0.5 g/m³	1
Nitrite-N	Saline sample. Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.0010 g/m³	1
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO2N. In-House.	0.0010 g/m³	1
Nitrate	Calculation from Nitrate-N.	0.005 g/m³	1
Nitrate-N + Nitrite-N	Saline sample. Total oxidised nitrogen. Automated cadmium reduction, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.0010 g/m³	1
Total Sulphate*	Calculation: from total sulphur.	2 g/m³	1
Ethylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	1
Propylene Glycol in Water*	Direct injection, dual column GC-FID.	4 g/m³	1
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	1
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	1
Formaldehyde in Water by DNPH & LCMSMS	Derivatisation, SPE extraction, LC-MS/MS analysis. In-house based on US EPA 8315A.	0.02 g/m³	1
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	1
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	1
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	1
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	1

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

Testing was completed between 10-May-2023 and 18-May-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.



Martin Cowell - BSc
Client Services Manager - Environmental

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Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3612135 SPv1
Contact:	Fiona Campbell	**Date Received:**	22-Jun-2024
	C/- Greymouth Petroleum Limited	**Date Reported:**	02-Jul-2024
	14 Connett Road West	**Quote No:**	85159
	Bell Block	**Order No:**	265078
	New Plymouth 4312	**Client Reference:**	Hydraulic fracturing fluid testing
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

Sample Name:		Turangi 17 Strim1 prepumped HF Fluid 19-Jun-2024
Lab Number:		3612135.1
Ethylene Glycol in Water*		
Ethylene glycol*	g/m³	690
Propylene Glycol in Water*		
Propylene glycol*	g/m³	< 20
Methanol in Water - Aqueous Solvents*		
Methanol*	g/m³	< 20
BTEX in Water by Headspace GC-MS		
Benzene	g/m³	< 0.0010
Toluene	g/m³	0.0068
Ethylbenzene	g/m³	0.0011
m&p-Xylene	g/m³	0.005
o-Xylene	g/m³	0.0022
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m³	< 0.5
C10 - C14	g/m³	< 1.0
C15 - C36	g/m³	< 2
Total hydrocarbons (C7 - C36)	g/m³	< 4

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
Individual Tests			
Ethylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	1
Propylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	1
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	1
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	1
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	1
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	1
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	1
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	1

This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

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

Testing was completed between 25-Jun-2024 and 02-Jul-2024. 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

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Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3616152 SPv1
Contact:	Fiona Campbell	**Date Received:**	29-Jun-2024
	C/- Greymouth Petroleum Limited	**Date Reported:**	08-Jul-2024
	14 Connett Road West	**Quote No:**	81870
	Bell Block	**Order No:**	265078
	New Plymouth 4312	**Client Reference:**	Return Fluid Composite
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

		Sample Name:	Composite of Turangi 17 Stim 1 Return HF Fluid - Start & Middle
		Lab Number:	3616152.3
Individual Tests			
pH	pH Units		8.0
Total Alkalinity	g/m³ as $CaCO_3$		550
Total Hardness	g/m³ as $CaCO_3$		123
Electrical Conductivity (EC)	mS/m		658
Salinity*			3.6
Total Suspended Solids	g/m³		270
Total Dissolved Solids (TDS)	g/m³		5,600
Dissolved Barium	g/m³		2.4
Dissolved Bromine	g/m³		5.3
Dissolved Calcium	g/m³		40
Dissolved Copper	g/m³		0.198
Dissolved Iron	g/m³		15.3
Dissolved Magnesium	g/m³		6
Dissolved Manganese	g/m³		0.168
Total Nickel*	g/m³		0.087
Total Potassium*	g/m³		43
Total Sodium*	g/m³		1,250
Total Sulphur	g/m³		12
Total Zinc*	g/m³		0.179
Chloride	g/m³		1,880
Nitrite-N	g/m³		0.015 #1
Nitrate-N	g/m³		< 0.010
Nitrate	g/m³		< 0.05
Nitrate-N + Nitrite-N	g/m³		0.013 #1
Sulphate*	g/m³		36
Ethylene Glycol in Water*			
Ethylene glycol*	g/m³		167
Propylene Glycol in Water*			
Propylene glycol*	g/m³		< 20
Methanol in Water - Aqueous Solvents*			
Methanol*	g/m³		< 20
BTEX in Water by Headspace GC-MS			
Benzene	g/m³		13.5
Toluene	g/m³		13.7
Ethylbenzene	g/m³		1.27
m&p-Xylene	g/m³		6.5
o-Xylene	g/m³		2.4

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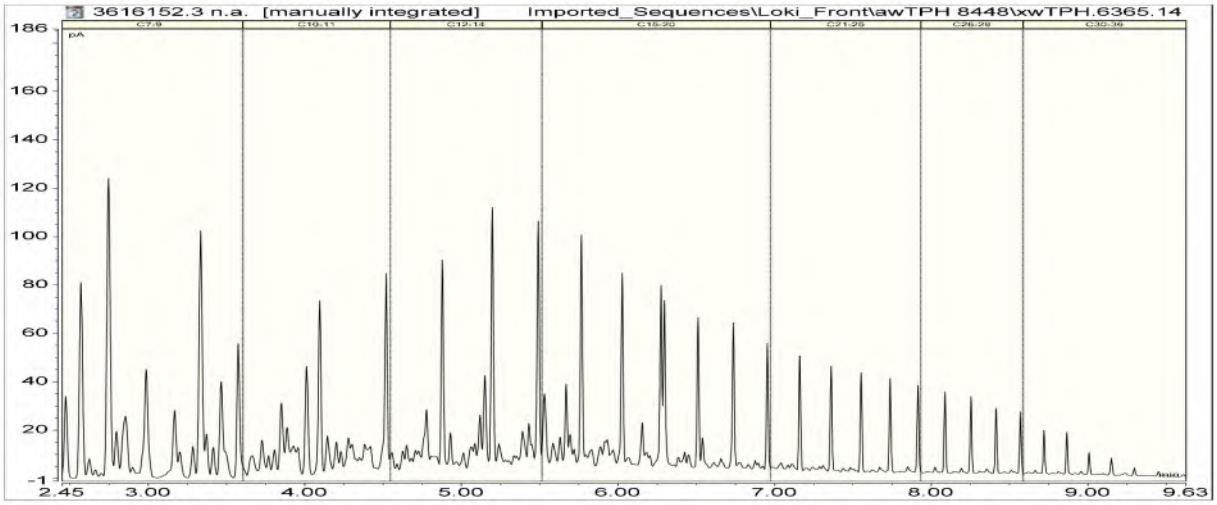
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

Sample Type: Aqueous		
Sample Name:		Composite of Turangi 17 Stim 1 Return HF Fluid - Start & Middle
Lab Number:		3616152.3
Formaldehyde in Water by DNPH & LCMSMS		
Formaldehyde	g/m^3	0.32
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m^3	60
C10 - C14	g/m^3	95
C15 - C36	g/m^3	117
Total hydrocarbons (C7 - C36)	g/m^3	270

3616152.3
Composite of Turangi 17 Stim 1 Return HF Fluid - Start & Middle
Client Chromatogram for TPH by FID



Analyst's Comments

[#1] Due to the nature of this sample a dilution was performed prior to analysis, resulting in a detection limit higher than that normally achieved for the NO2Nsal, NO3Nsal and NOxNsal 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**
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	3
Total Digestion	Boiling nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	3
Total Digestion of Saline Samples*	Nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	3
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	3
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 $CaCO_3$	3
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B : Online Edition.	1.0 g/m^3 as $CaCO_3$	3
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	0.1 mS/m	3
Salinity*	Conductivity Meter (WTW Cond 340i with nonlinear temperature compensation according to EN 27 888). APHA 2520 B : Online Edition.	0.2	3

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Suspended Solids	Saline sample. Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D (modified) : Online Edition.	3 g/m³	3
Total Dissolved Solids (TDS)	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) : Online Edition.	50 g/m³	3
Filtration for dissolved metals analysis - Ultratrace	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B : Online Edition.	-	3
Dissolved Barium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.0006 g/m³	3
Dissolved Bromine	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.10 g/m³	3
Dissolved Calcium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	1.0 g/m³	3
Dissolved Copper	Filtered sample, ICP-MS, ultratrace. APHA 3125 B : Online Edition.	0.0010 g/m³	3
Dissolved Iron	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B : Online Edition.	0.02 g/m³	3
Dissolved Magnesium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.4 g/m³	3
Dissolved Manganese	Filtered sample, ICP-MS, ultratrace. APHA 3125 B : Online Edition.	0.0010 g/m³	3
Total Nickel*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.0070 g/m³	3
Total Potassium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	1.1 g/m³	3
Total Sodium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.42 g/m³	3
Total Sulphur	Nitric acid digestion, ICP-OES (method may not fully account for H_2S due to volatilisation during digestion). All forms of oxidised and organic sulphur will be determined by this method. APHA 3120 B : Online Edition.	0.5 g/m³	3
Total Zinc*	Nitric acid digestion, ICP-MS, ultratrace. APHA 3125 B : Online Edition.	0.0042 g/m³	3
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m³	3
Nitrite-N	Saline sample. Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) : Online Edition.	0.0010 g/m³	3
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - Nitrite-N. In-House.	0.0010 g/m³	3
Nitrate	Calculation from Nitrate-N.	0.005 g/m³	3
Nitrate-N + Nitrite-N	Saline sample. Total oxidised nitrogen. Automated cadmium reduction, Flow injection analyser. APHA 4500-NO_3^- I (modified) : Online Edition.	0.0010 g/m³	3
Total Sulphate*	Calculation: from total sulphur.	2 g/m³	3
Ethylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	3
Propylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	3
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	3
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	3
Formaldehyde in Water by DNPH & LCMSMS	Derivatisation, SPE extraction, LC-MS/MS analysis. In-house based on US EPA 8315A.	0.02 g/m³	3
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	3
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	3
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	3
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	3

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

Testing was completed between 02-Jul-2024 and 08-Jul-2024. 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

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Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3616151 SPv1
Contact:	Fiona Campbell	**Date Received:**	29-Jun-2024
	C/- Greymouth Petroleum Limited	**Date Reported:**	08-Jul-2024
	14 Connett Road West	**Quote No:**	85159
	Bell Block	**Order No:**	265141
	New Plymouth 4312	**Client Reference:**	Hydraulic fracturing fluid testing
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

Sample Name:		Turangi 17 Stim 2 Prepumped HF Fluid 26-Jun-2024
Lab Number:		3616151.1
Ethylene Glycol in Water*		
Ethylene glycol*	g/m³	610
Propylene Glycol in Water*		
Propylene glycol*	g/m³	< 20
Methanol in Water - Aqueous Solvents*		
Methanol*	g/m³	< 20
BTEX in Water by Headspace GC-MS		
Benzene	g/m³	< 0.0010
Toluene	g/m³	0.0041
Ethylbenzene	g/m³	< 0.0010
m&p-Xylene	g/m³	0.004
o-Xylene	g/m³	0.0013
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m³	< 0.5
C10 - C14	g/m³	< 1.0
C15 - C36	g/m³	< 2
Total hydrocarbons (C7 - C36)	g/m³	< 4

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
Individual Tests			
Ethylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	1
Propylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	1
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	1
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	1
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	1
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	1
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	1
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	1

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

Testing was completed between 02-Jul-2024 and 08-Jul-2024. For completion dates of individual analyses please contact the laboratory.

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Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3621571 SPv1
Contact:	Fiona Campbell	**Date Received:**	06-Jul-2024
	C/- Greymouth Petroleum Limited	**Date Reported:**	19-Jul-2024
	14 Connett Road West	**Quote No:**	81870
	Bell Block	**Order No:**	265141
	New Plymouth 4312	**Client Reference:**	Return Fluid Composite
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

		Sample Name:	Composite of Turangi 17 Stim 2 Return HF Fluid Start, Turangi 17 Stim 2 Return HF Fluid Middle & Turangi 17 Stim 2 Return HF Fluid End
		Lab Number:	3621571.4
Individual Tests			
pH	pH Units		7.9
Total Alkalinity	g/m³ as $CaCO_3$		2,900
Total Hardness	g/m³ as $CaCO_3$		147
Electrical Conductivity (EC)	mS/m		1,283
Salinity*			7.6
Total Suspended Solids	g/m³		770
Total Dissolved Solids (TDS)	g/m³		11,100
Dissolved Barium	g/m³		42
Dissolved Bromine	g/m³		13.2
Dissolved Calcium	g/m³		47
Dissolved Copper	g/m³		0.168
Dissolved Iron	g/m³		5.9
Dissolved Magnesium	g/m³		7
Dissolved Manganese	g/m³		1.05
Total Nickel*	g/m³		0.152
Total Potassium*	g/m³		99
Total Sodium*	g/m³		3,200
Total Sulphur	g/m³		10
Total Zinc*	g/m³		0.89
Chloride	g/m³		2,500
Nitrite-N	g/m³		< 0.010 #1
Nitrate-N	g/m³		< 0.010
Nitrate	g/m³		< 0.05
Nitrate-N + Nitrite-N	g/m³		< 0.010 #1
Sulphate*	g/m³		29
Ethylene Glycol in Water*			
Ethylene glycol*	g/m³		91
Propylene Glycol in Water*			
Propylene glycol*	g/m³		< 20
Methanol in Water - Aqueous Solvents*			
Methanol*	g/m³		< 20
BTEX in Water by Headspace GC-MS			
Benzene	g/m³		199
Toluene	g/m³		570
Ethylbenzene	g/m³		50
m&p-Xylene	g/m³		270
o-Xylene	g/m³		77

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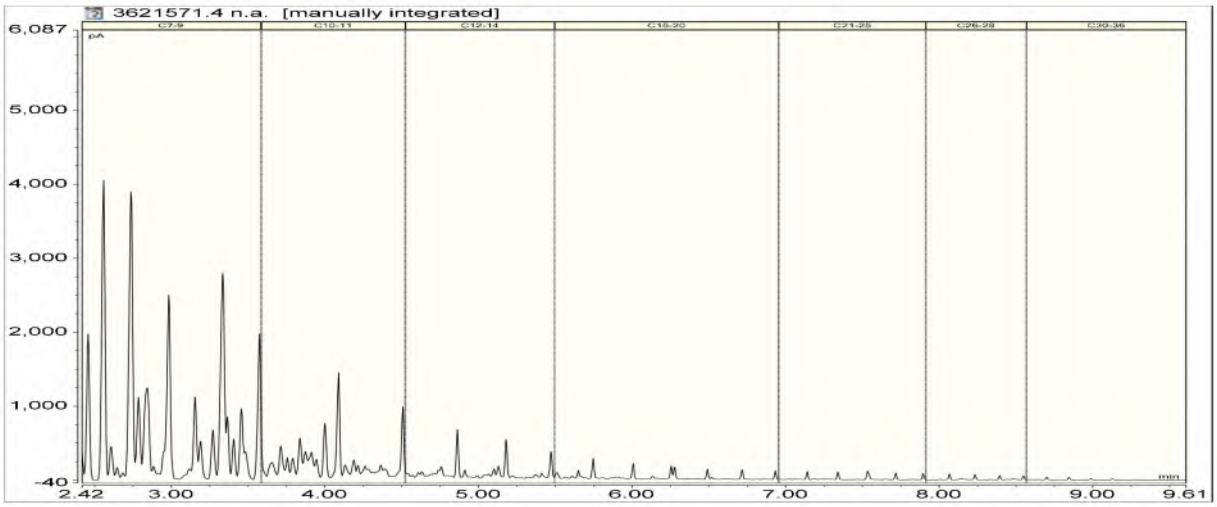
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

Sample Type: Aqueous		
Sample Name:		Composite of Turangi 17 Stim 2 Return HF Fluid Start, Turangi 17 Stim 2 Return HF Fluid Middle & Turangi 17 Stim 2 Return HF Fluid End
Lab Number:		3621571.4
Formaldehyde in Water by DNPH & LCMSMS		
Formaldehyde	g/m^3	0.74
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m^3	9,500
C10 - C14	g/m^3	4,200
C15 - C36	g/m^3	1,210
Total hydrocarbons (C7 - C36)	g/m^3	14,900

3621571.4
Composite of Turangi 17 Stim 2 Return HF Fluid Start, Turangi 17 Stim 2 Return HF Fluid Middle & Turangi 17 Stim 2 Return HF Fluid End
Client Chromatogram for TPH by FID



Analyst's Comments

#1 Due to the nature of this sample a dilution was performed prior to analysis, resulting in a detection limit higher than that normally achieved for the NO2N, NO3N and NOxN 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**
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	4
Total Digestion	Boiling nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	4
Total Digestion of Saline Samples*	Nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	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	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 $CaCO_3$	4
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B : Online Edition.	1.0 g/m^3 as $CaCO_3$	4
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	0.1 mS/m	4
Salinity*	Conductivity Meter (WTW Cond 340i with nonlinear temperature compensation according to EN 27 888). APHA 2520 B : Online Edition.	0.2	4

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Suspended Solids	Saline sample. Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D (modified) : Online Edition.	3 g/m³	4
Total Dissolved Solids (TDS)	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) : Online Edition.	50 g/m³	4
Filtration for dissolved metals analysis - Ultratrace	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B : Online Edition.	-	4
Dissolved Barium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.0006 g/m³	4
Dissolved Bromine	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.10 g/m³	4
Dissolved Calcium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	1.0 g/m³	4
Dissolved Copper	Filtered sample, ICP-MS, ultratrace. APHA 3125 B : Online Edition.	0.0010 g/m³	4
Dissolved Iron	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B : Online Edition.	0.02 g/m³	4
Dissolved Magnesium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.4 g/m³	4
Dissolved Manganese	Filtered sample, ICP-MS, ultratrace. APHA 3125 B : Online Edition.	0.0010 g/m³	4
Total Nickel*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.0070 g/m³	4
Total Potassium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	1.1 g/m³	4
Total Sodium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.42 g/m³	4
Total Sulphur	Nitric acid digestion, ICP-OES (method may not fully account for H_2S due to volatilisation during digestion). All forms of oxidised and organic sulphur will be determined by this method. APHA 3120 B : Online Edition.	0.5 g/m³	4
Total Zinc*	Nitric acid digestion, ICP-MS, ultratrace. APHA 3125 B : Online Edition.	0.0042 g/m³	4
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m³	4
Nitrite-N	Saline sample. Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) : Online Edition.	0.0010 g/m³	4
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - Nitrite-N. In-House.	0.0010 g/m³	4
Nitrate	Calculation from Nitrate-N.	0.005 g/m³	4
Nitrate-N + Nitrite-N	Saline sample. Total oxidised nitrogen. Automated cadmium reduction, Flow injection analyser. APHA 4500-NO_3^- I (modified) : Online Edition.	0.0010 g/m³	4
Total Sulphate*	Calculation: from total sulphur.	2 g/m³	4
Ethylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	4
Propylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	4
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	4
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	4
Formaldehyde in Water by DNPH & LCMSMS	Derivatisation, SPE extraction, LC-MS/MS analysis. In-house based on US EPA 8315A.	0.02 g/m³	4
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	4
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	4
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	4
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	4

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

Testing was completed between 09-Jul-2024 and 19-Jul-2024. For completion dates of individual analyses please contact the laboratory.

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Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3621572 SPv1
Contact:	Fiona Campbell	**Date Received:**	06-Jul-2024
	C/- Greymouth Petroleum Limited	**Date Reported:**	15-Jul-2024
	14 Connett Road West	**Quote No:**	85159
	Bell Block	**Order No:**	265211
	New Plymouth 4312	**Client Reference:**	Hydraulic fracturing fluid testing
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

Sample Name:		Turagi 17 Stim 3 Prepumped Fluid 04-Jul-2024
Lab Number:		3621572.1
Ethylene Glycol in Water*		
Ethylene glycol*	g/m³	670
Propylene Glycol in Water*		
Propylene glycol*	g/m³	< 20
Methanol in Water - Aqueous Solvents*		
Methanol*	g/m³	< 20
BTEX in Water by Headspace GC-MS		
Benzene	g/m³	< 0.0010
Toluene	g/m³	0.0017
Ethylbenzene	g/m³	< 0.0010
m&p-Xylene	g/m³	< 0.002
o-Xylene	g/m³	< 0.0010
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m³	< 0.5
C10 - C14	g/m³	< 1.0
C15 - C36	g/m³	< 2
Total hydrocarbons (C7 - C36)	g/m³	< 4

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
Individual Tests			
Ethylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	1
Propylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	1
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	1
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	1
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	1
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	1
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	1
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	1

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Testing was completed between 09-Jul-2024 and 12-Jul-2024. For completion dates of individual analyses please contact the laboratory.

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Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3633163 SPv1
Contact:	Fiona Campbell C/- Greymouth Petroleum Limited 14 Connett Road West Bell Block New Plymouth 4312	**Date Received:**	23-Jul-2024
		Date Reported:	30-Jul-2024
		Quote No:	81870
		Order No:	265211
		Client Reference:	Return Fluid Composite
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

		Sample Name:	Composite of Turangi 17 Stim 3 return HF Fluid Start, Turangi 17 Stim 3 return HF Fluid Middle, Turangi 17 Stim 3 return HF Fluid End
		Lab Number:	3633163.4
Individual Tests			
pH	pH Units		7.8
Total Alkalinity	g/m³ as $CaCO_3$		2,900
Total Hardness	g/m³ as $CaCO_3$		147
Electrical Conductivity (EC)	mS/m		845
Salinity*			4.7
Total Suspended Solids	g/m³		310
Total Dissolved Solids (TDS)	g/m³		8,100
Dissolved Barium	g/m³		8.5
Dissolved Bromine	g/m³		7.5
Dissolved Calcium	g/m³		46
Dissolved Copper	g/m³		0.036
Dissolved Iron	g/m³		1.98
Dissolved Magnesium	g/m³		8
Dissolved Manganese	g/m³		2.4
Total Nickel*	g/m³		0.047
Total Potassium*	g/m³		62
Total Sodium*	g/m³		2,100
Total Sulphur	g/m³		10 #1
Total Zinc*	g/m³		0.21
Chloride	g/m³		1,370
Nitrite-N	g/m³		< 0.10 #2
Nitrate-N	g/m³		< 0.10
Nitrate	g/m³		< 0.5
Nitrate-N + Nitrite-N	g/m³		< 0.10 #2
Sulphate*	g/m³		31
Ethylene Glycol in Water*			
Ethylene glycol*	g/m³		140
Propylene Glycol in Water*			
Propylene glycol*	g/m³		< 20
Methanol in Water - Aqueous Solvents*			
Methanol*	g/m³		< 20
BTEX in Water by Headspace GC-MS			
Benzene	g/m³		22
Toluene	g/m³		40
Ethylbenzene	g/m³		3.8
m&p-Xylene	g/m³		24
o-Xylene	g/m³		7.7

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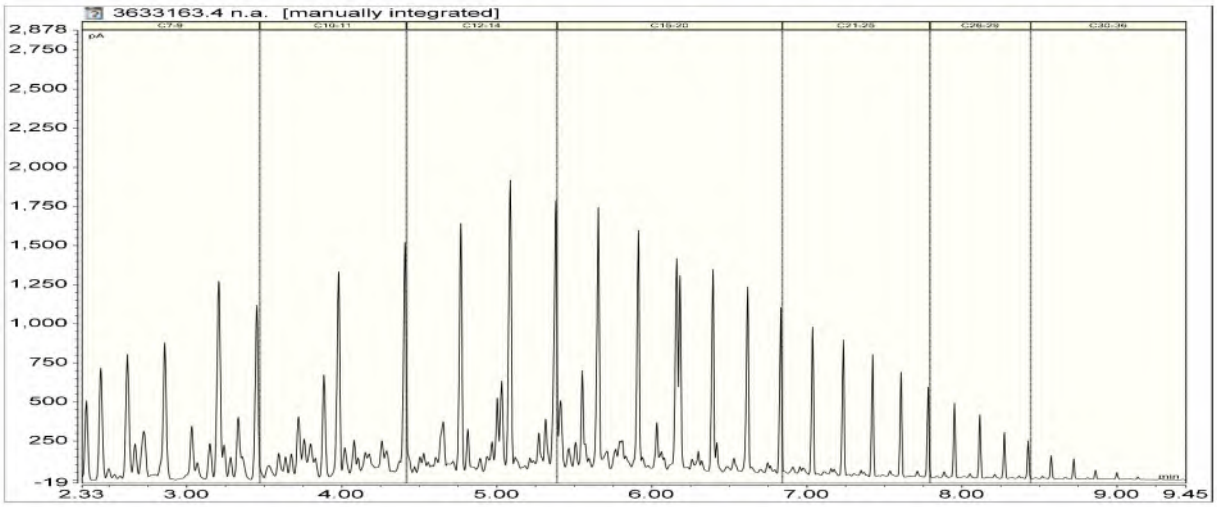
Sample Type: Aqueous		
Sample Name:		Composite of Turangi 17 Stim 3 return HF Fluid Start, Turangi 17 Stim 3 return HF Fluid Middle, Turangi 17 Stim 3 return HF Fluid End
Lab Number:		3633163.4
Formaldehyde in Water by DNPH & LCMSMS		
Formaldehyde	g/m^3	< 0.15
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m^3	7,200
C10 - C14	g/m^3	15,900
C15 - C36	g/m^3	17,100
Total hydrocarbons (C7 - C36)	g/m^3	40,000

3633163.4
Composite of Turangi 17 Stim 3 return HF Fluid Start, Turangi 17 Stim 3 return HF Fluid Middle, Turangi 17 Stim 3 return HF Fluid End
Client Chromatogram for TPH by FID



Analyst's Comments

#1 It was noted that this sample contained a significant portion of oil. The sample was left to settle and only the aqueous layer was tested.

#2 Due to the nature of this sample a dilution was performed prior to analysis, resulting in a detection limit higher than that normally achieved for the NO2N, NO3N and NOxN 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**
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	4
Total Digestion	Boiling nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	4
Total Digestion of Saline Samples*	Nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	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	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 $CaCO_3$	4
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B : Online Edition.	1.0 g/m^3 as $CaCO_3$	4
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	0.1 mS/m	4

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Salinity*	Conductivity Meter (WTW Cond 340i with nonlinear temperature compensation according to EN 27 888). APHA 2520 B : Online Edition.	0.2	4
Total Suspended Solids	Saline sample. Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D (modified) : Online Edition.	3 g/m³	4
Total Dissolved Solids (TDS)	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) : Online Edition.	50 g/m³	4
Filtration for dissolved metals analysis - Ultratrace	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B : Online Edition.	-	4
Dissolved Barium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.0006 g/m³	4
Dissolved Bromine	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.10 g/m³	4
Dissolved Calcium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	1.0 g/m³	4
Dissolved Copper	Filtered sample, ICP-MS, ultratrace. APHA 3125 B : Online Edition.	0.0010 g/m³	4
Dissolved Iron	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B : Online Edition.	0.02 g/m³	4
Dissolved Magnesium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.4 g/m³	4
Dissolved Manganese	Filtered sample, ICP-MS, ultratrace. APHA 3125 B : Online Edition.	0.0010 g/m³	4
Total Nickel*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.0070 g/m³	4
Total Potassium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	1.1 g/m³	4
Total Sodium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.42 g/m³	4
Total Sulphur	Nitric acid digestion, ICP-OES (method may not fully account for H_2S due to volatilisation during digestion). All forms of oxidised and organic sulphur will be determined by this method. APHA 3120 B : Online Edition.	0.5 g/m³	4
Total Zinc*	Nitric acid digestion, ICP-MS, ultratrace. APHA 3125 B : Online Edition.	0.0042 g/m³	4
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m³	4
Nitrite-N	Saline sample. Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) : Online Edition.	0.0010 g/m³	4
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - Nitrite-N. In-House.	0.0010 g/m³	4
Nitrate	Calculation from Nitrate-N.	0.005 g/m³	4
Nitrate-N + Nitrite-N	Saline sample. Total oxidised nitrogen. Automated cadmium reduction, Flow injection analyser. APHA 4500-NO_3^- I (modified) : Online Edition.	0.0010 g/m³	4
Total Sulphate*	Calculation: from total sulphur.	2 g/m³	4
Ethylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	4
Propylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	4
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	4
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	4
Formaldehyde in Water by DNPH & LCMSMS	Derivatisation, SPE extraction, LC-MS/MS analysis. In-house based on US EPA 8315A.	0.02 g/m³	4
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	4
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	4
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	4
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	4

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

Testing was completed between 24-Jul-2024 and 30-Jul-2024. For completion dates of individual analyses please contact the laboratory.

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Ara Heron BSc (Tech)
Client Services Manager - Environmental

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Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3631076 SPv1
Contact:	Fiona Campbell	**Date Received:**	19-Jul-2024
	C/- Greymouth Petroleum Limited	**Date Reported:**	30-Jul-2024
	14 Connett Road West	**Quote No:**	85159
	Bell Block	**Order No:**	265352
	New Plymouth 4312	**Client Reference:**	Hydraulic fracturing fluid testing
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

Sample Name:		Turangi 17 Stim 4 Prepumped HF Fluid 11-Jul-2024
Lab Number:		3631076.1
Ethylene Glycol in Water*		
Ethylene glycol*	g/m³	820
Propylene Glycol in Water*		
Propylene glycol*	g/m³	< 20
Methanol in Water - Aqueous Solvents*		
Methanol*	g/m³	< 20
BTEX in Water by Headspace GC-MS		
Benzene	g/m³	< 0.0010
Toluene	g/m³	0.0103
Ethylbenzene	g/m³	0.0025
m&p-Xylene	g/m³	0.009
o-Xylene	g/m³	0.0036
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m³	< 0.5
C10 - C14	g/m³	< 1.0
C15 - C36	g/m³	< 2
Total hydrocarbons (C7 - C36)	g/m³	< 4

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
Individual Tests			
Ethylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	1
Propylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	1
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	1
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	1
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	1
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	1
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	1
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	1

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Testing was completed between 23-Jul-2024 and 29-Jul-2024. For completion dates of individual analyses please contact the laboratory.

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Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3633164 SPv1
Contact:	Fiona Campbell	**Date Received:**	23-Jul-2024
	C/- Greymouth Petroleum Limited	**Date Reported:**	30-Jul-2024
	14 Connett Road West	**Quote No:**	81870
	Bell Block	**Order No:**	265352
	New Plymouth 4312	**Client Reference:**	Return Fluid Composite
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

		Sample Name:	Composite of Turangi 17 stim 4 return HF Fluid Start, Turangi 17 stim 4 return HF Fluid Middle, Turangi 17 stim 4 return HF Fluid End
		Lab Number:	3633164.4
Individual Tests			
pH	pH Units		7.8
Total Alkalinity	g/m³ as $CaCO_3$		1,920
Total Hardness	g/m³ as $CaCO_3$		122
Electrical Conductivity (EC)	mS/m		828
Salinity*			4.5
Total Suspended Solids	g/m³		320
Total Dissolved Solids (TDS)	g/m³		7,600
Dissolved Barium	g/m³		3.5
Dissolved Bromine	g/m³		9.5
Dissolved Calcium	g/m³		38
Dissolved Copper	g/m³		0.065
Dissolved Iron	g/m³		2.5
Dissolved Magnesium	g/m³		6
Dissolved Manganese	g/m³		1.32
Total Nickel*	g/m³		0.150
Total Potassium*	g/m³		57
Total Sodium*	g/m³		1,870
Total Sulphur	g/m³		15 #1
Total Zinc*	g/m³		0.39
Chloride	g/m³		1,770
Nitrite-N	g/m³		< 0.10 #2
Nitrate-N	g/m³		< 0.10
Nitrate	g/m³		< 0.5
Nitrate-N + Nitrite-N	g/m³		< 0.10 #2
Sulphate*	g/m³		45
Ethylene Glycol in Water*			
Ethylene glycol*	g/m³		260
Propylene Glycol in Water*			
Propylene glycol*	g/m³		< 20
Methanol in Water - Aqueous Solvents*			
Methanol*	g/m³		< 20
BTEX in Water by Headspace GC-MS			
Benzene	g/m³		58
Toluene	g/m³		144
Ethylbenzene	g/m³		17.2
m&p-Xylene	g/m³		103
o-Xylene	g/m³		33

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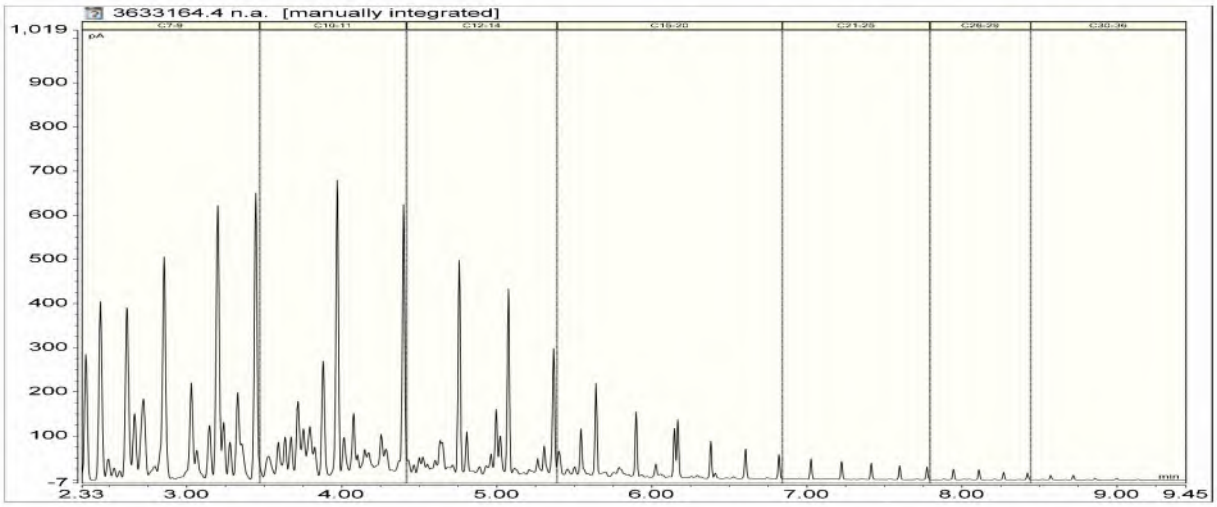
Sample Type: Aqueous		
Sample Name:		Composite of Turangi 17 stim 4 return HF Fluid Start, Turangi 17 stim 4 return HF Fluid Middle, Turangi 17 stim 4 return HF Fluid End
Lab Number:		3633164.4
Formaldehyde in Water by DNPH & LCMSMS		
Formaldehyde	g/m^3	< 1.5
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m^3	3,900
C10 - C14	g/m^3	4,900
C15 - C36	g/m^3	1,310
Total hydrocarbons (C7 - C36)	g/m^3	10,200

3633164.4
Composite of Turangi 17 stim 4 return HF Fluid Start, Turangi 17 stim 4 return HF Fluid Middle, Turangi 17 stim 4 return HF Fluid End
Client Chromatogram for TPH by FID



Analyst's Comments

#1 It was noted that this sample contained a significant portion of oil. The sample was left to settle and only the aqueous layer was tested.

#2 Due to the nature of this sample a dilution was performed prior to analysis, resulting in a detection limit higher than that normally achieved for the NO2N, NO3N and NOxN 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**
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	4
Total Digestion	Boiling nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	4
Total Digestion of Saline Samples*	Nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	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	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 $CaCO_3$	4
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B : Online Edition.	1.0 g/m^3 as $CaCO_3$	4
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	0.1 mS/m	4

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Salinity*	Conductivity Meter (WTW Cond 340i with nonlinear temperature compensation according to EN 27 888). APHA 2520 B : Online Edition.	0.2	4
Total Suspended Solids	Saline sample. Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D (modified) : Online Edition.	3 g/m³	4
Total Dissolved Solids (TDS)	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) : Online Edition.	50 g/m³	4
Filtration for dissolved metals analysis - Ultratrace	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B : Online Edition.	-	4
Dissolved Barium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.0006 g/m³	4
Dissolved Bromine	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.10 g/m³	4
Dissolved Calcium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	1.0 g/m³	4
Dissolved Copper	Filtered sample, ICP-MS, ultratrace. APHA 3125 B : Online Edition.	0.0010 g/m³	4
Dissolved Iron	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B : Online Edition.	0.02 g/m³	4
Dissolved Magnesium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.4 g/m³	4
Dissolved Manganese	Filtered sample, ICP-MS, ultratrace. APHA 3125 B : Online Edition.	0.0010 g/m³	4
Total Nickel*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.0070 g/m³	4
Total Potassium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	1.1 g/m³	4
Total Sodium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.42 g/m³	4
Total Sulphur	Nitric acid digestion, ICP-OES (method may not fully account for H_2S due to volatilisation during digestion). All forms of oxidised and organic sulphur will be determined by this method. APHA 3120 B : Online Edition.	0.5 g/m³	4
Total Zinc*	Nitric acid digestion, ICP-MS, ultratrace. APHA 3125 B : Online Edition.	0.0042 g/m³	4
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m³	4
Nitrite-N	Saline sample. Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) : Online Edition.	0.0010 g/m³	4
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - Nitrite-N. In-House.	0.0010 g/m³	4
Nitrate	Calculation from Nitrate-N.	0.005 g/m³	4
Nitrate-N + Nitrite-N	Saline sample. Total oxidised nitrogen. Automated cadmium reduction, Flow injection analyser. APHA 4500-NO_3^- I (modified) : Online Edition.	0.0010 g/m³	4
Total Sulphate*	Calculation: from total sulphur.	2 g/m³	4
Ethylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	4
Propylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	4
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	4
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	4
Formaldehyde in Water by DNPH & LCMSMS	Derivatisation, SPE extraction, LC-MS/MS analysis. In-house based on US EPA 8315A.	0.02 g/m³	4
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	4
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	4
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	4
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	4

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

Testing was completed between 24-Jul-2024 and 30-Jul-2024. For completion dates of individual analyses please contact the laboratory.

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Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3633162 SPv1
Contact:	Fiona Campbell	**Date Received:**	23-Jul-2024
	C/- Greymouth Petroleum Limited	**Date Reported:**	30-Jul-2024
	14 Connett Road West	**Quote No:**	85159
	Bell Block	**Order No:**	265360
	New Plymouth 4312	**Client Reference:**	Hydraulic fracturing fluid testing
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

Sample Name:		Turangi 17 Stim 5 Prepumped HF Fluid 18-Jul-2024
Lab Number:		3633162.1
Ethylene Glycol in Water*		
Ethylene glycol*	g/m³	750
Propylene Glycol in Water*		
Propylene glycol*	g/m³	< 20
Methanol in Water - Aqueous Solvents*		
Methanol*	g/m³	< 20
BTEX in Water by Headspace GC-MS		
Benzene	g/m³	< 0.0010
Toluene	g/m³	0.030
Ethylbenzene	g/m³	0.0071
m&p-Xylene	g/m³	0.030
o-Xylene	g/m³	0.0106
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m³	< 0.5
C10 - C14	g/m³	< 1.0
C15 - C36	g/m³	< 2
Total hydrocarbons (C7 - C36)	g/m³	< 4

Summary of Methods

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Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Ethylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	1
Propylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	1
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	1
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	1
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	1
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	1
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	1
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	1

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Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3641808 SPv1
Contact:	Fiona Campbell	**Date Received:**	03-Aug-2024
	C/- Greymouth Petroleum Limited	**Date Reported:**	15-Aug-2024
	14 Connett Road West	**Quote No:**	81870
	Bell Block	**Order No:**	265360
	New Plymouth 4312	**Client Reference:**	Return Fluid Composite
		Submitted By:	Fiona Campbell

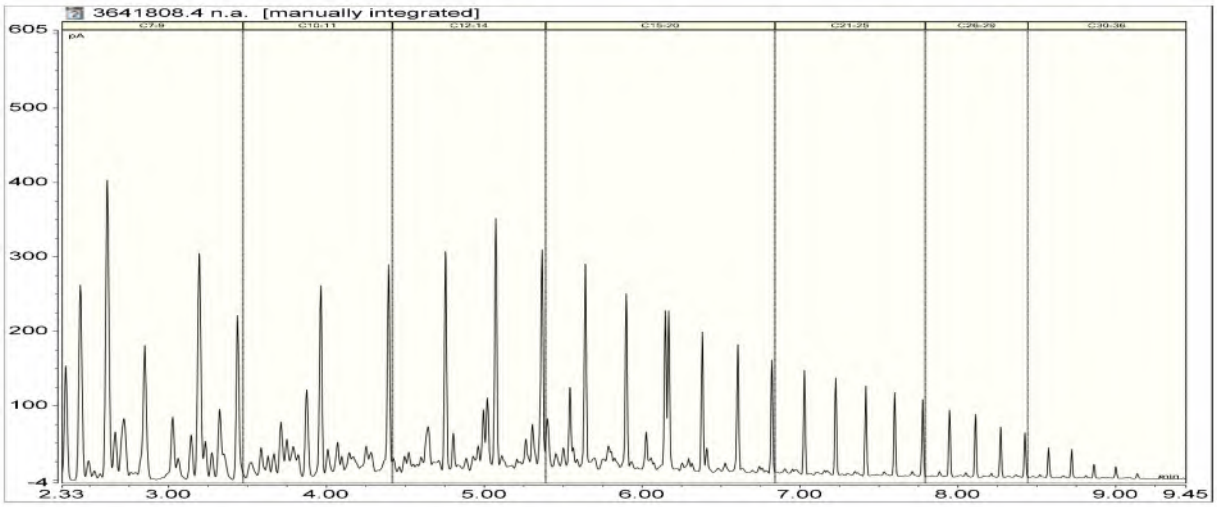
Sample Type: Aqueous

		Sample Name:	Composite of Turangi 17 Stim 5 Return HF Fluid Start, Turangi 17 Stim 5 Return HF Fluid Middle & Turangi 17 Stim 5 Return HF Fluid End
		Lab Number:	3641808.4
Individual Tests			
pH	pH Units		7.5
Total Alkalinity	g/m³ as $CaCO_3$		1,770
Total Hardness	g/m³ as $CaCO_3$		127
Electrical Conductivity (EC)	mS/m		736
Salinity*			4.0
Total Suspended Solids	g/m³		350
Total Dissolved Solids (TDS)	g/m³		6,300
Dissolved Barium	g/m³		1.69
Dissolved Bromine	g/m³		8.7
Dissolved Calcium	g/m³		39
Dissolved Copper	g/m³		0.018
Dissolved Iron	g/m³		1.81
Dissolved Magnesium	g/m³		7
Dissolved Manganese	g/m³		1.15
Total Nickel*	g/m³		0.083
Total Potassium*	g/m³		52
Total Sodium*	g/m³		1,640
Total Sulphur	g/m³		13
Total Zinc*	g/m³		0.185
Chloride	g/m³		1,560
Nitrite-N	g/m³		< 0.10 #1
Nitrate-N	g/m³		0.14
Nitrate	g/m³		0.6
Nitrate-N + Nitrite-N	g/m³		0.15 #1
Sulphate*	g/m³		39
Ethylene Glycol in Water*			
Ethylene glycol*	g/m³		220
Propylene Glycol in Water*			
Propylene glycol*	g/m³		37
Methanol in Water - Aqueous Solvents*			
Methanol*	g/m³		< 20
BTEX in Water by Headspace GC-MS			
Benzene	g/m³		43
Toluene	g/m³		66
Ethylbenzene	g/m³		6.7
m&p-Xylene	g/m³		40
o-Xylene	g/m³		12.1

This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

Sample Type: Aqueous		
Sample Name:		Composite of Turangi 17 Stim 5 Return HF Fluid Start, Turangi 17 Stim 5 Return HF Fluid Middle & Turangi 17 Stim 5 Return HF Fluid End
Lab Number:		3641808.4
Formaldehyde in Water by DNPH & LCMSMS		
Formaldehyde	g/m^3	0.93
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m^3	199
C10 - C14	g/m^3	300
C15 - C36	g/m^3	300
Total hydrocarbons (C7 - C36)	g/m^3	790

3641808.4
Composite of Turangi 17 Stim 5 Return HF Fluid Start, Turangi 17 Stim 5 Return HF Fluid Middle & Turangi 17 Stim 5 Return HF Fluid End
Client Chromatogram for TPH by FID



Analyst's Comments

#1 Due to the nature of this sample a dilution was performed prior to analysis, resulting in a detection limit higher than that normally achieved for the NO2N, NO3N and NOxN 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**
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	4
Total Digestion	Boiling nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	4
Total Digestion of Saline Samples*	Nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	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	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 $CaCO_3$	4
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B : Online Edition.	1.0 g/m^3 as $CaCO_3$	4
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	0.1 mS/m	4
Salinity*	Conductivity Meter (WTW Cond 340i with nonlinear temperature compensation according to EN 27 888). APHA 2520 B : Online Edition.	0.2	4

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Suspended Solids	Saline sample. Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D (modified) : Online Edition.	3 g/m³	4
Total Dissolved Solids (TDS)	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) : Online Edition.	50 g/m³	4
Filtration for dissolved metals analysis - Ultratrace	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B : Online Edition.	-	4
Dissolved Barium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.0006 g/m³	4
Dissolved Bromine	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.10 g/m³	4
Dissolved Calcium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	1.0 g/m³	4
Dissolved Copper	Filtered sample, ICP-MS, ultratrace. APHA 3125 B : Online Edition.	0.0010 g/m³	4
Dissolved Iron	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B : Online Edition.	0.02 g/m³	4
Dissolved Magnesium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.4 g/m³	4
Dissolved Manganese	Filtered sample, ICP-MS, ultratrace. APHA 3125 B : Online Edition.	0.0010 g/m³	4
Total Nickel*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.0070 g/m³	4
Total Potassium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	1.1 g/m³	4
Total Sodium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.42 g/m³	4
Total Sulphur	Nitric acid digestion, ICP-OES (method may not fully account for H_2S due to volatilisation during digestion). All forms of oxidised and organic sulphur will be determined by this method. APHA 3120 B : Online Edition.	0.5 g/m³	4
Total Zinc*	Nitric acid digestion, ICP-MS, ultratrace. APHA 3125 B : Online Edition.	0.0042 g/m³	4
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m³	4
Nitrite-N	Saline sample. Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) : Online Edition.	0.0010 g/m³	4
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - Nitrite-N. In-House.	0.0010 g/m³	4
Nitrate	Calculation from Nitrate-N.	0.005 g/m³	4
Nitrate-N + Nitrite-N	Saline sample. Total oxidised nitrogen. Automated cadmium reduction, Flow injection analyser. APHA 4500-NO_3^- I (modified) : Online Edition.	0.0010 g/m³	4
Total Sulphate*	Calculation: from total sulphur.	2 g/m³	4
Ethylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	4
Propylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	4
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	4
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	4
Formaldehyde in Water by DNPH & LCMSMS	Derivatisation, SPE extraction, LC-MS/MS analysis. In-house based on US EPA 8315A.	0.02 g/m³	4
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	4
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	4
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	4
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	4

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

Testing was completed between 05-Aug-2024 and 14-Aug-2024. 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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Client Services Manager - Environmental

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Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3661543 SPv1
Contact:	Fiona Campbell	**Date Received:**	31-Aug-2024
	C/- Greymouth Petroleum Limited	**Date Reported:**	16-Sep-2024
	14 Connett Road West	**Quote No:**	85159
	Bell Block	**Order No:**	265837
	New Plymouth 4312	**Client Reference:**	Hydraulic fracturing fluid testing
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

Sample Name:		Turangi 21 Stiml pre-pumped HF Fluid 29-Aug-2024
Lab Number:		3661543.1
Ethylene Glycol in Water*		
Ethylene glycol*	g/m³	820
Propylene Glycol in Water*		
Propylene glycol*	g/m³	< 20
Methanol in Water - Aqueous Solvents*		
Methanol*	g/m³	< 20
BTEX in Water by Headspace GC-MS		
Benzene	g/m³	0.0038
Toluene	g/m³	0.024
Ethylbenzene	g/m³	0.0038
m&p-Xylene	g/m³	0.020
o-Xylene	g/m³	0.0080
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m³	< 0.5
C10 - C14	g/m³	< 1.0
C15 - C36	g/m³	< 2
Total hydrocarbons (C7 - C36)	g/m³	< 4

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
Individual Tests			
Ethylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	1
Propylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	1
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	1
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	1
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	1
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	1
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	1
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	1

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

Testing was completed between 04-Sep-2024 and 16-Sep-2024. 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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Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3665913 SPv1
Contact:	Fiona Campbell	**Date Received:**	06-Sep-2024
	C/- Greymouth Petroleum Limited	**Date Reported:**	25-Sep-2024
	14 Connett Road West	**Quote No:**	81870
	Bell Block	**Order No:**	265837
	New Plymouth 4312	**Client Reference:**	Return Fluid Composite
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

		Sample Name:	Composite of Turangi 21 Stim 1 Return HF Fluid Start, Turangi 21 Stim 1 Return HF Fluid Middle & Turangi 21 Stim 1 Return HF Fluid End
		Lab Number:	3665913.4
Individual Tests			
pH	pH Units		7.3
Total Alkalinity	g/m³ as $CaCO_3$		540
Total Hardness	g/m³ as $CaCO_3$		153
Electrical Conductivity (EC)	mS/m		949
Salinity*			5.4
Total Suspended Solids	g/m³		210
Total Dissolved Solids (TDS)	g/m³		7,100
Dissolved Barium	g/m³		10.5
Dissolved Bromine	g/m³		14.6
Dissolved Calcium	g/m³		55
Dissolved Copper	g/m³		0.007
Dissolved Iron	g/m³		3.1
Dissolved Magnesium	g/m³		3
Dissolved Manganese	g/m³		1.28
Total Nickel*	g/m³		0.108
Total Potassium*	g/m³		76
Total Sodium*	g/m³		2,000
Total Sulphur	g/m³		14
Total Zinc*	g/m³		0.085
Chloride	g/m³		2,600
Nitrite-N	g/m³		< 0.10 #1
Nitrate-N	g/m³		< 0.10
Nitrate	g/m³		< 0.5
Nitrate-N + Nitrite-N	g/m³		< 0.10 #1
Sulphate*	g/m³		42
Ethylene Glycol in Water*			
Ethylene glycol*	g/m³		< 20
Propylene Glycol in Water*			
Propylene glycol*	g/m³		< 20
Methanol in Water - Aqueous Solvents*			
Methanol*	g/m³		< 20
BTEX in Water by Headspace GC-MS			
Benzene	g/m³		17.9
Toluene	g/m³		20
Ethylbenzene	g/m³		1.65
m&p-Xylene	g/m³		10.0
o-Xylene	g/m³		3.5

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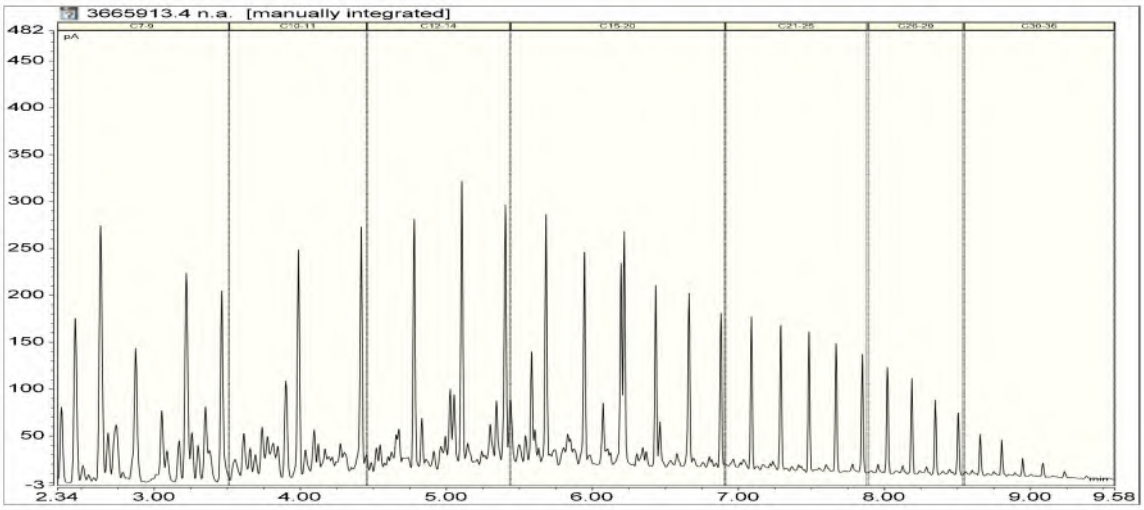
Sample Type: Aqueous		
Sample Name:		Composite of Turangi 21 Stim 1 Return HF Fluid Start, Turangi 21 Stim 1 Return HF Fluid Middle & Turangi 21 Stim 1 Return HF Fluid End
Lab Number:		3665913.4
Formaldehyde in Water by DNPH & LCMSMS		
Formaldehyde	g/m^3	< 0.15
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m^3	130
C10 - C14	g/m^3	270
C15 - C36	g/m^3	370
Total hydrocarbons (C7 - C36)	g/m^3	770

3665913.4
Composite of Turangi 21 Stim 1 Return HF Fluid Start, Turangi 21 Stim 1 Return HF Fluid Middle & Turangi 21 Stim 1 Return HF Fluid End
Client Chromatogram for TPH by FID



Analyst's Comments

#1 Due to the nature of this sample a dilution was performed prior to analysis, resulting in a detection limit higher than that normally achieved for the NO2N, NO3N and NOxN 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**
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	4
Total Digestion	Boiling nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	4
Total Digestion of Saline Samples*	Nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	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	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 $CaCO_3$	4
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B : Online Edition.	1.0 g/m^3 as $CaCO_3$	4
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	0.1 mS/m	4
Salinity*	Conductivity Meter (WTW Cond 340i with nonlinear temperature compensation according to EN 27 888). APHA 2520 B : Online Edition.	0.2	4

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Suspended Solids	Saline sample. Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D (modified) : Online Edition.	3 g/m³	4
Total Dissolved Solids (TDS)	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) : Online Edition.	50 g/m³	4
Filtration for dissolved metals analysis - Ultratrace	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B : Online Edition.	-	4
Dissolved Barium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.0006 g/m³	4
Dissolved Bromine	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.10 g/m³	4
Dissolved Calcium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	1.0 g/m³	4
Dissolved Copper	Filtered sample, ICP-MS, ultratrace. APHA 3125 B : Online Edition.	0.0010 g/m³	4
Dissolved Iron	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B : Online Edition.	0.02 g/m³	4
Dissolved Magnesium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.4 g/m³	4
Dissolved Manganese	Filtered sample, ICP-MS, ultratrace. APHA 3125 B : Online Edition.	0.0010 g/m³	4
Total Nickel*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.0070 g/m³	4
Total Potassium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	1.1 g/m³	4
Total Sodium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.42 g/m³	4
Total Sulphur	Nitric acid digestion, ICP-OES (method may not fully account for H_2S due to volatilisation during digestion). All forms of oxidised and organic sulphur will be determined by this method. APHA 3120 B : Online Edition.	0.5 g/m³	4
Total Zinc*	Nitric acid digestion, ICP-MS, ultratrace. APHA 3125 B : Online Edition.	0.0042 g/m³	4
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m³	4
Nitrite-N	Saline sample. Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) : Online Edition.	0.0010 g/m³	4
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - Nitrite-N. In-House.	0.0010 g/m³	4
Nitrate	Calculation from Nitrate-N.	0.005 g/m³	4
Nitrate-N + Nitrite-N	Saline sample. Total oxidised nitrogen. Automated cadmium reduction, Flow injection analyser. APHA 4500-NO_3^- I (modified) : Online Edition.	0.0010 g/m³	4
Total Sulphate*	Calculation: from total sulphur.	2 g/m³	4
Ethylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	4
Propylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	4
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	4
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	4
Formaldehyde in Water by DNPH & LCMSMS	Derivatisation, SPE extraction, LC-MS/MS analysis. In-house based on US EPA 8315A.	0.02 g/m³	4
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	4
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	4
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	4
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	4

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

Testing was completed between 09-Sep-2024 and 25-Sep-2024. 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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Client Services Manager - Environmental

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Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3665912 SPv1
Contact:	Fiona Campbell	**Date Received:**	06-Sep-2024
	C/- Greymouth Petroleum Limited	**Date Reported:**	25-Sep-2024
	14 Connett Road West	**Quote No:**	85159
	Bell Block	**Order No:**	265938
	New Plymouth 4312	**Client Reference:**	Hydraulic fracturing fluid testing
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

Sample Name:		Turangi 21 Stim 2 Prepumped HF Fluid 04-Sep-2024
Lab Number:		3665912.1
Ethylene Glycol in Water*		
Ethylene glycol*	g/m³	780
Propylene Glycol in Water*		
Propylene glycol*	g/m³	< 20
Methanol in Water - Aqueous Solvents*		
Methanol*	g/m³	< 20
BTEX in Water by Headspace GC-MS		
Benzene	g/m³	0.0031
Toluene	g/m³	0.022
Ethylbenzene	g/m³	0.0037
m&p-Xylene	g/m³	0.020
o-Xylene	g/m³	0.0080
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m³	< 0.5
C10 - C14	g/m³	< 1.0
C15 - C36	g/m³	< 2
Total hydrocarbons (C7 - C36)	g/m³	< 4

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
Individual Tests			
Ethylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	1
Propylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	1
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	1
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	1
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	1
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	1
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	1
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	1

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The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

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

Testing was completed between 10-Sep-2024 and 25-Sep-2024. 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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Client Services Manager - Environmental

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Certificate of Analysis

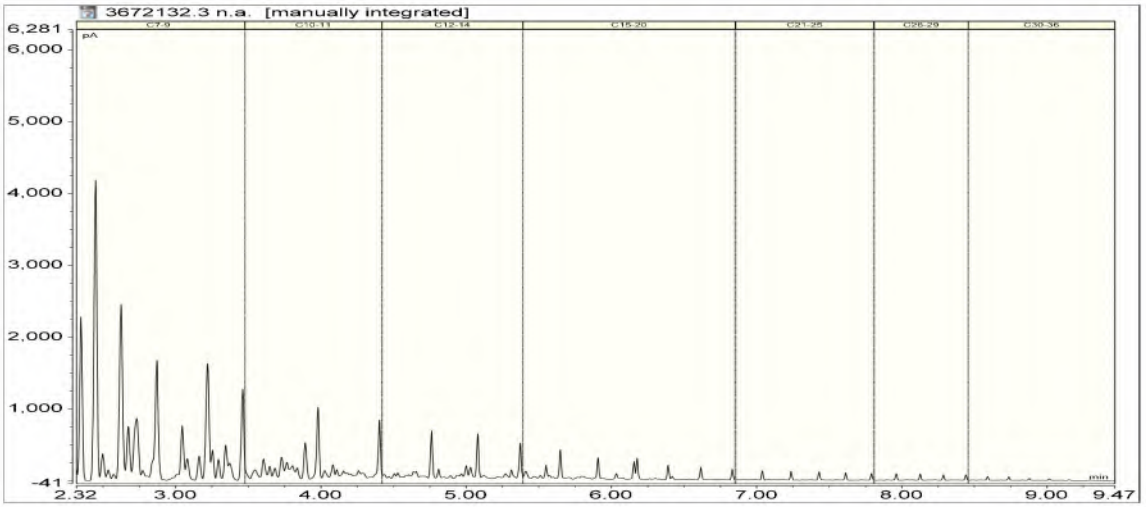
Client:	Greymouth Petroleum Limited	**Lab No:**	3672132 SPv1
Contact:	Fiona Campbell	**Date Received:**	14-Sep-2024
	C/- Greymouth Petroleum Limited	**Date Reported:**	27-Sep-2024
	14 Connett Road West	**Quote No:**	81870
	Bell Block	**Order No:**	265938
	New Plymouth 4312	**Client Reference:**	Return Fluid Composite
		Submitted By:	Fiona Campbell

Sample Type: Saline

	Sample Name:	Turangi 21 Stim 2 Return HF Fluid
	Lab Number:	3672132.3
Individual Tests		
pH*	pH Units	7.3
Total Alkalinity*	g/m³ as $CaCO_3$	490
Total Hardness*	g/m³ as $CaCO_3$	85
Electrical Conductivity (EC)*	mS/m	542
Salinity*		2.9
Total Suspended Solids	g/m³	360
Total Dissolved Solids (TDS)*	g/m³	5,600
Dissolved Barium	g/m³	3.4
Dissolved Bromine	g/m³	4.6
Dissolved Calcium	g/m³	29
Dissolved Copper	g/m³	0.015
Dissolved Iron	g/m³	1.09
Dissolved Magnesium	g/m³	3
Dissolved Manganese	g/m³	0.49
Total Nickel	g/m³	0.050
Total Potassium	g/m³	35
Total Sodium	g/m³	1,080
Total Sulphur*	g/m³	9
Total Zinc	g/m³	0.092
Chloride*	g/m³	1,550
Nitrite-N	g/m³	0.026
Nitrate-N	g/m³	< 0.010
Nitrate*	g/m³	< 0.05
Nitrate-N + Nitrite-N	g/m³	0.032
Sulphate*	g/m³	28
Ethylene Glycol in Water*		
Ethylene glycol*	g/m³	310
Propylene Glycol in Water*		
Propylene glycol*	g/m³	< 20
Methanol in Water - Aqueous Solvents*		
Methanol*	g/m³	< 20
BTEX in Water by Headspace GC-MS*		
Benzene*	g/m³	100
Toluene*	g/m³	126
Ethylbenzene*	g/m³	8.6
m&p-Xylene*	g/m³	53
o-Xylene*	g/m³	14.3

Sample Type: Saline		
Sample Name:		Turangi 21 Stim 2 Return HF Fluid
Lab Number:		3672132.3
Formaldehyde in Water by DNPH & LCMSMS*		
Formaldehyde*	g/m^3	1.48
Total Petroleum Hydrocarbons in Water*		
C7 - C9*	g/m^3	1,620
C10 - C14*	g/m^3	840
C15 - C36*	g/m^3	430
Total hydrocarbons (C7 - C36)*	g/m^3	2,900

3672132.3
Turangi 21 Stim 2 Return HF Fluid
Client Chromatogram for TPH by FID



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: Saline			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
Filtration, Unpreserved*	Sample filtration through 0.45µm membrane filter.	-	3
Total Digestion*	Boiling nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	3
Total Digestion of Saline Samples*	Nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	3
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	3
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 $CaCO_3$	3
Total Hardness*	Calculation from Calcium and Magnesium. APHA 2340 B : Online Edition.	1.0 g/m^3 as $CaCO_3$	3
Electrical Conductivity (EC)*	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	0.1 mS/m	3
Salinity*	Conductivity Meter (WTW Cond 340i with nonlinear temperature compensation according to EN 27 888). APHA 2520 B : Online Edition.	0.2	3
Total Suspended Solids	Saline sample. Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D (modified) : Online Edition.	3 g/m^3	3
Total Dissolved Solids (TDS)*	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) : Online Edition.	50 g/m^3	3

Sample Type: Saline			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Filtration for dissolved metals analysis - Ultratrace	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B : Online Edition.	-	3
Dissolved Barium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.0006 g/m³	3
Dissolved Bromine	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.10 g/m³	3
Dissolved Calcium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	1.0 g/m³	3
Dissolved Copper	Filtered sample, ICP-MS, ultratrace. APHA 3125 B : Online Edition.	0.0010 g/m³	3
Dissolved Iron	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B : Online Edition.	0.02 g/m³	3
Dissolved Magnesium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.4 g/m³	3
Dissolved Manganese	Filtered sample, ICP-MS, ultratrace. APHA 3125 B : Online Edition.	0.0010 g/m³	3
Total Nickel	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.0070 g/m³	3
Total Potassium	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	1.1 g/m³	3
Total Sodium	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.42 g/m³	3
Total Sulphur*	Nitric acid digestion, ICP-OES (method may not fully account for H_2S due to volatilisation during digestion). All forms of oxidised and organic sulphur will be determined by this method. APHA 3120 B : Online Edition.	0.5 g/m³	3
Total Zinc	Nitric acid digestion, ICP-MS, ultratrace. APHA 3125 B : Online Edition.	0.0042 g/m³	3
Chloride*	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m³	3
Nitrite-N	Saline sample. Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) : Online Edition.	0.0010 g/m³	3
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - Nitrite-N. In-House.	0.0010 g/m³	3
Nitrate*	Calculation from Nitrate-N.	0.005 g/m³	3
Nitrate-N + Nitrite-N	Saline sample. Total oxidised nitrogen. Automated cadmium reduction, Flow injection analyser. APHA 4500-NO_3^- I (modified) : Online Edition.	0.0010 g/m³	3
Total Sulphate*	Calculation: from total sulphur.	2 g/m³	3
Ethylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	3
Propylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	3
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	3
BTEX in Water by Headspace GC-MS*	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	3
Formaldehyde in Water by DNPH & LCMSMS*	Derivatisation, SPE extraction, LC-MS/MS analysis. In-house based on US EPA 8315A.	0.02 g/m³	3
Total Petroleum Hydrocarbons in Water			
C7 - C9*	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	3
C10 - C14*	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	3
C15 - C36*	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	3
Total hydrocarbons (C7 - C36)*	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	3

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

Testing was completed between 16-Sep-2024 and 26-Sep-2024. 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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Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3672131 SPv1
Contact:	Fiona Campbell	**Date Received:**	14-Sep-2024
	C/- Greymouth Petroleum Limited	**Date Reported:**	30-Sep-2024
	14 Connett Road West	**Quote No:**	85159
	Bell Block	**Order No:**	266052
	New Plymouth 4312	**Client Reference:**	Hydraulic fracturing fluid testing
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

Sample Name:		Turangi 21 Stim 3 Prepumped HF Fluid 11-Sep-2024
Lab Number:		3672131.1
Ethylene Glycol in Water*		
Ethylene glycol*	g/m³	790
Propylene Glycol in Water*		
Propylene glycol*	g/m³	< 20
Methanol in Water - Aqueous Solvents*		
Methanol*	g/m³	< 20
BTEX in Water by Headspace GC-MS		
Benzene	g/m³	0.0021
Toluene	g/m³	0.0182
Ethylbenzene	g/m³	0.0031
m&p-Xylene	g/m³	0.017
o-Xylene	g/m³	0.0067
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m³	< 0.5
C10 - C14	g/m³	< 1.0
C15 - C36	g/m³	< 2
Total hydrocarbons (C7 - C36)	g/m³	< 4

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
Individual Tests			
Ethylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	1
Propylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	1
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	1
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	1
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	1
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	1
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	1
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	1

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

Testing was completed between 17-Sep-2024 and 30-Sep-2024. 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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Certificate of Analysis

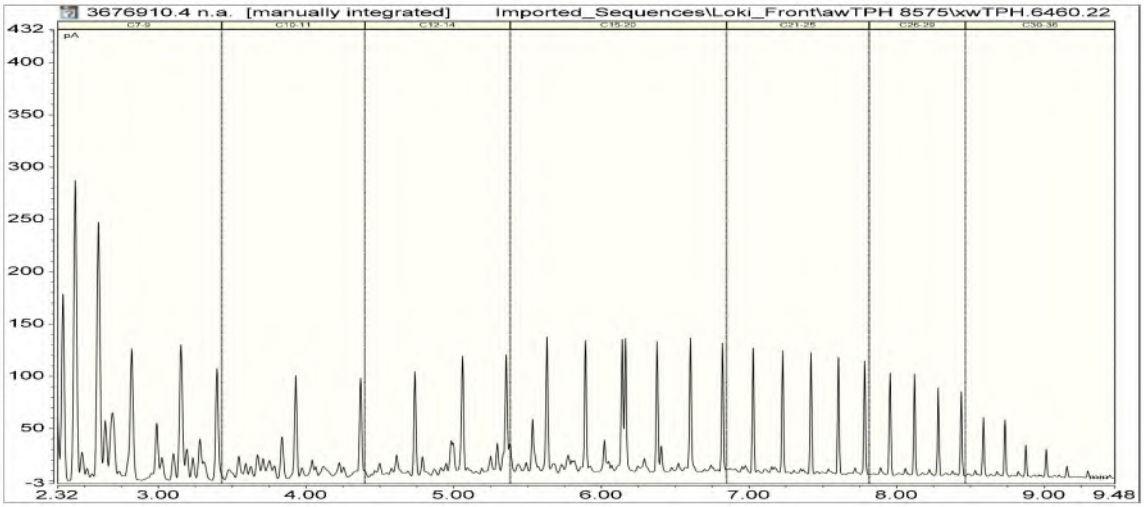
Client:	Greymouth Petroleum Limited	**Lab No:**	3676910 SPv1
Contact:	Fiona Campbell	**Date Received:**	21-Sep-2024
	C/- Greymouth Petroleum Limited	**Date Reported:**	02-Oct-2024
	14 Connett Road West	**Quote No:**	81870
	Bell Block	**Order No:**	266052
	New Plymouth 4312	**Client Reference:**	Return Fluid Composite
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

Sample Name:		Turangi 21 Stim 3 Return HF Fluid
Lab Number:		3676910.4
Individual Tests		
pH	pH Units	7.8
Total Alkalinity	g/m³ as $CaCO_3$	3,200
Total Hardness	g/m³ as $CaCO_3$	127
Electrical Conductivity (EC)	mS/m	1,277
Salinity*		7.4
Total Suspended Solids	g/m³	230
Total Dissolved Solids (TDS)	g/m³	9,900
Dissolved Barium	g/m³	40
Dissolved Bromine	g/m³	10.6
Dissolved Calcium	g/m³	42
Dissolved Copper	g/m³	< 0.005
Dissolved Iron	g/m³	1.55
Dissolved Magnesium	g/m³	6
Dissolved Manganese	g/m³	3.0
Total Nickel*	g/m³	< 0.032
Total Potassium*	g/m³	87
Total Sodium*	g/m³	3,100
Total Sulphur	g/m³	7
Total Zinc*	g/m³	0.035
Chloride	g/m³	2,700
Nitrite-N	g/m³	< 0.010
Nitrate-N	g/m³	< 0.010
Nitrate	g/m³	< 0.05
Nitrate-N + Nitrite-N	g/m³	< 0.010
Sulphate*	g/m³	21
Ethylene Glycol in Water*		
Ethylene glycol*	g/m³	44
Propylene Glycol in Water*		
Propylene glycol*	g/m³	< 20
Methanol in Water - Aqueous Solvents*		
Methanol*	g/m³	< 20
BTEX in Water by Headspace GC-MS		
Benzene	g/m³	30
Toluene	g/m³	14.8
Ethylbenzene	g/m³	0.68
m&p-Xylene	g/m³	4.1
o-Xylene	g/m³	1.32

Sample Type: Aqueous		
Sample Name:		Turangi 21 Stim 3 Return HF Fluid
Lab Number:		3676910.4
Formaldehyde in Water by DNPH & LCMSMS		
Formaldehyde	g/m^3	< 0.15
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m^3	135
C10 - C14	g/m^3	119
C15 - C36	g/m^3	270
Total hydrocarbons (C7 - C36)	g/m^3	520

3676910.4
Turangi 21 Stim 3 Return HF Fluid
Client Chromatogram for TPH by FID



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**
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	4
Total Digestion	Boiling nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	4
Total Digestion of Saline Samples*	Nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	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	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 $CaCO_3$	4
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B : Online Edition.	1.0 g/m^3 as $CaCO_3$	4
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	0.1 mS/m	4
Salinity*	Conductivity Meter (WTW Cond 340i with nonlinear temperature compensation according to EN 27 888). APHA 2520 B : Online Edition.	0.2	4
Total Suspended Solids	Saline sample. Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D (modified) : Online Edition.	3 g/m^3	4
Total Dissolved Solids (TDS)	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) : Online Edition.	50 g/m^3	4

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Filtration for dissolved metals analysis - Ultratrace	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B : Online Edition.	-	4
Dissolved Barium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.0006 g/m³	4
Dissolved Bromine	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.10 g/m³	4
Dissolved Calcium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	1.0 g/m³	4
Dissolved Copper	Filtered sample, ICP-MS, ultratrace. APHA 3125 B : Online Edition.	0.0010 g/m³	4
Dissolved Iron	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B : Online Edition.	0.02 g/m³	4
Dissolved Magnesium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.4 g/m³	4
Dissolved Manganese	Filtered sample, ICP-MS, ultratrace. APHA 3125 B : Online Edition.	0.0010 g/m³	4
Total Nickel*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.0070 g/m³	4
Total Potassium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	1.1 g/m³	4
Total Sodium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.42 g/m³	4
Total Sulphur	Nitric acid digestion, ICP-OES (method may not fully account for H_2S due to volatilisation during digestion). All forms of oxidised and organic sulphur will be determined by this method. APHA 3120 B : Online Edition.	0.5 g/m³	4
Total Zinc*	Nitric acid digestion, ICP-MS, ultratrace. APHA 3125 B : Online Edition.	0.0042 g/m³	4
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m³	4
Nitrite-N	Saline sample. Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) : Online Edition.	0.0010 g/m³	4
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - Nitrite-N. In-House.	0.0010 g/m³	4
Nitrate	Calculation from Nitrate-N.	0.005 g/m³	4
Nitrate-N + Nitrite-N	Saline sample. Total oxidised nitrogen. Automated cadmium reduction, Flow injection analyser. APHA 4500-NO_3^- I (modified) : Online Edition.	0.0010 g/m³	4
Total Sulphate*	Calculation: from total sulphur.	2 g/m³	4
Ethylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	4
Propylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	4
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	4
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	4
Formaldehyde in Water by DNPH & LCMSMS	Derivatisation, SPE extraction, LC-MS/MS analysis. In-house based on US EPA 8315A.	0.02 g/m³	4
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	4
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	4
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	4
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	4

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

Testing was completed between 24-Sep-2024 and 02-Oct-2024. 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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www.hill-labs.co.nz

Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3676911 SPv1
Contact:	Fiona Campbell	**Date Received:**	21-Sep-2024
	C/- Greymouth Petroleum Limited	**Date Reported:**	30-Sep-2024
	14 Connett Road West	**Quote No:**	85159
	Bell Block	**Order No:**	266191
	New Plymouth 4312	**Client Reference:**	Hydraulic fracturing fluid testing
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

Sample Name:		Turangi 21 Stim 4 Pre-Pumped HF Fluid 18-Sep-2024
Lab Number:		3676911.1
Ethylene Glycol in Water*		
Ethylene glycol*	g/m³	570
Propylene Glycol in Water*		
Propylene glycol*	g/m³	< 20
Methanol in Water - Aqueous Solvents*		
Methanol*	g/m³	< 20
BTEX in Water by Headspace GC-MS		
Benzene	g/m³	0.0015
Toluene	g/m³	0.0145
Ethylbenzene	g/m³	0.0026
m&p-Xylene	g/m³	0.014
o-Xylene	g/m³	0.0058
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m³	< 0.5
C10 - C14	g/m³	< 1.0
C15 - C36	g/m³	< 2
Total hydrocarbons (C7 - C36)	g/m³	< 4

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
Individual Tests			
Ethylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	1
Propylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	1
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	1
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	1
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	1
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	1
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	1
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	1

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

Testing was completed between 25-Sep-2024 and 30-Sep-2024. 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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Certificate of Analysis

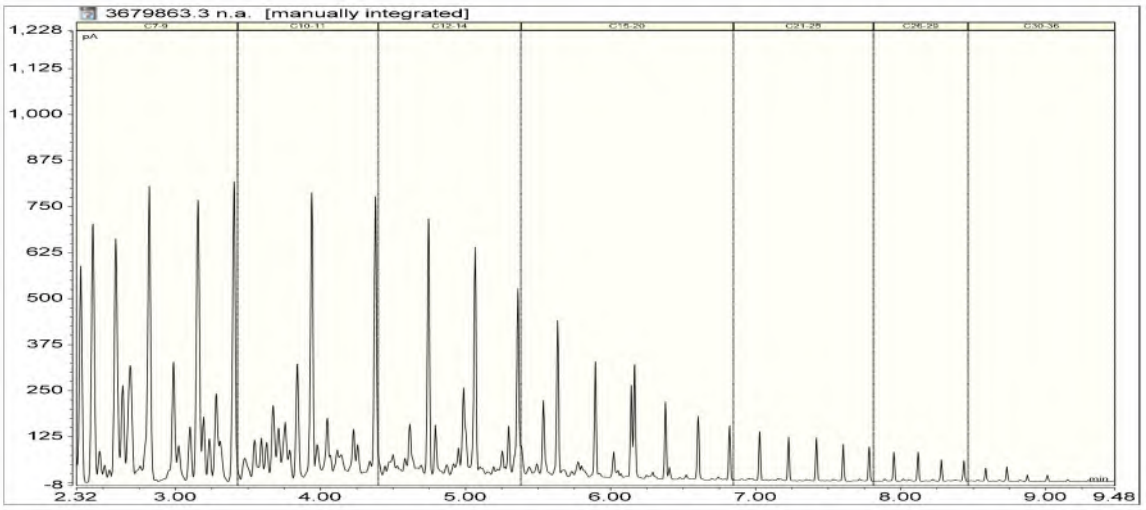
Client:	Greymouth Petroleum Limited	**Lab No:**	3679863 SPv1
Contact:	Fiona Campbell C/- Greymouth Petroleum Limited 14 Connett Road West Bell Block New Plymouth 4312	**Date Received:**	26-Sep-2024
		Date Reported:	04-Oct-2024
		Quote No:	81870
		Order No:	266191
		Client Reference:	Return Fluid Composite
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

Sample Name:		Composite of Turangi 21 Stim 4 return HF Fluid START & Turangi 21 Stim 4 return HF Fluid MIDDLE
Lab Number:		3679863.3
Individual Tests		
pH	pH Units	7.6
Total Alkalinity	g/m³ as $CaCO_3$	2,400
Total Hardness	g/m³ as $CaCO_3$	133
Electrical Conductivity (EC)	mS/m	791
Salinity*		4.3
Total Suspended Solids	g/m³	470
Total Dissolved Solids (TDS)	g/m³	7,300
Dissolved Barium	g/m³	4.8
Dissolved Bromine	g/m³	6.0
Dissolved Calcium	g/m³	42
Dissolved Copper	g/m³	0.078
Dissolved Iron	g/m³	2.2
Dissolved Magnesium	g/m³	7
Dissolved Manganese	g/m³	1.18
Total Nickel*	g/m³	0.098
Total Potassium*	g/m³	53
Total Sodium*	g/m³	1,880
Total Sulphur	g/m³	9
Total Zinc*	g/m³	0.33
Chloride	g/m³	1,330
Nitrite-N	g/m³	< 0.10 #1
Nitrate-N	g/m³	< 0.10
Nitrate	g/m³	< 0.5
Nitrate-N + Nitrite-N	g/m³	0.10 #1
Sulphate*	g/m³	27
Ethylene Glycol in Water*		
Ethylene glycol*	g/m³	380
Propylene Glycol in Water*		
Propylene glycol*	g/m³	< 20
Methanol in Water - Aqueous Solvents*		
Methanol*	g/m³	< 20
BTEX in Water by Headspace GC-MS		
Benzene	g/m³	35
Toluene	g/m³	76
Ethylbenzene	g/m³	8.5
m&p-Xylene	g/m³	56
o-Xylene	g/m³	16.9

Sample Type: Aqueous		
Sample Name:		Composite of Turangi 21 Stim 4 return HF Fluid START & Turangi 21 Stim 4 return HF Fluid MIDDLE
Lab Number:		3679863.3
Formaldehyde in Water by DNPH & LCMSMS		
Formaldehyde	g/m^3	0.78
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m^3	580
C10 - C14	g/m^3	700
C15 - C36	g/m^3	360
Total hydrocarbons (C7 - C36)	g/m^3	1,630

3679863.3
Composite of Turangi 21 Stim 4 return HF Fluid START & Turangi 21 Stim 4 return HF Fluid MIDDLE
Client Chromatogram for TPH by FID



Analyst's Comments

#1 Due to the nature of this sample a dilution was performed prior to analysis, resulting in a detection limit higher than that normally achieved for the NO2N, NO3N and NOxN 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**
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	3
Total Digestion	Boiling nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	3
Total Digestion of Saline Samples*	Nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	3
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	3
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 $CaCO_3$	3
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B : Online Edition.	1.0 g/m^3 as $CaCO_3$	3
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	0.1 mS/m	3
Salinity*	Conductivity Meter (WTW Cond 340i with nonlinear temperature compensation according to EN 27 888). APHA 2520 B : Online Edition.	0.2	3

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Suspended Solids	Saline sample. Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D (modified) : Online Edition.	3 g/m³	3
Total Dissolved Solids (TDS)	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) : Online Edition.	50 g/m³	3
Filtration for dissolved metals analysis - Ultratrace	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B : Online Edition.	-	3
Dissolved Barium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.0006 g/m³	3
Dissolved Bromine	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.10 g/m³	3
Dissolved Calcium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	1.0 g/m³	3
Dissolved Copper	Filtered sample, ICP-MS, ultratrace. APHA 3125 B : Online Edition.	0.0010 g/m³	3
Dissolved Iron	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B : Online Edition.	0.02 g/m³	3
Dissolved Magnesium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.4 g/m³	3
Dissolved Manganese	Filtered sample, ICP-MS, ultratrace. APHA 3125 B : Online Edition.	0.0010 g/m³	3
Total Nickel*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.0070 g/m³	3
Total Potassium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	1.1 g/m³	3
Total Sodium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.42 g/m³	3
Total Sulphur	Nitric acid digestion, ICP-OES (method may not fully account for H_2S due to volatilisation during digestion). All forms of oxidised and organic sulphur will be determined by this method. APHA 3120 B : Online Edition.	0.5 g/m³	3
Total Zinc*	Nitric acid digestion, ICP-MS, ultratrace. APHA 3125 B : Online Edition.	0.0042 g/m³	3
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m³	3
Nitrite-N	Saline sample. Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) : Online Edition.	0.0010 g/m³	3
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - Nitrite-N. In-House.	0.0010 g/m³	3
Nitrate	Calculation from Nitrate-N.	0.005 g/m³	3
Nitrate-N + Nitrite-N	Saline sample. Total oxidised nitrogen. Automated cadmium reduction, Flow injection analyser. APHA 4500-NO_3^- I (modified) : Online Edition.	0.0010 g/m³	3
Total Sulphate*	Calculation: from total sulphur.	2 g/m³	3
Ethylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	3
Propylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	3
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	3
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	3
Formaldehyde in Water by DNPH & LCMSMS	Derivatisation, SPE extraction, LC-MS/MS analysis. In-house based on US EPA 8315A.	0.02 g/m³	3
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	3
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	3
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	3
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	3

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

Testing was completed between 30-Sep-2024 and 04-Oct-2024. 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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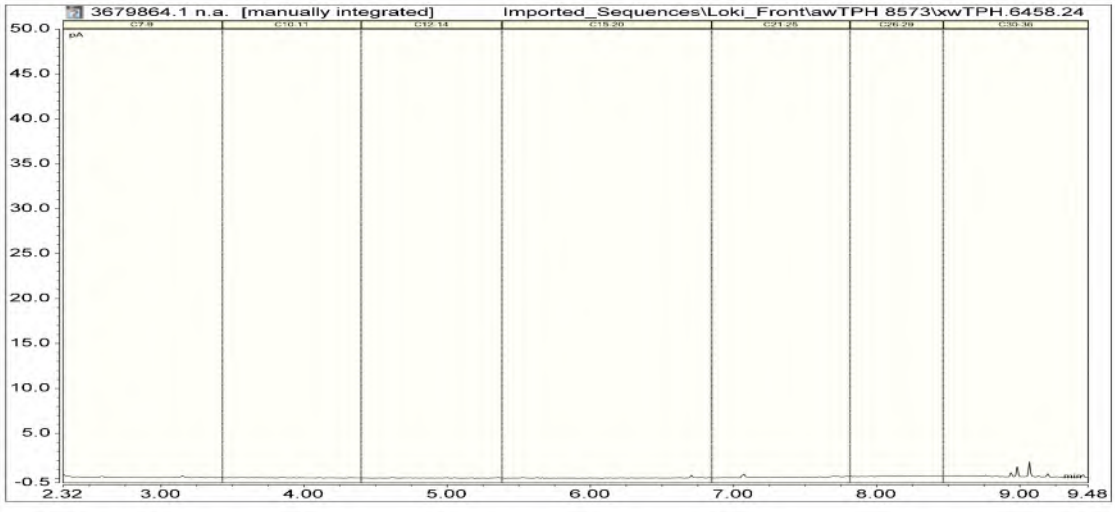
Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3679864 SPv1
Contact:	Fiona Campbell	**Date Received:**	26-Sep-2024
	C/- Greymouth Petroleum Limited	**Date Reported:**	01-Oct-2024
	14 Connett Road West	**Quote No:**	85159
	Bell Block	**Order No:**	266262
	New Plymouth 4312	**Client Reference:**	Hydraulic fracturing fluid testing
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

Sample Name:		Turangi 21 Stim5 Prepumped HF Fluid 24-Sep-2024
Lab Number:		3679864.1
Ethylene Glycol in Water*		
Ethylene glycol*	g/m³	770
Propylene Glycol in Water*		
Propylene glycol*	g/m³	< 20
Methanol in Water - Aqueous Solvents*		
Methanol*	g/m³	< 20
BTEX in Water by Headspace GC-MS		
Benzene	g/m³	0.0015
Toluene	g/m³	0.0127
Ethylbenzene	g/m³	0.0022
m&p-Xylene	g/m³	0.012
o-Xylene	g/m³	0.0051
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m³	< 0.5
C10 - C14	g/m³	< 1.0
C15 - C36	g/m³	2
Total hydrocarbons (C7 - C36)	g/m³	< 4

3679864.1
Turangi 21 Stim5 Prepumped HF Fluid 24-Sep-2024
Client Chromatogram for TPH by FID



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**
Individual Tests			
Ethylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m^3	1
Propylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m^3	1
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m^3	1
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m^3	1
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m^3	1
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m^3	1
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m^3	1
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m^3	1

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

Testing was completed between 30-Sep-2024 and 01-Oct-2024. 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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Certificate of Analysis

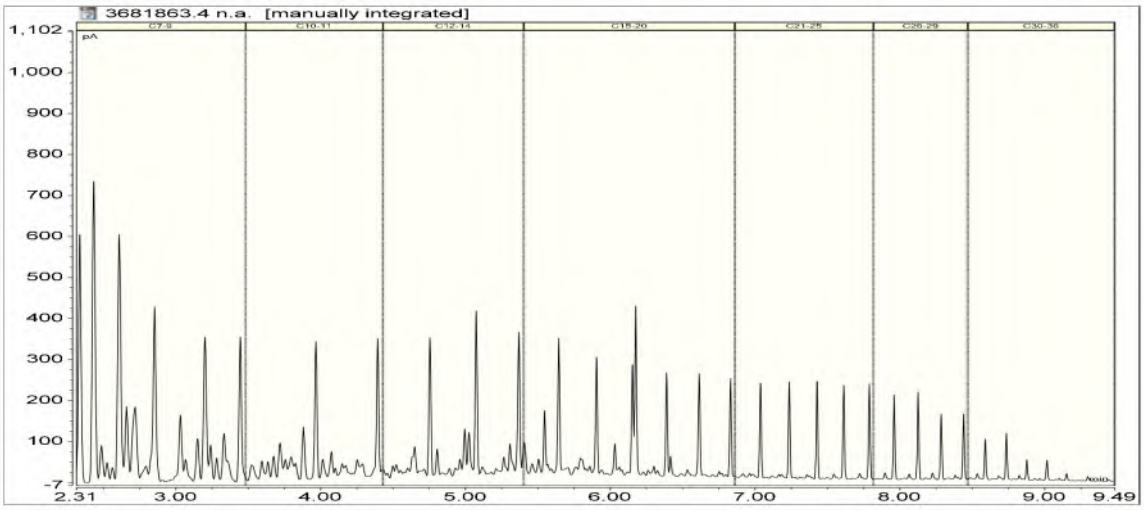
Client:	Greymouth Petroleum Limited	**Lab No:**	3681863 SPv1
Contact:	Fiona Campbell C/- Greymouth Petroleum Limited 14 Connett Road West Bell Block New Plymouth 4312	**Date Received:**	28-Sep-2024
		Date Reported:	07-Oct-2024
		Quote No:	81870
		Order No:	266262
		Client Reference:	Return Fluid Composite
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

Sample Name:		Composite of Turangi 21 Stim 5 Return HF Fluid Start, Turangi 21 Stim 5 Return HF Fluid Middle & Turangi 21 Stim 5 Return HF Fluid End
Lab Number:		3681863.4
Individual Tests		
pH	pH Units	7.2
Total Alkalinity	g/m³ as $CaCO_3$	2,600
Total Hardness	g/m³ as $CaCO_3$	104
Electrical Conductivity (EC)	mS/m	884
Salinity*		4.9
Total Suspended Solids	g/m³	193
Total Dissolved Solids (TDS)	g/m³	7,500
Dissolved Barium	g/m³	3.3
Dissolved Bromine	g/m³	8.5
Dissolved Calcium	g/m³	31
Dissolved Copper	g/m³	0.022
Dissolved Iron	g/m³	3.1
Dissolved Magnesium	g/m³	6
Dissolved Manganese	g/m³	1.89
Total Nickel*	g/m³	< 0.032
Total Potassium*	g/m³	66
Total Sodium*	g/m³	2,200
Total Sulphur	g/m³	11
Total Zinc*	g/m³	0.052
Chloride	g/m³	1,760
Nitrite-N	g/m³	< 0.10 #1
Nitrate-N	g/m³	< 0.10
Nitrate	g/m³	< 0.5
Nitrate-N + Nitrite-N	g/m³	< 0.10 #1
Sulphate*	g/m³	34
Ethylene Glycol in Water*		
Ethylene glycol*	g/m³	450
Propylene Glycol in Water*		
Propylene glycol*	g/m³	< 20
Methanol in Water - Aqueous Solvents*		
Methanol*	g/m³	< 110
BTEX in Water by Headspace GC-MS		
Benzene	g/m³	42
Toluene	g/m³	27
Ethylbenzene	g/m³	3.2
m&p-Xylene	g/m³	12.5
o-Xylene	g/m³	4.1

Sample Type: Aqueous		
Sample Name:		Composite of Turangi 21 Stim 5 Return HF Fluid Start, Turangi 21 Stim 5 Return HF Fluid Middle & Turangi 21 Stim 5 Return HF Fluid End
Lab Number:		3681863.4
Formaldehyde in Water by DNPH & LCMSMS		
Formaldehyde	g/m^3	0.33
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m^3	340
C10 - C14	g/m^3	320
C15 - C36	g/m^3	430
Total hydrocarbons (C7 - C36)	g/m^3	1,100

3681863.4
Composite of Turangi 21 Stim 5 Return HF Fluid Start, Turangi 21 Stim 5 Return HF Fluid Middle & Turangi 21 Stim 5 Return HF Fluid End
Client Chromatogram for TPH by FID



Analyst's Comments

#1 Due to the nature of this sample a dilution was performed prior to analysis, resulting in a detection limit higher than that normally achieved for the NO2N, NO3N and NOxN 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**
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	4
Total Digestion	Boiling nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	4
Total Digestion of Saline Samples*	Nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	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	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 $CaCO_3$	4
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B : Online Edition.	1.0 g/m^3 as $CaCO_3$	4
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	0.1 mS/m	4
Salinity*	Conductivity Meter (WTW Cond 340i with nonlinear temperature compensation according to EN 27 888). APHA 2520 B : Online Edition.	0.2	4

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Suspended Solids	Saline sample. Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D (modified) : Online Edition.	3 g/m³	4
Total Dissolved Solids (TDS)	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) : Online Edition.	50 g/m³	4
Filtration for dissolved metals analysis - Ultratrace	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B : Online Edition.	-	4
Dissolved Barium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.0006 g/m³	4
Dissolved Bromine	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.10 g/m³	4
Dissolved Calcium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	1.0 g/m³	4
Dissolved Copper	Filtered sample, ICP-MS, ultratrace. APHA 3125 B : Online Edition.	0.0010 g/m³	4
Dissolved Iron	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B : Online Edition.	0.02 g/m³	4
Dissolved Magnesium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.4 g/m³	4
Dissolved Manganese	Filtered sample, ICP-MS, ultratrace. APHA 3125 B : Online Edition.	0.0010 g/m³	4
Total Nickel*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.0070 g/m³	4
Total Potassium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	1.1 g/m³	4
Total Sodium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.42 g/m³	4
Total Sulphur	Nitric acid digestion, ICP-OES (method may not fully account for H_2S due to volatilisation during digestion). All forms of oxidised and organic sulphur will be determined by this method. APHA 3120 B : Online Edition.	0.5 g/m³	4
Total Zinc*	Nitric acid digestion, ICP-MS, ultratrace. APHA 3125 B : Online Edition.	0.0042 g/m³	4
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m³	4
Nitrite-N	Saline sample. Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) : Online Edition.	0.0010 g/m³	4
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - Nitrite-N. In-House.	0.0010 g/m³	4
Nitrate	Calculation from Nitrate-N.	0.005 g/m³	4
Nitrate-N + Nitrite-N	Saline sample. Total oxidised nitrogen. Automated cadmium reduction, Flow injection analyser. APHA 4500-NO_3^- I (modified) : Online Edition.	0.0010 g/m³	4
Total Sulphate*	Calculation: from total sulphur.	2 g/m³	4
Ethylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	4
Propylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	4
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	4
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	4
Formaldehyde in Water by DNPH & LCMSMS	Derivatisation, SPE extraction, LC-MS/MS analysis. In-house based on US EPA 8315A.	0.02 g/m³	4
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	4
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	4
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	4
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	4

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

Testing was completed between 01-Oct-2024 and 07-Oct-2024. 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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Certificate of Analysis

Client:	Greymouth Petroleum Limited	**Lab No:**	3684241 SPv1
Contact:	Fiona Campbell	**Date Received:**	02-Oct-2024
	C/- Greymouth Petroleum Limited	**Date Reported:**	08-Oct-2024
	14 Connett Road West	**Quote No:**	85159
	Bell Block	**Order No:**	266381
	New Plymouth 4312	**Client Reference:**	Hydraulic fracturing fluid testing
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

Sample Name:		Turangi 21 Stim 6 prepumped HF Fluid 30-Sep-2024
Lab Number:		3684241.1
Ethylene Glycol in Water*		
Ethylene glycol*	g/m³	620
Propylene Glycol in Water*		
Propylene glycol*	g/m³	< 20
Methanol in Water - Aqueous Solvents*		
Methanol*	g/m³	< 110
BTEX in Water by Headspace GC-MS		
Benzene	g/m³	0.0012
Toluene	g/m³	0.0139
Ethylbenzene	g/m³	0.0030
m&p-Xylene	g/m³	0.015
o-Xylene	g/m³	0.0060
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m³	< 0.5
C10 - C14	g/m³	< 1.0
C15 - C36	g/m³	< 2
Total hydrocarbons (C7 - C36)	g/m³	< 4

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
Individual Tests			
Ethylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	1
Propylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	1
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	1
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	1
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	1
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	1
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	1
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	1

This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

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

Testing was completed between 03-Oct-2024 and 08-Oct-2024. 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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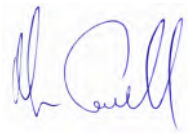

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Certificate of Analysis

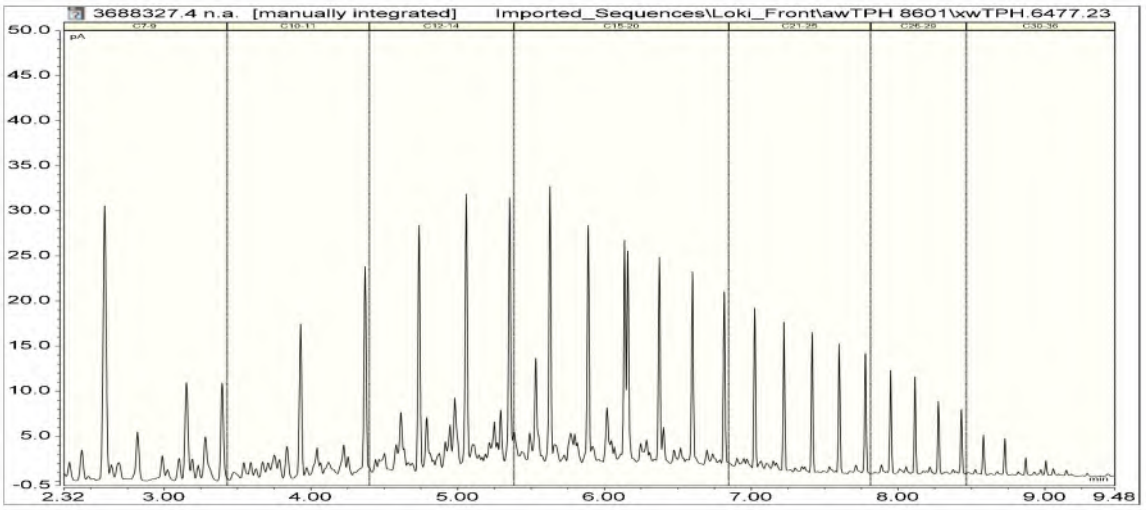
Client:	Greymouth Petroleum Limited	**Lab No:**	3688327 SPv1
Contact:	Fiona Campbell	**Date Received:**	08-Oct-2024
	C/- Greymouth Petroleum Limited	**Date Reported:**	17-Oct-2024
	14 Connett Road West	**Quote No:**	81870
	Bell Block	**Order No:**	266324
	New Plymouth 4312	**Client Reference:**	Return Fluid Composite
		Submitted By:	Fiona Campbell

Sample Type: Aqueous

Sample Name:		Composite of Turangi 21 Stim 6 Return HF Fluid Start, Turangi 21 Stim 6 Return HF Fluid Middle & Turangi 21 Stim 6 Return HF Fluid End
Lab Number:		3688327.4
Individual Tests		
pH	pH Units	7.3
Total Alkalinity	g/m³ as $CaCO_3$	1,880
Total Hardness	g/m³ as $CaCO_3$	100
Electrical Conductivity (EC)	mS/m	737
Salinity*		4.0
Total Suspended Solids	g/m³	270
Total Dissolved Solids (TDS)	g/m³	6,200
Dissolved Barium	g/m³	1.60
Dissolved Bromine	g/m³	9.5
Dissolved Calcium	g/m³	31
Dissolved Copper	g/m³	< 0.005
Dissolved Iron	g/m³	0.65
Dissolved Magnesium	g/m³	6
Dissolved Manganese	g/m³	1.72
Total Nickel*	g/m³	< 0.032
Total Potassium*	g/m³	54
Total Sodium*	g/m³	1,620
Total Sulphur	g/m³	12
Total Zinc*	g/m³	0.107
Chloride	g/m³	1,380
Nitrite-N	g/m³	< 0.10 #1
Nitrate-N	g/m³	< 0.10
Nitrate	g/m³	< 0.5
Nitrate-N + Nitrite-N	g/m³	< 0.10 #1
Sulphate*	g/m³	36
Ethylene Glycol in Water*		
Ethylene glycol*	g/m³	38
Propylene Glycol in Water*		
Propylene glycol*	g/m³	< 20
Methanol in Water - Aqueous Solvents*		
Methanol*	g/m³	< 20
BTEX in Water by Headspace GC-MS		
Benzene	g/m³	5.8
Toluene	g/m³	3.8
Ethylbenzene	g/m³	0.169
m&p-Xylene	g/m³	0.87
o-Xylene	g/m³	0.38

Sample Type: Aqueous		
Sample Name:		Composite of Turangi 21 Stim 6 Return HF Fluid Start, Turangi 21 Stim 6 Return HF Fluid Middle & Turangi 21 Stim 6 Return HF Fluid End
Lab Number:		3688327.4
Formaldehyde in Water by DNPH & LCMSMS		
Formaldehyde	g/m^3	< 0.15
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m^3	7.6
C10 - C14	g/m^3	26
C15 - C36	g/m^3	46
Total hydrocarbons (C7 - C36)	g/m^3	79

3688327.4
Composite of Turangi 21 Stim 6 Return HF Fluid Start, Turangi 21 Stim 6 Return HF Fluid Middle & Turangi 21 Stim 6 Return HF Fluid End
Client Chromatogram for TPH by FID



Analyst's Comments

#1 Due to the nature of this sample a dilution was performed prior to analysis, resulting in a detection limit higher than that normally achieved for the NO2N, NO3N and NOxN 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**
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	4
Total Digestion	Boiling nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	4
Total Digestion of Saline Samples*	Nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	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	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 $CaCO_3$	4
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B : Online Edition.	1.0 g/m^3 as $CaCO_3$	4
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	0.1 mS/m	4
Salinity*	Conductivity Meter (WTW Cond 340i with nonlinear temperature compensation according to EN 27 888). APHA 2520 B : Online Edition.	0.2	4

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Suspended Solids	Saline sample. Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D (modified) : Online Edition.	3 g/m³	4
Total Dissolved Solids (TDS)	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) : Online Edition.	50 g/m³	4
Filtration for dissolved metals analysis - Ultratrace	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B : Online Edition.	-	4
Dissolved Barium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.0006 g/m³	4
Dissolved Bromine	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.10 g/m³	4
Dissolved Calcium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	1.0 g/m³	4
Dissolved Copper	Filtered sample, ICP-MS, ultratrace. APHA 3125 B : Online Edition.	0.0010 g/m³	4
Dissolved Iron	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B : Online Edition.	0.02 g/m³	4
Dissolved Magnesium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.4 g/m³	4
Dissolved Manganese	Filtered sample, ICP-MS, ultratrace. APHA 3125 B : Online Edition.	0.0010 g/m³	4
Total Nickel*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.0070 g/m³	4
Total Potassium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	1.1 g/m³	4
Total Sodium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B : Online Edition.	0.42 g/m³	4
Total Sulphur	Nitric acid digestion, ICP-OES (method may not fully account for H_2S due to volatilisation during digestion). All forms of oxidised and organic sulphur will be determined by this method. APHA 3120 B : Online Edition.	0.5 g/m³	4
Total Zinc*	Nitric acid digestion, ICP-MS, ultratrace. APHA 3125 B : Online Edition.	0.0042 g/m³	4
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m³	4
Nitrite-N	Saline sample. Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) : Online Edition.	0.0010 g/m³	4
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - Nitrite-N. In-House.	0.0010 g/m³	4
Nitrate	Calculation from Nitrate-N.	0.005 g/m³	4
Nitrate-N + Nitrite-N	Saline sample. Total oxidised nitrogen. Automated cadmium reduction, Flow injection analyser. APHA 4500-NO_3^- I (modified) : Online Edition.	0.0010 g/m³	4
Total Sulphate*	Calculation: from total sulphur.	2 g/m³	4
Ethylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	4
Propylene Glycol in Water*	Direct injection, dual column GC-FID analysis.	4 g/m³	4
Methanol in Water - Aqueous Solvents*	GC-FID analysis. In-house.	1.0 g/m³	4
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis. In-house based on US EPA 8260 and 5021.	0.0010 - 0.002 g/m³	4
Formaldehyde in Water by DNPH & LCMSMS	Derivatisation, SPE extraction, LC-MS/MS analysis. In-house based on US EPA 8315A.	0.02 g/m³	4
Total Petroleum Hydrocarbons in Water			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.10 g/m³	4
C10 - C14	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.2 g/m³	4
C15 - C36	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	0.4 g/m³	4
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	0.7 g/m³	4

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

Testing was completed between 11-Oct-2024 and 17-Oct-2024. 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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