Todd Energy Limited
Deep Well Injection
Monitoring Programme
Annual Report
2017-2018

Technical Report 2018-57

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Executive summary

Todd Energy Limited (the Company) operate a number of wellsites across the Taranaki region, including the Tuhua, Pouri, Mangahewa and McKee wellsites, located east of New Plymouth in North Taranaki and the Kapuni wellsites located west of Stratford, in South Taranaki. Each wellsite contains varying numbers of producing wells and associated production infrastructure. This report for the period July 2017 to June 2018 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 and consent compliance performance during the period under review and the environmental effects of their DWI activities.

The Company holds six resource consents for DWI activities, which include a total of 110 conditions setting out the requirements that the Company must satisfy. Four of the six consents were exercised during the period being reported.

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 annual site inspections, four injectate samples and twenty groundwater 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 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 good level of administrative performance with the resource consents.

For reference, in the 2017-2018 year, consent holders were found to achieve a high level of environmental performance and compliance for 76% of the consents monitored through the Taranaki tailored monitoring programmes, while for another 20% of the consents, a good level of environmental performance and compliance was achieved.

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 high level.

This report includes recommendations to be implemented during the 2018–2019 monitoring period.

Table of contents

Appendix II Groundwater Sampling Reports

List of tables

List of figures

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 2017 to June 2018 by the Taranaki Regional Council (the Council) on the monitoring programme associated with resource consents held by Todd Energy Limited (the Company) for deep well injection (DWI) activities. During the period under review, the Company held six resource consents for the subsurface injection of fluids by DWI. The consents authorise discharges from seven separate wellsites within the Company's McKee and Mangahewa oil and gas fields, located east of New Plymouth, in North Taranaki, and Kapuni oil and gas field, transferred to the Company by Shell Todd Oil Services Limited (STOS) on 1 August 2017, located south of Stratford, in South Taranaki.

The resource consents held by the Company permit the discharge of a range of fluids by DWI, including produced water, contaminated stormwater, well drilling fluids, hydraulic fracturing (HF) fluids, production sludges and any other fluids approved by the Council in writing. 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 seventh 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 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 2018-2019 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 *Resource Management Act 1991* (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 Company, this report also assigns them a rating for their 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 2017-2018 year, consent holders were found to achieve a high level of environmental performance and compliance for 76% of the consents monitored through the Taranaki tailored monitoring programmes, while for another 20% of the consents, a good level of environmental performance and compliance was achieved.

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 than produced water. The range of fluid types authorised for injection varies by consent, but includes contaminated stormwater, production sludges, well workover fluids, well drilling fluids, HF fluids and HF return fluids.

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.

Water flooding is the primary purpose of a number of the injection wells that inject into the Mangahewa and McKee reservoirs.

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 region can be found in previous compliance reports published by the Council (see Bibliography).

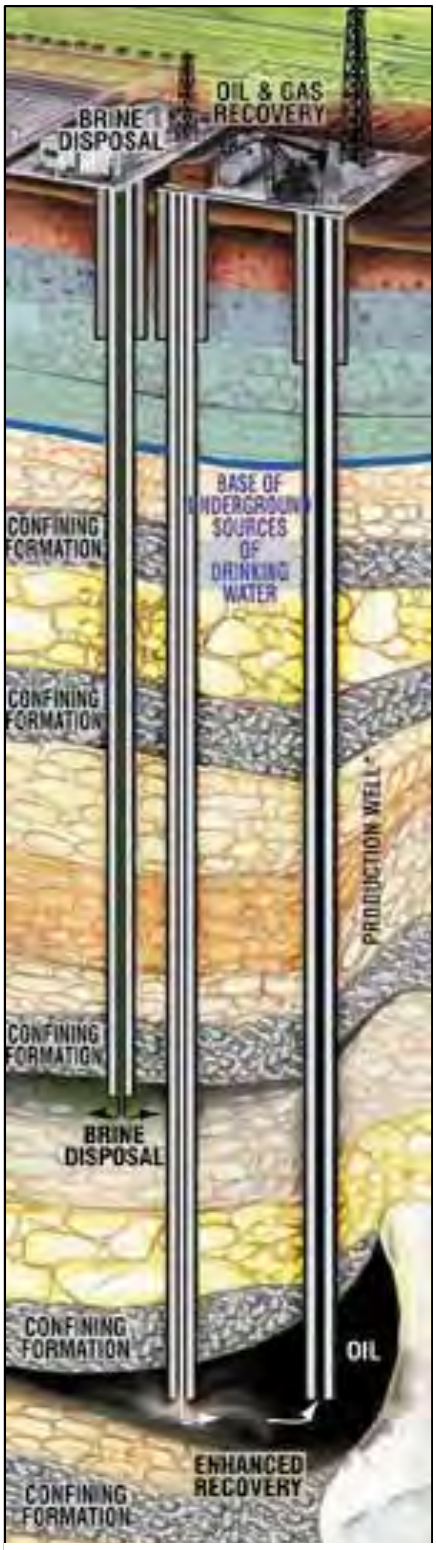

Figure 1 DWI schematic (www.epa.gov/uic)

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 six discharge consents covering their DWI activities during the review period of which four were exercised (Table 1).

Table 1 Consents held by the Company during the Review period

Consent number	Wellsite	Status	Injection well(s)	TRC bore id.	Formation	Issued	Expiry
1315-1	Tuhua-B	Active	McKee Disposal-1	GND1749	Mount Messenger	08/08/1984	01/06/2023
4182-2	McKee-A	Active	McKee-1	GND0443	McKee	24/06/2003	01/06/2033
5037-2.2	Pouri-A	Active	Pouri-1A	GND1508	McKee	20/11/2003	01/06/2033
5052-2	McKee-B	Not exercised	McKee-4	GND1455	Mount Messenger	27/05/2014	01/06/2033
9970-1.1	KA9	Active	KW2 KA16	GND1412 GND2669	Matemateaonga	07/10/2014	01/06/2029
	KA1,7,19,20		KA1 KA7	GND1683 GND1684	Mangahewa		
10661-1	Tuhua-D	Not exercised	Tuhua-4	GND2828	Mckee	13/06/2018	01/06/2033

Consent **1315-1** was issued by the Council on 8 August 1984 and was transferred to the Company by the previous holder on 31 May 2006. A variation to the consent was granted on 1 October 2013 which included the changing of the purpose of the consent and adding thirteen conditions to take the total number of conditions to seventeen. It is due to expire on 1 June 2023. The consent authorises the discharge of fluid waste generated by oil and gas exploration and production activities to the Mount Messenger Formation by deep well injection at the Tuhua-B wellsite.

The current consent has 17 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 requires the discharge to cease 5 years prior to consent expiry date to allow for on-going environmental monitoring after the discharge has ceased;
- condition 4 refers to the best practicable option requirements;
- condition 5 requires injected fluids to be contained within the Mount Messenger Formation, deeper than 1,200 m BGL;
- condition 6 prohibits the fracturing of the geological seals confining the injection zone;
- condition 7 prohibits the discharge from endangering or contaminating any freshwater aquifer;
- condition 8 limits the range of fluids that may be injected;
- conditions 9, 10, 11 & 12 refer to process monitoring and data submission requirements;
- condition 13, 14 & 15 relate to the requirement for the consent holder to implement a groundwater monitoring programme;
- condition 16 is an annual reporting requirement; and
- condition 17 is a review provision.

Consent **4182-2** was issued by the Council on 24 June 2003 under Section 87(e) of the RMA. It is due to expire on 1 June 2033. The consent authorises the discharge of fluid waste generated by oil and gas exploration and production activities into the McKee Formation by deep well injection at the McKee-A wellsite.

The current consent has seventeen 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 requires the discharge to cease 5 years prior to consent expiry date to allow for on-going environmental monitoring after the discharge has ceased;
- condition 4 refers to the BPO requirements;
- condition 5 requires injected fluids to be contained within the McKee Formation, deeper than 2,300 m BGL;
- condition 6 prohibits the fracturing of the geological seals confining the injection zone;
- condition 7 prohibits the discharge from endangering or contaminating any freshwater aquifer;
- condition 8 limits the range of fluids that may be injected;
- condition 9, 10,11 & 12 refer to process monitoring and data submission requirements;
- condition 13, 14 & 15 relate to the requirement for the consent holder to implement a groundwater monitoring programme;
- condition 16 is an annual reporting requirement; and
- condition 17 is a review provision.

Consent **5037-2.2** was issued by the Council on 20 November 2003 under Section 87(e) of the RMA. It is due to expire on 1 June 2033. The consent authorises the discharge of waste drilling fluids, water, produced water and stormwater from hydrocarbon exploration and production operations by deep well injection at the Pouri-A wellsite.

The current consent has 19 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 requires the discharge to cease 5 years prior to consent expiry date to allow for on-going environmental monitoring after the discharge has ceased;
- condition 4 refers to the best practicable option requirements;
- condition 5 requires injected fluids to be contained within the Mckee Formation, deeper than 2,149 m TVD;
- condition 6 limits the injection pressure at the wellhead to below 4000 psi (276 bar);
- condition 7 prohibits the fracturing of the geological seals confining the injection zone;
- condition 8 prohibits the discharge from endangering or contaminating any freshwater aquifer;
- condition 9 and 10 limits the range of fluids that may be injected;
- conditions 11, 12, 13 & 14 refer to process monitoring and data submission requirements;
- condition 15, 16 & 17 relate to the requirement for the consent holder to implement a groundwater monitoring programme;
- condition 18 is an annual reporting requirement; and
- condition 19 is a review provision.

Consent **5052-2** was issued by the Council on 27 May 2014 under Section 87(e) of the RMA. It is due to expire on 1 June 2033. The consent authorises the discharge of fluid waste generated by oil and gas

exploration and production activities to the Mount Messenger Formation by deep well injection at the Mckee-B wellsite. The consent has not yet been exercised.

The consent has 18 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 requires that no fluids be injected after 1 June 2028;
- condition 4 refers to the BPO requirements;
- condition 5 requires the injected fluids to be confined to the Mount Messenger Formation, and to be injected at a minimum depth of 945 m BGL;
- condition 6 prohibits the fracturing of the geological seals confining the injection zone;
- condition 7 prohibits the discharge from endangering or contaminating any freshwater aquifer;
- condition 8 limits the range of fluids that may be injected;
- conditions 9, 10, 11 and 12 refer to process monitoring and data submission requirements;
- condition 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; and
- condition 18 is a review provision.

Consent **9970-1.1** was granted to STOS on 7 October 2014 and transferred to the Company in August 2017. The consent authorises the discharge of waste fluids, associated with hydrocarbon exploration and production by deep well injection, into the Matemateaonga Formation via the KW2 and KA16 wells, or into the Mangahewa Formation via wells KA1 and/or KA7 as a contingency.

The current consent has 21 conditions, as summarised below:

- condition 1 requires the rate of discharge not exceed 2,000 m^3 per day;
- condition 2 required to consent holder to submit an "Injection Operation Management Plan" prior to exercising the consent;
- condition 3 requires the consent holder to submit well completion information following drilling;
- condition 4 requires the discharge to cease 5 years prior to consent expiry date to allow for on-going environmental monitoring after the discharge has ceased;
- condition 5 refers to the best practicable option requirements;
- condition 6 requires injection to be below 1,200 m BGL;
- condition 7 requires to consent holder to submit an "Injection Operation Management Plan" prior to utilising either contingency well;
- condition 8 prohibits the fracturing of the geological seals confining the injection zone;
- condition 9 prohibits the discharge from endangering or contaminating any freshwater aquifer;
- condition 10 and 11 limits the range of fluids that may be injected;
- conditions 12, 13, 14 & 15 refer to process monitoring and data submission requirements;
- condition 16, 17 & 18 relate to the requirement for the consent holder to implement a groundwater monitoring programme;
- condition 19 is an annual reporting requirement;
- condition 20 is a lapse condition; and

- condition 21 is a review provision.

Consent **10661-1** was issued to the Company on 13 June 2018. The consent authorises the discharge of produced water, well drilling fluids, well work over fluids and hydraulic fracturing fluids from hydrocarbon exploration and production operations into the McKee Formation by deep well injection at the Tuhua-D wellsite.

The current consent has 17 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 requires that no fluids be injected after 1 June 2028;
- condition 4 refers to the BPO requirements;
- condition 5 requires the injected fluids to be confined to the Mount Messenger Formation, and to be injected at a minimum depth of 2,319 m BGL;
- condition 6 prohibits the fracturing of the geological seals confining the injection zone;
- condition 7 prohibits the discharge from endangering or contaminating any freshwater aquifer;
- condition 8 limits the range of fluids that may be injected;
- conditions 9, 10, 11 and 12 refer to process monitoring and data submission requirements;
- condition 13, 14 & 15 relate to the requirement for the consent holder to implement a groundwater monitoring programme;
- condition 16 is an annual reporting requirement; and
- condition 18 is a review provision. M n

This summary of consent conditions may not reflect the full requirements of each condition. The consent conditions for the Company's DWI consents in full can be found in the resource consents which are appended to this report (Appendix I).

Figure 2 shows the location of the DWI consents held by the Company during the period under review.

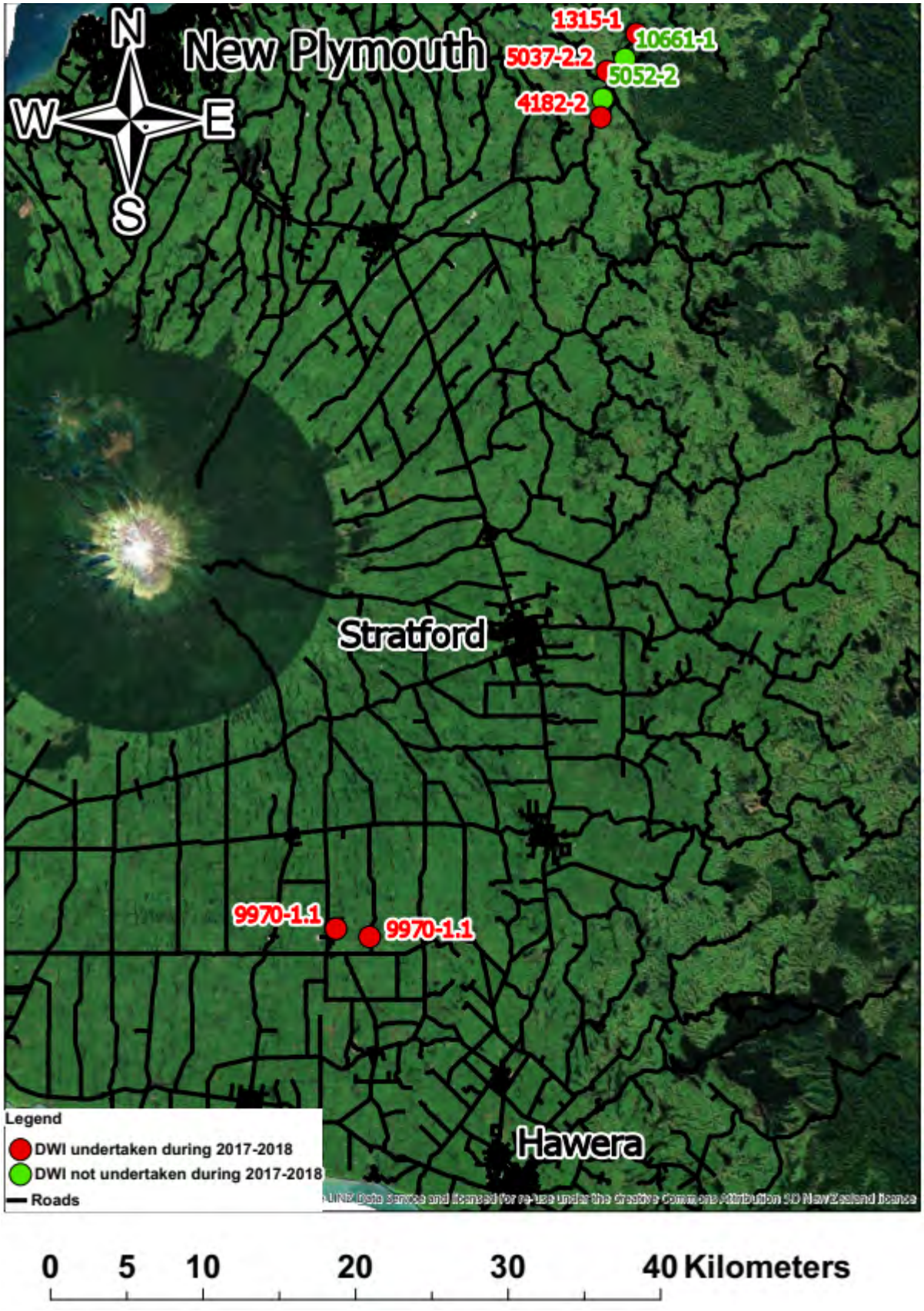

Figure 2 Location of the DWI consents held by the Company during the period under review.

1.4 Monitoring programme

1.4.1 Introduction

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

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

The monitoring programme for the Company's 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 consent reviews, renewals or new consent applications;
- advice on the Council's environmental management strategies and content of regional plans; and
- consultation on associated matters.

1.4.3 Site inspections

The Company's wellsites were visited once during the monitoring period and inspected for any signs of environmental impact. With regard to consents for DWI activities, the main points of interest are general housekeeping and any processes with potential or actual discharges, including any surface water runoff, and their receiving environments.

An additional two visits to the Company's Mckee Production Station and Kapuni Production Station were undertaken by Council Officer's for sampling purposes, as outlined in Section 1.4.4.

1.4.4 Injectate sampling

Injectate samples were obtained for analysis in the Council's IANZ accredited laboratory on two occasions during the monitoring period. 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.

Injectate samples were collected from the bulk storage tank at the Mckee Production Station identified on-site as tank T-100 and the bulk storage tank (T604) at the Kapuni Production Station (Figure 3). The injectate samples were analysed for the following parameters:

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

1.4.5 Groundwater sampling

Groundwater samples were obtained on two occasions in the vicinity of the active wellsites during the monitoring period. This sampling is a continuation of the groundwater monitoring component of this programme which was initiated during the 2013-2014 monitoring period.

Four monitoring sites were sampled during the review period, including two dedicated monitoring bores which were installed by the Company under the conditions of consents 4182-2 and 5037-2.2. One in the vicinity of the Mckee-A wellsite (GND2455) and the second in the vicinity of the Pouri-A wellsite (GND3005).

A programme of monitoring was also undertaken on behalf of the Company by BTW Company Limited (BTW) at five sites (GND1701, GND2369, GND1659, GND2357 and GND0093) in the vicinity of the Kapuni wellsites. A quality assurance/control sample was also collected by the Council at GND1659 on 7 May 2018 as sampling is undertaken on behalf of the Company by a third party.

A review of the ongoing suitability of the monitoring programme was undertaken during the monitoring period. As a result of this review, GND1143 being removed from the programme due to on-going access issues. GND0093, located on the KA1/7/19/20 wellsite, was also added to the programme following the commencement of injection via the KA1 contingency well in December 2017.

GND2748 was not sampled during the monitoring period as the consent held for DWI at the McKee-B wellsite (5052-2) has not yet been exercised.

Details of the groundwater monitoring sites are listed below in Table 2. The location of the groundwater sites in relation to the injection well being monitored is illustrated in Figure 3 and Figure 4.

Table 2 Groundwater monitoring sites

Site code	Wellsite	Type	Distance from wellsite (m)	Interval (m BMP)	Depth (m BMP)	Aquifer	Sample method
GND2453	Tuhua-B	Spring	169	-	N/A	Volcanics	Grab
GND2454	Tuhua-B	Spring	161	-	N/A	Volcanics	Grab
GND2455	McKee-A	Bore	38	28.5-35.5	35.5	Volcanics	Peri-pump
GND3005	Pouri-A	Bore	<50	30.6-33.6	33.6	Marine Terraces	Peri-pump
GND2748	McKee-B	Bore	<50	18-30	30	Volcanics	Bladder
GND1143	KA9	Bore	948	50-65	65	Volcanics	Tap
GND1701	KA9	Bore	2,971	92	337	Matemateaonga	Tap
GND2369	KA9	Bore	4,643	280-448	448	Matemateaonga	Tap
GND1659	KA9	Bore	4,020	123-432	432	Matemateaonga	Tap
GND2357	KA9	Bore	<50	35*	unknown	Volcanics	Low flow/purge
GND0093	KA1/7/19/20	Bore	<10	unknown	42.6	Volcanics	Bladder

** The pump was pushed down to 35 m during remediation of the bore however the total depth of bore is unknown*

Groundwater samples taken by the Council were sent on behalf of the Company to Hill Laboratories Limited (Hills) and analysed for a range of parameters including the following which are required under the conditions of each consent:

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

The parameters above are deemed sufficient to enable identification of any significant changes in groundwater quality related to DWI activities.

In addition, baseline samples have been collected from all monitored sites and analysed by Hills for general ion chemistry, BTEX and dissolved gas concentrations. These more detailed analyses will allow a more in depth assessment of variations in groundwater composition should the need arise in the future.

Groundwater samples taken by BTW were also sent to Hills for analysis on behalf of the Company and results were provided to the Council. These are appended to this report as Appendix II.

1.4.6 Assessment of data submitted by the Company

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 DWI consent.

As required by the conditions of their consent, 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, and average and maximum injection 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.

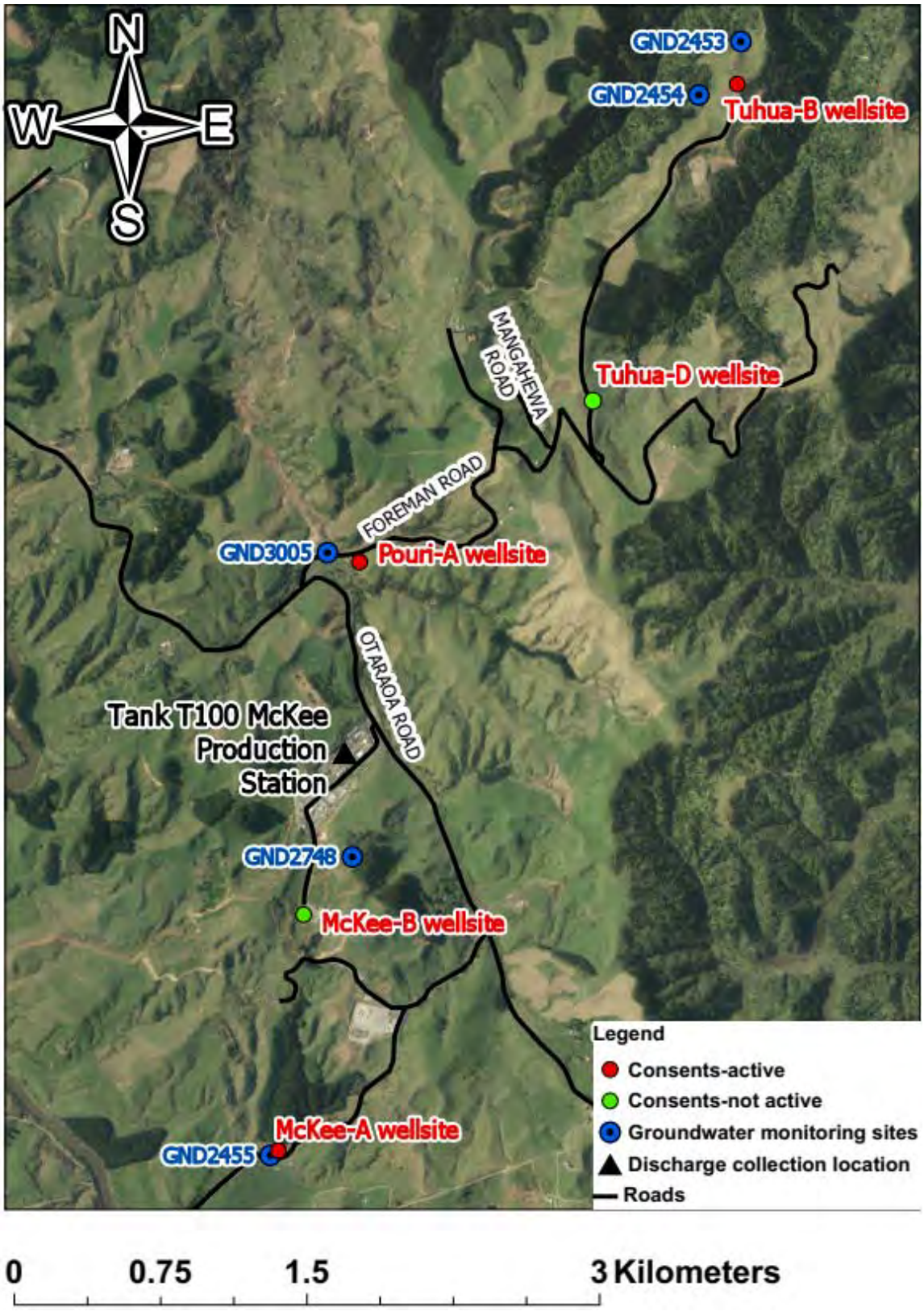

Figure 3 Location of monitoring sites in relation to the Company's DWI wellsites in North Taranaki

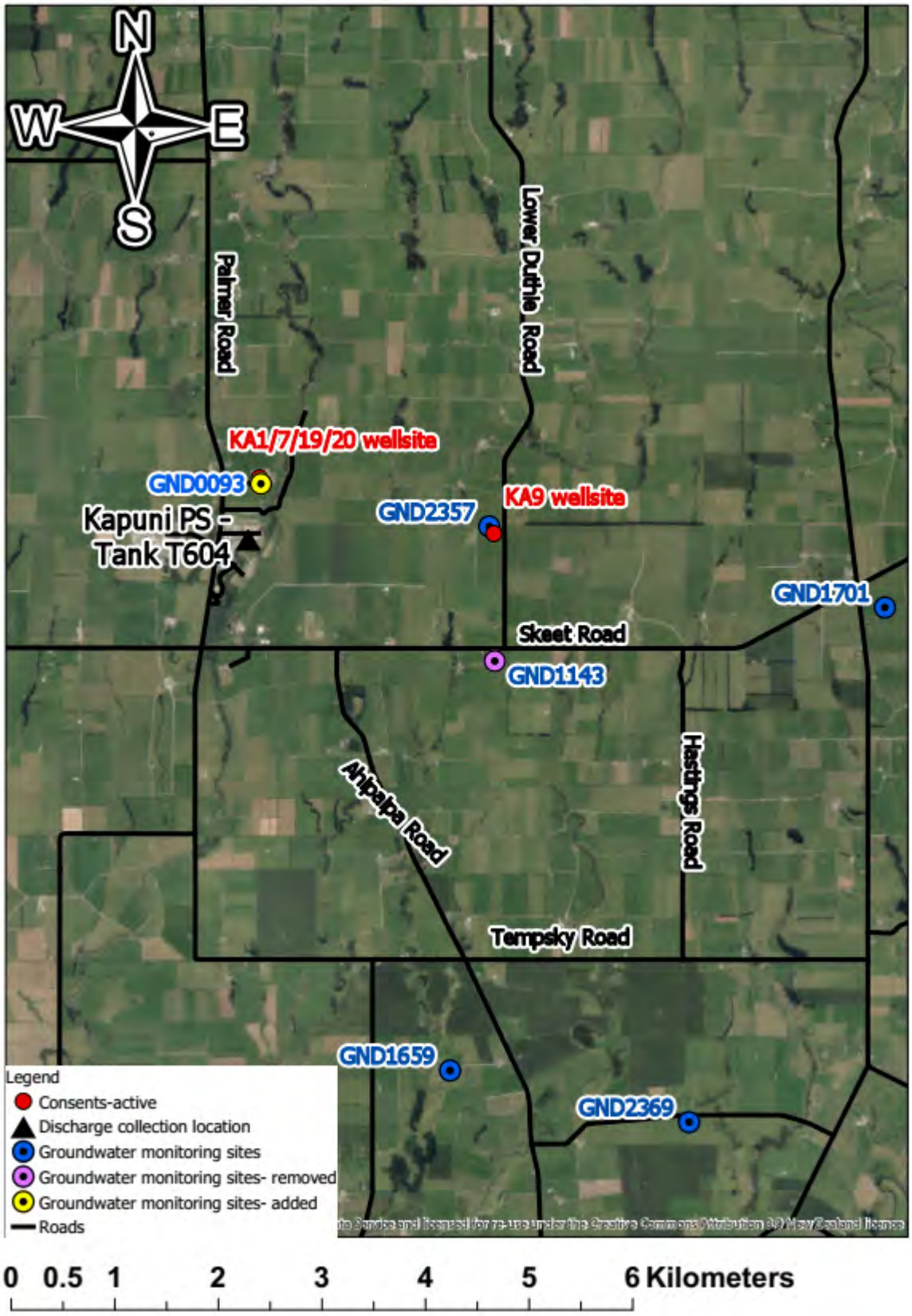

Figure 4 Location of monitoring sites in relation to the Company's DWI wellsites in South Taranaki

2 Results

2.1 Inspections

During the period under review, the Company's wellsites were all inspected once and a further six inspections were carried out at the Mckee and Kapuni Production Stations. Routine inspections included undertaking a general visual assessment of the operational equipment, storage facilities and associated equipment. The inspecting officer concluded that the wellsites were in good condition and being well managed. There were no issues noted specific to any of the Company's DWI consents.

The bulk storage facilities were also visited by a Council officer on two occasions during the monitoring year for the purpose of injectate sampling. This involved accessing the Company's bulk liquid storage tanks at the Mckee and Kapuni Production Stations. No issues were noted by staff during these visits.

2.2 Injectate monitoring

Samples of injectate were obtained from the Company's Mckee Production Station on 17 October 2017 and 26 April 2018 and at the Kapuni Production Station on 13 November 2017 and 2 May 2018. All fluids for disposal are handled and controlled through the production stations. The samples were submitted to the Council's laboratory on the same day for physicochemical analysis.

The results of the sample analyses undertaken by the Council are included in Table 3. The range of results for each analyte since 2004 are also presented for comparison. The Company also undertakes analysis of injectate. The results provided to the Council for the 2017-2018 monitoring year are presented in Table 4.

The concentrations of each analyte measured over the 2017-2018 period are within the expected range for injectate samples at these sites.

2.3 Groundwater sampling

The results of analyses carried out during the period are set out below in Table 5, Table 6, Table 7 and Table 8. Historical data has also been provided for comparison if available.

The results show there have been no significant changes in groundwater composition at any of the sites since monitoring commenced, demonstrated by the relatively narrow ranges between minimum and maximum analyte concentrations. The variations in analyte concentrations at each site are a result of natural seasonal fluctuation and sampling variability. The sample collected from GND2369 on 26 July 2018 recorded a sizable decrease in electrical conductivity and pH, indicating that the bore may not have been adequately purged prior to sampling or that the bore may now be receiving recharge from a shallower water source.

Table 3 Results of injectate sampling undertaken by the Council (2017-2018)

Parameter	Unit	McKee Production Station (Sample Point T100)				Kapuni Production Station (Sample Point T604)			
Date		July 2003 to June 2018		17-Oct-17	26-Apr-18	July 2003 to June 2018		13 Nov 2017	02 May 2018
Time	NZST	Minimum	Maximum	8:30	9:15	Minimum	Maximum	13:00	11:15
TRC sample number	-	-	-	TRC173633	TRC182063	-	-	TRC174032	TRC182061
pH	pH Units	7.0	9.0	8.3	7.0	6.7	9.0	9.0	8.0
Electrical conductivity	mS/m	188	3,590	3,000	2,870	1,400	3,540	2,950	3,030
Chloride	g/m^3	5,000	14,600	10,600	10,200	6,070	12,000	7,160	7,410
Total petroleum hydrocarbons	g/m^3	0.8	480	270	69	29	1,300	Not analysed*	29

*Note * The laboratory was unable to analyse the sample for hydrocarbons as the sample was to oily for standard analysis methods*

Table 4 Results of the Company's injectate sampling (2017-2018)

Parameter	Unit	McKee Production Station (Sample Point T100)			Kapuni Production Station (Sample Point T604)		
Date		July 2017 to June 2018			July 2017 to June 2018		
Time	NZST	Minimum	Maximum	Mean	Minimum	Maximum	Mean
pH	pH Units	7.0	7.4	7.3	6.8	7.5	7.2
Conductivity @ 20°C	mS/m	3,210	3,530	3,430	32	357	80
Suspended Solids	g/m^3	16	220	99	3	506	95
Salinity	TDS g/m^3	22,000	25,000	23,750	19,850	24,500	21,464
Chloride	g/m^3	10,700	11,700	11,180	6,508	25,900	14,124
Total petroleum* hydrocarbons	g/m^3	134	134	134	89	6,392	1,956

**Mckee T100 narrow range is a result of only one samplemn being analysed for total hydrocarbons to date*

Table 5 Results of groundwater sampling undertaken by the Council in relation to the Tuhua-B wellsite

Sample details	Units	GND2453			
TRC sample number	-	Minimum	Maximum	TRC173629	TRC182067
Sample date	-	July 2014-to June 2018		17-Oct-17	26-Apr-18
Sample time	NZST	-	-	12:25	12:35
pH	pH	6.2	7.1	7.1	6.2
Electrical conductivity	mS/m@20°C	10.7	18.9	18.4	12.2
Chloride	g/m^3	18.9	44.6	21.5	20.4
Total hydrocarbons	g/m^3	<0.5	<0.5	<0.5	<0.5
Sample details	**Units**	**GND2454**			
TRC sample number	-	Minimum	Maximum	TRC173628	TRC182068
Sample date	-	July 2014-to June 2018		17-Oct-17	26-Apr-18
Sample time	NZST	-	-	12:40	13:10
pH	pH	6.3	7.5	6.4	6.3
Electrical conductivity	mS/m@20°C	6.4	9.4	7.7	8.9
Chloride	g/m^3	8.4	11.7	9.3	10.2
Total hydrocarbons	g/m^3	<0.5	<0.5	<0.5	<0.5

Table 6 Results of groundwater sampling undertaken by the Council in relation to the McKee-A wellsite

Sample details	Units	GND2455			
TRC sample number	-	Minimum	Maximum	TRC173631	TRC182069
Sample date	-	July 2014-to June 2018		17-Oct-17	03-May-18
Sample time	NZST	-	-	11:30	11:50
pH	pH	7.3	9.7	7.6	7.8
Electrical conductivity	mS/m@20°C	32.3	39.8	38.7	39.0
Chloride	g/m^3	12.9	15.2	13.2	12.9
Total hydrocarbons	g/m^3	<0.5	<0.5	<0.5	<0.5

Table 7 Results of groundwater sampling undertaken by the Council in relation to the Pouri-A wellsite

Sample details	Units	GND3005			
TRC sample number	-	Minimum	Maximum	TRC173630	TRC182071
Sample date	-	July 2014-to June 2018		17-Oct-17	26-Apr-18
Sample time	NZST	-	-	13:35	10:55
pH	pH	8.0	8.1	8.1	8.1
Electrical conductivity	mS/m@20°C	22.7	25.7	22.7	22.8
Chloride	g/m^3	9.5	11.1	9.5	10.2
Total hydrocarbons	g/m^3	<0.7	<0.5	<0.5	<0.5

Table 8 Results of groundwater sampling undertaken by BTW in relation to the Kapuni wellsites

Sample details	Units	GND1701				GND2357			
TRC sample number	-	Minimum	Maximum	17214.2	2022638.1	Minimum	Maximum	17214.2	2022638.6
Sample date	-	July 2012 to June 2018		20-Oct-17	26-Jul-18	July 2014 to June 2018		20-Oct-17	26-Jul-18
Sample time	NZST	-	-	10:30	10:30	-	-	13:00	15:00
pH	pH	8.3	8.8	8.3	8.4	6.8	7.6	7.4	7.6
Electrical conductivity	mS/m	30.1	34.1	33.5	32.2	54.8	86.9	58.2	56.7
Chloride	g/m^3	10.7	12.0	11.4	11.1	23.0	36.0	28.0	27.0
Total hydrocarbons	g/m^3	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7
Sample details	**Units**	**GND2369**				**GND0093**			
TRC sample number	-	Minimum	Maximum	17214.2	2022638.4	Minimum	Maximum	TRC174124	2022638.5
Sample date	-	July 2012 to June 2018		20-Oct-17	26-Jul-18	July 2013 to June 2018		21-Nov-17	26-Jul-18
Sample time	NZST	-	-	11:00	11:15	-	-	-	-
pH	pH	7.8	8.9	8.8	7.8	6.4	7.9	7.2	7.1
Electrical conductivity	mS/m	13.2	37.8	32.0	13.2	14.2	25.4	14.3	14.2
Chloride	g/m^3	10.8	14.3	11.7	14.3	16.9	34.0	18.0	16.9
Total hydrocarbons	g/m^3	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	< 0.7	< 0.7
Sample details	**Units**	**GND1659**							
TRC sample number	-	Minimum	Maximum	17214.2	2022638.2				
Sample date	-	July 2012 to June 2018		20-Oct-17	26-Jul-18				
Sample time	NZST	-	-	11:30	11:30				
pH	pH	8.0	8.4	8.1	8.1				
Electrical conductivity	mS/m	30.6	37.9	37.6	30.6				
Chloride	g/m^3	10.4	12.9	12.2	11.8				
Total hydrocarbons	g/m^3	<0.7	<0.7	<0.7	<0.7				

2.4 Injection monitoring

The Company provided records of their injection activities during the 2017-2018 monitoring period, including daily injection volumes, pumping duration and maximum and average injection pressures. All data was provided within the consented timeframes with the exception of data for the Kapuni KA9 and KA1/7/19/20 wellsites from March-June 2018, which was not provided until July 2018.

Table 9 provides an overview of the Company's injection activities across all consents during the monitoring period and shows that DWI occurred at the Tuhua-B, McKee-A, Pouri-A and Kapuni KA9 and KA1/7/19/20 wellsites over this period. Injection at the KA9 wellsite, via the KW2 well, ceased in October 2017 and injection at KA1/7/19/20 wellsite, via the KA1 well, commenced in December 2017. No DWI was undertaken at either the McKee-B or Tuhua-D wellsites.

The majority of discharge was undertaken at the McKee-A wellsite, with 72% of the total volume of fluids discharged being injected via the McKee-1 well under consent 4182-2.

The total annual injection volumes since 2009 are presented in Table 10 and this shows that the volume of fluid requiring discharge has increased over recent years.

Table 9 Summary of injection activity during the 2017-2018 monitoring year

Consent	Wellsite	Injection wells	Total volume discharged (m^3) 01/07/17 – 30/06/18	Discharge period		TRC well ID
				From	To	
1315-1	Tuhua-B	McKee Disposal-1	68,013.54	01/07/2017	30/06/2018	GND1749
4182-2	McKee-A	McKee-1	224,954.99	01/07/2017	30/06/2018	GND0443
5037-2.2	Pouri-A	Pouri-1A	542.66	01/07/2017	30/06/2018	GND1508
5052-2	McKee-B	McKee-4	0.00	-	-	GND1455
9970-1.1	KA9	KW2	8,687.68	01/07/2017	06/10/2017	GND1412
		KA16*	48.99	02/12/2017	03/12/2017	GND2669
			44.60	19/04/2018	20/04/2018	
	KA1/7/19/20	KA1	10,782.08	06/12/2017	30/06/2018	GND1683
10661-1	Tuhua-D	Tuhua-4	0.00	-	-	GND2828
Total			313,074.53	-	-	

*Note * flow testing only*

Table 10 Summary of the Company's historical injection activity since 2009

Period	Total volume discharged (m^3)	Period	Total volume discharged (m^3)
2017-2018	313,075	2012-2013	91,919
2016-2017	279,670	2011-2012	91,325*
2015-2016	240,298	2010-2011	91,325*
2014-2015	239,428	2009-2010	91,324*
2013-2014	41,105	-	-

Note volumes are reported from the 2009-2012 (273,974 m^3) so total has been averaged over three years*

Table 11, Table 12, Table 13 and Table 14 below provide a summary of the historical injection activities undertaken at each active wellsite.

Between 2009 and 2014, the majority of the Company's disposal was undertaken at the Tuhua-B wellsite. More recently, the McKee-A wellsite has received the greatest volumes of discharge. Injection at the wellsite has increased overtime in response to the increase in the volumes of fluids that require disposal as oil and gas reservoirs deplete.

Table 11 Summary of injection occurring under consent 1315 (2009-2018)

Deep well injection undertaken at Tuhua-B wellsite via the McKee Disposal-1 injection well					
Year	Annual volume (m^3)	Max. injection volume (m^3/day)	Maximum injection rate (m^3/hr)	Max. injection pressure (bar)	Avg. injection pressure (bar)
2017-2018	68,014	1,100	45.8	65.0	10.4
2016-2017	82,784	1,015	42.3	63.0	19.6
2015-2016	95,406	642	28.5	58.0	33.4
2014-2015	60,720	1,142	48.0	82.0	15.0
2013-2014	30,239	759	41.0	70.0	29.0
2009-2012*	90,390	450	-	44.0	28.0

*Note *volume was reported from 2009-2012 (271,172 m^3) so total has been averaged over the three year period.*

Table 12 Summary of injection occurring under consent 4182 (2009-2018)

Deep well injection undertaken at McKee-A wellsite via the McKee-1 injection well					
Year	Annual volume (m^3)	Max. injection volume (m^3/day)	Maximum injection rate (m^3/hr)	Max. injection pressure (bar)	Avg. injection pressure (bar)
2017-2018	224,955	1,134	47.3	91.8	9.7
2016-2017	191,534	907	52.4	76.0	11.4
2015-2016*	125,876	1,203	166.0	38.0	9.1
2014-2015	178,708	1,064	83.0	17.0	5.0
2013-2014	10,866	336	97.0	No pressure required - vacuum	
2009-2012	2,802	462	-	No pressure required - vacuum	

Table 13 Summary of injection occurring under consent 5037 (2015-2018)

Deep well injection undertaken at Pouri-A wellsite via the Pouri-1A injection well					
Year	Annual volume (m^3)	Max. injection volume (m^3/day)	Maximum injection rate (m^3/hr)	Max. injection pressure (bar)	Avg. injection pressure (bar)
Consent limit	-	-	-	276.0	-
2017-2018	542	197.29	8.2	98.3	13.8
2016-2017	5,381	163.10	6.8	99.6	5.7
2015-2016*	19,016	311.98	45.9	48.0	15.8

Table 14 Summary of injection occurring under consent 9970 (2015-2018)

Deep well injection undertaken at the KA9 and KA1/9/19/20 wellsites via the KW2, KA16 and KA1 wells					
Year	**Annual volume (m^3)**	**Max. injection volume (m^3/day)**	**Maximum injection rate (m^3/hr)***	**Max. injection pressure (bar)**	**Avg. injection pressure (bar)**
Consent limit	-	2,000	-	-	-
2017-2018	19,563	565	72	100	32
2016-2017	*32,500*	*584*	*35*	*63*	*42*
2015-2016	*35,830*	*489*	*73*	*61*	*44*
2014-2015	*43,014*	*617*	*-*	*60*	*45*
2013-2014	*62,648*	*890*	*164*	*66*	*38*
2012-2013	*62,228*	*790*	*147*	*65*	*47*

Note *not measured calculated using daily volume and injection hours.

Prior to August 2017 consent 9970 was held by STOS

The daily volume, maximum daily injection pressure and a comparison of volume and maximum daily pressure over the entire data record for consent 1315-1 (Tuhua-B) is presented in Figure 5, Figure 6 and Figure 7. A visual assessment of the data indicates that:

- Disposal has reduced steadily over the review period;
- Increases in maximum daily pressures generally respond to higher daily injection volumes; and
- Disposal at the site has been more sporadic since 2014 than in previous years.

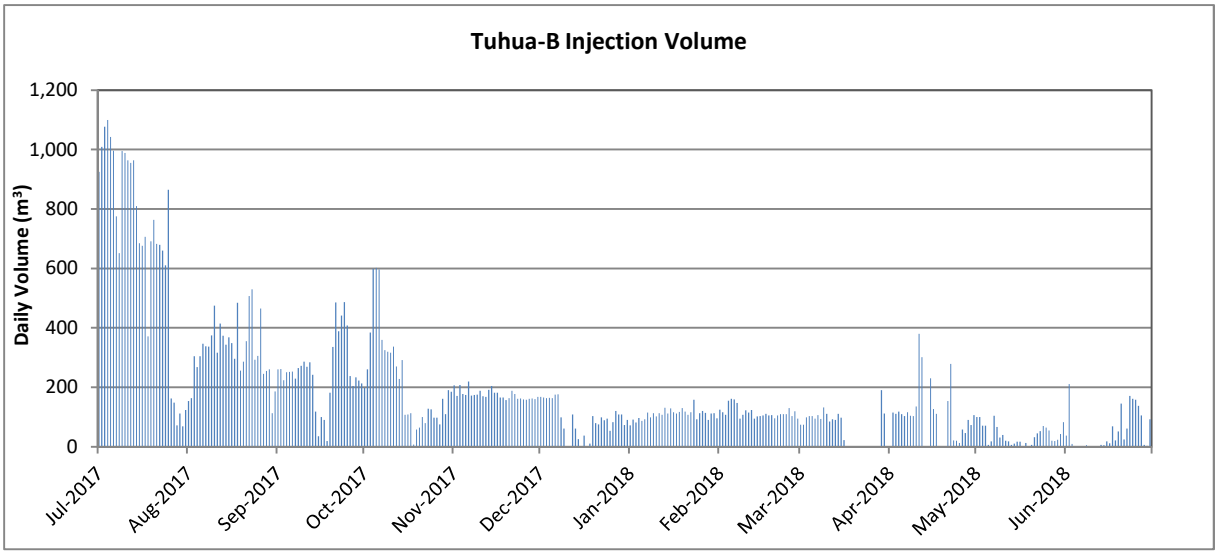

Figure 5 Total daily injection volume consent 1315-1 (2017-2018)

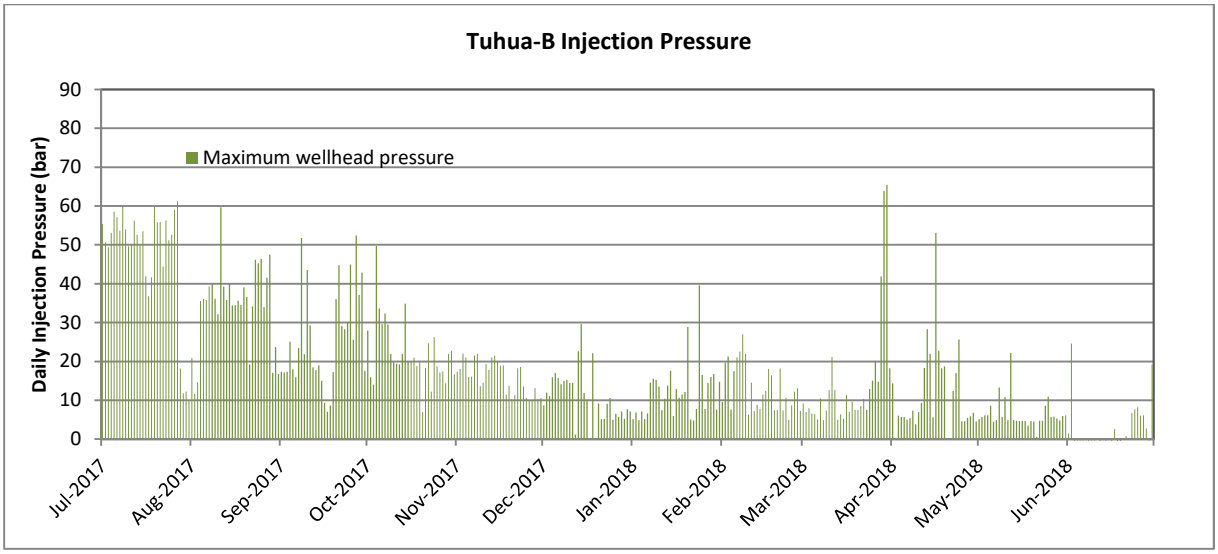

Figure 6 Total daily maximum injection pressure 1315-1 (2017-2018)

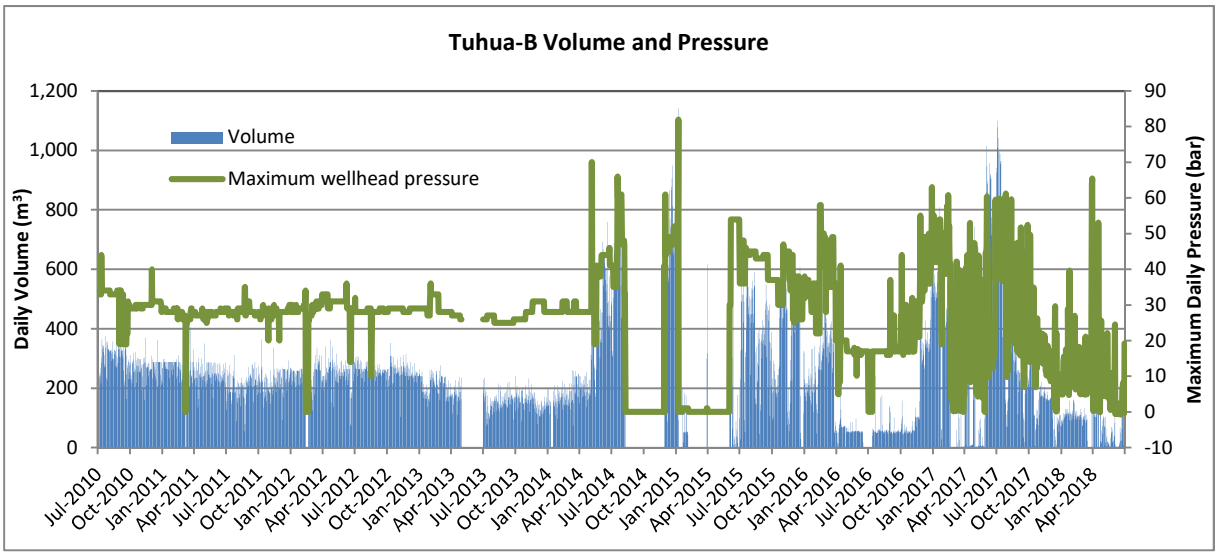

Figure 7 Daily injection volume and daily maximum injection pressure consent 1315-1 (2010-2018)

The daily volume, maximum daily injection pressure and a comparison of volume and maximum daily pressure over the entire data record for consent 4182-2 (McKee-A) is presented in Figure 8, Figure 9 and Figure 10. A visual assessment of the data indicates that:

- Daily injection volumes and maximum daily injection pressures although fluctuating have declined slightly over the monitoring period; and
- Historically, daily discharge volumes and maximum wellhead pressure have both increased over time.

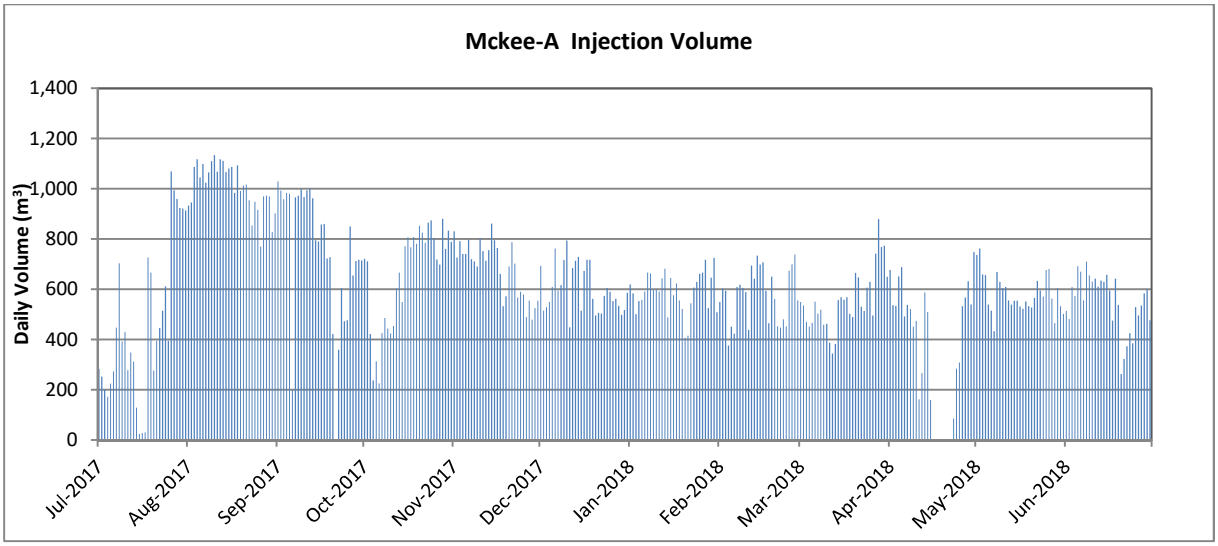

Figure 8 Total daily injection volume consent 4182-2 (2017-2018)

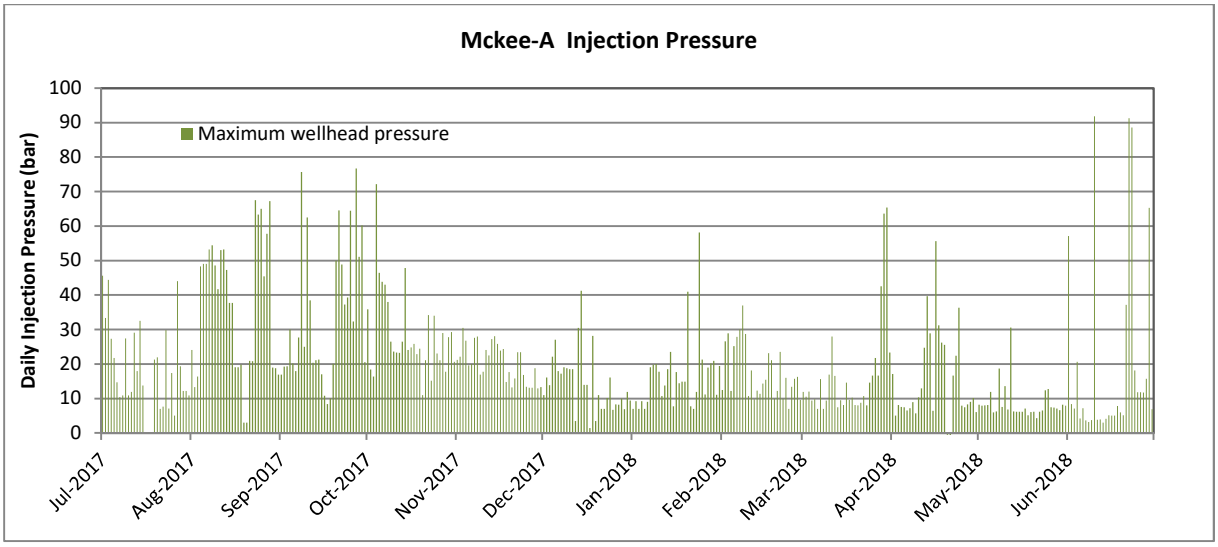

Figure 9 Total daily maximum injection pressure 4182-2 (2017-2018)

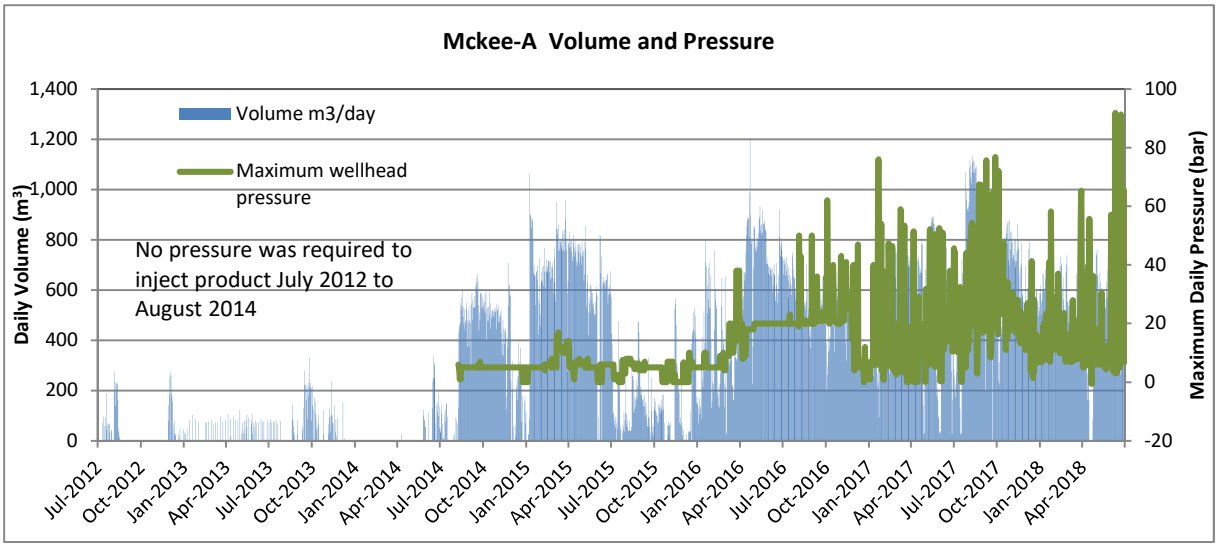

Figure 10 Daily injection volume and daily maximum pressure consent 4182-2 (2012-2018)

The daily volume, maximum daily injection pressure and a comparison of volume and maximum daily pressure over the entire data record for consent 5037-2.2 (Pouri-A) is presented in Figure 11, Figure 12 and Figure 13. A visual assessment of the data indicates that:

- Injection only occurred during June 2018;
- Pressures have remained well below the consented maximum pressures over the duration of the consent;
- Pressures during injection are generally low suggesting the reservoir is depleted; and
- Pressure is required in the annulus whilst the bore is not pumping, which reflects the presence of a column of dry gas from the reservoir to surface.

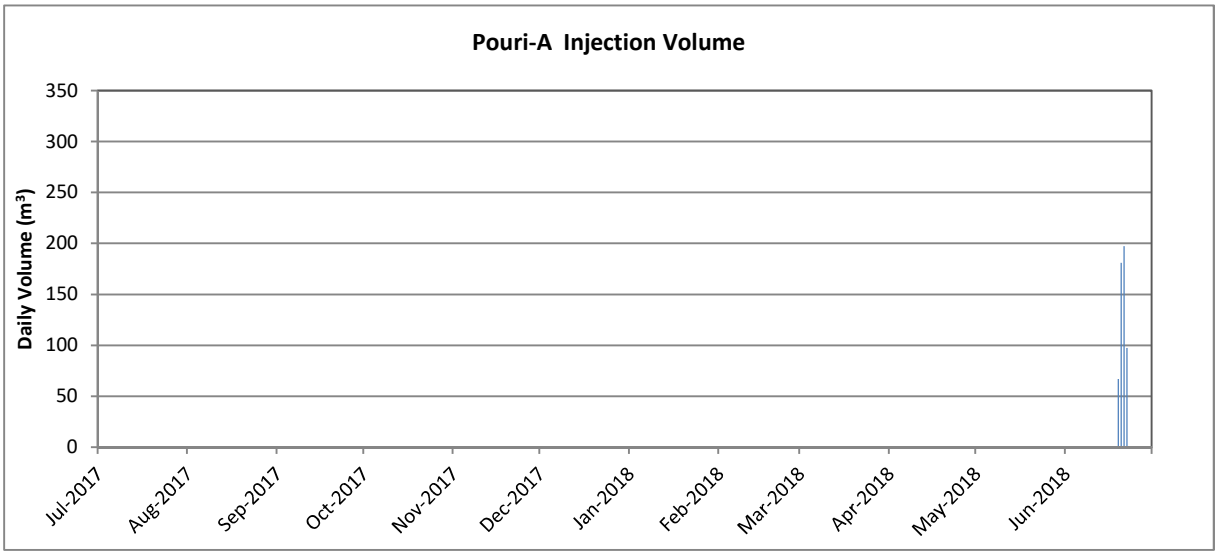

Figure 11 Total daily injection volume consent 5037-2.2 (2017-2018)

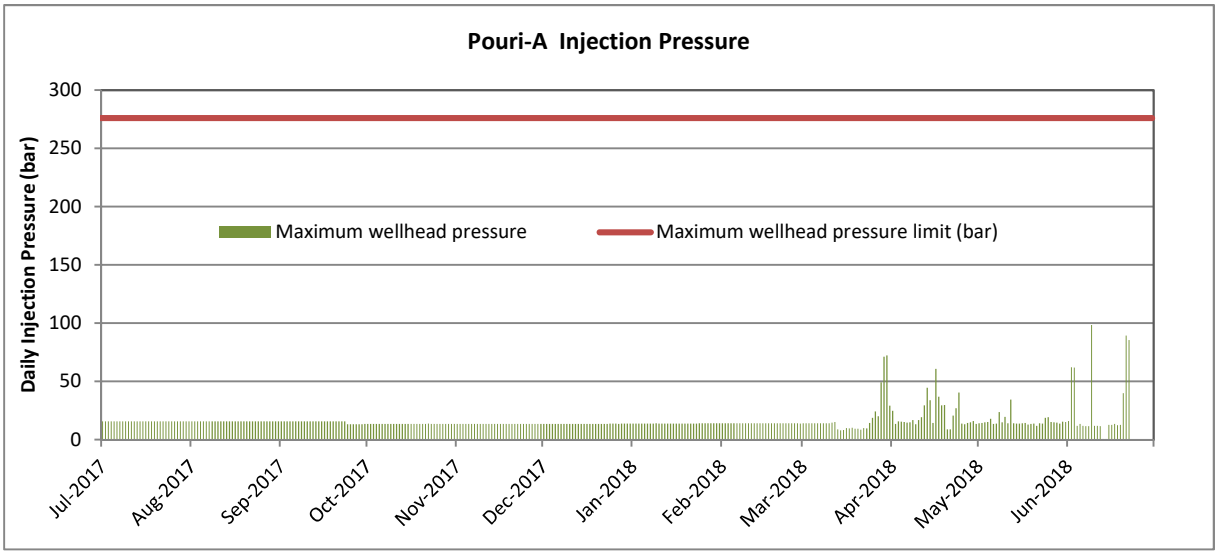

Figure 12 Total daily injection pressure consent 5037-2.2 (2017-2018)

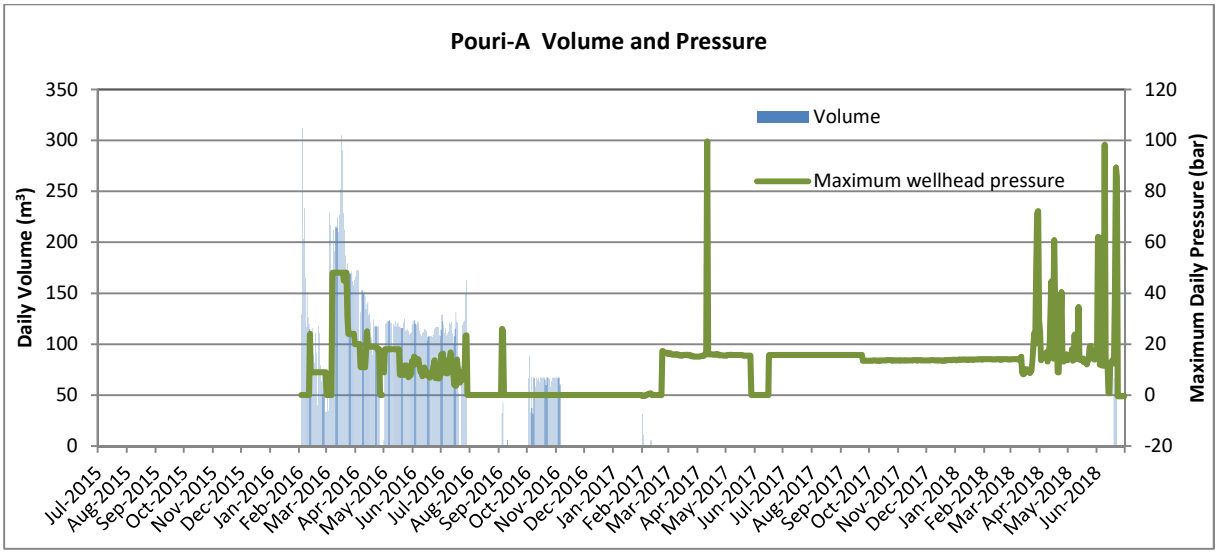

Figure 13 Total daily injection volume and maximum pressure consent 5037-2.2 (2015-2018)

The daily volume, maximum daily injection pressure and a comparison of volume and maximum daily pressure over the entire data record for consent 9970-1.1 is presented in Figure 14, Figure 15 and Figure 16.

A visual assessment of the data indicates that:

- Injection ceased in October 2017 via the KW2 well and has been undertaken primarily via the KA1 well since December 2017;
- Volumes have remained well below the consented daily limit of 2,000 m^3 per day over the duration of the consent; and
- Higher pressures are required to inject lower volumes of fluid via the KA1 well than was required for injection via the KW2 well, due to the greater depth of injection and the reduced porosity of the formation due to compaction.
- Small volumes of fluid were discharged via the KA16 well for the purpose of injectivity testing. The well was ultimately found to be unsuitable for use as an injector.
- At the end of the review period the KA1 well was the only operational DWI well in the Kapuni field.

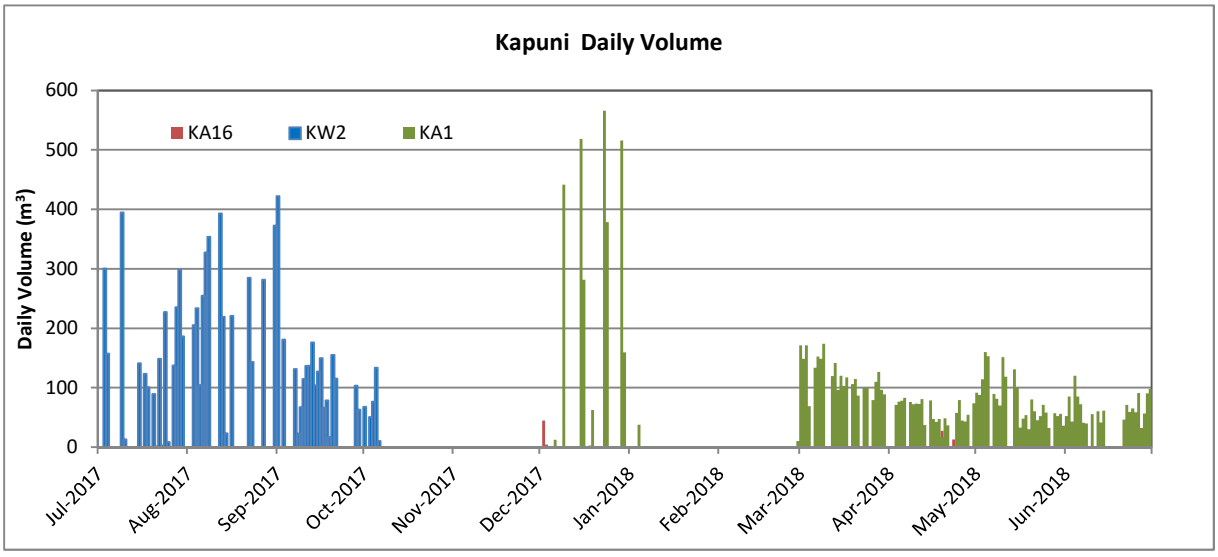

Figure 14 Total daily injection volume consent 9970-1.1 (2017-2018)

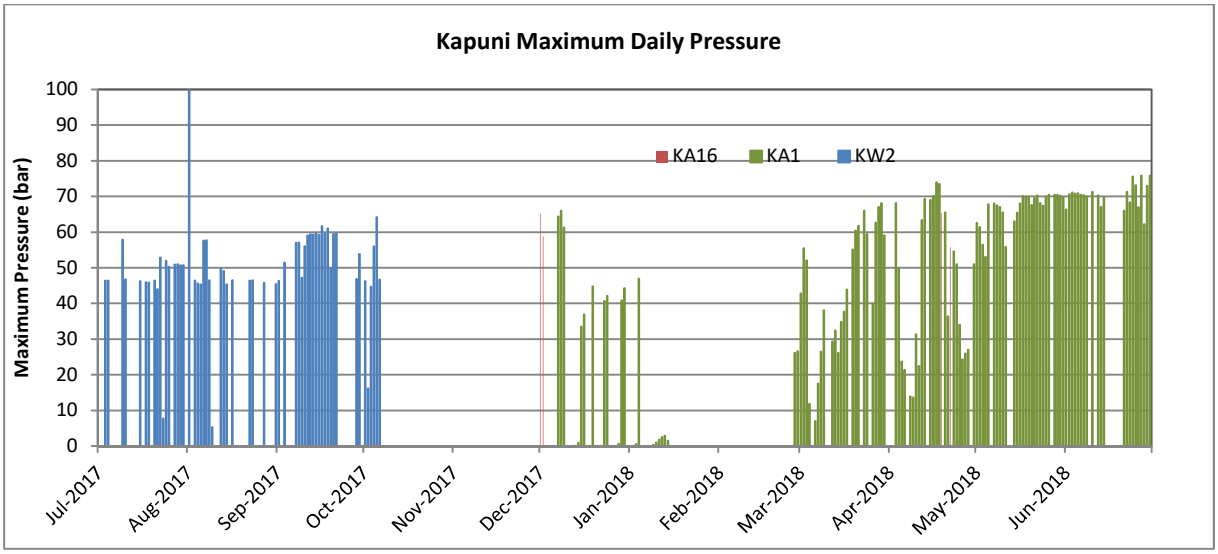

Figure 15 Total daily injection pressure and volume consent 9970-1.1 (2009-2018)

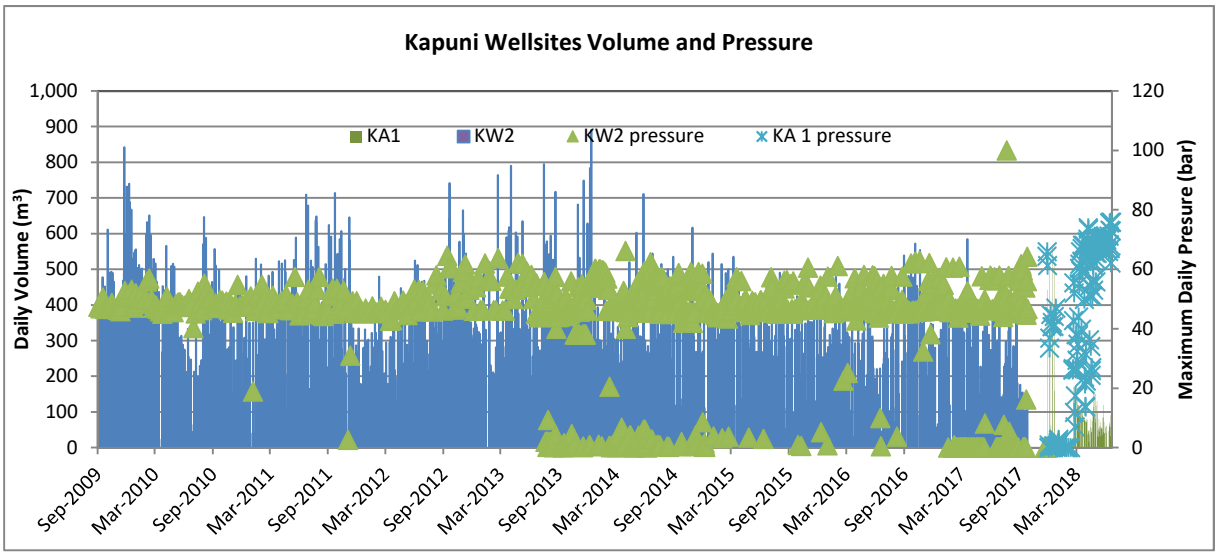

Figure 16 Total daily injection volume and maximum pressure consent 9970-1.1 (2009-2018)

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 Company. During the year matters may arise which require additional activity by the Council, for example provision of advice and information, or investigation of potential or actual causes of non-compliance or failure to maintain good practices. A pro-active approach that in the first instance avoids issues occurring is favoured.

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 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 2017-2018 period, the Council was required to undertake additional investigations and interventions, and record incidents in association with the Company's conditions in resource consents.

During the 2017-2018 monitoring period injection via the KW2 well ceased in response to an unexpected increase in pressure recorded within the well annulus. The pressure increase was reported to the Council and the Company commenced an investigation to ensure that the well remained secure. A summary of the actions undertaken to date was provided to the Council. There was no breach of consent conditions caused by the anomalous pressures and all mitigation methods and safety systems in place worked as required. The investigation to confirm the underlying cause of the pressure increase is still underway.

Due to recent staff changes in the Company, the data required to be submitted under consent 9970-1.1 from January to June 2018 period was submitted late, as was the Company's annual report. The Council reminded the Company of its responsibilities under its consents and no further action was taken given a full record of data was provided and no adverse effects arose as a result of the late data submissions.

Due to an administrative oversight by the Company, injection continued at the Tuhua-B wellsite in breach of condition 3 of consent 1315-1, which requires there to be no injection of fluids after 1 June 2018. The breach of conditions was brought to the attention of the Company on Monday 17 September 2018 and an abatement notice (EAC-22178) was issued under Sections 324 of the RMA, on 24 September 2018. Following discussions with the Council, the Company submitted an application to change condition 3 of the consent, to enable injection to continue until 1 June 2019 and give the Company time to submit an application to renew the consent. The variation to the consent condition was granted on 11 October 2018. There were no environmental risks related to the breach, therefore no further action was deemed necessary.

3 Discussion

3.1 Discussion of site performance

During the period under review, the Company exercised four resource consents (1315-1, 4182-2, 5037-2.2 and 9970-1.1) for the injection of fluids by DWI. These consents licensed discharges of various forms of fluid into the Mount Messenger and McKee Formations, via the McKee Disposal-1, McKee-1, Pouri-1A and KA1 and KA7 injection wells and the Matemateaonga Formation via the KW2 and KA16 injection wells. The main source of fluids for injection was produced water from the Company's Mangahewa, McKee and Kapuni fields.

Injection wells are fitted with engineering controls and in built safety systems. Well integrity is constantly assessed by monitoring injection and annular pressures. In the event of any sudden pressure losses or increases, indicating a loss of tubing or annular pressure, safety systems isolate the wellbore and shut down the injectate pumping system. It should also be noted that maximum pressure that can be generated by the injectate pumps is well below the safe operating pressures of the wellhead, casing and tubing.

The operation of the injection well is monitored by Company staff, with automated systems recording the injection data required under the conditions of their consent.

The monitoring undertaken by the Company was effective in identifying a pressure anomaly in KW2 well during the period being reported. As discussed in section 2.5, the Company responded in the appropriate manner to this event and investigations into the cause and possible remedial actions remained ongoing at the end of the review period.

Routine inspections of the Company's wellsites conducted 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.

Monitoring during the year shows that the Company's DWI activities were generally carried out in compliance with the conditions of the applicable resource consents, however there were some administrative compliance issues which resulted in the Company being issued with an abatement notice. The administrative issues arising did not result in any adverse effects on the environment and overall, the Company's environmental performance remains at a high level.

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. 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.

All results are within the ranges expected for shallow Taranaki groundwater and indicate that there has been no contamination by DWI fluids.

Compliance with the conditions of the Company's DWI consents exercised during the 2017-2018 monitoring period is summarised below in Section 3.3.

3.3 Evaluation of performance

A tabular summary of the consent holder's compliance record for the year under review is set out in Tables 15 to 18 and an evaluation of the Company's environmental performance in relation to their DWI activities since 2009 is presented in Table 19.

Table 15 Summary of performance for consent 1315-1

Purpose: ***To discharge fluid waste generated by oil and gas exploration and production activities to the Mount Messenger Formation by deep well injection at the Tuhua-B 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. No injection permitted after 1 June 2018	Assessment of injection records and site inspection notices.	No- injection continued following this date
4. The consent holder shall at all times adopt the best practicable option.	Assessment of consent holder records and site inspection notices.	Yes
5. The injection of fluids shall be confined to the Mount Messenger Formation, deeper than 1,200 m BGL.	Review of "Injection Operation Management Plan," well construction log and injection data.	Yes
6. The injection of fluids does not result in fracturing of geological seals confining the injection zone	Assessment of injection records and results of groundwater sampling and analysis programme.	Yes
7. 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
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

Purpose: *To discharge fluid waste generated by oil and gas exploration and production activities to the Mount Messenger Formation by deep well injection at the Tuhua-B wellsite.*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
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. Ensure that the analysis required by 10 (c) is carried out in an International Accreditation New Zealand (IANZ) accredited laboratory	Assessment of injection data	Yes
12. The data required by conditions 9 & 10 above, for each calendar month, is required to be submitted by the 28th day of the following month.	Receipt of satisfactory data by the date specified.	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. All groundwater samples taken for monitoring purposes shall be taken in accordance with recognised field procedures and analysed for: • pH; • conductivity; • chloride; and • 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 first round of sampling being undertaken.	Yes

Purpose: *To discharge fluid waste generated by oil and gas exploration and production activities to the Mount Messenger Formation by deep well injection at the Tuhua-B wellsite.*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
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.	No-provided late
17. Consent review provision.	N/A	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent Overall assessment of administrative performance in respect of this consent		**High** **Improvement required**

N/A = not applicable

Table 16 Summary of performance for consent 4182-2

Purpose: *To discharge fluid waste generated by oil and gas exploration and production activities to the McKee Formation by deep well injection at the McKee-A 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. No injection permitted after 1 June 2028.	Assessment of injection records and site inspection notices.	N/A
4. The consent holder shall at all times adopt the best practicable option.	Assessment of consent holder records and site inspection notices.	Yes
5. The injection of fluids shall be confined to the Mount Messenger Formation, deeper than 1200 m BGL.	Review of "Injection Operation Management Plan," well construction log and injection data.	Yes

Purpose: *To discharge fluid waste generated by oil and gas exploration and production activities to the McKee Formation by deep well injection at the McKee-A wellsite.*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
6. The injection of fluids does not result in fracturing of geological seals confining the injection zone	Assessment of injection records and results of groundwater sampling and analysis programme.	Yes
7. 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
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. Ensure that the analysis required by 10 (c) is carried out in an International Accreditation New Zealand (IANZ) accredited laboratory	Assessment of injection data	Yes
12. The data required by conditions 9 & 10 above, for each calendar month, is required to be submitted by the 28th day of the following month.	Receipt of satisfactory data by the date specified.	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

Purpose: *To discharge fluid waste generated by oil and gas exploration and production activities to the McKee Formation by deep well injection at the McKee-A wellsite.*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
14. All groundwater samples taken for monitoring purposes shall be taken in accordance with recognised field procedures and analysed for: • pH; • conductivity; • chloride; and • 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.	No-submitted late
17. Consent review provision.	N/A	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**
Overall assessment of administrative performance in respect of this consent		**Good**

N/A = not applicable

Table 17 Summary of performance for consent 5037-2.2

Purpose: *To discharge waste drilling fluids, water, produced water and stormwater from hydrocarbon exploration and production operations by deepwell injection at the Pouri-A 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. No injection permitted after 1 June 2028.	Assessment of injection records and site inspection notices.	N/A
4. The consent holder shall at all times adopt the best practicable option.	Assessment of consent holder records and site inspection notices.	Yes
5. The injection of fluids shall be confined to the Mount Messenger Formation, deeper than 1200 m BGL.	Review of "Injection Operation Management Plan," well construction log and injection data.	Yes
6. The injection of fluids does not result in fracturing of geological seals confining the injection zone	Assessment of injection records and results of groundwater sampling and analysis programme.	Yes
7. 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
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

Purpose: *To discharge waste drilling fluids, water, produced water and stormwater from hydrocarbon exploration and production operations by deepwell injection at the Pouri-A wellsite*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
11. Ensure that the analysis required by 10 (c) is carried out in an International Accreditation New Zealand (IANZ) accredited laboratory	Assessment of injection data	Yes
12. The data required by conditions 9 & 10 above, for each calendar month, is required to be submitted by the 28th day of the following month.	Receipt of satisfactory data by the date specified.	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. All groundwater samples taken for monitoring purposes shall be taken in accordance with recognised field procedures and analysed for: • pH; • conductivity; • chloride; and • 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

Purpose: *To discharge waste drilling fluids, water, produced water and stormwater from hydrocarbon exploration and production operations by deepwell injection at the Pouri-A wellsite*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
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.	No
17. Consent review provision.	N/A	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent Overall assessment of administrative performance in respect of this consent		**High** **Good**

N/A = not applicable

Table 18 Summary of performance for consent 9970-1.1

Purpose: *To discharge waste fluids, associated with hydrocarbon exploration and production by deep well injection, into the Matemateaonga Formation via the KW2 well, or into the Mangahewa Formation via wells KA1 and/or KA7 as a contingency*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. The volume of fluid injected shall not exceed 200 cubic metres per day	Review and analysis of injection data	Yes
2. By 1 January 2015, the consent holder shall submit an "Injection Operation Management Plan	Receipt of satisfactory "Injection Operation Management Plan," by 1 January 2015	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 by 1 January 2015	Yes
4. No injection permitted after 1 June 2024	Assessment of injection records and site inspection notices	N/A
5. The consent holder shall at all times adopt the best practicable option	Assessment of consent holder records and site inspection notices	Yes
6. No injection of fluids above 1,200 m BGL	Review of " Injection Operation Management Plan," well construction log and injection data	Yes

Purpose: *To discharge waste fluids, associated with hydrocarbon exploration and production by deep well injection, into the Matemateaonga Formation via the KW2 well, or into the Mangahewa Formation via wells KA1 and/or KA7 as a contingency*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
7. Before Contingency wells are utilised, an "Injection Operation Management Plan" specific to the well being utilised must be provided to the Council	Receipt of satisfactory "Injection Operation Management Plan	N/A
8. The consent holder shall ensure that the exercise of this consent does not result in the fracturing of the geological seals confining the injection zone	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 fresh water (groundwater or surface water)	Assessment of injection records and results of groundwater sampling and analysis programme	Yes
10. Only the listed fluids may be discharged	Receipt and assessment of injection data	Yes
11. These are the only other fluids that may be injected apart from those listed in condition 10	Receipt and assessment of injection data	Yes
12. Consent holder shall keep daily injection records	Receipt and assessment of injection data	Yes
13. Maintain records an undertake analysis to characterise each type of waste arriving on-site for discharge	Receipt and assessment of injection data	Yes
14. If analysis required by condition 13 is not carried out in an IANZ laboratory, it shall be undertaken in accordance with a Quality Assurance Plan certified by the Council	Receipt and assessment of injection data	Yes
15. The data required by conditions 12 & 13 above, for each calendar month, is required to be submitted by the 28th day of the following month	Receipt of satisfactory data by the date specified	Generally- January to June submitted late

Purpose: *To discharge waste fluids, associated with hydrocarbon exploration and production by deep well injection, into the Matemateaonga Formation via the KW2 well, or into the Mangahewa Formation via wells KA1 and/or KA7 as a contingency*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
16. The consent holder shall undertake a programme of sampling and testing (the 'Monitoring Programme') that monitors the effects of the exercise of this consent on fresh water resources	Monitoring Programme submitted to the Chief Executive, Taranaki Regional Council	Yes
17. 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
18. 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 first round of sampling being undertaken	Yes
19. 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	No-submitted late
20. Lapse Clause	Receive notice of exercise of consent	Yes
21. Consent review clause	N/A	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**
Overall assessment of administrative performance in respect of this consent		**Good**

N/A = not applicable

Table 19 Evaluation of environmental performance over time

Year	Consent number	High	Good	Improvement required	Poor
2017-2018	1315	1			
	4182	1			
	5037	1			
	5052*	-			
	9970	1			
	10661*	-			
2016-2017	1315	1			
	4182	1			
	5037	1			
	5052*	-			
2015-2016	1315	1			
	4182	1			
	5037	1			
	5052*	-			
2014-2015	1315	1			
	4182	1			
	5052*	-			
2013-2014	1315	1			
	3895*	-			
	4182	1			
	5052*	-			
2012-2013	1315	1			
	3895*	-			
	4182	1			
	5052*	-			
2009-2012	1315	1			
	3895*	-			
	4182	-		1	
	5052*	-		-	
Totals		**10**		**1**	

*Note * not exercised during monitoring period*

During the year, the Company demonstrated a high level of environmental and good level of administrative performance with the resource consents as defined in Section 1.1.4.

3.4 Recommendations from the 2016-2017 Annual Report

In the 2016-2017 Annual Report, it was recommended:

1. THAT monitoring of consented activities in the 2017-2018 year continues at the same level as in the 2016-2017 monitoring period.
2. THAT the McKee-A monitoring bore GND2455 be sampled for dissolved gases in May 2018.
3. THAT there is no requirement at this time for a consent review to be pursued or grounds to exercise the review options.

The recommendations above were implemented during the period under review with the exception of the sampling of dissolved gases at the McKee-A monitoring bore in May 2018. This sampling will be undertaken in October 2018.

3.5 Alterations to monitoring programmes for 2018-2019

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

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

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

It is proposed the range of monitoring carried out during the 2017-2018 period be continued during the 2018-2019 monitoring period, including the sampling and analysis for dissolved gas sampling at GND2455.

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

It should be noted that the proposed programme represents a reasonable and risk-based level of monitoring for the site(s) in question. The Council reserves the right to subsequently adjust the programme from that initially prepared, should the need arise if potential or actual non-compliance is determined at any time during 2018-2019.

3.6 Exercise of optional review of consent

Resource consents 1315-1, 4182-2, 5037-2.2, 5052-2, 9970-1.1 and 10661-1 provide for optional reviews in June 2019. Conditions 17, 17, 19, 21 and 17 respectively allow the Council to review the consents, if there are grounds that the conditions are not adequate to deal with any adverse effects on the environment arising from the exercise of the resource consent, which were either not foreseen at the time the application was considered or which was not appropriate to deal with at the time.

Based on the results of monitoring in the year under review, and in previous years as set out in earlier annual compliance monitoring reports, it is considered that there are no grounds that require a review to be pursued or grounds to exercise the review option.

4 Recommendations

1. THAT in the first instance, monitoring of consented activities in the 2018-2019 year continue at the same level as in 2017-2018.
2. THAT should there be issues with environmental or administrative performance in 2018-2019, monitoring may be adjusted to reflect any additional investigation or intervention as found necessary.
3. THAT the option for a review of resource consents in June 2019, as set out in the respective consent conditions not be exercised.

Glossary of common terms and abbreviations

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

Aquifer (freshwater)	A formation, or group or part of a formation that contains sufficient saturated permeable media to yield exploitable quantities of fresh water.
BPO	Best practicable option
Conductivity	A measure of the level of dissolved salts in a sample. Usually measured at 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 earth's crust changes with depth. It is usually measured in units of "pounds per square inch per foot" (psi/ft) and varies with the type of rock and the strain of the rock.
g/m^3	Grams per cubic metre. A measure of concentration which is equivalent to milligrams per litre (mg/L), or parts per million (ppm).
Hydraulic fracturing (HF)	The process of increasing reservoir permeability by injecting fluids at pressures sufficient to fracture rock within the reservoir ("fracking").
Injectate	Fluid disposed of by deep well injection.
Incident	An event that is alleged or is found to have occurred that may have actual or potential environmental consequences or may involve non-compliance with a consent or rule in a regional plan. Registration of an incident by the Council does not automatically mean such an outcome had actually occurred.
Intervention	Action/s taken by Council to instruct or direct actions be taken to avoid or reduce the likelihood of an incident occurring.
Investigation	Action taken by Council to establish what were the circumstances/events surrounding an incident including any allegations of an incident.
IR	Unauthorised Incident Register – contains a list of events recorded by the Council on the basis that they may have the potential or actual environmental consequences that may represent a breach of a consent or provision in a Regional Plan.
L/s	Litres per second.
m BGL	Metres below ground level.
m BMP	Metres below measuring point.
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 a Science Services Manager.

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Taranaki Regional Council (2011): *Todd Energy Limited Deep Well Injection Monitoring Programme, Triennial Report (2009-2012)*. Technical Report 2011-86. Document number 1108053.

Appendix I

Resource consents held by Todd Energy Limited

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

Consent Number	Wellsite	Status	Injection Well(s)	TRC bore id.	Formation	Issued	Expiry
1315-1	Tuhua-B	Active	McKee Disposal-1	GND1749	Mount Messenger	08/08/1984	01/06/2023
4182-2	McKee-A	Active	McKee-1	GND0443	McKee	01/10/2013	01/06/2033
5037-2.2	Pouri-A	Active	Pouri-1A	GND1508	McKee	15/10/2015	01/06/2033
5052-2	McKee-B	Not exercised	McKee-4	GND1455	Mount Messenger	27/05/2014	01/06/2033
9970-1.1	KA9	Active	KW2 KA16	GND1412 GND2669	Matemateaonga	07/10/2014	01/06/2029
	KA1,7,19,20		KA1 KA7	GND1683 GND1684	Mangahewa		
10661-1	Tuhua-D	Not exercised	Tuhua-4	GND2828	Mckee	13/06/2018	01/06/2033

Discharge Permit

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

Name of Consent Holder:	Todd Energy Limited P O Box 802 NEW PLYMOUTH 4340
Decision Date (Change):	1 October 2013
Commencement Date (Change):	1 October 2013 (Granted: 8 August 1984)

Conditions of Consent

Consent Granted:	To discharge fluid waste generated by oil and gas exploration and production activities to the Mount Messenger Formation by deep well injection at the Tuhua-B wellsite
Expiry Date:	1 June 2023
Review Date(s):	June Annually
Site Location:	Tuhua-B-wellsite, Otaraoa Road, Tikorangi, Waitara (Property owner: HJ, JK & CJ Megaw)
Legal Description:	Lot 3 DP 15159 Blk XI Waitara SD (Discharge source & site)
Grid Reference (NZTM)	1716911E-5675265N
Catchment:	Onaero
Tributary:	Pukemai

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 January 2014, 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 January 2014, 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;
   (e) confirmation of the depth to which fresh water resources, as defined in condition 7, 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 2 may be included within the "Injection Operation Management Plan" required by condition 1.)

3. There shall be no injection of any fluids after 1 June 2018.

4. 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.

5. The injected fluids shall be confined to the Mount Messenger Formation, deeper than 1,200 metres below ground level.

6. 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.

7. 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.

8. Only the following fluids may be discharged:

   (a) produced water;
   (b) well workover fluids, including hydraulic fracturing return fluids;
   (c) well drilling fluids;
   (d) production sludges;
   (e) contaminated stormwater; and
   (f) other fluids that if discharged will cause no greater environmental risk than those fluids listed above, and certified as such by the by the Chief Executive, Taranaki Regional Council.

9. 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.

10. 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 8);
   (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 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. If the analysis required by condition 10(c) 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 10. 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.

12. 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 28th day of the following month.

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 within an Area of Review (AoR) to assess compliance with condition 7 (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 2014, and shall include:

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

    The AoR shall extend 1,000 m 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.

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.

    Note: *The samples required, under conditions 0 and 14, could be taken and analysed by the Council or other contracted party on behalf of the consent holder.*

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. 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 0.*

16. 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.

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 15 November 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:	Todd Taranaki Limited P O Box 802 NEW PLYMOUTH 4340
Decision Date (Change):	1 October 2013
Commencement Date (Change):	1 October 2013 (Granted: 24 June 2003)

Conditions of Consent

Consent Granted:	To discharge fluid waste generated by oil and gas exploration and production activities to the Mckee Formation by deep well injection at the McKee-A wellsite
Expiry Date:	1 June 2033
Review Date(s):	June Annually
Site Location:	McKee-A wellsite, Otaraoa Road, Tikorangi
Legal Description:	Pt Lot 6 DP 658 Blk XIV Waitara SD (Discharge source & site)
Grid Reference (NZTM)	1715113E-5670963N
Catchment:	Waitara

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 January 2014, 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 January 2014, 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;
   (e) confirmation of the depth to which fresh water resources, as defined in condition 7, 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 2 may be included within the "Injection Operation Management Plan" required by condition 1.)

3. There shall be no injection of any fluids after 1 June 2028.

4. 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.

5. The injected fluids shall be confined to the McKee Formation, deeper than 2,300 metres below ground level.

6. 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.

7. 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.

8. Only the following fluids may be discharged:

   (a) produced water;
   (b) well workover fluids, including hydraulic fracturing return fluids;
   (c) well drilling fluids;
   (d) production sludges;
   (e) contaminated stormwater; and
   (f) other fluids, that if discharged, will cause no greater environmental risk than those fluids listed above, and certified as such by the by the Chief Executive, Taranaki Regional Council.

9. 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.

10. 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 8);
   (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 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. If the analysis required by condition 10(c) 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 10. 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.

12. 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 28th day of the following month.

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 within an Area of Review (AoR) to assess compliance with condition 7 (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 2014, and shall include:

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

    The AoR shall extend 1,000 m 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.

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.

    Note: *The samples required, under conditions 0 and 14, could be taken and analysed by the Council or other contracted party on behalf of the consent holder.*

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. 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 0.*

16. 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.

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 1 October 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:	Todd Energy Limited PO Box 802 New Plymouth 4340	
Decision Date (Change):	7 June 2018	
Commencement Date (Change):	7 June 2018	(Granted Date: 20 November 2003)

Conditions of Consent

Consent Granted:	To discharge waste drilling fluids, water, produced water and stormwater from hydrocarbon exploration and production operations by deepwell injection at the Pouri-A wellsite
Expiry Date:	1 June 2033
Review Date(s):	June annually
Site Location:	Pouri-A wellsite, Foreman Road, Tikorangi (Property owner: FD & KS Wyatt)
Grid Reference (NZTM)	1715348E-5673407N & 1715410E-5673360N
Catchment:	Onaero
Tributary:	Mangahewa

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 exercising this consent, 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. Before exercising this consent, 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;
   e) confirmation of the depth to which fresh water resources, as defined in condition 8, 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 2 may be included within the "Injection Operation Management Plan" required by condition 1).

3. There shall be no injection of any fluids after 1 June 2028.

4. 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.

5. The injection of fluids shall be confined to the McKee Formation, and be injected at a minimum depth of 2149 metres true vertical depth below ground level.

6. The injection pressure at the wellhead shall not exceed 4,000 psi (276 bars). If exceeded, the injection operation shall cease immediately and the Chief Executive, Taranaki Regional Council informed immediately.

7. 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.

8. 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.

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

    a. produced water;
    b. well workover fluids, including hydraulic fracturing return fluids;
    c. well drilling fluids;
    d. production sludges;
    e. contaminated stormwater; and
    f. other fluids in accordance with condition 10 below.

10. The fluids discharged under this consent shall only be those listed in condition 9(a) to 9(e) above, and other fluids that:

    a) can reasonably be expected to be used in petrochemical well maintenance and development in accordance with industry best practice;
    b) have environmental effects that are no more adverse than those listed in 9(a) to 9(e) above;
    c) have been certified by the Chief Executive, Taranaki Regional Council as complying with 9(a) to 9(e) above; and
    d) have been the subject of a specific request for certification, in accordance with 9(a) to 9(e) above, that includes details of the proposed contaminant.

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. 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 9);
    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 analysis required by 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 condition 12. 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 modelling 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 7 June 2018

For and on behalf of
Taranaki Regional Council

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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:	Todd Energy Limited PO Box 802 NEW PLYMOUTH 4340
Decision Date:	27 May 2014
Commencement Date:	27 May 2014

Conditions of Consent

Consent Granted:	To discharge fluid waste generated by oil and gas exploration and production activities to the Mount Messenger Formation by deepwell injection
Expiry Date:	01 June 2033
Review Date(s):	June Annually
Site Location:	McKee-B wellsite, Otaraoa Road, Tikorangi
Legal Description:	Lot 1 DP 14374 Blk X Waitara SD (Discharge source & site)
Grid Reference (NZTM)	1715303E-5671934N
Catchment:	Onaero
Tributary:	Mangahewa

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 exercising this consent, 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. Before exercising this consent, 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;
   (e) confirmation of the depth to which fresh water resources, as defined in condition 7, 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 2 may be included within the "Injection Operation Management Plan" required by condition 1).

3. There shall be no injection of any fluids after 1 June 2028.

4. 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.

5. The injection of fluids shall be confined to the Mount Messenger Formation, and be injected at a minimum depth of 945 metres true vertical depth below ground level.

6. 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.

7. 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.

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

   (a) produced water;
   (b) well workover fluids, including hydraulic fracturing return fluids;
   (c) well drilling fluids;
   (d) production sludges;
   (e) contaminated stormwater; and
   (f) any other fluids approved in writing by the Chief Executive, Taranaki Regional Council.

9. 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.

10. 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 8);
   (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 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. If the analysis required by condition 10(c) 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 10. 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.

12. 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 28th day of the following month.

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 within an Area of Review (AoR) to assess compliance with condition 7 (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.

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.

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

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. 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 13.*

16. 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.

17. This consent shall lapse on 30 June 2019, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991.

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 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 27 May 2014

For and on behalf of
Taranaki Regional Council

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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:	Todd Petroleum Mining Company Limited PO Box 802 New Plymouth 4340
Decision Date (Change):	7 November 2017
Commencement Date (Change):	7 November 2017 (Granted Date: 7 October 2014)

Conditions of Consent

Consent Granted:	To discharge waste fluids, associated with hydrocarbon exploration and production by deep well injection, into the Matemateaonga Formation via the KW-2 and KA-16 wells, or into the Mangahewa Formation via wells KA-01 and/or KA-07 as a contingency
Expiry Date:	1 June 2029
Review Date(s):	June Annually
Site Location:	KA-09 wellsite (KW-2/KA-16), 83 Lower Duthie Road & KA-1/7/19/20 wellsite (KA-01/KA-07), 360 Palmer Road, Kapuni
Grid Reference (NZTM)	1702850E-5629709N 1701152E-5630141N
Catchment:	Inaha Kapuni

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

General condition

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

Special conditions

1. The volume discharged shall not exceed 2,000 cubic metres per day.

2. The consent holder shall submit an updated "Injection Operation Management Plan" prior to any future deep well injection activities. The plan shall include the operational details of the injection activities and identify the conditions that would trigger concerns about the integrity of any 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.

3. Before exercising this consent, 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) confirmation of the depth to which fresh water resources, as defined in condition 9, are encountered below the site.

   (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 2024.

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. Fluids shall be injected at a minimum depth of 1,200 mbgl.

7. Before either contingency back-up wells (KA-01 and/or KA-07) are utilised for injection purposes, the consent holder must provide to the Chief Executive, Taranaki Regional Council an Injection Operation Management Plan specific to the well to be used, which includes all information required by condition 3.

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) hydraulic fracturing and return fluids;
    (c) well workover fluids;
    (d) well servicing and intervention fluids;
    (e) well drilling fluids;
    (f) production chemicals
    (g) production sludges;
    (h) contaminated stormwater; and
    (i) other fluids in accordance with condition 11 below.

11. The fluids discharged under this consent shall only be those listed in condition 10(a) to 10(h) above, and other fluids that:

    (a) Can reasonably be expected to be used in petrochemical well maintenance and development in accordance with industry best practice;
    (b) Have environmental effects that are no more adverse than those listed in 10(a)–10(h) above;
    (c) Have been certified by the Chief Executive, Taranaki Regional Council as complying with 11(a) and 11(b) above; and
    (d) Have been the subject of a specific request for certification, in accordance with 11(c) above, that includes details of the proposed contaminant.

12. 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.

13. 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.

    (Note: The analysis required by condition 13 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).

14. If the analysis required by condition 13 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 13. 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.

15. The information required by conditions 12 and 13 above, for each calendar month, shall be provided to the Chief Executive, Taranaki Regional Council before the 28th day of the following month.

16. 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) wellsite/wellbore 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 injection well. 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.

17. 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 16 and 17, could be taken and analysed by the Taranaki Regional Council or other contracted party on behalf of the consent holder.*

18. 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 16.*

19. 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) A summary of injection activities over the period being reported;
    b) an assessment of injection well performance;
    c) an assessment of the on-going integrity and isolation of the wellbore; and
    d) an assessment of the on-going integrity and isolation of the receiving formation.

20. This consent shall lapse on 31 December 2019, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991.

21. 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 7 November 2017

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:	Todd Energy Limited PO Box 802 New Plymouth 4340
Decision Date:	13 June 2018
Commencement Date:	13 June 2018

Conditions of Consent

Consent Granted:	To discharge produced water, well drilling fluids, well work over fluids and hydraulic fracturing fluids from hydrocarbon exploration and production operations into the McKee Formation by deep well injection at the Tuhua-D wellsite
Expiry Date:	1 June 2033
Review Date(s):	June annually
Site Location:	Tuhua-D wellsite, Foreman Road, Tikorangi (Property owner: Cheryll & Lynn Foreman)
Grid Reference (NZTM)	1716441E-5673950N
Catchment:	Onaero
Tributary:	Pouri

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 exercising the consent, 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. Before exercising the consent, 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;
   (e) confirmation of the depth to which fresh water resources, as defined in condition 7, 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 2 may be included within the "Injection Operation Management Plan" required by condition 1).

3. There shall be no injection of any fluids after 1 June 2028.

4. 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.

5. The injection of fluids shall be confined to the McKee Formation, and be injected at a minimum depth of 2,319 metres true vertical depth below ground level.

6. 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.

7. 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.

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

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

9. 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 8);
   (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 9(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.

10. 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.

11. If the analysis required by condition 9(c) 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 9. 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.

12. 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 28th day of the following month.

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 7 (the 'Monitoring Programme'). The Monitoring Programme shall be submitted to the Chief Executive, Taranaki Regional Council, for certification before exercising the consent, and shall include:

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

    It is a minimum 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.

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.

    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 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 13.

16. 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.

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 13 June 2018

For and on behalf of
Taranaki Regional Council

_____

A D McLay
Director - Resource Management

Appendix II

Groundwater Sampling Reports

ENVIRONMENTAL REPORT

Kapuni Bore Compliance Monitoring Programme

for Todd Energy Limited

Rev 1 - 02/08/2018






BTW COMPANY

SURVEYING | ENGINEERING | PLANNING & ENVIRONMENT

Kapuni Bore Compliance Monitoring Programme

for Todd Energy Limited

	Reviewed	
Report Author	Greg Larkin	8-8-18 Date
Reviewed by	Graeme Johnston	8 Aug 2018 Date

180737
Rev 1 - 02/08/2018

CONTENTS

TABLES

1 INTRODUCTION

1.1 Monitoring Programme Background

This report has been prepared for Todd Energy Limited (Todd) by BTW Company (BTW). It documents a groundwater monitoring event (GME) on selected bores in the Kapuni area, South Taranaki. This is the third GME undertaken by BTW on the five sites in this monitoring programme. Ten previous GMEs had been undertaken on the third-party farm bores between December 2012 and August 2016. These were undertaken by AECOM and URS Consulting Services (NZ) Ltd on behalf of Shell Todd Oil Service ('STOS') prior to divestment of the Kapuni field to Todd.

Todd has agreed to continue the programme of monitoring three bores located on third-party farms in the Kapuni area (used for farming purposes) and two wellsite bores; one located on the KA 1/7/19/20 wellsite and the other on KA 9/16 wellsite. The bores on the KA 9/16 wellsite (GND 2357) and KA 1/7/19/20 wellsite (GND 0093) are adjacent to produced water re-injection wells.

1.2 Objectives

The primary objective of this compliance monitoring is to provide updated water chemistry data from the five sites located in the Kapuni area (See Appendix A for location plan). The water chemistry data will assist in delineating any potential or actual adverse effects to the groundwater resources in South Taranaki as a result of Todd's Deep Well Injection (DWI) activities.

1.3 Scope of Works

The scope of works comprised the following;

- Produce a project specific health safety and environmental (HSE) management plan outlining BTW's policy and procedural commitments. This includes journey management, permit to work requirements and land liaison with the third-party landowners.
- Collection of groundwater samples from the three third-party farm bores and the two wellsites. Site access approval and Hot Works 2 permits were obtained from both Kapuni Operations and the third-party landowners prior to works commencing.
- Interpretation of laboratory results from the collected groundwater samples.
- Technical report for Todd.

2 GROUNDWATER MONITORING EVENT (GME) METHODOLOGY

2.1 July 2018 Groundwater Monitoring Event

The July 28 monitoring compromised the collection of water samples from the following;

- GND 1701-PKW Farms, 468 Hastings Road;
- GND 2369- Kiley Estate, Inuawai Road;
- GND 1659- Naplin Trust, Ahipaipa Road;
- GND 0093-KA1/7/19/20 Wellsite, Palmer Road;
- GND 2357- KA 9/16 Wellsite, Lower Duthie Road.

See Appendix B for site details.

Prior to sample collection, the groundwater pumps on GND 1701, GND 2369 and GND 1659 were run for several minutes to ensure adequate purging. As these three sites provide up to 150 m^3 of abstraction water volume per day for farm dairy supply it is considered that the bores were purged sufficiently.

Groundwater samples for GND 1701, GND 2369 and GND 1659 were collected from taps close to the wellhead at each site.

The wellsite groundwater samples were collected with a GeoControl Bladder Pump, with individual downhole LPDE tubing and bladders for each site. Due to HSE requirements, which preclude the use of non-IS equipment such cell phones, the purge rate was set at 30/30 which ensured constant head and yielded a purge rate at less than 100 ml per minute. In-field groundwater parameters (pH, Dissolved Oxygen, Electrical Conductivity, Temperature and Oxidation-Reduction Potential) were continuously monitored until the parameters stabilised for five consecutive readings.

During the GME all field measurements and observations were recorded as per BTW's internal standard operating procedures (SOP) for groundwater sampling. All field sheets are in Appendix C.

Groundwater samples were collected directly into laboratory supplied sample bottles and sent cold via courier to Hill Laboratories for analysis.

Groundwater samples were analysed for the following: -

1. GND 1701, GND 2369 and GND 1659 - pH, Electrical Conductivity, Chloride, Total Petroleum Hydrocarbons (TPH).
2. GND 2357 and GND 0093 - Electrical Conductivity, Chloride, Total Petroleum Hydrocarbons (TPH) and Benzene, Toluene, Ethylbenzene and Xylenes (BTEX).

2.2 Chain of Custody Requirements

As per standard procedures with Hill Laboratories, a chain of custody form was completed and sent to the laboratory with the water samples. The analysis could be tracked via an online service provided to customers. The samples were processed under a 'high' priority status. Chain of Custody forms are in Appendix D.

3 JULY 2018 RESULTS

3.1 Groundwater Quality

See Appendix E for Hill Laboratories analytical reports. The July 2018 water quality results are summarised in Table 3.1 and in the key bullet points below.

Table 3.1: 2018 Analytical Results

Test	Sample Name	GND 1701 26-Jul-2018 10:30 am	GND 1659 26-Jul-2018 11:30 am	GND 1659A 26-Jul-2018 11:35 am	GND 2369 26-Jul-2018 11:15 am	GND 0093 26-Jul-2018 2:00 pm	GND 2357 26-Jul-2018 3:00 pm
	Lab Number:	2022638.1	2022638.2	2022638.3	2022638.4	2022638.5	2022638.6
pH	pH Units	8.4	8.1	-	7.8	7.1	7.6
Chloride	g/m3	11.1	11.8	-	14.3	16.9	27
BTEX in Water by Headspace GC-MS							
Benzene	g/m3	-	-	-	-	< 0.0010	< 0.0010
Toluene	g/m3	-	-	-	-	< 0.0010	< 0.0010
Ethylbenzene	g/m3	-	-	-	-	< 0.0010	< 0.0010
m&p-Xylene	g/m3	-	-	-	-	< 0.002	< 0.002
o-Xylene	g/m3	-	-	-	-	< 0.0010	< 0.0010
Total Petroleum Hydrocarbons in Water							
C7 - C9	g/m3	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
C10 - C14	g/m3	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
C15 - C36	g/m3	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Total hydrocarbons (C7 - C36)	g/m3	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7

- No TPH concentrations were recorded above the analytical method of detection limit (MDL) for all sites sampled during the July 2018 sampling.
- No BTEX concentrations were recorded above the analytical MDL for GND 2357 and GND 0093.
- Concentrations of Electrical Conductivity and Chloride at all sites are consistent with background concentrations for unimpacted shallow groundwater.
- The QA/QC sample collected at GND 1659 recorded an identical TPH result as its duplicate.
- The results from the July 2018 sampling indicate that there is no hydrocarbon contamination to the groundwater resources adjacent to the third-party farm abstraction bores and on the KA1/7/19/20 and KA 9/16 wellsites.
- The results from the July 2018 sampling are consistent with the sampling results from the previously groundwater monitoring undertaken between 2012 and 2017, indicating no hydrocarbon contamination within the groundwater resources adjacent to the sampling sites.

4 SUMMARY AND RECOMMENDATIONS

From the July 2018 sampling results the following points are noted;

- The analytical results of the July 2018 sampling are consistent with the results from the previous sampling undertaken between 2012 and 2017.
- The results indicate that no hydrocarbon contamination exists at the five sampling sites which can be attributed to Todd Deep Well Injection (DWI) activities in the Kapuni area.

4.1 Limitations

All information in this report is provided strictly in accordance with the following limitations and recommendations:

- This report has been produced in accordance with the project specific brief and scope of works and, therefore, should be read in its entirety.
- The responsibility of BTW Company is solely to the client Todd Energy Limited. This report is not intended for any third party and, as such, no liability is undertaken to any third party.
- Conclusions in this report are based solely on the information and findings of the July 2018 sampling and all previous sampling rounds.
- Groundwater and soil conditions are subject to continual natural and anthropogenic influences and can, therefore, exhibit a range of spatial and temporal variances. The collected data in this report is only directly relevant to the groundwater resources at the sampling sites and at the time the sampling was undertaken.
- If different groundwater conditions are encountered subsequent to the production of this report, BTW Company should be notified and allowed to provide an opportunity to review both the findings of this report and the new evidence.

APPENDIX A KAPUNI BORES - SITE MAP

Site Name	Northing	Easting
GND0093	5630102.00	1701117.00
GND1659	5625717.17	1702466.52
GND1701	5629108.47	1705759.39
GND2357	5629755.00	1702806.00
GND2369	5625312.83	1704246.99

1,700,000

5,630,000

GND0093

GND2357

Lower Duthie Rd

Palmer Rd

GND1701

Skeet Rd

Kokiri Rd

Little Tempsky Rd

Hastings Rd

Omahuru Rd

Tempsky Rd

Ahipaipa Rd

GND1659

Mawhitiwhiti Rd

Inuawai Rd

GND2369

Katotauru Rd

Inaha Rd

Kohiti Rd

Barclay Rd

Normanby Rd

Ngutu Rd

Manu Rd

Tito Rd

Burgon Rd

Forbes Rd

Legend

▲ Kapuni Sampling Locations

1,700,000

GENERAL NOTES
1. Coordinates are in terms of New Zealand Transverse Mercator

DISCLAIMER
GIS data and imagery are for indicative purposes only.
Cadastral information sourced from LINZ. Crown copyright reserved.
No works may be undertaken in the vicinity of pipelines without a work permit and 2 days' notice.
Contact Details: FirstGas: (06) 755-0861 Core Group: (06) 769-9391, (0800) 267-347

TITLE

KAPUNI WELL MONITORING SITE LOCATIONS

DRAWN	R. CADENHEAD	10.08.18
CHECKED	G. LARKIN	10.08.18
PROJECT No	17214.02	
LOCATION	KAPUNI	
SCALE	1:25,000	
ORIGINAL SIZE	A3	

TODD ENERGY

BTW COMPANY
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NO	DATE	BY	CHKD.	
1	10.08.18	TS	GL	Sites updated

REVISIONS

0 100 200 400 600 800 1,000 Meters

1:25,000

DRAWING No	SHEET	REVISION
17214.02-101-GIS	1	1

APPENDIX B SITE DETAILS

Site Id	Easting	Northing	Depth to water	Depth (m)	Cased	Screen mbgl	Comments
GND1701	1705759.39	5629108.47	Unknown	337	To 90 m	30-60	Approximately 130,000 litres of groundwater are pumped each day.
GND2369	1704246.99	5625312.83	Unknown	448	To 280 m	Unknown	The bore is pumped to supply water to a dairy shed
GND1659	1702466.52	5625717.17	Unknown	432	To 123 m	Unknown	The bore artesians and supplies a dairy shed
GND2357	1702806.00	5629755.00	11.4	35	Open ended	None	Bore Depth is effective depth that redundant pump could be pushed to.
GND0093	1701117.00	5630102.00	Bore Probe failure	42.6	Unknown	Unknown	Bore is 45 m south of the KA1 Wellhead reinjection well

APPENDIX C FIELD SHEETS

FIELD SHEET - GROUNDWATER MONITORING

BTW Company Groundwater Fieldsheet Kapuni DWI bores

Site Name		BORE No:	GND1701
Date	26-7-18	Collected by	GL/TS
Screen Depth	NA	m	
Well Depth	337	m	
Location	90	Easting/Northing	

↳ Hastings Rd PKW Farm 3

BTW Company Job No:

Sample ID (Hills)	GND 1701
Duplicate ID	NA
Routine Water test	✓
E.coli Profile	
Turbidity	

Other Notes

- Discretes only
- Farm purged in morning
- H_2S odour
- ran bore head tap for 60 sec
- 130,000 Litres per day

Aquifer 'slug test'

Static Water Level (m)	Time (hr)
NA	

Purging/drawdown

Purge method	sub
Time started	NA
Time stopped	
Flow rate	NA
Sample appearance	clear

Purge depth	NA
SWL (Start)	
SWL (End)	
Purge/drawdown volume (litres)	

Field Analysis

Static Water Level (m)	Time (~~Hr~~) (Sec)	Volume Purged	EC (µS)	pH	T(°)	ORP (mV)	DO2 (%)	Comments (Colour, Odour)
NA	60.	—	321.5	8.8	17.2	195.	53.6	H_2S odour.

BTWCOMPANY
SURVEYING | ENGINEERING | PLANNING & ENVIRONMENT

ENVIRONMENT FORMS

Section: ENV12
No. of Pages: 1
Issue: 1
Date: 8 November 2016

FIELD SHEET - GROUNDWATER MONITORING

BTW Company Groundwater Fieldsheet Kapuni DWI bores

Site Name		BORE No:	GND0603
Date	26-7	Collected by	GL/TS
Screen Depth	280	m	
Well Depth	448	m	
Location		Easting/Northing	

→ public trust (Inuwai Rd)

BTW Company Job No:

		Other Notes
Sample ID (Hills)	GND2369	
Duplicate ID	NA	
Routine Water test	✓	- TPH/CC/pH
E.coli Profile	✗	
Turbidity	✗	- Discrete only

- no odour; clear
- ran borehead tap for 60 sec

Aquifer 'slug test'

Static Water Level (m)	Time (hr)

Purging/drawdown

Purge method	
Time started	
Time stopped	
Flow rate	clear
Sample appearance	

Purge depth	
SWL (Start)	
SWL (End)	
Purge/drawdown volume (litres)	

NA

Field Analysis

Static Water Level (m)	Time (Hr)	Volume Purged	EC (µS)	pH	T(°)	ORP (mV)	DO2 (%)	Comments (Colour, Odour)
NA			131.9	8.38	10.6	244.8	85	none odour, clear

621 Akipaipa

FIELD SHEET - GROUNDWATER MONITORING

BTW Company Groundwater Fieldsheet Kapuni DWI bores

Site Name		BORE No:	GMP1659
Date	26/7/18	Collected by	GL & TS
Screen Depth	123	m	
Well Depth	432	m	
Location		Easting/Northing	

↳ 261 Ahipapa Rd (Leeroy Nelles)

BTW Company Job No:

Sample ID (Hills)	GMP 1659 & GMP 1659A
Duplicate ID	
Routine Water test	✓
E.coli Profile	\
Turbidity	\

Other Notes

- discretes only
- pump operating so purged already
- very wet ground form

Aquifer 'slug test'

Static Water Level (m)	Time (hr)
NA	

Purging/drawdown

Purge method	
Time started	
Time stopped	
Flow rate	
Sample appearance	clear no odour

Purge depth	NA
SWL (Start)	
SWL (End)	
Purge/drawdown volume (litres)	

Field Analysis

Static Water Level (m)	Time (Hr)	Volume Purged	EC (µS)	pH	T(°)	ORP (mV)	DO2 (%)	Comments (Colour, Odour)
			306.2	8.44	17.1	221.6	37.8	No odour, clear

FIELD SHEET - GROUNDWATER MONITORING

BTW Company Groundwater Fieldsheet Kapuni DWI bores

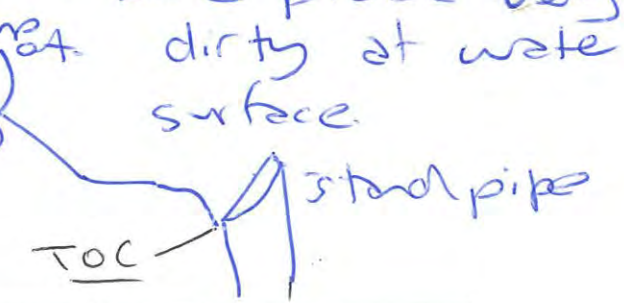
Site Name	KA1	BORE No:	GND0093
Date	26-7	Collected by	GL/TS
Screen Depth	in screen	m	
Well Depth	42.5	m	
Location	4 KA-1/7	Easting/Northing	

BTW Company Job No:

Sample ID (Hills)	GND0093
Duplicate ID	x
Routine Water test	✓
E.coli Profile	\
Turbidity	\

Other Notes

- TPH / BTEX / CC / pH
- bore probe very dirty at water surface



Aquifer 'slug test'

Static Water Level (m)	Time (hr)

Purging/drawdown

Purge method	bladder
Time started	00:00
Time stopped	08:30
Flow rate	<100 ml/min
Sample appearance	clear/slight cloudy @ start
Purge depth	25m
SWL (Start)	17:01 (16.93)
SWL (End)	17:02
Purge/drawdown volume (litres)	

Field Analysis

Static Water Level (m)	Time (Hr) min	Volume Purged	EC (µS)	pH	T(°)	ORP (mV)	DO2 (%)	Comments (Colour, Odour)
pump 17:01	00:00	100	138	8.7	13.9	180	10.4	Sandy in sample,
17:02	01:00	200	14.2	8.7	13.4	208	6.6	
	02:00	300	14.4	8.71	133	208	4.7	
17.02	03:00	400	14.3	"	131	211	4.3	constant head
	04:00	500	13.8	8.7	131	213	3.6	
	05:00	600	14.1	8.68	"	214	3.5	
	0600	700	"	"	"	214	"	
	07:00	800	"	8.67	"	218	4.5	Flowcell tipped in wind
1702	08:00	900	14.2	"	"	219	7.	constant head.
						stable	&	sampled @

FIELD SHEET - GROUNDWATER MONITORING

BTW Company Groundwater Fieldsheet Kapuni DWI bores

Site Name	KA9	BORE No:	GND 2357
Date	26-7	Collected by	GL / TS
Screen Depth	unknown m		
Well Depth	35 m		
Location		Easting/Northing	

↳ KA 9 'KW02' emergency bore

BTW Company Job No:

Sample ID (Hills)	GND 2357
Duplicate ID	NA
Routine Water test	✓
E.coli Profile	✓
Turbidity	✗

Other Notes

- TPH / BTEX / Cl⁻ / pH
- Bore Tape not working so estimated
- purge depth on 1 of sample.
- 25/25 rate < 100ml/min

Aquifer 'slug test'

Static Water Level (m)	Time (hr)
NA	

Purging/drawdown

Purge method	bladder
Time started	00:00
Time stopped	08:00
Flow rate	<100ml/min
Sample appearance	clear

Purge depth	22m
SWL (Start)	–
SWL (End)	–
Purge/drawdown volume (litres)	800ml

Field Analysis

Static Water Level (m)	Time (Hr) min	Volume Purged ml	EC (µS)	pH	T(°)	ORP (mV)	DO2 (%)	Comments (Colour, Odour)
NA	0000	100ml	556	7.9	12.5	188	11.7	clear, no odour
	0200	200ml	565	7.88	12.8	202	6.4	
	0300	300	567	7.82	13.1	203	4.8	
	0400	400	566	7.8	13.1	202	3.6	
	0500	500	567	7.8	13.0	202	3.7	
	0600	600	567	7.8	13.1	202	3.6	
	0700	700	567.	7.8	"	"	"	Stable
NA	0800	800	"	"	"	"	"	& sampled

APPENDIX D CHAIN OF CUSTODY FORMS

Hill Laboratories
TRIED, TESTED AND TRUSTED

ANALYSIS REQUEST

R J Hill Laboratories Limited
1 Clyde Street Hamilton 3216
Private Bag 3205
Hamilton 3240 New Zealand

T 0508 HILL LAB (44 555 2
T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Job No: **202 2638**

Date Recv: 28-Jul-18 07:54

Received by: Nathaniel Sue

3120226380

Quote No 84336

Primary Contact Greg Larkin

Submitted By Greg Larkin

Client Name BTW Company Limited 40949

Address PO Box 551, New Plymouth 4340

Phone 06 759 5040 *Mobile* 027 669 9190

Email

Charge To BTW Company Limited 40949

Client Reference 180737

Order No

Results To *Reports will be emailed to Primary Contact by default. Additional Reports will be sent as specified below.*

☑ Email Primary Contact ☐ Email Submitter ☐ Email Client

☐ Email Other

☐ Other

CHAIN OF CUSTODY RECORD

Sent to Hill Laboratories
☑ Tick if you require COC to be emailed back

Date & Time: 27-7-18 12:00
Name: Greg L
Signature:

Received at Hill Laboratories
Date & Time:
Name:
Signature:

Condition ☐ Room Temp ☑ Chilled ☐ Frozen
Temp: 0.5

☐ Sample & Analysis details checked
Signature:

ADDITIONAL INFORMATION

Priority ☐ Low ☐ Normal ☑ High
☐ **Urgent** (ASAP, extra charge applies, please contact lab first)

NOTE: The estimated turnaround time for the types and number of samples and analyses specified on this quote is by 4:30 pm, 5 working days following the day of receipt of the samples at the laboratory.

Requested Reporting Date:

Quoted Sample Types
Ground Water (GW)

No.	Sample Name	Sample Date/Time	Sample Type	Tests Required
1	GMD 1701	10:30	GW	TPH / Cl⁻ / pH (Aspequok)
2	GMD 1659	11:30	"	" " "
3	GMD 1659A	11:35	"	" " " "
4	GMD 0603	11:15	"	" " " "
5	GMD 0093	14:00	"	" " " plus BTEX
6	GMD 2357	15:00	"	" " " plus BTEX
7				
8	Miss labelled			
9	GMD 2369			
10				

Hill Laboratories
TRIED, TESTED AND TRUSTED

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

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

Job Information Summary

Client:	BTW Company Limited	**Lab No:**	2022638
Contact:	Greg Larkin	**Date Registered:**	28-Jul-2018 1:03 pm
	C/- BTW Company Limited	**Priority:**	High
	PO Box 551	**Quote No:**	84336
	New Plymouth 4340	**Order No:**	
		Client Reference:	180737
		Add. Client Ref:	
		Submitted By:	Greg Larkin
		Charge To:	BTW Company Limited
		Target Date:	06-Aug-2018 4:30 pm

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
1	GND 1701 26-Jul-2018 10:30 am	Ground Water	UP250, TPH250	pH; Chloride; Total Petroleum Hydrocarbons in Water
2	GND 1659 26-Jul-2018 11:30 am	Ground Water	UP250, TPH250	pH; Chloride; Total Petroleum Hydrocarbons in Water
3	GND 1659A 26-Jul-2018 11:35 am	Ground Water	TPH250	Total Petroleum Hydrocarbons in Water
4	GND 0603 26-Jul-2018 11:15 am	Ground Water	UP250, TPH250	pH; Chloride; Total Petroleum Hydrocarbons in Water
5	GND 0093 26-Jul-2018 2:00 pm	Ground Water	TPH250, VOC40, VOC40, cUP250	pH; Chloride; TPH + BTEX profile, Water
6	GND 2357 26-Jul-2018 3:00 pm	Ground Water	cUP250, TPH250, VOC40, VOC40	pH; Chloride; TPH + BTEX profile, Water

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis, US EPA 8260B [KBIs:26687,3629]	0.0010 - 0.002 g/m^3	5-6
Total Petroleum Hydrocarbons in Water	Solvent Hexane extraction, GC-FID analysis, Headspace GC-MS FS analysis US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:2803,10734;26687,3629]	0.06 - 0.7 g/m^3	1-6
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-2, 4-6
pH	pH meter. APHA 4500-H^+ B 22nd ed. 2012. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-2, 4-6
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 22nd ed. 2012.	0.5 g/m^3	1-2, 4-6
C7 - C9	Head Space, GCMS analysis.	0.06 g/m^3	1-6

APPENDIX E HILL LABORATORIES ANALYTICAL REPORT

Hill Laboratories
TRIED, TESTED AND TRUSTED

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

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

Certificate of Analysis

Client:	BTW Company Limited	**Lab No:**	2022638	SPv1
Contact:	Greg Larkin	**Date Received:**	28-Jul-2018	
	C/- BTW Company Limited	**Date Reported:**	06-Aug-2018	
	PO Box 551	**Quote No:**	84336	
	New Plymouth 4340	**Order No:**		
		Client Reference:	180737	
		Submitted By:	Greg Larkin	

Miss Labelled GND 2369

Sample Type: Aqueous

Sample Name:	GND 1701 26-Jul-2018 10:30 am	GND 1659 26-Jul-2018 11:30 am	GND 1659A 26-Jul-2018 11:35 am	GND 0603 26-Jul-2018 11:15 am	GND 0093 26-Jul-2018 2:00 pm
Lab Number:	2022638.1	2022638.2	2022638.3	2022638.4	2022638.5
Individual Tests					
pH pH Units	8.4	8.1	-	7.8	7.1
Chloride g/m³	11.1	11.8	-	14.3	16.9
BTEX in Water by Headspace GC-MS					
Benzene g/m³	-	-	-	-	< 0.0010
Toluene g/m³	-	-	-	-	< 0.0010
Ethylbenzene g/m³	-	-	-	-	< 0.0010
m&p-Xylene g/m³	-	-	-	-	< 0.002
o-Xylene g/m³	-	-	-	-	< 0.0010
Total Petroleum Hydrocarbons in Water					
C7 - C9 g/m³	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
C10 - C14 g/m³	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
C15 - C36 g/m³	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Total hydrocarbons (C7 - C36) g/m³	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7

Sample Name:	GND 2357 26-Jul-2018 3:00 pm
Lab Number:	2022638.6
Individual Tests	
pH pH Units	7.6
Chloride g/m³	27
BTEX in Water by Headspace GC-MS	
Benzene g/m³	< 0.0010
Toluene g/m³	< 0.0010
Ethylbenzene g/m³	< 0.0010
m&p-Xylene g/m³	< 0.002
o-Xylene g/m³	< 0.0010
Total Petroleum Hydrocarbons in Water	
C7 - C9 g/m³	< 0.06
C10 - C14 g/m³	< 0.2
C15 - C36 g/m³	< 0.4
Total hydrocarbons (C7 - C36) g/m³	< 0.7

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis, US EPA 8260B [KBIs:26687,3629]	0.0010 - 0.002 g/m^3	5-6
Total Petroleum Hydrocarbons in Water	Solvent Hexane extraction, GC-FID analysis, Headspace GC-MS FS analysis US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:2803,10734;26687,3629]	0.06 - 0.7 g/m^3	1-6
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-2, 4-6
pH	pH meter. APHA 4500-H$^+$ B 22nd ed. 2012. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-2, 4-6
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 22nd ed. 2012.	0.5 g/m^3	1-2, 4-6
C7 - C9	Head Space, GCMS analysis.	0.06 g/m^3	1-6

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

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

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

ENVIRONMENTAL REPORT

Kapuni Farm Bore Compliance Monitoring Programme

for Todd Energy New Zealand

Rev 4 - 18/12/2017






BTW COMPANY

SURVEYING | ENGINEERING | PLANNING & ENVIRONMENT

Kapuni Farm Bore Compliance Monitoring Programme

for Todd Energy New Zealand

	Reviewed	
Report Author		27/11/2017
	Greg Larkin Senior Environmental Scientist, M.Sc. Environmental Science, B.Sc. Ecology	Date
Reviewed by		27/11/2017
	Dave Bolger Senior Environmental Scientist, CEnvP.	Date

17214.02
Rev 4 - 18/12/2017

CONTENTS

TABLES

1 INTRODUCTION

1.1 Background to Monitoring Programme

This report has been prepared for Todd Energy Limited (Todd) by BTW Company (BTW). It documents a groundwater monitoring event (GME) on selected bores in the Kapuni area, South Taranaki Appendix A. This is the second GME undertaken by BTW on the four sites in the monitoring programme.

The selected groundwater monitoring sites were sampled in accordance with the initial proposal to Shell Todd Oil Services (STOS) dated March 23rd, 2017, prior to its divestment of the Kapuni natural gas field to Todd. Ten previous GME's had been undertaken on the third-party farm bores between December 2012 and August 2016 by AECOM and URS Consulting Services (NZ) Ltd on behalf of STOS. Todd have agreed to continue the monitoring programme of the three bores located on third party farms in the Kapuni area (used for farming purposes) and fourth site located on the KA 9 wellsite. The site on the KA 9 wellsite is the Emergency Bore adjacent the produced water re-injection well KW-02.

The groundwater bores within this monitoring programme range from 35 to 448 metres deep, see Appendix A for site details.

1.2 Objectives

The primary objective of the GME is to provide updated water chemistry data from the four sites located in the Kapuni area (Appendix A). The water chemistry data would assist in delineating any potential or actual adverse effects to the groundwater resources as a result of Todd's activities.

1.3 Scope of Works

The GME scope of works comprised of the following;

- Produce a project specific health safety and environmental (HSE) management plan outlining BTW's policy and procedural commitments, which included journey management, permit to work requirements and land liaison with the third-party landowners.
- Collection of groundwater samples from the three third party farm bores and the former emergency bore on the KA 9 wellsite. Site access approval was obtained from both Kapuni Operations and the third-party landowners prior to works commencing.
- Interpretation of laboratory results from the collected groundwater samples.
- Technical report for Todd.

2 GROUNDWATER MONITORING EVENT (GME) METHODOLOGY

2.1 October 2017 Groundwater Monitoring Event

The October 2017 GME utilising the four monitoring bores was undertaken on October 20th, 2017 and compromised of the collection of water samples from the following;

- Site 2 (GND 1701)-PKW Farms, 468 Hastings Road
- Site 3 (GND 2369) Kiley Estate, Inuawai Road
- Site 4 (GND 1659) Naplin Trust, Ahipaipa Road
- KA 9 Emergency Bore (GND 2357) on KA 9 wellsite, Lower Duthie Road

Note; Site 1 GND 1143 has now been removed from the Farm Bore Monitoring Programme and at the time of publication Todd were preparing to replace Site 1 with another purpose built monitoring bore(s).

- Prior to sample collection, the groundwater pumps on GND 1701, GND2369 and GND 1659 were run for several minutes to ensure adequate purging. However, it is assumed that as these three sites provide up to 150 m^3 of abstraction water volume per day, therefore it is considered they are purged adequately for this GME.
- Volatile Organic Compounds (VOC) concentrations in the headspace of GND 2357 were measured using a photo ionisation detector (PID) immediately after opening the well cap.
- Groundwater samples for GND 1701, GND2369 and GND 1659 were collected from sampling taps close to the wellhead at each site.
- The groundwater sample for KA 9-EB was collected using a downhole 12-volt submersible pump. Due to HSE requirements for not allowing Non-IS equipment such cell phones, the purge was estimated at less than 1 litre/min and ran for 30 minutes until the groundwater parameters (pH, Dissolved Oxygen, Electrical Conductivity, Temperature and Chloride) readings stabilised for five consecutive readings.
- During the GME all field measurements and observations were recorded as per BTW's internal standard operating procedures (SOP) for groundwater sampling. All field sheets are in Appendix C.
- Groundwater samples were collected directly into laboratory supplied sample bottles and sent cold via courier to the analytical laboratory (RJ Hill's Laboratory).

2.1.1 Groundwater samples were analysed for the following;

1. GND 1701, GND2369 and GND 1659 - pH, Electrical Conductivity, Chloride, Total Petroleum Hydrocarbons (TPH).
2. GND 2357- Electrical Conductivity, Chloride, Total Petroleum Hydrocarbons (TPH) and Benzene, Toluene, Ethylbenzene and Xylenes (BTEX).

2.2 Chain of Custody Requirements

As per standard procedures with the analytical Laboratory ('RJ Hill Laboratories'), a chain of custody form was completed and sent to the laboratory with the water sample. Information included; sample

name, date of sample, tests required, type of material, sent by whom, date received by lab and sample temperature on arrival. Hill Laboratories send the chain of custody form back to BTW via email the following day to complete the chain of custody requirements. The analysis could be tracked via an online service Hill Laboratories provides to customers. The samples were processed under a high priority status by Hill Laboratories. Chain of Custody forms are in Appendix D.

3 OCTOBER 2017 GME RESULTS

3.1 Groundwater Quality

The October 2017 GME and the previous May 2017 GME analytical results are summarised in Table 3.1 and the key bullet points below. No positive headspace VOC measurements were recorded from GND 2357 in either of the GME's undertaken in 2017.

Table 3.1: 2017 GME Analytical Results

	Site 1 08-May-2017	GND 1701 Site 2 08-May-2017	GND 1701 Site 2 20-Oct-2017	GND 2369 Site 3 08-May-2017	GND 2369 Site 3 20-Oct-2017	Site 4 02-May-2017	GND 1659 Site 4 20-Oct-2017	GND 2357 KW02 08-May-2017	GND 2357 KW02 20-Oct-2017
pH (pH Units)	7	8.4	8.3	8.8	8.8	8.1	8.1	7.6	7.4
Electrical Conductivity (EC)	31.7	33.6	33.5	31.9	32	37.5	37.6	57.8	58.2
Chloride g/m3	36	11.4	11.4	11.6	11.7	12.4	12.2	27	28
BTEX in Water by Headspace GC-MS									
Benzene g/m3	-	-	-	-	-		-	< 0.0010	< 0.0010
Toluene g/m3	-	-	-	-	-		-	< 0.0010	< 0.0010
Ethylbenzene g/m3	-	-	-	-	-		-	< 0.0010	< 0.0010
m&p-Xylene g/m3	-	-	-	-	-		-	< 0.002	< 0.002
o-Xylene g/m3	-	-	-	-	-		-	< 0.0010	< 0.0010
Total Petroleum Hydrocarbons in Water									
C7 - C9 g/m3	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
C10 - C14 g/m3	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
C15 - C36 g/m3	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Total hydrocarbons (C7 - C36) g/m3	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7

- TPH concentrations were not recorded above the analytical method of detection limit in all sites sampled during the May and October 2017 GME.
- BTEX concentrations were not recorded above the analytical method of detection limit in the GND 2357 Emergency Bore on the KA9 wellsite.
- Concentrations of Electrical Conductivity and Chloride at all sites are consistent with background concentrations for clean groundwater.
- The results from the October 2017 GME indicate there is no hydrocarbon contamination to the groundwater resources adjacent to the third-party farm abstraction bores and the KA 9 wellsite.
- The results from the October 2017 GME are consistent with the sampling results from the previously GME's between 2012 and 2017, indicating no hydrocarbon contamination within the groundwater resources adjacent to the sampling sites.

4 SUMMARY

From the results from the October 2017 GME, the following points are noted;

- The analytical results of the October 2017 GME are consistent with the results from the previous GME's undertaken between 2012 and 2017.
- The results indicate that no hydrocarbon contamination exists in the four sampling sites which can be attributed to Todd activities in the Kapuni area.

APPENDIX A KAPUNI FARM BORE MONITORING SITES

Site Name	Northing	Easting
GND0093	5630102.00	1701117.00
GND1659	5625717.17	1702466.52
GND1701	5629108.47	1705759.39
GND2357	5629755.00	1702806.00
GND2369	5625312.83	1704246.99

1,700,000

5,630,000

GND0093

GND2357

Lower Duthie Rd

Palmer Rd

GND1701

Skeet Rd

Kokiri Rd

Little Tempsky Rd

Hastings Rd

Omahuru Rd

Tempsky Rd

Ahipaipa Rd

GND1659

Mawhitiwhiti Rd

Inuawai Rd

GND2369

Katotauru Rd

Inaha Rd

Kohiti Rd

Barclay Rd

Normanby Rd

Ngutu Rd

Manu Rd

Tito Rd

Burgon Rd

Forbes Rd

Legend

▲ Kapuni Sampling Locations

1,700,000

GENERAL NOTES
1. Coordinates are in terms of New Zealand Transverse Mercator

DISCLAIMER
GIS data and imagery are for indicative purposes only.
Cadastral information sourced from LINZ. Crown copyright reserved.
No works may be undertaken in the vicinity of pipelines without a work permit and 2 days' notice.
Contact Details: FirstGas: (06) 755-0861 Core Group: (06) 769-9391, (0800) 267-347

TITLE

KAPUNI WELL MONITORING SITE LOCATIONS

DRAWN	R. CADENHEAD	10.08.18
CHECKED	G. LARKIN	10.08.18
PROJECT No	17214.02	
LOCATION	KAPUNI	
SCALE	1:25,000	
ORIGINAL SIZE	A3	

TODD ENERGY

BTW COMPANY
SURVEYING | ENGINEERING | PLANNING & ENVIRONMENT

NO	DATE	BY	CHKD.	
1	10.08.18	TS	GL	Sites updated

REVISIONS

0 100 200 400 600 800 1,000 Meters

1:25,000

DRAWING No	SHEET	REVISION
17214.02-101-GIS	1	1

APPENDIX B KAPUNI FARM BORE CONSTRUCTION DETAILS

Site	TRC Site Identification	Easting_NZTM	Northing_NZTM	Depth to water	Depth (m)	Cased	Screen mbgl)	Comments
Site 2	GND1701	1705759.39	5629108.47	Unknown	337	To 90 m	30-60	Approximately 130,000 litres of groundwater are pumped each day.
Site 3	GND2369	1704246.99	5625312.83	Unknown	448	To 280 m	Unknown	The well is pumped to supply water to a dairy shed
Site 4	GND1659	1702466.52	5625717.17	Unknown	432	To 123 m	Unknown	The well is artesian and supplies a dairy shed
Site 5	GND2357	1702850.35	5629709.25	11.4	35	Open ended	None	Bore Depth is effective depth that redundant pump could be pushed to.

APPENDIX C OCTOBER 2017 GME SAMPLING FIELD SHEETS

FIELD SHEET - GROUNDWATER MONITORING

Site: S.te 2 Bore ID# GMO 1701 Sampled by: Teone/Greg BTW Job No: 17214.02 Lab Quote: — Date: 29-10-17

Well Depth: 337m Screen Depth: 30-60 Purge Method: Tap Time started: — Time Stopped: —

Field Analysis							
SWL (m)	Time NZST	Volume purged (L)	Temp (°C)	pH	Chloride (mg/L)	Conductivity (µS)	Comments (odour, colour, conductivity stable after purging)
unknown	10:20	40	18.0	8.52	36.9	764	discretes only from Tap, DO_2 = 19.5
							Sulphide smell

Purge Volume Calculation = 3.14(well depth-depth to water)*(well radius)^2*1000. Note well radius must be in metres, a 6.5 cm PVC casing is 0.065m*

FIELD SHEET - GROUNDWATER MONITORING

KWO2 Compliance:

Site: Site 3 Bore ID# GMO2369 Sampled by Greg/Teone BTW Job No: 17214.02 Lab Quote: — Date: 20-10-2017

Well Depth: 4.48 Screen Depth: unknown Purge Method: Tap Time started: — Time Stopped: —

Field Analysis

SWL (m)	Time NZST	Volume purged (L)	Temp (°C)	pH	Chloride (mg/L)	Conductivity (µS)	Comments (odour, colour, conductivity stable after purging)
unknown	11:00	40	17.6°C	9.16	17.69	305.2	Discretes only; sample off hose, ran tap for 2 mins, tap covered in grass, sulphide smell, slightly discoloured.

Purge Volume Calculation = 3.14(well depth-depth to water)*(well radius)²*1000. Note well radius must be in metres, a 6.5 cm PVC casing is 0.065m*

FIELD SHEET - GROUNDWATER MONITORING

Site: Ste 4 Bore ID# GND 1569 Sampled by: Teone/Greg BTW Job No: 17214.02 Lab Quote: ~ Date: 20-10-2017

Well Depth: 432 Screen Depth: unknown Purge Method: Tap Time started: ~ Time Stopped: ~

Field Analysis							
SWL (m)	Time NZST	Volume purged (L)	Temp (°C)	pH	Chloride (mg/L)	Conductivity (µS)	Comments (odour, colour, conductivity stable after purging)
unknown	1130	40	17.6	8.42	11.69	361.5	discretes only, slight odar & H_2O discoloured, black flecks in wate. DO% = 6.6

Purge Volume Calculation = 3.14(well depth-depth to water)*(well radius)^2*1000. Note well radius must be in metres, a 6.5 cm PVC casing is 0.065m*

FIELD SHEET - GROUNDWATER MONITORING

Site: KA9 KW02 Bore ID# GND2357 Sampled by: Teo/Greg BTW Job No: 17214-02 Lab Quote: — Date: —

Well Depth: 35 Screen Depth: open Purge Method: bladder Time started: 00:00 Time Stopped: 08:00

Field Analysis							
SWL (m)	Time NZST	Volume purged (L) (mL)	Temp (°C)	pH	Chloride (mg/L)	Conductivity (µS)	Comments (odour, colour, conductivity stable after purging)
12.70	01:00	~~0~~ 100	18.0	8	49	570	100mL/min, DO_2 = 22%
	02:00	200	18.7	7.9	40	570	DO_2 = 16%
	03:00	300	18.8	7.8	39	569	DO_2 = 10%, slight discolored.
	04:00	400	19.0	7.9	39	568	DO_2 = 7.2%
	05:00	500	18.5	7.91	35	569	DO_2 = 6.1%
	06:00	600	18.6	7.91	37	570	DO_2 = 5.8%
	07:00	700	"	"	"	"	DO_2 = 5.2%
12.~~80~~	08:00	800	"	"	"	"	DO_2 = 4.8%,
							Stable except DO_2 =

Purge Volume Calculation = 3.14(well depth-depth to water)*(well radius)²*1000. Note well radius must be in metres, a 6.5 cm PVC casing is 0.065m*

APPENDIX D OCTOBER 2017 GME CHAIN OF CUSTODY FORMS

Hill Laboratories
TRIED, TESTED AND TRUSTED

ANALYSIS REQUEST

R J Hill Laboratories Limited
1 Clyde Street Hamilton 3216
Private Bag 3205
Hamilton 3240 New Zealand

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

Job No: **186 4194**

Date Recv: 21-Oct-17 07:16

Received by: Sarah Collier

311864 1943

Quote No 84336

Primary Contact

Submitted By

Client Name BTW Company Limited 40949

Address PO Box 551, New Plymouth 4340

Phone 06 759 5040 Mobile

Email Greg.Lash@btw.nz

Charge To BTW Company Limited 40949

Client Reference

Order No

Results To *Reports will be emailed to Primary Contact by default. Additional Reports will be sent as specified below.*

☐ Email Primary Contact ☐ Email Submitter ☐ Email Client

☐ Email Other

☐ Other

ADDITIONAL INFORMATION

All GW Samples collected on the 20th Oct

CHAIN OF CUSTODY RECORD

Sent to Hill Laboratories

Date & Time: 20-10-17 16:00

☑ Tick if you require COC to be emailed back

Name: Greg L

Signature:

Received at Hill Laboratories

Date & Time:

Name:

Signature:

Condition ☐ Room Temp ☐ Chilled ☐ Frozen

Temp: 11.9

☐ Sample & Analysis details checked

Signature:

Priority ☐ Low ☐ Normal ☑ High

☐ Urgent (ASAP, extra charge applies, please contact lab first)

NOTE: The estimated turnaround time for the types and number of samples and analyses specified on this quote is by 4:30 pm, 5 working days following the day of receipt of the samples at the laboratory.

Requested Reporting Date:

Quoted Sample Types

Ground Water (GW)

No.	Sample Name	Sample Date/Time	Sample Type	Tests Required
1	GMD 1701 Site 2	10:30	GW	As per quote
2	GMD 2369 Site 3	11:00	"	"
3	GMD 1659 Site 4	11:30	"	"
4	GMD 2357 KWO2	13:30	"	"
5				
6				
7				
8				
9				
10				

Hill Laboratories
TRIED, TESTED AND TRUSTED

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28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand

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E mail@hill-labs.co.nz
W www.hill-laboratories.com

Job Information Summary

Client:	BTW Company Limited	**Lab No:**	1864194
Contact:	Greg Larkin	**Date Registered:**	21-Oct-2017 12:09 pm
	C/- BTW Company Limited	**Priority:**	High
	PO Box 551	**Quote No:**	84336
	New Plymouth 4340	**Order No:**	
		Client Reference:	
		Add. Client Ref:	
		Submitted By:	Greg Larkin
		Charge To:	BTW Company Limited
		Target Date:	31-Oct-2017 4:30 pm

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
1	GND 1701 Site 2 20-Oct-2017 10:30 am	Ground Water	NWU100, TPH250, UP1L, cVOC40, cVOC40	pH; Electrical Conductivity (EC); Chloride; Total Petroleum Hydrocarbons in Water
2	GND 0603 Site 3 20-Oct-2017 11:00 am	Ground Water	NWU100, TPH250, UP1L, cVOC40, cVOC40	pH; Electrical Conductivity (EC); Chloride; Total Petroleum Hydrocarbons in Water
3	GND 1659 Site 4 20-Oct-2017 11:30 am	Ground Water	NWU100, TPH250, UP1L, cVOC40, cVOC40	pH; Electrical Conductivity (EC); Chloride; Total Petroleum Hydrocarbons in Water
4	GND 2357 KW02 20-Oct-2017 1:30 pm	Ground Water	VOC40, VOC40, NWU100, TPH250, UP1L	pH; Electrical Conductivity (EC); Chloride; TPH + BTEX profile, Water

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis, US EPA 8260B [KBIs:26687,3629] Analysis performed at 1 Clyde Street, Hamilton	0.0010 - 0.002 g/m^3	4
Total Petroleum Hydrocarbons in Water	Solvent Hexane extraction, GC-FID analysis, Headspace GC-MS FS analysis US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:2803,10734;26687,3629] Analysis performed at 1 Clyde Street, Hamilton	0.06 - 0.7 g/m^3	1-4
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter. Analysis performed at 1 Clyde Street, Hamilton.	-	1
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	2-4
pH	pH meter. Analysis performed at 1 Clyde Street, Hamilton. APHA 4500-H^+ B 22nd ed. 2012. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field.	0.1 pH Units	1
pH	pH meter. APHA 4500-H^+ B 22nd ed. 2012. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field.	0.1 pH Units	2-4
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 22nd ed. 2012.	0.1 mS/m	2-4
Electrical Conductivity (EC)	Conductivity meter, 25°C. Analysis performed at 1 Clyde Street, Hamilton. APHA 2510 B 22nd ed. 2012.	0.1 mS/m	1
Chloride	Filtered sample. Ferric thiocyanate colorimetry. Discrete Analyser. APHA 4500 Cl^- E (modified from continuous flow analysis) 22nd ed. 2012.	0.5 g/m^3	2-4
Chloride	Filtered sample. Ferric thiocyanate colorimetry. Discrete Analyser. Analysis performed at 1 Clyde Street, Hamilton. APHA 4500 Cl^- E (modified from continuous flow analysis) 22nd ed. 2012.	0.5 g/m^3	1

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
C7 - C9	Head Space, GCMS analysis. Analysis performed at 1 Clyde Street, Hamilton.	0.06 g/m^3	1-4

APPENDIX E OCTOBER 2017 HILLS ANALYTICAL RESULTS

Hill Laboratories
TRIED, TESTED AND TRUSTED

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

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E mail@hill-labs.co.nz
W www.hill-laboratories.com

ANALYSIS REPORT

Client:	BTW Company Limited	**Lab No:**	1864194	SPv1
Contact:	Greg Larkin	**Date Received:**	21-Oct-2017	
	C/- BTW Company Limited	**Date Reported:**	03-Nov-2017	
	PO Box 551	**Quote No:**	84336	
	New Plymouth 4340	**Order No:**		
		Client Reference:		
		Submitted By:	Greg Larkin	

Mislabelled GND 2369

Sample Type: Aqueous

Sample Name:	GND 1701 Site 2 20-Oct-2017 10:30 am	GND 0603 Site 3 20-Oct-2017 11:00 am	GND 1659 Site 4 20-Oct-2017 11:30 am	GND 2357 KW02 20-Oct-2017 1:30 pm	
Lab Number:	1864194.1	1864194.2	1864194.3	1864194.4	
Individual Tests					
pH	pH Units	8.3	8.8	8.1	7.4	-
Electrical Conductivity (EC)	mS/m	33.5	32.0	37.6	58.2	-
Chloride	g/m³	11.4	11.7	12.2	28	-
BTEX in Water by Headspace GC-MS						
Benzene	g/m³	-	-	-	< 0.0010	-
Toluene	g/m³	-	-	-	< 0.0010	-
Ethylbenzene	g/m³	-	-	-	< 0.0010	-
m&p-Xylene	g/m³	-	-	-	< 0.002	-
o-Xylene	g/m³	-	-	-	< 0.0010	-
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m³	< 0.06	< 0.06	< 0.06	< 0.06	-
C10 - C14	g/m³	< 0.2	< 0.2	< 0.2	< 0.2	-
C15 - C36	g/m³	< 0.4	< 0.4	< 0.4	< 0.4	-
Total hydrocarbons (C7 - C36)	g/m³	< 0.7	< 0.7	< 0.7	< 0.7	-

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
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Total Petroleum Hydrocarbons in Water	Solvent Hexane extraction, GC-FID analysis, Headspace GC-MS FS analysis US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:2803,10734;26687,3629] Analysis performed at 1 Clyde Street, Hamilton	0.06 - 0.7 g/m³	1-4
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-4
pH	pH meter. APHA 4500-H^+ B 22nd ed. 2012. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field.	0.1 pH Units	1-4
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 22nd ed. 2012.	0.1 mS/m	1-4
Chloride	Filtered sample. Ferric thiocyanate colorimetry. Discrete Analyser. APHA 4500 Cl^- E (modified from continuous flow analysis) 22nd ed. 2012.	0.5 g/m³	1-4
C7 - C9	Head Space, GCMS analysis. Analysis performed at 1 Clyde Street, Hamilton.	0.06 g/m³	4
C7 - C9	Head Space, GCMS analysis.	0.06 g/m³	1-3

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

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

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Ara Heron BSc (Tech)
Client Services Manager - Environmental