Greymouth Petroleum Limited
Deep Well Injection
Monitoring Programme
Annual Report
2015-2016

Technical Report 2016-58

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Executive summary

Greymouth Petroleum Limited (the Company) operates a number of wellsites across the Taranaki region, with major fields located in the Tikorangi and Kaimiro areas. Each wellsite contains varying numbers of producing wells and associated production infrastructure. This report for the period July 2015 to June 2016 describes the monitoring programme implemented by the Taranaki Regional Council (the Council) in relation to the Company's deep well injection (DWI) activities. The report details the results of the monitoring undertaken, assesses the Company's environmental performance during the period under review and the environmental effects of their DWI activities.

During the 2015-2016 monitoring period, the Company exercised five DWI consents. These consents authorised discharges at the Kaimiro-O, Kowhai-A, Kaimiro-J, Turangi-A and Kaimiro-G wellsites. The Company hold a further four DWI consents which were not exercised during the review period.

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

The Council's monitoring programme for the year under review included 15 site inspections, 12 groundwater samples and two injectate samples collected for physicochemical analysis. The monitoring programme also included a significant data review component, with all injection data submitted by the company assessed for compliance on receipt.

The monitoring showed that the Company's DWI activities were being carried out in compliance with the conditions of the applicable resource consents. There is no evidence of any issues with any injection well currently in use, or the on-going ability of the receiving formation to accept injected fluids. The results of groundwater quality monitoring undertaken show no adverse effects of the activity at monitored locations. Inspections undertaken during the monitoring year found sites being operated in a professional manner and there were no Unauthorised Incidents in relation to any of the Company's DWI consents.

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

For reference, in the 2015-2016 year, 71% of consent holders in Taranaki monitored through tailored compliance monitoring programmes achieved a high level of environmental performance and compliance with their consents, while another 24% demonstrated a good level of environmental performance and compliance with their consents.

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

This report includes recommendations to be implemented during the 2016–2017 monitoring period.

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1. Introduction

1.1 Compliance monitoring programme reports and the Resource Management Act 1991

1.1.1 Introduction

This report is for the period July 2015 to June 2016 by the Taranaki Regional Council (the Council) on the monitoring programme associated with resource consents held by Greymouth Petroleum Limited (the Company) for deep well injection (DWI) activities. The consents authorise discharges from various wellsites operated by the Company across North Taranaki.

The resource consents held by the Company permit the discharge of a range of fluids by DWI, including produced water, well drilling fluids, well workover fluids, (including hydraulic fracturing and return fluids), contaminated and 'off spec' stormwater and groundwater from the Matemateaonga formation. The consents include a number of special conditions which set out specific requirements the Company must satisfy.

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

1.1.2 Structure of this report

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

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

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

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

Section 4 presents recommendations to be implemented in the 2016-2017 monitoring year.

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' inasmuch 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 and administrative 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.

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 significant 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 in response to unauthorised incident reports, 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 in response to unauthorised incident reports. 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 in response to unauthorised incident reports. 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.

For reference, in the 2015-2016 year, 71% of consent holders in Taranaki monitored through tailored compliance monitoring programmes achieved a high level of environmental performance and compliance with their consents, while another 24% demonstrated a good level of environmental performance and compliance with their consents.

1.2 Process description

The process of DWI involves injecting fluids deep underground into geological formations which are confined from overlying groundwater aquifers by low permeability strata. Injection wells are also designed and constructed to provide multi barrier protection against contaminant migration to groundwater systems.

The subsurface injection of fluids by DWI is often used as a method for disposing of waste fluids generated during oil and gas exploration and production activities. The greatest volume of waste fluids generated through these activities is saline water (brine) that is drawn to the surface with hydrocarbons through producing wells ('produced water'). The DWI consents currently held by the Company also authorise the injection of fluid types other the produced water. The range of fluid types authorised for injection varies by consent, but includes well drilling fluids, well workover fluids, including hydraulic fracturing and return fluids, contaminated and 'off spec' stormwater and groundwater from the Matemateaonga formation.

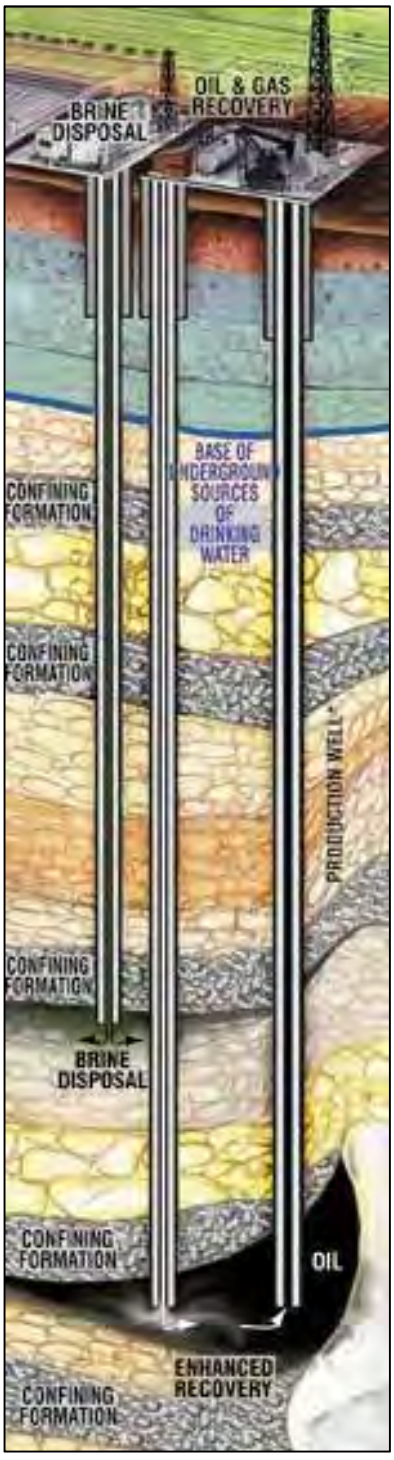

Figure 1 DWI schematic (www.epa.gov/uic)

In addition to providing a means to dispose of waste fluids, the subsurface injection of fluids by DWI is also an established oilfield technique for regulating reservoir pressure as a means of enhancing the rate of hydrocarbon recovery from a reservoir.

This process, commonly referred to as water flooding, is often implemented when natural reservoir pressures become reduced due to ongoing production. Fluids can also be heated prior to injection to reduce the viscosity of the oil being produced, improving its flow toward a producing well and upward through the wellbore itself.

A schematic representation of injection wells for both waste discharge and enhanced oil recovery is presented in Figure 1.

Further details regarding hydrocarbon exploration and production in Taranaki, the DWI process and its history within the region can be found in previous compliance reports published by the Council (see Bibliography).

1.3 Resource consents

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.

The Company held nine discharge consents covering their DWI activities (Table 1) during the period under review. One of these consents expired (9272-1) and was renewed (9272-2) during the period under review, while another expired (9206-1) and was not renewed.

Table 1 DWI consents held by the Company during the 2015–2016 monitoring year

Consent number	Wellsite	Injection well	Formation	Issued	Expiry
5312-2.1	Kaimiro-O	Kaimiro-17	Mt. Messenger	06/05/2015	01/06/2032
7390-1	Turangi-A	Turangi-3	Mt. Messenger	10/10/2008	01/06/2027
7466-1.1	Kowhai-A	Kowhai-2 (WDW)	Mt. Messenger	03/02/2014	01/06/2027
7897-1	Kaimiro-J	Kaimiro-11	Mt. Messenger	12/09/2011	01/06/2026
9206-1(expired)	Kowhai-B	N/A*	N/A*	11/05/2012	01/06/2016
9272-1(expired)	Turangi-A	Turangi-5 (WDW)	Mt Messenger	02/11/2012	01/06/2016
9272-2	Turangi-A	Turangi-5 (WDW)	Mt. Messenger	02/06/2016	01/06/2036
9470-1	Kaimiro-G	Kaimiro-10	Mt. Messenger	04/02/2013	01/06/2032
9476-1	Kowhai-C	N/A*	N/A*	28/02/2013	01/06/2027
Note: Consent 9272-1 was renewed and Consent 9206-1 expired					

Consent **5312-2.1** was issued by the Council on 06 May 2015 under Section 87(e) of the RMA. It is due to expire on 1 June 2032. The consent authorises the discharge of groundwater from the Matemateaonga Formation and produced water into the Mount Messenger Formation for improved hydrocarbon recovery purposes at the Kaimiro-O wellsite.

The current consent has eighteen special conditions, as summarised below.

Condition 1 required to consent holder to submit an "Injection Operation Management Plan" prior to exercising the consent.

Condition 2 requires the consent holder to submit well completion information following drilling.

Condition 3 sets a maximum injection pressure limit of 85 bar.

Condition 4 sets a maximum injection rate limit of 41.6 m^3/hour.

Condition 5 sets a maximum daily injection volume of 1,000 m^3/day.

Condition 6 requires that no injection be made after 1 June 2027.

Condition 7 refers to the best practicable option (BPO) requirements.

Condition 8 requires the discharge to be made into the Mount Messenger Formation, deeper than 1,000 m TVD sub-sea.

Condition 9 requires that discharge does not result in fracturing of the geological seals confining the injection zone.

Condition 10 prohibits the discharge from endangering or contaminating any freshwater aquifer.

Conditions 11, 12, 13, 14, 15 and 16 refer to process monitoring and data submission requirements.

Condition 17 is an annual reporting requirement.

Condition 18 is a review provision.

Consent **7390-1** was issued by the Council on 10 October 2008 under Section 87(e) of the RMA. It is due to expire on 1 June 2027. The consent authorises the discharge of produced water from hydrocarbon exploration and production operations by deep well injection via the Turangi-3 well at the Turangi-A wellsite.

The current consent has nine special conditions, as summarised below.

Condition 1 sets a maximum injection pressure limit of 55 bar (800 psi).

Condition 2 sets a maximum daily injection volume of 300 m^3/day.

Conditions 3, 4 and 5 refer to process monitoring and data submission requirements.

Condition 6 required the consent holder to submit an Injection Operation Management Plan prior to exercising the consent.

Condition 7 prohibits the discharge from endangering or contaminating any freshwater aquifer.

Condition 8 is a lapse clause.

Condition 9 is a review provision.

Consent **7466-1.1** was issued by the Council on 3 February 2014 under Section 87(e) of the RMA. It is due to expire on 1 June 2027. The consent authorises the discharge of produced water from hydrocarbon exploration and production operations by deep well injection via the Kowhai-2 well at the Kowhai wellsite.

The current consent has thirteen special conditions, as summarised below.

Condition 1 requires the consent holder to submit well completion information following drilling.

Condition 2 sets a maximum injection pressure limit of 92 bar (1,352 psi).

Condition 3 sets a maximum daily injection volume of 916 m^3/day.

Condition 4 sets a maximum hourly injection rate of 38 m^3/day (4 bpm).

Condition 5 requires the discharge to be made into the Mount Messenger Formation, deeper than 970 m TVD below ground level.

Conditions 6, 7 & 8 refer to process monitoring and data submission requirements.

Condition 9 requires the consent holder to notify the Council at least five working days prior to exercising the consent.

Condition 10 required the consent holder to submit an Injection Operation Management Plan prior to exercising the consent.

Condition 11 prohibits the discharge from endangering or contaminating any freshwater aquifer.

Condition 12 is a lapse clause.

Condition 13 is a review provision.

Consent **7897-1** was issued by the Council on 12 September 2011 under Section 87(e) of the RMA. It is due to expire on 1 June 2026. The consent authorises the discharge of produced water, well drilling fluids, well workover fluids, hydraulic fracturing fluids; and 'off-spec' stormwater from the consent holder's wellsites by deep well injection into the Mount Messenger formation following from hydrocarbon exploration operations at the Kaimiro-J wellsite.

The current consent has eighteen special conditions, as summarised below.

Condition 1 required to consent holder to submit an "Injection Operation Management Plan" prior to exercising the consent.

Condition 2 requires the consent holder to submit well completion information following drilling.

Condition 3 sets a maximum injection pressure limit of 115 bar (1,669 psi).

Condition 4 sets a maximum injection rate limit of 29 m^3/hour (3 bpm).

Condition 5 sets a maximum daily injection volume of 687 m^3/day.

Condition 6 requires the discharge to be made into the Mount Messenger Formation, deeper than 1,320 m TVD.

Condition 7 refers to the BPO requirements.

Conditions 8, 9 & 10 refer to process monitoring and data submission requirements.

Condition 11 requires the consent holder to notify the Council at least 5 working days prior to exercising the consent.

Condition 12 prohibits the discharge from endangering or contaminating any freshwater aquifer.

Conditions 13, 14 & 15 relate to the requirement for the consent holder to implement a groundwater monitoring programme.

Condition 16 is an annual reporting requirement.

Condition 17 is a lapse clause.

Condition 18 is a review provision.

Consent **9206-1** was issued by the Council on 11 May 2012 under Section 87(e) of the RMA. It expired on 1 June 2016. The consent authorises the discharge of produced water, well workover fluids, well drilling fluids and contaminated stormwater from hydrocarbon exploration and production operations into land by deep well injection below 1,185 m TVD at the Kowhai-B wellsite.

The expired consent had seventeen special conditions, as summarised below.

Condition 1 required to consent holder to submit an "Injection Operation Management Plan" prior to exercising the consent.

Condition 2 requires the consent holder to submit well completion information following drilling.

Condition 3 sets a maximum injection pressure limit of 26.1 bar (379 psi).
Condition 4 sets a maximum rate of injection of 14.3 m^3/hr (1.5 bpm).

Condition 5 sets a maximum daily injection volume of 300 m^3/day.

Condition 6 requires the discharge to be made into the Mount Messenger Formation, deeper than 1,185 m TVD below ground level.

Condition 7 refers to the BPO requirements.

Condition 8 limits the range of fluids that may be injected.

Conditions 9 & 10 refer to process monitoring and data submission requirements.

Condition 11 prohibits the discharge from endangering or contaminating any freshwater aquifer.

Conditions 12, 13 & 14 relate to the requirement for the consent holder to implement a groundwater monitoring programme.

Condition 15 is an annual reporting requirement.

Condition 16 requires the consent holder to notify the Council at least five working days prior to exercising the consent.

Condition 17 is a review provision.

Consent **9272-1** was issued by the Council on 2 November 2012 under Section 87(e) of the RMA. It expired on 1 June 2016. The consent authorises the discharge of produced water, well drilling fluids, well workover fluids and contaminated stormwater into the Mount Messenger Formation by deep well injection via the Turangi-A waste disposal well at the Turangi-A wellsite. This consent was renewed during the monitoring period and has now been superseded by Consent 9272-2.

The expired consent had seventeen special conditions, as summarised below. Condition 1 required to consent holder to submit an "Injection Operation Management Plan" prior to exercising the consent.

Condition 2 requires the consent holder to submit well completion information following drilling.

Condition 3 sets a maximum injection pressure limit of 115 bar (1,685 psi).

Condition 4 sets a maximum rate of injection of 687 m^3/day (3 bpm).

Condition 5 sets a maximum daily injection volume of 687 m^3/day.

Condition 6 requires the discharge to be made into the Mount Messenger Formation, deeper than 1,350 m TVD below ground level.

Condition 7 refers to the BPO requirements.

Condition 8 limits the range of fluids that may be injected.

Conditions 9 & 10 refer to process monitoring and data submission requirements.

Condition 11 prohibits the discharge from endangering or contaminating any freshwater aquifer.

Conditions 12, 13 & 14 relate to the requirement for the consent holder to implement a groundwater monitoring programme.

Condition 15 is an annual reporting requirement.

Condition 16 requires the consent holder to notify the Council at least five working days prior to exercising the consent.

Condition 17 is a review provision.

Consent **9272-2** was issued by the Council on 02 June 2016 under Section 87(e) of the RMA. The consent authorises the discharge of produced water, well drilling fluids, well workover fluids and contaminated stormwater into the Mount Messenger Formation by deep well injection at the Turangi-A wellsite. This consent replaced Consent 9272-1 during the monitoring period.

The current consent has nineteen special conditions, as summarised below.

Condition 1 authorises the use of the Turangi-5 well or another well located at the site to be used for DWI.

Condition 2 requires the consent holder to undertake activities in accordance with an "Injection Operation Management Plan.

Condition 3 requires the consent holder to submit well completion information before discharging to any well.

Condition 4 stipulates that there shall be no injection after 1 June 2029.

Condition 5 requires the best practicable option to be adopted for fluid injection.

Condition 6 limits the injection of fluids to the Mount Messenger Formation, below 1,200 m TVD below ground.

Condition 7 sets a maximum injection pressure limit of 111 bar (1,610 psi).

Condition 8 prohibits the discharge resulting in fracturing of the geological seals confining the injection zone.

Condition 9 prohibits the discharge from resulting in any contaminants reaching any useable freshwater resources.

Condition 10 limits the range of fluids that may be injected.
Conditions 11, 12, 13 and 14 refer to process monitoring and data submission requirements.

Conditions 15, 16 and 17 refer to local groundwater quality monitoring requirements.

Condition 18 stipulates the annual reporting requirements.

Condition 19 is a review condition.

Consent **9470-1** was issued by the Council on 4 February 2013 under Section 87(e) of the RMA. It is due to expire on 1 June 2032. The consent authorises the discharge of produced water, well drilling fluids, well workover fluids, by deep well injection into the Mount Messenger formation at the Kaimiro-G wellsite.

The current consent has 19 special conditions, as summarised below.
Special condition 1 required to consent holder to submit an "Injection Operation Management Plan" prior to exercising the consent.

Special condition 2 requires the consent holder to submit well completion information following drilling.

Special condition 3 sets a maximum injection pressure limit of 1,077 psi.

Special condition 4 sets a maximum rate of injection of 8.6 m^3/hr (0.9 bpm).

Special condition 5 sets a maximum daily injection volume of 206 m^3/day (1,296 bpd).

Special condition 6 requires the discharge to be made into the Mount Messenger Formation, deeper than 995 m TVD sub-sea.

Special condition 7 refers to the BPO requirements.

Special condition 8 limits the range of fluids that may be injected.

Special conditions 9, 10 & 11 refer to process monitoring and data submission requirements.

Special condition 12 prohibits the discharge from endangering or contaminating any freshwater aquifer.

Special conditions 13, 14 & 15 relate to the requirement for the consent holder to implement a groundwater monitoring programme.

Special condition 16 is an annual reporting requirement.

Special condition 17 requires the consent holder to notify the Council at least five working days prior to exercising the consent.

Special condition 18 requires the discharge to cease five years prior to consent expiry date to allow for on-going environmental monitoring after the discharge has ceased.

Special condition 19 is a review provision.

Consent **9476-1** was issued by the Council on 28 February 2013 under Section 87(e) of the RMA. It is due to expire on 1 June 2027. The consent authorises the discharge of produced water, well drilling fluids, well workover fluids including hydraulic

fracturing fluids, and contaminated stormwater from hydrocarbon exploration operations into the Mount Messenger Formation by deep well injection via the Kowhai-C waste disposal well.

The current consent has 19 special conditions, as summarised below.

Special condition 1 required to consent holder to submit an "Injection Operation Management Plan" prior to exercising the consent.

Special condition 2 requires the consent holder to submit well completion information following drilling.

Special condition 3 sets a maximum injection pressure limit of 1,685 psi (115 bar).

Special condition 4 sets a maximum rate of injection of 0.48 m^3/min (3 bpm).

Special condition 5 sets a maximum daily injection volume of 687 m^3/day (4320 bpd).

Special condition 6 requires the discharge to be made into the Mount Messenger Formation, deeper than 1,350 m TVD.

Special condition 7 refers to the BPO requirements.

Special condition 8 limits the range of fluids that may be injected.

Special conditions 9, 10 & 11 refer to process monitoring and data submission requirements.

Special condition 12 prohibits the discharge from endangering or contaminating any freshwater aquifer.

Special conditions 13, 14 & 15 relate to the requirement for the consent holder to implement a groundwater monitoring programme.

Special condition 16 is an annual reporting requirement.

Special condition 17 requires the consent holder to notify the Council at least five working days prior to exercising the consent.

Special condition 18 requires the discharge to cease five years prior to consent expiry date to allow for on-going environmental monitoring after the discharge has ceased.

Special condition 19 is a review provision.

Figure 2 shows the location of the DWI consents held by the Company during the period under review alongside active injection wells. Copies of the consent certificates are attached in Appendix I.

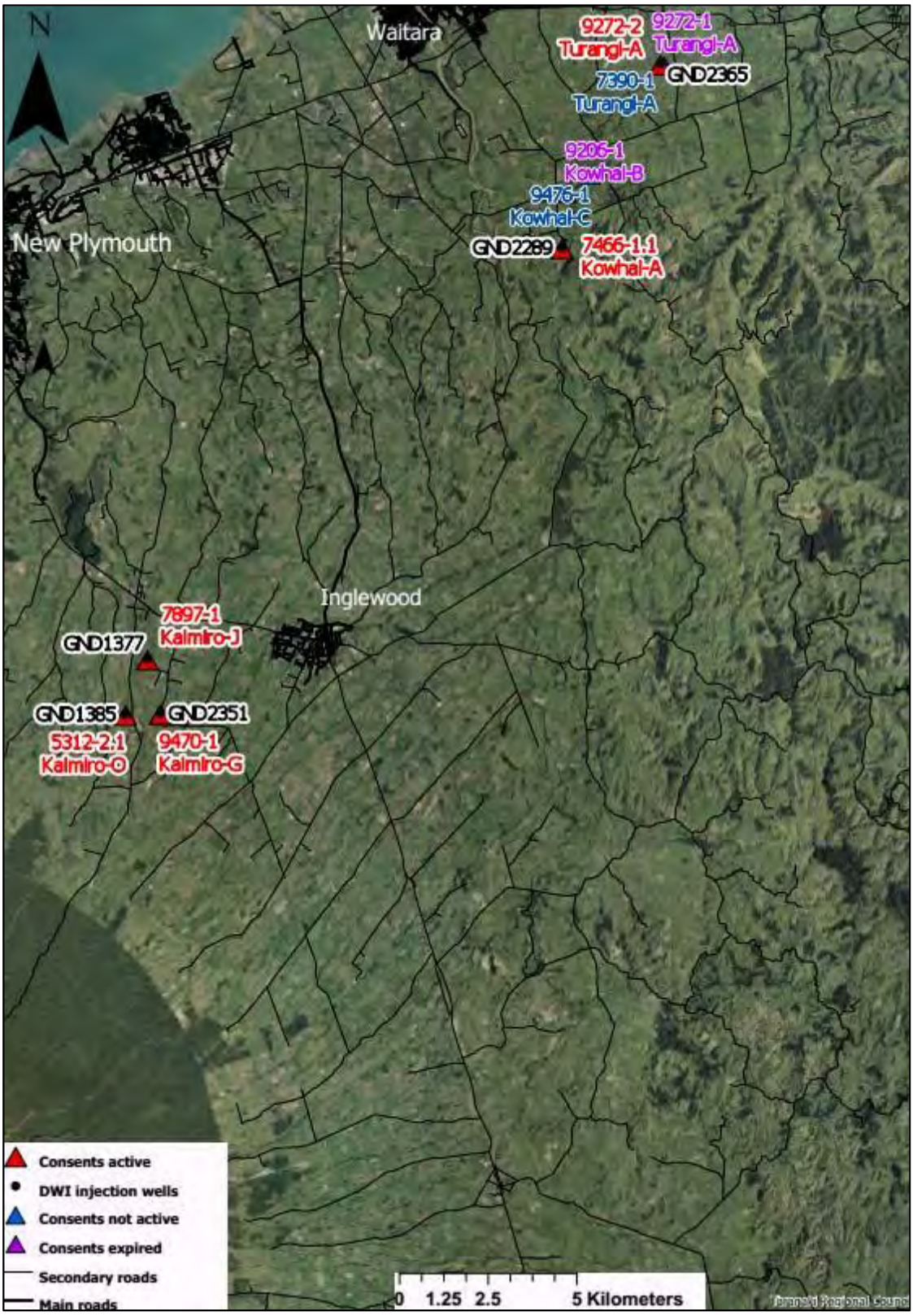

Figure 2 Location of the Company's consented DWI sites 2015-2016

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 active DWI sites consisted of five primary components.

1.4.2 Programme liaison and management

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

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

1.4.3 Site inspections

The Company's Turangi-A and Kowhai-A wellsites were each inspected by Council Officer's on six occasions as part of the Greymouth Production Station monitoring programme. The remaining wellsites at Kaimiro-O, Kaimiro-J and Kaimiro-G were each inspected on one occasion during the monitoring period. With regard to consents related to production stations and wellsite operations, the main points of interest are plant processes with potential or actual discharges to receiving watercourses, including contaminated stormwater and process wastewaters. Air inspections focus on plant processes with associated actual and potential emission sources and characteristics, including potential odour, dust, noxious or offensive emissions. Sources of data being collected by the Company are identified and accessed, so that performance in respect of operation, internal monitoring, and supervision can be reviewed by the Council. At all DWI sites the neighbourhood is surveyed for environmental effects.

1.4.4 Injectate sampling

The sampling of injectate is carried out in order to characterise the general chemical nature of the discharge and also the variation in its chemical composition across the monitoring period.

The injectate monitoring required by the respective DWI consents is primarily undertaken by the Company. The Company are required to analyse each different waste stream arriving on-site for discharge, or a minimum of two samples per year if there are no significant changes to the composition of the discharge. Results of this monitoring are submitted to the Council on a monthly basis.

In addition to the Company's injectate sampling, the Council undertakes sampling of the groundwater abstracted via the Kaimiro-O groundwater, which is subsequently injected for water flooding purposes. These groundwater samples therefore also constitute an injectate sample for the purposes of this programme.

Injectate samples are generally collected from the bulk fluid storage tanks at each wellsite. Details of the specific sampling points accessed to obtain samples during the period under review are listed in Table 2.

The range of sample analyses required for each sample varies by consent.

Table 2 Active DWI wellsites 2015-2016

Consent	Wellsite	Injection well	Sample point	Site code
5312-2	Kaimiro-O	Kaimiro-17	Kaimiro-O well head tank*	GND1385
7466-1	Kowhai-A	Kowhai-2 (WDW)	Kowhai-2 well head tank	GND2289
7897-1	Kaimiro-J	Kaimiro-11	KPS – Tank-033	GND1377
9272-2	Turangi-A	Turangi-5 (WDW)	Tank 4	GND2365
9470-1	Kaimiro-G	Kaimiro-10	KPS – Tank-033	GND2351

** well head tank is fed from groundwater supply bore GND2456.*

1.4.5 Groundwater sampling

The groundwater monitoring component of this programme was initiated during the 2012-2013 monitoring period and continued during the period under review.

Groundwater sampling was undertaken in the vicinity of the five wellsites where injection occurred during the review period. These wellsites were Turangi-A, Kaimiro-G, Kaimiro-J, Kaimiro-O and Kowhai-A. Groundwater samples were obtained from each monitored site on two occasions.

Where possible, samples of groundwater were obtained using bladder or peristaltic pumps, using low-flow sampling methodologies. Where well or bore construction precluded the use of these techniques, samples were obtained from taps or by bailer.

Details of the groundwater monitoring sites currently included in the monitoring programme are listed below in Table 3. The location of the groundwater sites in relation to the DWI wellsites is illustrated in Figure 3.

Table 3 Groundwater sampling site details

Site code	Type	Sampling method	Wellsite	Distance from injection well (m)	Casing depth (m)	Open or screened interval (m)	Total depth (m)	Aquifer
GND1673	Bore	Tap	Turangi-A	362	0-26	26-42	42	Marine Terraces
GND2232	Well	Bailer		210	unlined	0-2.5	2.5	Marine Terraces
GND0701	Well	Peri. pump	Kaimiro-G	56	0-7	7-10	10	Volcanics
GND2353	Well	Bailer		685	unlined	0-4.2	4.2	Volcanics
GND2456	Well	Tap	Kaimiro-O	15	0-330	330-342	342	Matemateaonga
GND2464	Spring	Bailer	Kowhai-A	144	spring	NA (spring)	NA	Marine Terraces
GND2472	Bore	Bladder pump	Kaimiro-J	905	18	18-30	30	Volcanics

The range of analyses carried out on groundwater samples is dictated by the requirements of the respective DWI consents. Consents for DWI generally include a requirement to analyse groundwater samples for a basic range of parameters, which are deemed sufficient to enable identification of any significant changes in groundwater quality. These include:

- pH;
- conductivity;
- chlorides; and
- total petroleum hydrocarbons.

These basic analyses are undertaken in the Council's IANZ accredited laboratory.

Baseline samples have also been collected at each site for general ion chemistry, BTEX and dissolved gas concentration analysis. These more detailed analyses will allow a more in depth assessment of variations in groundwater composition should the need arise in the future.

Prior to the renewal of consent 9272-1, samples taken at GND1673 were also analysed for the following parameters:

- major ions (Ca, Mg, K, Na, total alkalinity, bromide, chloride, nitrate-nitrogen, and sulphate);
- trace metals (barium, copper, iron, manganese, nickel, and zinc);
- formaldehyde;
- dissolved methane and ethane gas;
- methanol;
- glycols;
- benzene, toluene, ethylbenzene, and xylenes (BTEX); and
- carbon-13 composition of any dissolved methane gas discovered (13C-CH4).

Following the renewal of the consent in June 2016, the range of analyses required on samples from GND1673 reverted to the basic range outlined above.

Consent 5312-2 (Kaimiro-O) requires groundwater samples to be analysed for the following range of parameters:

- pH;

- conductivity;
- anion/cation profile;
- total petroleum hydrocarbons; and
- BTEX.

These analyses are undertaken by Hill Laboratories Limited.

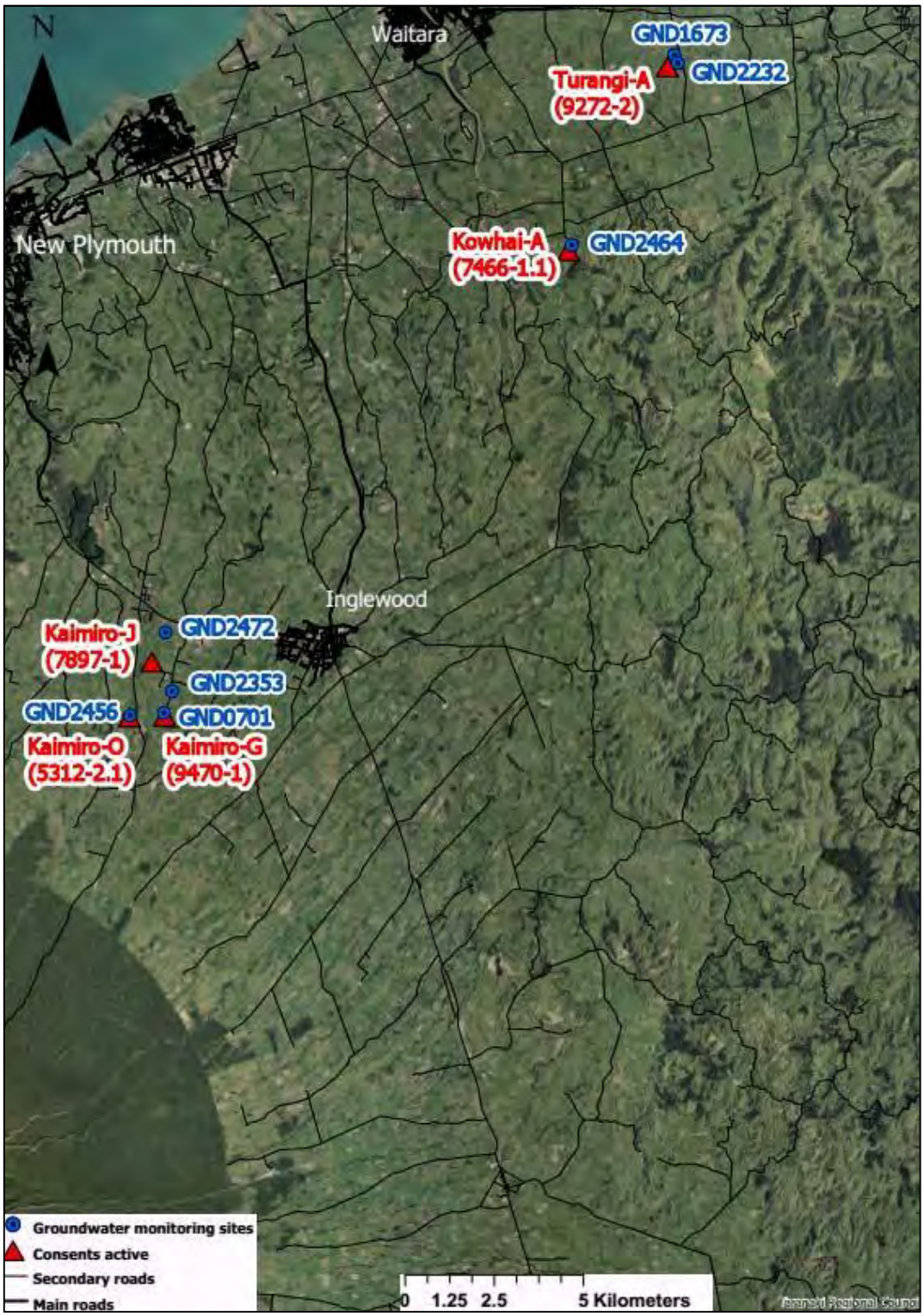

Figure 3 Location of groundwater sampling sites in relation to DWI injection sites

1.4.6 Assessment of data submitted by consent holder

A significant component of the monitoring programme is the assessment of consent holder submitted data. The Company is required to submit a wide range of data under the conditions of their respective DWI consents.

As required by the conditions of their consents, the Company has submitted an Injection Operation Management Plan for each active injection well. The plans are required to include the operational details of the injection activities and to identify the conditions that would trigger concerns about the integrity of the injection well, the receiving formation or overlying geological seals. The plans are also required to detail the action(s) to be taken by the consent holder if trigger conditions are reached. The Company was also required to submit well construction details, an assessment of the local geological environment, results of well integrity testing and details of the proposed monitoring plan for the injection well.

The Company is also required to maintain continuous records of injection volumes, rates and pressures, and to characterise the chemical characteristics of all waste types being discharged. This data is submitted to the Council on a monthly basis where it is assessed for compliance against the relevant consent conditions.

2. Results

2.1 Site inspections

During the period under review, the Council carried out 15 inspections in relation to the Company's DWI activities. Six inspections were undertaken at each of the Turangi-A production station, Kowhai-A production station and the Kaimiro production station (KPS). These inspections were undertaking as part of the more extensive production station monitoring programmes. KPS, although not specifically a DWI site, serves as a central fluid collection and storage facility for waste generated within the Company's Kaimiro, Ngatoro, Surrey and Radnor fields. It is also the site from which all injection within these fields is controlled and monitored. The remaining wellsites (Kaimiro-G, Kaimiro-O and Kaimiro-J) were all inspected annually as per the requirement of the Company's DWI monitoring programme.

No issues were identified during inspections.

2.2 Injectate sampling

The results of the injectate monitoring carried out by both the Company and the Council are summarised by injection well in Tables 4, 5, 6, 7 and 8.

The maximum and mean values associated with the results of these analyses illustrate the variability in the composition of injectate across the monitoring period. The composition of the injectate varies depending on the origin and volume of fluids transferred from each individual source at the time of injection.

The concentrations of each analyte are within the historical range of injectate samples collected during preceding monitoring periods.

Table 4 Results of Kaimiro-17 injectate analysis 2015-2016 (5312-2.1)

Parameter	Unit	Number of samples	Maximum value	Minimum value	Average value
pH	pH units	2	7.6	7.2	7.4
Electrical conductivity	mS/m	2	144	143	143.5
Suspended solids	g/m³	2	<2	<2	<2
Chloride	g/m³	2	166	70	118
Total petroleum hydrocarbons	g/m³	2	<0.5	<0.5	<0.5

Table 5 Results of Kowhai-2 (WDW) injectate analysis 2015-2016 (7466-1)

Parameter	Unit	Number of samples	Maximum value	Minimum value	Average value
Temperature	°C	12	32.5	19.8	26.9
pH	pH units	12	6.8	6.5	6.6
Suspended solids	g/m³	12	28	3	9.5
Salinity	PSU	12	22	21	21.7
Chloride	g/m³	12	12,600	4,500	10,717
Total petroleum hydrocarbons	g/m³	12	2,700	43	317

Table 6 Results of Kaimiro-11 injectate analysis 2015-2016 (7897-1)

Parameter	Unit	Number of samples	Maximum value	Minimum value	Average value
Temperature	°C	12	32.8	17.9	25.4
pH	pH units	12	6.8	6.3	6.6
Suspended solids	g/m³	12	4,900	60	992
Salinity	PSU	12	38	35	36
Chloride	g/m³	12	22,000	2,300	17,542
Total petroleum hydrocarbons	g/m³	12	9,400	25	839

Table 7 Results of Turangi-5 (WDW) injectate analysis 2015-2016 (9272-1 and 9272-2)

Parameter	Unit	Number of samples	Maximum value	Minimum value	Average value
Temperature	°C	12	31.7	23.1	26.4
pH	pH units	12	6.9	6.5	6.7
Suspended solids	g/m³	12	61	12	32.8
Salinity	PSU	12	16.9	13.1	15.8
Chloride	g/m³	12	9,200	4,700	194
Total petroleum hydrocarbons	g/m³	12	22,000	194	4,198

Table 8 Results of Kaimiro-10 injectate analysis 2015-2016 (9470-1)

Parameter	Unit	Number of samples	Maximum value	Minimum value	Average value
Temperature	°C	5	24.7	8.8	17.6
pH	pH units	5	7.3	6.4	7.0
Suspended solids	g/m³	5	400	89	193
Salinity	PSU	5	20.0	4.6	9.7
Chloride	g/m³	6	9,800	1,210	4,668
Total petroleum hydrocarbons	g/m³	8	18,400	29	2,812

2.3 Groundwater sampling

Groundwater samples were obtained from two sites located in the vicinity of the Kaimiro–G wellsite (GND0701 and GND2353). Single site surveys were carried out in the vicinity of the Turangi-A (GND1673), Kowhai-A (GND2464), Kaimiro-O (GND2456) and Kaimiro-J wellsites (GND2472).

Sampling was undertaken on a biannual basis at all sites, with the exception of GND2232 and GND2456, which were each sampled on a single occasion. GND1673 has a much greater sampling record than all other sites monitored, as it has been included in numerous other monitoring programmes implemented by the Council, including the monitoring of hydraulic fracturing activities at the Company's Turangi-A and Turangi-B wellsites.

All groundwater samples were collected following the Council's standard groundwater sampling procedures and generally in accordance with the National Protocol for State of the Environment Groundwater Sampling in New Zealand (2006).

A summary of all monitoring results is presented by site in Tables 9, 10, 11, 12 and 13.

The results of the monitoring undertaken show there have been no significant changes in groundwater composition at any site since monitoring commenced. This is demonstrated by the relatively narrow ranges between minimum and maximum analyte concentrations recorded. The subtle variation in analyte concentrations at each site are a result of natural seasonal fluctuation and sampling variability. Historical data has been included for reference.

Methane was detected in all samples analysed in GND1673. The concentrations recorded are within the expected range for shallow groundwater in Taranaki. Carbon 13 analysis undertaken on the dissolved methane detected indicate that it's biogenic in origin.

Table 9 Results of groundwater sampling at site GND2456 under consent 5312-2.1 (Kaimiro-O)

Parameter	Unit	Sample Details		Historical max	Historical mean	Sample n.
Sample reference	-	TRC151532	TRC161550	-	-	-
Sample date	-	23-Apr-15	09-May-16	-	-	-
Sample time	NZST	8:40	13:20	-	-	-
Temperature	^{o}C	22.2	25.6	25.6	22.7	4
pH	pH units	7.2	7.6	7.6	7.4	5
Electrical conductivity	mS/m	144.0	143.0	144.0	143.0	5
Chloride	g/m^3	166.0	70.4	216.0	160.0	5
Total petroleum hydrocarbons	g/m^3	<0.5	<0.5	1.8	-*	5

* *Only a single sample recording a concentration above detection limit*

Table 10 Results of groundwater sampling at site GND2464 under consent 7466-1 (Kowhai-A)

Parameter	Unit	Sample Details		Historical max	Historical mean	Sample n.
Sample reference	-	TRC153360	TRC161633	-	-	-
Sample date	-	22-Oct-15	16-May-16	-	-	-
Sample time	NZST	08:10	08:20	-	-	-
Temperature	^{o}C	-	14.7	14.7	14.2	3
pH	pH units	6	6.5	6.6	6.3	5
Electrical conductivity	mS/m	18.4	25.8	30.6	24.4	5
Chloride	g/m^3	48.8	51.6	86.8	61.6	5
Total petroleum hydrocarbons	g/m^3	<0.5	<0.5	<5	-	5

Table 11 Results of groundwater sampling at site GND2472 under consent 7897-1 (Kaimiro-J)

Parameter	Unit	Sample Details		Historical max	Historical mean	Sample n.
Sample reference	-	TRC153301	TRC161548	-	-	-
Sample date	-	15-Oct-15	06-May-16	-	-	-
Sample time	NZST	12:30	12:30	-	-	-
Temperature	^{o}C	15.9	15.4	15.9	15.4	4

Parameter	Unit	Sample Details		Historical max	Historical mean	Sample n.
pH	pH units	7.5	7.6	7.6	7.5	4
Electrical conductivity	mS/m	45.5	39.5	45.5	43.1	4
Chloride	g/m³	19.0	17.1	19.0	18.2	4
Total petroleum hydrocarbons	g/m³	<0.5	<0.5	0.8	-*	4

* *Only a single sample recording a concentration above detection limit*

Table 12 Results of groundwater sampling at site GND1673 under consent 9272-1/2 (Turangi-A)

Parameter	Unit	Sample Details		Historical max	Historical mean	Sample n.
Sample reference	-	TRC153361	TRC161634	-	-	-
Sample date	-	22-Oct-15	16-May-16	-	-	-
Sample time	NZST	08:56	09:10	-	-	-
Temperature	°C	16.6	18.0	18.4	16.3	14
pH	pH units	7.4	7.4	7.6	7.3	15
Electrical conductivity	mS/m	33.2	29.8	33.2	30.5	15
Chloride	g/m³	15	15	25.6	16.2	15
Total petroleum hydrocarbons	g/m³	<0.7	<0.7	<0.7	-	14

Table 13 Results of groundwater sampling at site GND0701 under consent 9470-1 (Kaimiro-G)

Parameter	Unit	Sample Details		Historical max	Historical mean	Sample n.
Sample reference	-	TRC153165	TRC161423	-	-	-
Sample date	-	07-Oct-15	29-Apr-16	-	-	-
Sample time	NZST	08:11	08:45	-	-	-
Temperature	°C	13.7	14.0	14.5	13.9	4
pH	pH units	7.0	6.8	7.1	6.9	4
Electrical conductivity	mS/m	18.5	19.9	22.0	20.0	4
Chloride	g/m³	21.3	21.6	22.3	21.2	4
Total petroleum hydrocarbons	g/m³	<0.5	<0.5	<0.5	<0.5	4

Table 14 Results of groundwater sampling at site GND2353 under consent 9470-1 (Kaimiro-G)

Parameter	Unit	Sample Details		Historical max	Historical mean	Sample n.
Sample reference	-	TRC153166	TRC161424	-	-	-
Sample date	-	07-Oct-15	29-Apr-16	-	-	-
Sample time	NZST	08:40	09:30	-	-	-
Temperature	°C	12.5	15.6	17.6	14.8	-
pH	pH units	6.0	5.9	6.2	5.9	-
Electrical conductivity	mS/m	9.7	10.4	14.0	11.0	-
Chloride	g/m³	9.7	10.8	14.7	12.2	-
Total petroleum hydrocarbons	g/m³	<0.5	<0.5	<0.5	<0.5	-

2.4 Assessment of injection data submitted by the Company

The Company provided full records of injection activities carried out during the 2015-2016 monitoring period, including injection hours, volumes, rate, and pressure data.

An initial review of the data indicated that the Company had exceeded the injection rate permitted under consent 5312-2.1 on 4 January 2016. Data also indicated that the maximum injection pressure allowed under this consent was exceeded for several days in November 2015. After discussions with the Company, it was determined that these exceedances were a result of faults with measurement equipment, and did not accurately represent the actual injection pressure at the time. The data presented by the Company does show that injection rates and pressures remained well within the consented limits throughout the remainder of the year. As a result, the explanation was accepted by the Council and the erroneous data was excluded from the injection pressure calculations presented in this report.

Table 15 provides an overview of the Company's injection activities across all consents during the monitoring period.

The injection data provided by the Company is summarised by consent in Tables 16, 17, 18, 19, 20 and 21. Data from the two preceding monitoring periods is also presented in each table for comparison.

Table 15 Overall summary of total annual volumes injected at each active injection site (2015-2016)

Consent	Wellsite	Injection well	Total volume discharged (m^3) 01/07/15 – 30/06/16	Discharge period		Well ID
				From	To	
5312-2.1	Kaimiro-O	Kaimiro-17	9,919	01/07/2015	30/06/2016	GND1385
7466-1	Kowhai-A	Kowhai-2 (WDW)	30,106	01/07/2015	30/06/2016	GND2289
7897-1	Kaimiro-J	Kaimiro-11	30,615	03/02/2016	30/06/2016	GND1377
9272-1/2	Turangi-A	Turangi-5 (WDW)	16,772	01/07/2015	30/06/2016	GND2365
9470-1	Kaimiro-G	Kaimiro-10	1,896	01/07/2015	30/06/2016	GND2351
		Total	89,308	-	-	-

Table 16 Summary of injection occurring under consent 5312-2.1 (2013-2016)

Kaimiro-17 injection well					
Year	Annual Volume (m^3)	Max. injection volume (m^3/day)	Max. injection rate (m^3/hr)	Max. injection pressure (bar)	Avg. injection pressure (bar)
Consent limit*	-	1,000	41.6	85	-
2015-2016	9,919	92	36.8	70	59
2014-2015	13,403	58	18.3	119**	74
2013-2014	15,299	69	18.0	93**	72

** As of 6 May 2015*

***Maximum injection pressures recorded during the 2013-2014 and 2015-2016 reporting periods were under previous versions of the consent prior to the consent limited of 85 bar being applied.*

Table 17 Summary of injection occurring under consent 7466-1 (2013-2016)

Kowhai-2 (WDW) injection well					
Year	**Annual Volume (m^3)**	**Max. injection volume (m^3/day)**	**Max. injection rate (m^3/hr)**	**Max. injection pressure (bar)**	**Avg. injection pressure (bar)**
Consent limit	-	916	38	92	-
2015-2016	30,106	109	6.9	27	23
2014-2015	35,918	121	7.0	27	22
2013-2014	36,552	159	6.6	28	24

Table 18 Summary of injection occurring under consent 7897-1 (2013-2016)

Kaimiro-11 injection well					
Year	**Annual Volume (m^3)**	**Max. injection volume (m^3/day)**	**Max. injection rate (m^3/hr)**	**Max. injection pressure (bar)**	**Avg. injection pressure (bar)**
Consent limit	-	687	29	115	-
2015-2016	30,615	186	15.3	53	52
2014-2015	16,960	137	14.0	56	49
2013-2014	24,885	191	10.9	76	44

Table 19 Summary of injection occurring under consent 9272-1 (2013-2016)

Turangi-5 (WDW) injection well					
Year	**Annual Volume (m^3)**	**Max. injection volume (m^3/day)**	**Max. injection rate (m^3/hr)**	**Max. injection pressure (bar)**	**Avg. injection pressure (bar)**
Consent limit	-	687	28.6	115	-
2015-2016	15,468	192	12.1	29	22
2014-2015	14,746	59	31.1	27	20
2013-2014	17,411	142	20.6	32	27

Table 20 Summary of injection occurring under consent 9272-2 (2013-2016)

Turangi-5 (WDW) injection well					
Year	**Annual Volume (m^3)**	**Max. injection volume (m^3/day)**	**Max. injection rate (m^3/hr)**	**Max. injection pressure (bar)**	**Avg. injection pressure (bar)**
Consent limit	-	-	-	111	-
2015-2016	1,304	53	10.2	22	21
2014-2015	-	-	-	-	-
2013-2014	-	-	-	-	-

Table 21 Summary of injection occurring under consent 9470-1 (2013-2016)

Kaimiro-10 injection well					
Year	**Annual Volume (m^3)**	**Max. injection volume (m^3/day)**	**Max. injection rate (m^3/hr)**	**Max. injection pressure (bar)**	**Avg. injection pressure (bar)**
Consent limit	-	206	8.6	73	-
2015-2016	1,896	76	7.2	73	72
2014-2015	10,882	121	9.1	73	42
2013-2014	4,370	63	8.6	74	69

The injection volume and pressure data provided by the Company for injection carried out via the Kaimiro-O, Kowhai-A, Kaimiro-J, Kowhai-A, Turangi-A and Kaimiro-G injection wells are presented graphically in Figures 4, 5, 6, 7 and 8.

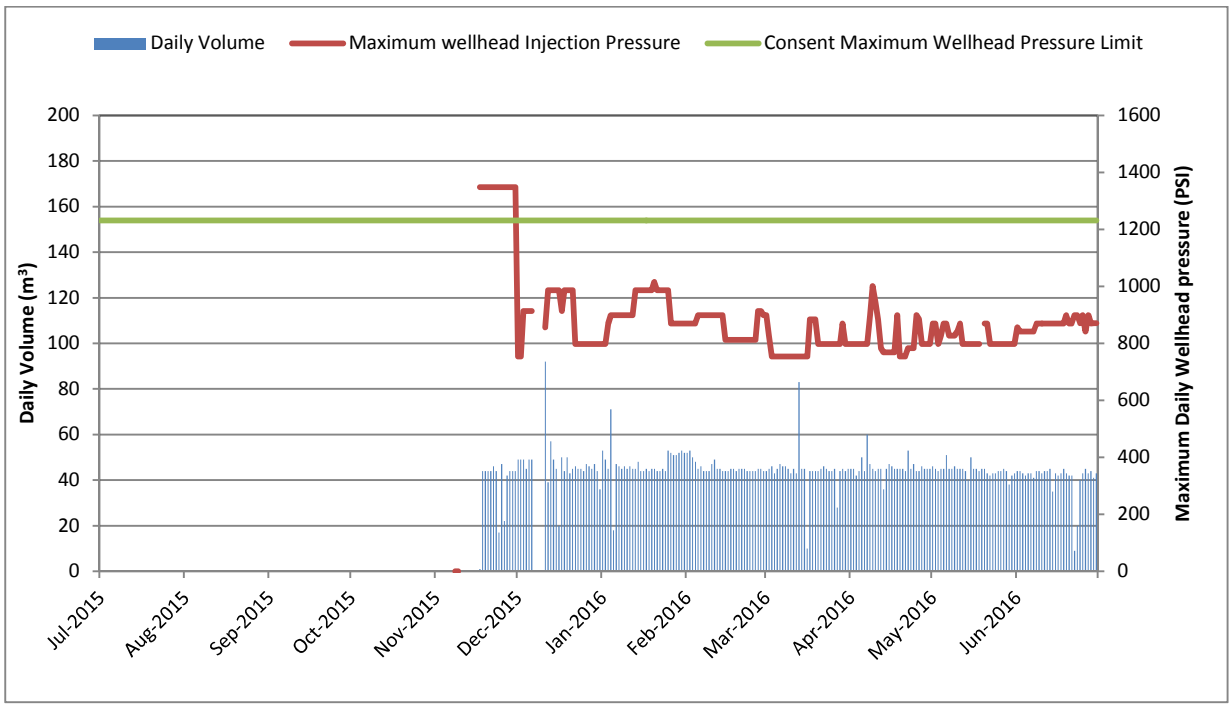

Figure 4 2015-2016 daily injection volumes and pressure - consent 5312-2.1 (Kaimiro-O)

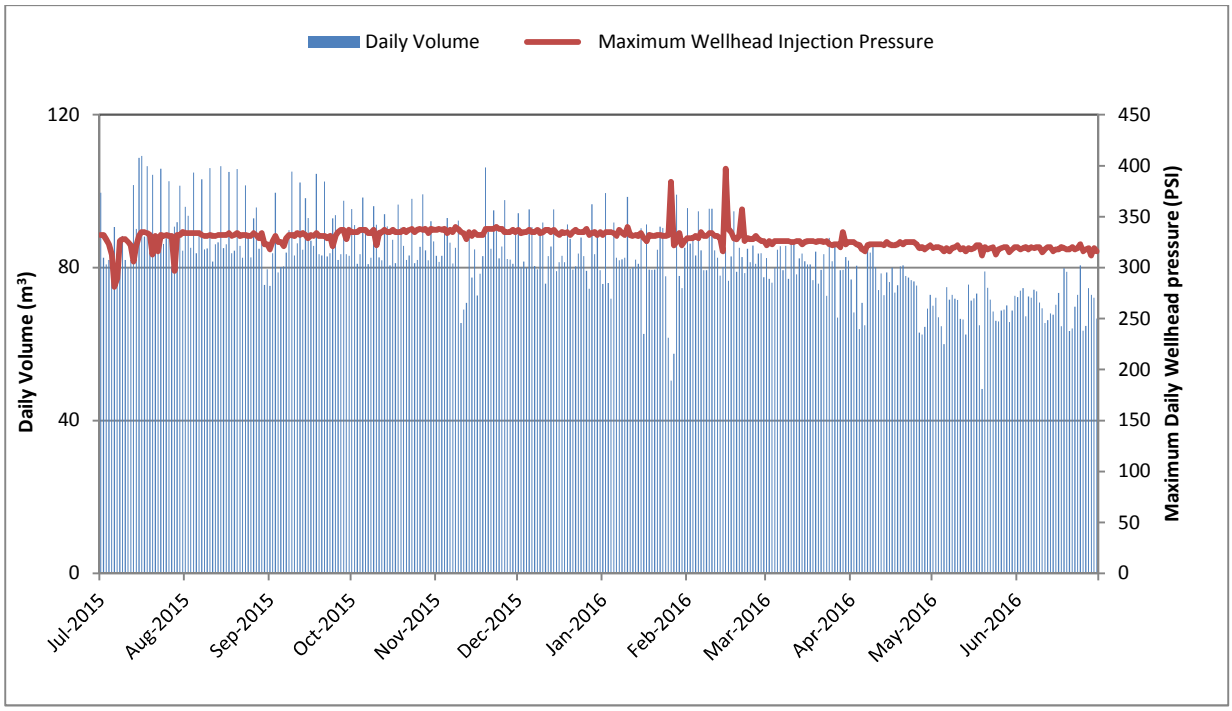

Figure 5 2015-2016 daily injection volumes and pressure - consent 7466-1 (Kowhai-A)

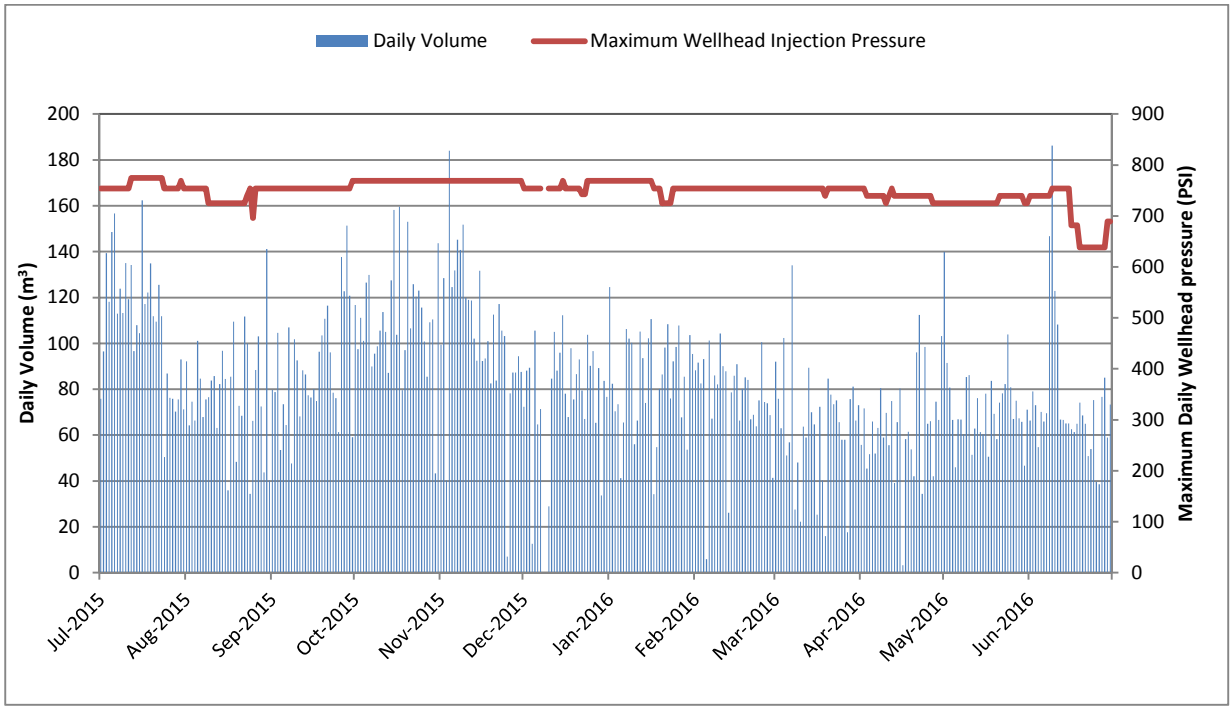

Figure 6 2015-2016 daily injection volumes and pressure - consent 7897-1 (Kaimiro-J)

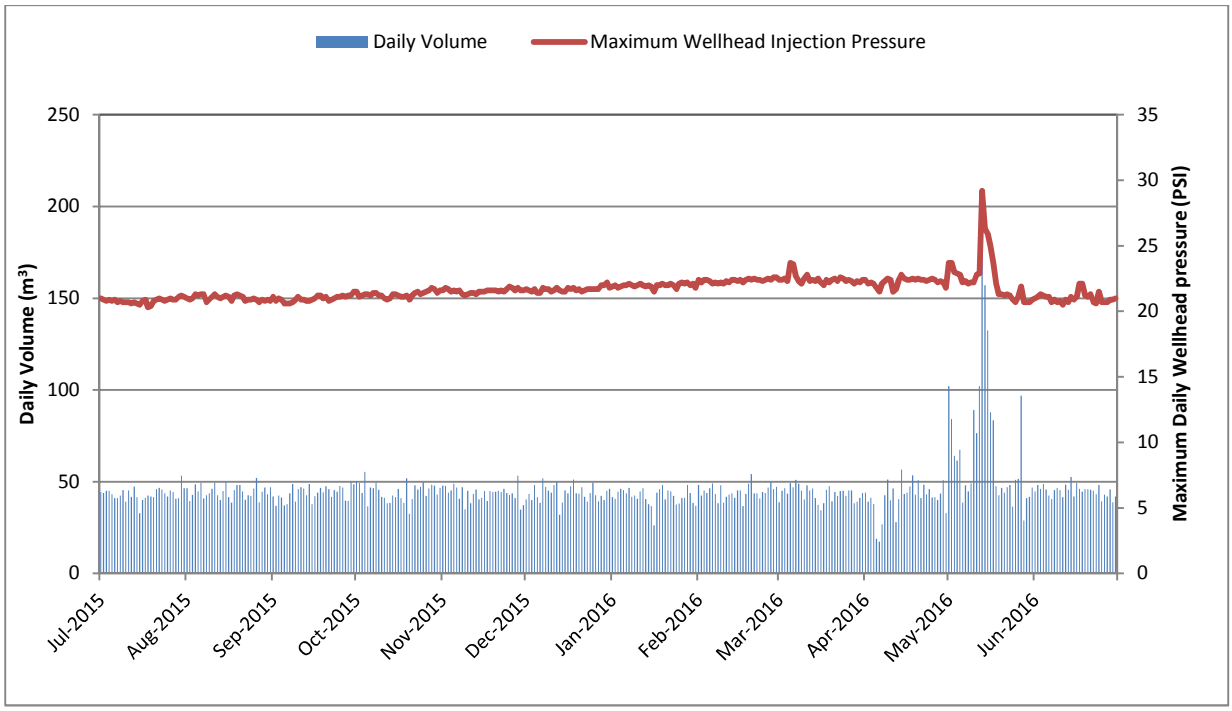

Figure 7 2015-2016 daily injection volumes and pressure - consent 9272-1 and 9272-2 (Turangi-A)

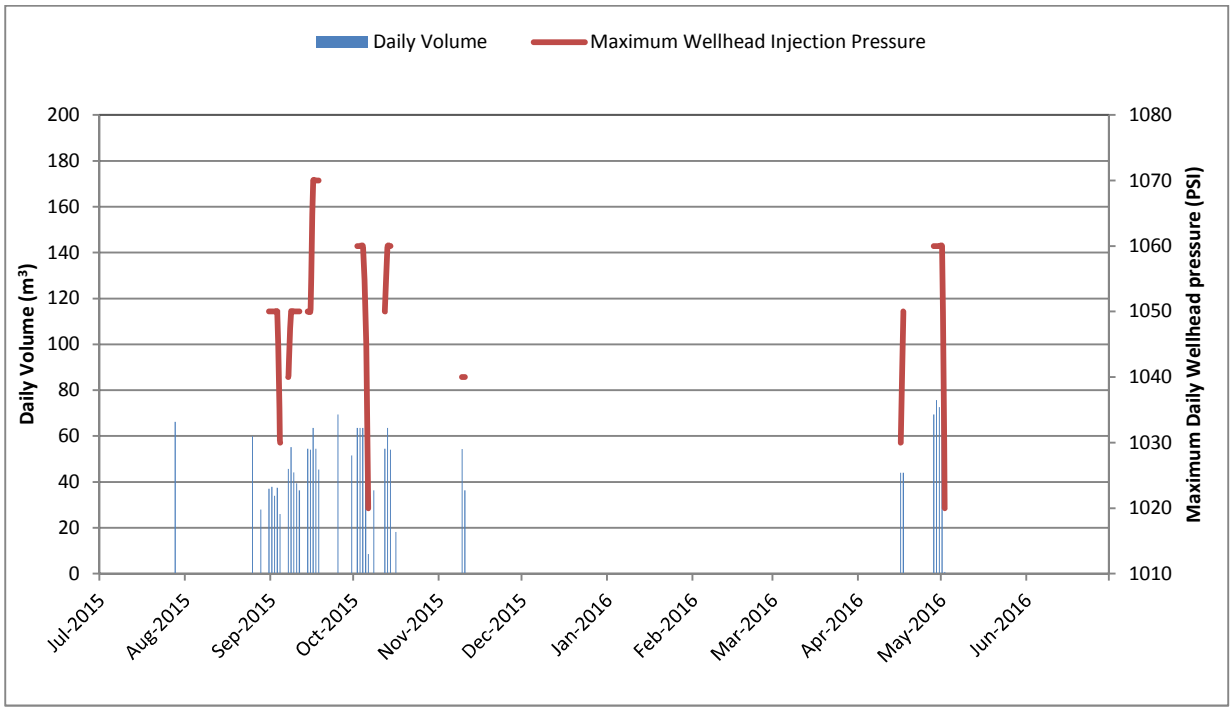

Figure 8 2015-2016 daily injection volumes and pressure - consent 9470-1 (Kaimiro-G)

2.5 Investigations, interventions, and incidents

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 consent holder. 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 courses of non-compliance or failure to maintain good practices. A pro-active approach that in the first instance avoids issues occurring is favoured.

The Council operates and maintains a register of all complaints or reported and discovered excursions from acceptable limits and practices, including non-compliance with consents, which may damage the environment. The Incident Register (IR) includes events where the Company concerned has itself notified the Council. The register contains details of any investigation and corrective action taken.

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 company is indeed the source of the incident (or that the allegation cannot be proven).

In the 2015-2016 period, the Council was not required to undertake significant additional investigations and interventions, or record incidents, in association with the Company's conditions in resource consents or provisions in Regional Plans.

3. Discussion

3.1 Discussion of site performance

During the period under review, the Company exercised five resource consents authorising the discharge of fluids by DWI. The exercised consents licensed discharges of various forms of fluid into the Mount Messenger formation. The main source of fluids for injection was produced water from the Company's Turangi, Kowhai and Kaimiro fields.

The operation of the injection wells is monitored by Company staff, with automated systems recording the injection data required under the conditions of their consent. This data was submitted to the Council at the specified frequency throughout the monitoring period.

A review of the injection data provided by the Company shows that a total of 89,308 m^3 of fluid was discharged by DWI across all consents exercised during the 2015-2016 period. The volume injected represents a continued decline in total injection volumes over the previous two periods of monitoring, which saw 91,909 m^3 and 98,517 m^3 discharged in the 2014-2015 and 2013-2014 periods, respectively.

At the Kaimiro-O wellsite, the Company injected 9,919 m^3 of fluid into the Mount Messenger Formation, via the Kaimiro-17 well. The injection of fluids was managed to comply with the conditions of consent 5312-2.1. The injection data provided shows that the maximum daily volume injected at the site was 92 m^3, which occurred on 11 December 2015. The maximum injection pressure of 70 bar was recorded on 20 January 2016.

A total of 30,106 m^3 of fluid was injected into the Mount Messenger Formation from the Kowhai-A wellsite, via the Kowhai-2 (WDW) well. The injection of fluids was authorised by consent 7466-1. The injection data provided by the Company shows that the maximum daily volume injected was 109 m^3, which occurred on 16 July 2015. The maximum injection rate reached during the review period was 6.9 m^3/hr. The maximum injection pressure of 70 bar was recorded on 15 February 2016. All monitored injection parameters were within the limits stipulated in the relevant consent conditions.

The Company also injected 30,615 m^3 of fluid injected into the Mount Messenger Formation from the Kaimiro-J wellsite, via the Kaimiro-11 well. The injection of fluids from this site was managed to comply with the conditions of consent 7897-1. The volume injected represents the greatest volume of fluid injected via any single well in use by the Company during the 2015-2016 period. The data also shows that the maximum daily volume injected was 186 m^3, occurring on 9 June 2016. The maximum injection rate reached during the review period was 15.3 m^3/hr. The maximum injection pressure of 53 bar was recorded on multiple occasions during July 2015.

At the Turangi-A wellsite a total of 15,468 m^3 of fluid was injected into the Mount Messenger Formation, via the Turangi-5 (WDW) well, as authorised by consent 9272-1. The data provided shows that the maximum daily volume injected was 192 m^3, which occurred on 13 May 2016, as was the maximum injection pressure of 29 bar. The maximum injection rate reached during the review period was 12.1 m^3/hr. All

monitored injection parameters were within the limits stipulated in the relevant consent conditions. Injection via the same well took place under the varied consent 9272-2 from 2 June 2016. A total of 1,304 m^3 of fluid was injected under the varied consent, between 2 June and 30 June 2016. All monitored injection parameters were within the limits stipulated in the relevant consent conditions throughout the review period.

A total of 1,896 m^3 of fluid was injected from the Kaimiro-G wellsite, via the Kaimiro-10 well, as authorised by consent 9470-1. Injection was into the Mount Messenger Formation. The Company managed their injection activities at the site to comply with the conditions of their consent. The injection data provided by the Company shows that a maximum daily volume of 76 m^3 was injected, which occurred on 29 April 2016. The maximum injection rate reached during the review period was 7.2 m^3/hr. The maximum injection pressure of 73 bar was recorded on multiple occasion during September 2015.

During the review period the Company has managed their injection activities to comply with specific restrictions on injection volumes, rates and pressures stipulated in the conditions of their DWI consents.

Modelling of injection zones undertaken by the Company indicates that injection operations being undertaken within the limits stipulated in their consent conditions pose no risk to the integrity of geological seals confining the injection zone targeted at each active injection site. Additionally, the modelling shows that the receiving formations targeted for injection at all sites retain capacity for on-going injection.

To monitor the mechanical integrity of each active injection well, the Company also undertakes continuous monitoring of annular pressure in each well. The results of the monitoring show no evidence of any potential integrity issues in any well currently utilised for injection.

Routine inspections of active injection sites undertaken by the Council during the period under review found them to be in good condition and being well managed. The Council was not required to enter any incidents in relation to the exercising of the Company's DWI consents during the review period, nor were any complaints received from the public in relation to these consents.

3.2 Environmental effects of exercise of consents

To date, no adverse environmental effects have been recorded by the Council in relation to any DWI consent exercised by the Company.

The groundwater monitoring component of this programme continued during the period under review, with two samples being taken from monitoring sites in the vicinity of the Company's active injection wells. The results of the monitoring carried out show that the groundwater composition at each site has remained stable since the commencement of monitoring during the 2012-2013 period. Some very minor fluctuations in analyte concentrations are attributable to seasonal variations in water composition and standard sampling variability. There is no evidence to suggest that injection activities undertaken by the Company during the review period have had any adverse effect on local groundwater quality.

No complaints were received from the public with regard to any of the Company's DWI activities during the period under review, and no incidents were recorded by the Council.

Compliance with the conditions of the Company's DWI consents exercised during the 2015-2016 monitoring period is summarised below in Section 3.3.

3.3 Evaluation of performance

A summary of the Company's level of compliance with the special conditions attached to the DWI consents exercised during this period is provided below in Tables 22, 23, 24, 25 and 26.

Table 22 Summary of Company performance with regard to consent 5312-2.1

Purpose: ***To discharge groundwater from the Matemateaonga Formation and produced water into the Mount Messenger Formation for improved hydrocarbon recovery purposes at the Kaimiro-O wellsite.***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Prior to exercising the consent, the consent holder shall submit an "Injection Operation Management Plan."	Receipt of satisfactory "Injection Operation Management Plan."	Yes
2. Injection well, geological and operational data submission requirements. This information can be included in the "Injection Operation Management Plan."	Receipt of satisfactory information.	Yes
3. The injection pressure at the wellhead shall not exceed 85 bar	Review and analysis of injection data.	Yes
4. The rate of injection shall not exceed 41.6 m^3/hour	Review and analysis of injection data.	Yes
5. The volume of fluid injected shall not exceed 1,000 m^3/day.	Review and analysis of injection data.	Yes
6. No injection permitted after 1 June 2027	Assessment of injection records and site inspection notices	Yes
7. The consent holder shall at all times adopt the best practicable option.	Assessment of consent holder records and site inspection notices.	Yes
8. The injection of fluids shall be confined to the Mount Messenger Formation, deeper than 1,000 metres total vertical depth sub-sea.	Review of "Injection Operation Management Plan," well construction log and injection data.	Yes
9. Discharge must not result in fracturing of geological seals confining the injection zone.	Assessment of injection records and results of groundwater sampling and analysis programme.	Yes

Purpose: ***To discharge groundwater from the Matemateaonga Formation and produced water into the Mount Messenger Formation for improved hydrocarbon recovery purposes at the Kaimiro-O wellsite.***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
10. The consent holder shall ensure that the exercise of this consent does not result in contaminants reaching any useable freshwater (groundwater or surface water).	Assessment of injection records and results of groundwater sampling and analysis programme.	Yes
11. Maintain full records of injection data.	Receipt and assessment of injection data.	Yes
12. Maintain records and undertake analysis to characterise injectate at intervals not exceeding six months.	Receipt and assessment of injection data.	Yes
13. If not carried out by an IANZ accredited laboratory, analysis shall be carried out in accordance with QA plan which has been certified by the Chief Executive	Inspection of QA plan.	N/A
14. The consent holder shall undertake a programme of sampling and testing (the 'Monitoring Programme') that monitors the effects of the exercise of this consent on freshwater resources.	Monitoring Programme submitted to the Chief Executive, Taranaki Regional Council, for certification.	Yes
15. Lists the range of parameters required to be tested for in the analysis of groundwater samples.	Implementation of groundwater monitoring programme and assessment of results.	Yes
16. All groundwater 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.	Receipt of Sampling and Analysis Plan prior to fist round of sampling being undertaken.	Yes
17. The consent holder shall provide to the Council, before 30 June each year, a summary of all data required by conditions 11 and 12, and a report detailing compliance with consent conditions over the previous 1 July to 30 June period. The report shall also provide an assessment of injection well condition, well integrity and an updated injection modelling report.	Receipt of satisfactory report before 30 June each year.	Yes
18. Review provision.	N/A	N/A

Purpose: ***To discharge groundwater from the Matemateaonga Formation and produced water into the Mount Messenger Formation for improved hydrocarbon recovery purposes at the Kaimiro-O wellsite.***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**
Overall assessment of consent compliance and administrative performance in respect of this consent		**High**

N/A = not applicable

Table 23 Summary of Company performance with regard to consent 7466-1

Purpose: ***To discharge produced water from hydrocarbon exploration and production operations by deep well injection at the Kowhai wellsite.***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Provision of geological and injection well construction information.	Receipt of satisfactory information.	Yes
2. The maximum injection pressure shall not exceed 92 bar (1,352 psi).	Assessment of consent holder records.	Yes
3. The volume of liquid re-injected shall not exceed 916 m^3/day.	Assessment of consent holder records.	Yes
4. The rate of injection shall not exceed 38 m^3/hour.	Assessment of consent holder records.	Yes
5. The injection of fluids shall be confined to the Mount Messenger Formation, deeper than 970 metres true vertical depth below ground level.	Review of "Injection Operation Management Plan," well construction log and injection data.	Yes
6. Recording requirements for discharge volumes, rates, and pressures.	Receipt of well discharge data.	Yes
7. Chemical analysis of discharge.	Receipt of discharge analysis results.	Yes
8. Provision of annual report detailing all records collected in accordance with conditions 4 & 5.	Receipt of satisfactory information.	Yes
9. Notification provision.	Received five working days prior to consent exercise.	Yes
10. Submission of an Injection Operation Management Plan.	Receipt of satisfactory information.	Yes
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**
Overall assessment of consent compliance and administrative performance in respect of this consent		**High**

Table 24 Summary of Company performance with regard to consent 7897-1

Purpose: ***To discharge produced water, well drilling fluids, well workover fluids, hydraulic fracturing fluids and 'off-spec' stormwater from the consent holder's wellsites into the Mount Messenger Formation by deep well injection via the KAI-11 waste disposal well.***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Prior to exercising the consent, the consent holder shall submit an "Injection Operation Management Plan".	Receipt of satisfactory "Injection Operation Management Plan".	Yes
2. Injection well, geological and operational data submission requirements. This information can be included in the "Injection Operation Management Plan".	Receipt of satisfactory information.	Yes
3. The injection pressure at the wellhead shall not exceed 115 bar (1,685 psi).	Review and analysis of injection data.	Yes
4. The rate of injection shall not exceed 687 m^3/day (3 bpm).	Review and analysis of injection data.	Yes
5. The volume of fluid injected shall not exceed 687 m^3/day.	Review and analysis of injection data.	Yes
6. The injection of fluids shall be confined to the Mount Messenger Formation, deeper than 1,320 metres true vertical depth below ground level.	Review of "Injection Operation Management Plan", well construction log and injection data.	Yes
7. The consent holder shall at all times adopt the best practicable option.	Assessment of consent holder records and site inspection notices.	Yes
8. Maintain full records of injection data.	Receipt and assessment of injection data.	Yes
9. Maintain records and undertake analysis to characterise each type of waste arriving on-site for discharge.	Receipt and assessment of injection data.	Yes
10. The data required by conditions 9 & 10 above, for each calendar month, is required to be submitted by the 15th day of the following month.	Receipt of satisfactory data by the date specified.	Yes
11. The consent holder shall notify the Chief Executive, Taranaki Regional Council, in writing at least five days prior to the first exercise of this consent.	Notification received by Council.	Yes

Purpose: ***To discharge produced water, well drilling fluids, well workover fluids, hydraulic fracturing fluids and 'off-spec' stormwater from the consent holder's wellsites into the Mount Messenger Formation by deep well injection via the KAI-11 waste disposal well.***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
12. The consent holder shall ensure that the exercise of this consent does not result in contaminants reaching any useable freshwater (groundwater or surface water).	Assessment of injection records and results of groundwater sampling and analysis programme.	Yes
13. The consent holder shall undertake a programme of sampling and testing (the 'Monitoring Programme') that monitors the effects of the exercise of this consent on freshwater resources.	Monitoring Programme submitted to the Chief Executive, Taranaki Regional Council, for certification.	Yes
14. Lists the range of parameters required to be tested for in the analysis of groundwater samples.	Implementation of Groundwater Monitoring Programme and assessment of results.	Yes
15. All groundwater 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.	Receipt of Sampling and Analysis Plan prior to fist round of sampling being undertaken.	Yes
16. The consent holder shall provide to the Council, during the month of May each year, a summary of all data collected and a report detailing compliance with consent conditions over the previous 1 July to 30 June period. The report shall also provide an assessment of injection well condition, well integrity and an updated injection modelling report.	Receipt of satisfactory report during May each year.	Yes
17. Lapse clause.	Receive notice of exercise of consent.	Yes
18. Consent review provision.	N/A	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent Overall assessment of consent compliance and administrative performance in respect of this consent		**High** **High**

N/A = not applicable

Table 25 Summary of Company performance with regard to consent 9272-2

Purpose: ***To discharge produced water, well drilling fluids, well workover fluids and contaminated stormwater into the Mount Messenger Formation by deep well injection via the Turangi-A waste disposal well.***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Authorises discharge via Turangi-5 well or an alternate well at the wellsite	Receipt of satisfactory information	Yes
2. Prior to exercising the consent, the consent holder shall submit an "Injection Operation Management Plan."	Receipt of satisfactory "Injection Operation Management Plan."	Yes
3. Injection well, geological and operational data submission requirements. This information can be included in the "Injection Operation Management Plan."	Receipt of satisfactory information	Yes
4. No injection permitted after 1 June 2031	Review and analysis of injection data.	
5. The consent holder shall at all times adopt the best practicable option.	Assessment of consent holder records and site inspection notices.	Yes
6. The injection of fluids shall be confined to the Mount Messenger Formation, deeper than 1,350 metres true vertical depth below ground level.	Review of "Injection Operation Management Plan," well construction log and injection data.	Yes
7. The wellhead pressure shall not exceed 1610 PSI (111 bar)	Review and analysis of injection data.	Yes
8. The consent holder shall ensure discharge does not fracture any geological seal	Assessment of injection records and results of groundwater sampling and analysis programme.	Yes
9. The consent holder shall ensure that the exercise of this consent does not result in contaminants reaching any useable freshwater (groundwater or surface water).	Assessment of injection records and results of groundwater sampling and analysis programme.	Yes
10. Limits the range of fluids that can be discharged under the consent.	Assessment of consent holder records and injectate sample analysis.	Yes
11. Maintain full records of injection data.	Receipt and assessment of injection data.	Yes
12. Maintain records and undertake analysis to characterise each type of waste arriving on-site for discharge.	Receipt and assessment of injection data.	Yes

Purpose: ***To discharge produced water, well drilling fluids, well workover fluids and contaminated stormwater into the Mount Messenger Formation by deep well injection via the Turangi-A waste disposal well.***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
13. If not carried out by an IANZ accredited laboratory, analysis shall be carried out in accordance with QA plan which has been certified by the Chief Executive QA/QC	Inspection of QA plan	Yes
14. Discharge must not result in fracturing of geological seals confining the injection zone.		
15. The consent holder shall undertake a programme of sampling and testing (the 'Monitoring Programme') that monitors the effects of the exercise of this consent on freshwater resources.	Monitoring Programme submitted to the Chief Executive, Taranaki Regional Council, for certification.	Yes
16. Lists the range of parameters required to be tested for in the analysis of groundwater samples.	Implementation of groundwater monitoring programme and assessment of results.	Yes
17. All groundwater 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.	Receipt of Sampling and Analysis Plan prior to fist round of sampling being undertaken.	Yes
18. The consent holder shall provide to the Council, during the month of May each year, a summary of all data collected and a report detailing compliance with consent conditions over the previous 1 July to 30 June period. The report shall also provide an assessment of injection well condition, well integrity and an updated injection modelling report.	Receipt of satisfactory report during May each year.	Yes
19. Consent review provision.	N/A	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent Overall assessment of consent compliance and environmental performance in respect of this consent		**High** **High**

N/A = not applicable

Table 26 Summary of Company performance with regard to consent 9470-1

Purpose: ***To discharge produced water, well drilling fluids, well workover fluids into the Mount Messenger Formation by deep well injection via the Kaimiro-G wellsite.***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Prior to exercising the consent, the consent holder shall submit an "Injection Operation Management Plan."	Receipt of satisfactory "Injection Operation Management Plan."	Yes
2. Injection well, geological and operational data submission requirements. This information can be included in the "Injection Operation Management Plan."	Receipt of satisfactory information.	Yes
3. The injection pressure at the wellhead shall not exceed 1,077 psi (73 bars).	Review and analysis of injection data.	Yes
4. The rate of injection shall not exceed 8.6 m^3/hr (0.9 bpm).	Review and analysis of injection data.	Yes
5. The volume of fluid injected shall not exceed 206 m^3/day.	Review and analysis of injection data.	Yes
6. The injection of fluids shall be confined to the Mount Messenger Formation, deeper than - 995 metres true vertical depth Sub-sea.	Review of "Injection Operation Management Plan," well construction log and injection data.	Yes
7. The consent holder shall at all times adopt the best practicable option.	Assessment of consent holder records and site inspection notices.	Yes
8. Limits the range of fluids that can be discharged under the consent.	Assessment of consent holder records and injectate sample analysis.	Yes
9. Maintain full records of injection data.	Receipt and assessment of injection data.	Yes
10. Maintain records and undertake analysis to characterise each type of waste arriving on-site for discharge.	Receipt and assessment of injection data.	Yes
11. The data required by conditions 9 & 10 above, for each calendar month, is required to be submitted by the 15th day of the following month.	Receipt of satisfactory data by the date specified.	Yes
12. The consent holder shall ensure that the exercise of this consent does not result in contaminants reaching any useable freshwater (groundwater or surface water).	Assessment of injection records and results of groundwater sampling and analysis programme.	Yes

Purpose: ***To discharge produced water, well drilling fluids, well workover fluids into the Mount Messenger Formation by deep well injection via the Kaimiro-G wellsite.***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
13. The consent holder shall undertake a programme of sampling and testing (the 'Monitoring Programme') that monitors the effects of the exercise of this consent on freshwater resources.	Monitoring Programme submitted to the Chief Executive, Taranaki Regional Council, for certification.	Yes
14. All groundwater samples taken for monitoring purposes shall be taken in accordance with recognised field procedures and analysed for: a. pH; b. conductivity; c. chloride; and d. total petroleum hydrocarbons.	Implementation of Groundwater Monitoring Programme and assessment of results.	Yes
15. All groundwater 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.	Receipt of Sampling and Analysis Plan prior to fist round of sampling being undertaken.	Yes
16. The consent holder shall provide to the Council, before 31 August each year, a summary of all data collected and a report detailing compliance with consent conditions over the previous 1 July to 30 June period.	Receipt of satisfactory report by 31 August each year.	Yes
17. The consent holder shall notify the Chief Executive, Taranaki Regional Council, in writing at least five days prior to the first exercise of this consent.	Notification received by Council.	Yes
18. No injection permitted after 1 June 2027.	Assessment of injection records and site inspection notices.	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**
Overall assessment of consent compliance and administrative performance 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 consents as defined in Section 1.1.4.

3.4 Recommendations from the 2014-2015 Annual Report

In the 2014-2015 Annual Report, it was recommended:

1. THAT the range of monitoring carried out during the 2014-2015 period in relation to the Company's DWI activities be continued during the 2015-2016 monitoring period.

2. THAT the Council notes there is no requirement at this time for a consent review to be pursued or grounds to exercise the review options.

These recommendations were implemented during the reported period.

3.5 Alterations to monitoring programmes for 2016-2017

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

- the extent of information made available by previous authorities,
- its relevance under the RMA,
- its obligations to monitor emissions/discharges and effects under the RMA, and
- report 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 emitting to the atmosphere/discharging to the environment.

It is proposed that the range of monitoring carried out during the 2015-2016 period in relation to the Company's DWI activities be continued during the 2016-2017 monitoring period. Recommendations to this effect are included in Section 4 of this report.

3.6 Exercise of optional review of consent

The next optional review dates for consents 5312-2.1, 7390-1, 7897-1, 9272-2 and 9470-1 are provided for in June 2017.

The Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent. A review may be required for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Based on the results of monitoring carried out in the period under review, and in previous years as set out in earlier annual compliance monitoring reports, it is considered that there are no grounds to require a consent review to be pursued or grounds to exercise the review options. A recommendation to this effect is presented in Section 4 of this report.

4. Recommendations

1. THAT the range of monitoring carried out during the 2015-2016 period in relation to the Company's DWI activities be continued during the 2016-2017 monitoring period.

2. THAT the Council notes there is no requirement at this time for a consent review to be pursued or grounds to exercise the review options.

Glossary of common terms and abbreviations

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

Aquifer (freshwater)	A formation, or group or part of a formation that contains sufficient saturated permeable media to yield exploitable quantities of fresh water.
Conductivity	A measure of the level of dissolved salts in a sample. Usually measured at 20°C and expressed as millisiemens per metre (mS/m) or as Total Dissolved Solids (g/m3).
Confining layer	A geological layer or rock unit that is impermeable to fluids.
Deep well injection (DWI)	Injection of fluids at depth for disposal or enhanced recovery.
Fracture gradient	A measure of how the pressure required to fracture rock in the earths crust changes with depth. It is usually measured in units of "pounds per square inch per foot" (psi/ft) and varies with the type of rock and the strain of the rock.
Freshwater-saline-water interface	The depth in a well at which fresh water becomes saline. The interface may be a gradational or sharp transition, depending on geology. The FW-SW transition is demonstrated by down-hole geophysical logging.
g/m^3	Grams per cubic metre. A measure of concentration which is equivalent to milligrams per litre (mg/L), or parts per million (ppm).
Hydraulic fracturing (HF)	The process of increasing reservoir permeability by injecting fluids at pressures sufficient to fracture rock within the reservoir ("fraccing").
Injectate	Fluid disposed of by deep well injection.
Incident	An event that is alleged or is found to have occurred that may have actual or potential environmental consequences or may involve non-compliance with a consent or rule in a regional plan. Registration of an incident by the Council does not automatically mean such an outcome had actually occurred.
Intervention	Action/s taken by Council to instruct or direct actions be taken to avoid or reduce the likelihood of an incident occurring.
Investigation	Action taken by Council to establish what were the circumstances/events surrounding an incident including any allegations of an incident.
IR	Unauthorised Incident Register – contains a list of events recorded by the Council on the basis that they may have the potential or actual environmental consequences that may represent a breach of a consent or provision in a Regional Plan.
L/s	Litres per second.
m BGL	Metres below ground level.
mS/m	Millisiemens per metre.
m TVD	Metres true vertical depth
m^3	Cubic metre.

pH	Numerical system for measuring acidity in solutions, with 7 as neutral. Values lower than 7 are acidic and higher than 7 are alkaline. The scale is logarithmic i.e. a change of 1 represents a ten-fold change in strength. For example, a pH of 4 is ten times more acidic than a pH of 5.
Produced water	Water associated with oil and gas reservoirs that is produced along with the oil and gas. Typically highly saline with salt concentrations similar to seawater and containing low levels of hydrocarbons.
Resource consent	Refer Section 87 of the RMA. Resource consents include land use consents (refer Sections 9 and 13 of the RMA), coastal permits (Sections 12, 14 and 15), water permits (Section 14) and discharge permits (Section 15).
UI	Unauthorised Incident.
Water flooding	A method of thermal recovery in which hot water is injected into a reservoir through specially distributed injection wells. Hot water flooding reduces the viscosity of the crude oil, allowing it to move more easily toward production wells.

For further information on analytical methods, contact the Council's laboratory.

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

Taranaki Regional Council (2016): *Greymouth Petroleum Limited Deep Well Injection Monitoring Programme Annual Report 2014-2015.* Technical Report 2015-24. Document number 1554285.

Taranaki Regional Council (2015): *Greymouth Petroleum Limited Deep Well Injection Monitoring Programme Annual Report 2013-2014.* Technical Report 2014-90. Document number 1468969.

Taranaki Regional Council (2011): *Greymouth Petroleum Acquisitions Company Limited - Deep Well Injection Monitoring Programme - Triennial Report, 2009-2012.* Technical Report 2012-47. Document number 1119464.

Appendix I

Resource consents held by Greymouth Petroleum Limited

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

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 Acquisition Company Limited PO Box 3394 New Plymouth 4341
Decision Date (Change):	6 May 2015
Commencement Date (Change):	6 May 2015 (Granted Date: 24 July 2014)

Conditions of Consent

Consent Granted:	To discharge groundwater from the Matemateaonga Formation and produced water into the Mount Messenger Formation for improved hydrocarbon recovery purposes at the Kaimiro-O wellsite
Expiry Date:	1 June 2032
Review Date(s):	June 2020, June 2026
Site Location:	Kaimiro-O wellsite, 455 Alfred Road, Egmont Village (Property owner: Cradles Trust Nominees Limited)
Legal Description:	Pt Secs 115 & 116 Hua & Waiwhakaiho Hun (Discharge source & site)
Grid Reference (NZTM)	1698671E-5663161N
Catchment:	Waiwhakaiho

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. By 1 July 2015, the consent holder shall submit an "Injection Operation Management Plan." The plan shall include the operational details of the injection activities and identify the conditions that would trigger concerns about the integrity of the injection well, the receiving formation or overlying geological seals. The plan shall also detail the action(s) to be taken by the consent holder if trigger conditions are reached.

2. By 1 July 2015, the consent holder shall provide to the Chief Executive, Taranaki Regional Council:

   (a) a geological assessment of the environment in which the well is located, including the injection zone, the geological seals confining the injection zone and any associated faulting;
   (b) details of the injection well design and its structural integrity;
   (c) an assessment of the suitability of the injection well for the proposed activity;
   (d) details of how the integrity of the injection well will be monitored and maintained; and
   (e) a chemical assessment of the receiving formation water which confirms its Total Dissolved Solids (TDS) concentration, and also demonstrates that the mixing of formation and injection fluids will not result in any adverse effects on the receiving formation or the injection well.

   (Note: The information required by condition 2 may be included within the "Injection Operation Management Plan" required by condition 1.)

3. The injection pressure at the wellhead shall not exceed a maximum injection pressure of 85 bar.

4. The rate of injection shall not exceed 41.6 cubic metres per hour.

5. The volume of fluid injected shall not exceed 1000 cubic metres per day.

6. There shall be no injection of any fluids after 1 June 2027.

7. The consent holder shall at all times adopt the best practicable option, as defined in Section 2 of the Resource Management Act 1991, to prevent or minimise any actual or likely adverse effect on the environment.

8. The injected fluids shall be confined to the Mount Messenger Formation, deeper than 1,000 metres total vertical depth sub-sea.

9. The consent holder shall ensure that the discharge authorised by this consent does not result in the fracturing of the geological seals confining the injection zone.

10. 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). Useable fresh groundwater is defined as any groundwater having a TDS concentration of less than 1,000 mg/l.

11. Once the consent is exercised, the consent holder shall keep daily records of the:

    (a) injection hours;
    (b) volume of fluid discharged; and
    (c) maximum and average injection pressure.

12. The consent holder shall have the injection fluid analysed for the following parameters, at intervals not exceeding six months:

    i. pH;
    ii. conductivity;
    iii. chloride concentration;
    iv. total dissolved solids; and
    v. suspended solids concentration.

13. If the analysis required by condition 12 above is not carried out in an International Accreditation New Zealand (IANZ) accredited laboratory, it shall be undertaken in accordance with a "Quality Assurance (QA) Plan" that has been certified by the Chief Executive, Taranaki Regional Council, as meeting the requirements of condition 12. The Taranaki Regional Council may also, at its discretion, carry out an audit of the consent holder's sampling and analysis regime to assess adherence to the QA plan.

14. 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 within an Area of Review (AoR) to assess compliance with condition 10 (the 'Monitoring Programme'). The Monitoring Programme shall be designed to characterise local groundwater quality, and be submitted to the Chief Executive, Taranaki Regional Council, for certification before 1 January 2015, and shall include:

    (a) the location of sampling sites;
    (b) well/bore construction details; and
    (c) sampling frequency.

    The AoR shall extend 1,000 metres from the point of injection. It is a requirement that at least one suitable monitoring bore be located within 500 metres of the well head. If no suitable existing bores are available, it will be necessary for the Monitoring Programme to include installation of, and sampling from, a suitable bore. The bore would be of a depth, location and design determined after consultation with the Chief Executive, Taranaki Regional Council and installed in accordance with NZS 4411:2001.

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

    (a) pH;
    (b) conductivity
    (c) anion and cation profile
    (d) total petroleum hydrocarbons; and
    (e) BTEX.

    Note: *The samples required, under conditions 15 and 16 could be taken and analysed by the Taranaki Regional Council or other contracted party on behalf of the consent holder.*

16. All groundwater 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. This Plan shall specify the use of standard protocols recognised to constitute good professional practice including quality control and assurance. An IANZ accredited laboratory shall be used for all sample analysis. Results shall be provided to the Chief Executive, Taranaki Regional Council within 30 days of sampling and shall include supporting quality control and assurance information.

    Note: *The Sampling and Analysis Plan may be combined with the Monitoring Programme required by condition 14.*

17. The consent holder shall provide to the Chief Executive, Taranaki Regional Council, before 30 June each year, all data required by conditions 11 and 12, and a report detailing compliance with consent conditions over the previous 1 July to 30 June period. Based on the data provided, the report shall also provide:

    a) an assessment of injection well performance;
    b) an assessment of the on-going integrity and isolation of the wellbore; and
    c) an assessment of the on-going integrity and isolation of the receiving formation.

18. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2020 and/or June 2026 for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the timeThe consent holder shall ensure that the discharge authorised by this consent does not result in the fracturing of the geological seals confining the injection zone.

Signed at Stratford on 6 May 2015

For and on behalf of
Taranaki Regional Council

A D McLay
Director - Resource Management

Discharge Permit

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

Name of Consent Holder:	Petrochem Limited P O Box 3394 NEW PLYMOUTH 4341
Decision Date (Change):	3 February 2014
Commencement Date (Change):	3 February 2014 (Granted: 1 May 2009)

Conditions of Consent

Consent Granted:	To discharge produced water from hydrocarbon exploration and production operations by deep well injection at the Kowhai wellsite (via Kowhai-2 well)
Expiry Date:	1 June 2027
Review Date(s):	June 2015, June 2021 and within one month following the receipt of information required under special condition 8
Site Location:	Kowhai-A wellsite, Ngatimaru Road, Tikorangi (Property owners: RN & BJ Jupp)
Legal Description:	Pt Sec 44 Tikorangi Dist Blks IX & X Waitara SD (Discharge source & site)
Grid Reference (NZTM)	1710931E-5676289N
Catchment:	Waiau

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

General conditions

a) On receipt of a re.quirement from the Chief Executive, Taranaki Regional Council the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.

b) Unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.

c) The consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:

   i) the administration, monitoring and supervision of this consent; and
   ii) charges authorised by regulations.

Special conditions

1. Upon completion of well the following information shall be provided to the Chief Executive of the Taranaki Regional Council:

   a) Subsurface construction details, including design of the exterior surface casing, the intermediate protective casing, and the innermost casing, tubing, and packer;
   b) Borelog of the well from 0.0 mbgl to 500 metres below ground level;
   c) Annular pressure; and
   d) Cementing details

2. The injection pressure at the wellhead shall not exceed a maximum injection pressure of 1,352 pounds per square inch (92 Bar).

3. The volume of liquid re-injected shall not exceed 916 cubic metres per day.

4. The rate of injection shall not exceed 4 barrels per minute (38 cubic metres per hour).

5. The fluids shall be injected into the Mount Messenger Formation at a minimum depth of 970 metres below ground level (true vertical depth).

6. The consent holder shall keep daily records of:

   a) Maximum and average injection pressure;
   b) Maximum and average rate of injection; and
   c) Volume of fluid injected.

7. The consent holder shall measure and record the following constituents of the discharge:

   a) pH;
   b) Suspended Solids concentration;
   c) Temperature;
   d) Salinity;
   e) Chloride concentration; and
   f) Total hydrocarbon concentration.

These constituents shall be measured at time intervals sufficiently frequent to yield data representative of the injected fluid in the opinion of the Chief Executive of the Taranaki Regional Council.

8. The consent holder shall report to the Taranaki Regional Council's Chief Executive, during the month of May of every year, a monthly summary of all records collected in accordance with conditions 6 and 7. The report shall cover details on the major changes in characteristics or sources of injected fluid.

9. The consent holder shall notify the Chief Executive, Taranaki Regional Council, in writing at least 5 working days prior to the exercise of this consent. Notification shall include the consent number and a brief description of the activity consented and be emailed to worknotification@trc.govt.nz. Notification by fax or post is acceptable only if the consent holder does not have access to email.

10. Before the well is used for deepwell injection the consent holder shall submit an "Injection Operation Management Plan" which describes the reinjection process and identifies the conditions that would trigger concerns about the integrity of the well, or the injection zone, and the action to be taken by the consent holder if trigger conditions are reached.

11. The consent holder shall ensure that the exercise of this consent not contaminate or put at risk actual or potential usable freshwater aquifer.

12. This consent shall lapse on the 30th June 2014, 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(b) of the Resource Management Act 1991.

13. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent, by giving notice of review during the month following receipt of information required under special condition 8 above, and the month of June 2015 and/or June 2021, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 3 February 2014

For and on behalf of
Taranaki Regional Council

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Director-Resource Management

Discharge Permit

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

Name of Consent Holder:	Greymouth Petroleum Limited P O Box 3394 NEW PLYMOUTH 4341
Decision Date (Change):	19 July 2013
Commencement Date (Change):	19 July 2013 (Granted: 12 September 2011)

Conditions of Consent

Consent Granted:	To discharge the following from hydrocarbon exploration operations at the Kaimiro-J wellsite by deepwell injection into the Mount Messenger formation: • produced water; • well drilling fluids; • well workovers fluids; • hydraulic fracturing fluids; and • 'off-spec' stormwater from the consent holder's wellsites
Expiry Date:	1 June 2026
Review Date(s):	June annually
Site Location:	Kaimiro-J wellsite, 1140 Junction Road, Inglewood (Property owner: BJ & SM Duynhoven)
Legal Description:	Lot 1 DP 19651 (Discharge source & site)
Grid Reference (NZTM)	1699274E-5664725N
Catchment:	Waiongana
Tributary:	Mangaoraka

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. Before this consent is exercised the consent holder shall submit an "Injection Operation Management Plan" which describes the reinjection process and identifies the conditions that would trigger concerns about the integrity of the well, or the injection zone, and the action to be taken by the consent holder if trigger conditions are reached.

2. Before this consent is exercised the consent holder shall provide to the Chief Executive of the Taranaki Regional Council:

   (a) Subsurface construction details, including design of the exterior surface casing, the intermediate protective casing, and the innermost casing, tubing, and packer;
   (b) A log of the well from 0.0 metres below ground level to 1,000 metres below ground level; clearly showing the freshwater/brine water interface zone;
   (c) Annular pressure; pressure testing which demonstrates well integrity [Mechanical Integrity Test];
   (d) Receiving Formation fracture pressure and geological seal fracture pressure;
   (e) A chemical analysis of the formation-water;
   (f) Cementing details.

3. The injection pressure at the wellhead shall not exceed a maximum injection pressure of 1669 psi (115 bar).

4. The rate of injection shall not exceed 29 cubic metres per hour (3 bpm).

5. The volume of fluid injected shall not exceed 687 cubic metres per day (4,320 bpd).

6. The injection of fluids shall be confined to the Mt. Messenger Formation, deeper than 1,320 metres true vertical depth.

7. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any actual or likely adverse effect on the environment; in particular, ensuring that the injection material is contained within the injection zone.

8. The consent holder shall keep daily records of the:

   (a) maximum injection pressure;
   (b) maximum and average rate of injection; and
   (c) volume of fluid injected;

   during exercise of this consent.

9. For each waste stream arriving on site for discharge, the consent holder shall record the following information:

   (a) type of fluid;
   (b) source of fluid (site name and location);
   (c) an analysis of the fluid for:
      (i) pH;
      (ii) suspended solids concentration;
      (iii) temperature;
      (iv) salinity;
      (v) chloride concentration; and
      (vi) total hydrocarbon concentration.

   The analysis required by condition 9 above is not necessary if a sample of the same type of fluid, from the same source, has been taken, analysed and provided to the Chief Executive, Taranaki Regional Council within the previous 6 months.

10. The information required by conditions 8 and 9 above, for each calendar month, shall be provided to the Chief Executive, Taranaki Regional Council before the 15th day of the following month.

11. The consent holder shall notify the Chief Executive, Taranaki Regional Council, in writing at least 5 working days prior to the first exercise of this consent. Notification shall include the consent number and a brief description of the activity consented and be emailed to worknotification@trc.govt.nz.

12. 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.

13. 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 12 (the 'Monitoring Programme'). The Monitoring Programme shall be certified by the Chief Executive, Taranaki Regional Council ('the Chief Executive'), before 30 June 2013, and shall include:

   (a) the location of sampling sites;
   (b) well/bore construction details; and
   (c) sampling frequency.

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

   (a) pH;
   (b) conductivity;
   (c) chloride; and
   (d) total petroleum hydrocarbons.

   Note: *The samples required, under conditions 13 and 14, could be taken and analysed by the Council or other contracted party on behalf of the consent holder.*

15. All sampling and analysis shall be undertaken in accordance with a *Sampling and Analysis Plan*, which shall be submitted to the Chief Executive for review and certification before the first sampling is undertaken. This 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 12.

    Note: The Sampling and Analysis Plan may be combined with the Monitoring Programme required by condition 13.

16. The consent holder shall provide to Taranaki Regional Council, during the month of July of every year, a summary of all data collected and a report detailing compliance with consent conditions over the previous 1 July to 30 June period. The report shall also provide and assess data which illustrates the on-going integrity and isolation of the wellbore, well performance and condition. The consent holder shall also provide an updated injection modeling report, illustrating the ability of the receiving formation to continue to accept additional waste fluids and estimating its remaining storage capacity.

17. This consent shall lapse on the 30 September 2016, 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(b) of the Resource Management Act 1991.

18. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review annually during the month of June, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 19 July 2013

For and on behalf of
Taranaki Regional Council

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Director-Resource Management

Discharge Permit

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

Name of Consent Holder:	Greymouth Petroleum Limited P O Box 3394 NEW PLYMOUTH 4341
Decision Date (Change):	2 November 2012
Commencement Date (Change):	2 November 2012 (Granted: 4 May 2012)

Conditions of Consent

Consent Granted:	To discharge produced water, well drilling fluids, well workover fluids and contaminated stormwater into the Mount Messenger Formation by deepwell injection via the Turangi-A waste disposal well at or about (NZTM) 1713843E-5681399N
Expiry Date:	1 June 2016
Review Date(s):	June 2013, June 2014, June 2015
Site Location:	Turangi-A wellsite, 126 Turangi Road, Motonui (Property owner: B & J McKenzie)
Legal Description:	Sec 21 Blk VI Waitara SD (Discharge source & site)
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. Before this consent is exercised, the consent holder shall submit an "Injection Operation Management Plan" which shall include the operational details of the injection activities and identify the conditions that would trigger concerns about the integrity of the injection well, injection zone or overlying geological formations. The plan will also detail the action(s) to be taken by the consent holder if trigger conditions are reached.

2. Before this consent is exercised the consent holder shall provide to the Chief Executive of the Taranaki Regional Council:

   (a) A final well completion log for the injection well including subsurface construction details, design of the exterior surface casing, the intermediate protective casing, and the innermost casing, tubing, and/or packer(s);
   (b) Well cementing details, cement bond log and results of annular pressure testing which demonstrates well integrity;
   (c) Details of on-going well integrity monitoring, well maintenance procedures and safe operating limits for the well;
   (d) A detailed geological log of the well;
   (e) Details and results of the Formation Integrity Testing carried out on the receiving formation and confining layers and an assessment of the results against the estimated modelled values submitted in the consent application;
   (f) Results of an electrical resistivity survey, clearly showing the confirmed depth of freshwater as defined in condition 11; and
   (g) A full chemical analysis of the receiving formation-water.

   (Note: These details can be included within the "Injection Operation Management Plan.")

3. The injection pressure at the wellhead shall not exceed 115 bar (1,685 psi). If exceeded, the injection operation shall be ceased immediately and the Chief Executive of the Taranaki Regional Council informed immediately.

4. The rate of injection shall not exceed 687 m^3/day (3 bpm).

5. The volume of fluid injected shall not exceed 687 m^3/day.

6. The injection of fluids shall be confined to the Mt. Messenger Formation, deeper than 1,350 metres Total Vertical Depth.

7. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any actual or likely adverse effect on the environment; in particular, ensuring that the injection material is contained within the injection zone.

8. Only the fluids listed below and originating from the consent holder's operations may be discharged:

   (a) Produced water;
   (b) Well drilling fluids;
   (c) Well workover fluids, including hydraulic fracturing return fluids; and
   (d) Contaminated stormwater.

9. Once the consent is exercised, the consent holder shall keep daily records of the:

   (a) Injection pressure (regular logged measurements over each injection period);
   (b) Maximum and average rate of injection; and
   (c) Volume of fluid injected.

   During the operation of the well, these records shall be provided to the Taranaki Regional Council at the end of each month.

10. For each discharge, the consent holder shall record the following information, and provide this to the Chief Executive, Taranaki Regional Council upon request:

    (a) Type of fluid;
    (b) Source of fluid (site name and location);
    (c) Subject to condition 10(d) below, an analysis of the fluid for:
        (i) pH;
        (ii) suspended solids concentration;
        (iii) temperature;
        (iv) salinity;
        (v) chloride concentration;
        (vi) total hydrocarbon concentration; and
    (d) The analysis required by condition 10(c) above is not necessary if a sample of the same type of fluid, from the same source, has been taken and analysed within the previous 6 months.

11. 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 1000 mg/l.

12. 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 11 (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 sampling sites;
    (b) well/bore construction details; and
    (c) sampling frequency.

13. 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 (^{13}C-CH_4).

    Note: *The samples required, under conditions 12 and 13, could be taken and analysed by the Council or other contracted party on behalf of the consent holder.*

14. All sampling and analysis shall be undertaken in accordance with a *Sampling and Analysis Plan*, which shall be submitted to the Chief Executive for review and certification before the first sampling is undertaken. This 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 11.

    Note: *The Sampling and Analysis Plan may be combined with the Monitoring Programme required by condition 12.*

15. The consent holder shall provide to Taranaki Regional Council, during the month of May of every year, a summary of all data collected and a report detailing compliance with consent conditions. The report shall also provide and assess data which illustrates the on-going integrity and isolation of the wellbore, well performance and condition. The consent holder shall also provide an updated injection modeling report, illustrating the ability of the receiving formation to continue to accept additional waste fluids and estimating its remaining storage capacity.

16. The consent holder shall notify the Chief Executive, Taranaki Regional Council, in writing at least 5 days prior to the first exercise of this consent. Notification shall include the consent number and a brief description of the activity consented and be emailed to worknotification@trc.govt.nz.

17. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June each year, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 2 November 2012

For and on behalf of
Taranaki Regional Council

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Director-Resource Management

Discharge Permit

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

Name of Consent Holder:	Greymouth Petroleum Turangi Limited PO Box 3394 Fitzroy New Plymouth 4341
Decision Date:	2 June 2016
Commencement Date:	2 June 2016

Conditions of Consent

Consent Granted:	To discharge produced water, well drilling fluids, well workover fluids and contaminated stormwater into the Mount Messenger Formation by deepwell injection
Expiry Date:	1 June 2036
Review Date(s):	June annually
Site Location:	Turangi-A wellsite, 160 Turangi Road Upper, Motunui (Property owner: BA & JM McKenzie)
Grid Reference (NZTM)	1713836E-5681373N
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. This consent only authorises discharges via deepwell injection into:

   (a) the well known as Turangi-5 located at the Turangi-A wellsite; or
   (b) another well located on the Turangi-A wellsite.

2. The discharge shall be undertaken in accordance with an "Injection Operation Management Plan" prepared by the consent holder and approved by the Chief Executive, Taranaki Regional Council, acting in a certification capacity. The plan shall include, as a minimum, details of:

   (a) the operational details of the injection activities;
   (b) identification of the conditions that would trigger concerns about the integrity of the injection well, the receiving formation or overlying geological seals; and
   (c) the action(s) to be taken by the consent holder if trigger conditions are reached.

3. Before discharging to any well, the consent holder shall provide to the Chief Executive, Taranaki Regional Council:

   (a) a geological assessment of the environment in which the well is located, including the injection zone, the geological seals confining the injection zone and any associated faulting;
   (b) details of the well design and its structural integrity;
   (c) an assessment of the suitability of the well for the proposed activity;
   (d) details of how the integrity of the well will be monitored and maintained;
   (e) confirmation of the depth to which fresh water resources, as defined in condition 9, are encountered below the site; and
   (f) a chemical assessment of the receiving formation water which confirms its Total Dissolved Solids (TDS) concentration, and also demonstrates that the mixing of formation and injection fluids will not result in any adverse effects on the receiving formation or the injection well.

   (Note: The information required by condition 3 may be included within the "Injection Operation Management Plan" required by condition 2).

4. There shall be no injection of any fluids after 1 June 2031.

5. The consent holder shall at all times adopt the best practicable option, as defined in Section 2 of the Resource Management Act 1991, to prevent or minimise any actual or likely adverse effect on the environment.

6. The injection of fluids shall be confined to the Mount Messenger Formation, and be injected below a minimum depth of 1,200 metres true vertical depth below ground level.

7. The injection pressure at the wellhead shall not exceed 1610 psi (111 bar). If exceeded, the injection operation shall cease immediately and the Chief Executive, Taranaki Regional Council informed immediately.

8. The consent holder shall ensure that the discharge authorised by this consent does not result in the fracturing of the geological seals confining the injection zone.

9. 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). Useable fresh groundwater is defined as any groundwater having a TDS concentration of less than 1,000 mg/L.

10. Only the following types of fluid may be discharged:

    (a) produced water;
    (b) well workover fluids;
    (c) well drilling fluids; and
    (d) contaminated stormwater.

11. From the date of the first discharge the consent holder shall keep a record of the:

    (a) hours of injection each day;
    (b) volume of fluid discharged each day; and
    (c) maximum and average injection pressure each day.

12. For each waste stream arriving on site for discharge, the consent holder shall characterise the fluids by recording the following information:

    (a) type of fluid (as listed in condition 10);
    (b) source of fluid (site name and company);
    (c) an analysis of a representative sample of the fluid for:
        (i) pH;
        (ii) conductivity;
        (iii) suspended solids concentration;
        (iv) temperature;
        (v) salinity;
        (vi) chloride concentration; and
        (vii) total hydrocarbon concentration.

    The analysis required by condition 12(c) above is not necessary if a sample of the same type of fluid, from the same source, has been taken, analysed and provided to the Chief Executive, Taranaki Regional Council within the previous 6 months.

13. If the analyses required by the condition 12(c) above is not carried out in an International Accreditation New Zealand accredited laboratory, it shall be undertaken in accordance with a "Quality Assurance (QA) Plan" that has been certified by the Chief Executive, Taranaki Regional Council, as meeting the requirements of conditions. The Council may also, at its discretion, carry out an audit of the consent holder's sampling and analysis regime to assess adherence to the QA plan.

14. The information required by conditions 11 and 12 above, for each calendar month, shall be provided to the Chief Executive, Taranaki Regional Council before the 28th day of the following month.

15. 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 within an Area of Review (AoR) to assess compliance with condition 9 (the 'Monitoring Programme'). The Monitoring Programme shall be designed to characterise local groundwater quality, and be submitted to the Chief Executive, Taranaki Regional Council, for certification before the exercising of this consent, and shall include:

    (a) the location of sampling sites;
    (b) well/bore construction details; and
    (c) sampling frequency.

    The AoR shall extend 1,000 metres from the point of injection. It is a requirement that at least one suitable monitoring bore be located within 500 metres of the well head. If no suitable existing bores are available, it will be necessary for the Monitoring Programme to include installation of, and sampling from, a suitable bore. The bore would be of a depth, location and design determined after consultation with the Chief Executive, Taranaki Regional Council and installed in accordance with NZS 4411:2001. The bore shall be completed no later than 6 months after granting this consent.

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

    (a) pH;
    (b) conductivity;
    (c) chloride; and
    (d) total petroleum hydrocarbons.

    Note: The samples required, under conditions 15 and 16, could be taken and analysed by the Taranaki Regional Council or other contracted party on behalf of the consent holder.

17. All groundwater 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. This Plan shall specify the use of standard protocols recognised to constitute good professional practice including quality control and assurance. An IANZ accredited laboratory shall be used for all sample analysis. Results shall be provided to the Chief Executive, Taranaki Regional Council within 30 days of sampling and shall include supporting quality control and assurance information.

    Note: The Sampling and Analysis Plan may be combined with the Monitoring Programme required by condition 15.

18. The consent holder shall provide to the Chief Executive, Taranaki Regional Council, before 31 August each year, a summary of all data collected and a report detailing compliance with consent conditions over the previous 1 July to 30 June period. Based on the data provided, the report shall also provide:

    a) an assessment of injection well performance;
    b) an assessment of the on-going integrity and isolation of the wellbore;
    c) an assessment of the on-going integrity and isolation of the receiving formation; and
    d) an updated injection modeling report, demonstrating the ability of the receiving formation to continue to accept additional waste fluids and an estimation of remaining storage capacity.

19. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June each year, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 2 June 2016

For and on behalf of
Taranaki Regional Council

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Director - Resource Management

Discharge Permit

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

Name of Consent Holder:	Greymouth Petroleum Limited P O Box 3394 NEW PLYMOUTH 4341
Decision Date:	4 February 2013
Commencement Date:	4 February 2013

Conditions of Consent

Consent Granted:	To discharge produced water, well drilling fluids, well workover fluids into the Mount Messenger Formation by deepwell injection via the Kaimiro-G wellsite at or about (NZTM) 1699622E-5663210N
Expiry Date:	1 June 2032
Review Date(s):	June annually
Site Location:	Kaimiro-G wellsite, 1240 Upland Road, Kaimiro (Property owner: NJ & LS Seconi)
Legal Description:	Sec 138 Tarurutangi Dist (Discharge source & site)
Catchment:	Waiongana
Tributary:	Mangaoraka

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. Before this consent is exercised, the consent holder shall submit an "Injection Operation Management Plan" which shall include the operational details of the injection activities and identify the conditions that would trigger concerns about the integrity of the injection well, injection zone or overlying geological formations. The plan will also detail the action(s) to be taken by the consent holder if trigger conditions are reached.

2. Before this consent is exercised the consent holder shall provide to the Chief Executive of the Taranaki Regional Council:

   (a) a final well completion log for the injection well including subsurface construction details, design of the exterior surface casing, the intermediate protective casing, and the innermost casing, tubing, and/or packer(s);
   (b) well cementing details, cement bond log and results of annular pressure testing which demonstrates well integrity;
   (c) details of on-going well integrity monitoring, well maintenance procedures and safe operating limits for the well;
   (d) a detailed geological log of the well;
   (e) details and results of the Formation Integrity Testing carried out on the receiving formation and confining layers and an assessment of the results against the estimated modelled values submitted in the consent application 7032;
   (f) results of an electrical resistivity survey, clearly showing the confirmed depth of freshwater as defined in condition 11; and
   (g) a full chemical analysis of the receiving formation-water.

   (Note: These details can be included within the "Injection Operation Management Plan.")

3. The injection pressure at the wellhead shall not exceed 1,077 psi (73 bars). If exceeded, the injection operation shall be ceased immediately and the Chief Executive of the Taranaki Regional Council informed immediately.

4. The rate of injection shall not exceed 8.6 cubic metres per hour (0.9 bpm)

5. The volume of fluid injected shall not exceed 206 cubic metres per day (1,296 bpd).

6. The injection of fluids shall be confined to the Mt. Messenger Formation, deeper than -995 metres True Vertical Depth Sub-sea.

7. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any actual or likely adverse effect on the environment; in particular, ensuring that the injection material is contained within the injection zone.

8. Only the fluids listed below and originating from the consent holder's operations may be discharged:

   (a) produced water;
   (b) well drilling fluids;
   (c) well workover fluids, including hydraulic fracturing return fluids; and
   (d) contaminated stormwater.

9. Once the consent is exercised, the consent holder shall keep daily records of the:

   (a) total injection hours;
   (b) volume of fluid injected;
   (c) maximum and average rate of injection; and
   (d) maximum and average injection pressure.

10. For each waste stream arriving on site for discharge, the consent holder shall record the following information:

    (a) type of fluid;
    (b) source of fluid (site name and location);
    (c) an analysis of the fluid for:
        (i) pH;
        (ii) suspended solids concentration;
        (iii) temperature;
        (iv) salinity;
        (v) chloride concentration; and
        (vi) total hydrocarbon concentration.

    The analysis required by condition 10(c) above is not necessary if a sample of the same type of fluid, from the same source, has been taken, analysed and provided to the Chief Executive, Taranaki Regional Council within the previous 6 months.

11. The information required by conditions 9 and 10 above, for each calendar month, shall be provided to the Chief Executive, Taranaki Regional Council before the 15th day of the following month.

12. 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 1000 mg/l.

13. 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 12 (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 sampling sites;
    (b) well/bore construction details; and
    (c) sampling frequency.

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

    (a) pH;
    (b) conductivity;
    (c) chloride; and
    (d) total petroleum hydrocarbons.

    Note: The samples required, under conditions 13 and 14, could be taken and analysed by the Council or other contracted party on behalf of the consent holder.

15. All sampling and analysis shall be undertaken in accordance with a *Sampling and Analysis Plan*, which shall be submitted to the Chief Executive for review and certification before the first sampling is undertaken. This 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 12.

    Note: The Sampling and Analysis Plan may be combined with the Monitoring Programme required by condition 13.

16. The consent holder shall provide to Taranaki Regional Council, during the month of July of every year, a summary of all data collected and a report detailing compliance with consent conditions over the previous 1 July to 30 June period. The report shall also provide and assess data which illustrates the on-going integrity and isolation of the wellbore, well performance and condition. The consent holder shall also provide an updated injection modeling report, illustrating the ability of the receiving formation to continue to accept additional waste fluids and estimating its remaining storage capacity.

17. The consent holder shall notify the Chief Executive, Taranaki Regional Council, in writing at least 5 days prior to the first exercise of this consent. Notification shall include the consent number and a brief description of the activity consented and be emailed to worknotification@trc.govt.nz.

18. There shall be no fluids discharged under this consent after 1 June 2027.

19. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June each year, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 4 February 2013

For and on behalf of
Taranaki Regional Council

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Director-Resource Management