Todd Energy Limited
Te Kiri North-A Wellsite
Monitoring Programme Report
2015-2016

Technical Report 2017-20

ISSN: 1178-1467 (Online)
Document: 1849533 (Word)
Document: 1862327 (Pdf)

Taranaki Regional Council
Private Bag 713
STRATFORD

June 2017

Executive summary

In 2015, Todd Energy Limited (the Company) established a hydrocarbon exploration site located on Kina Road at Oaonui, in the Oaoiti catchment. The site is called Te Kiri North-A wellsite. This report covers the period from January 2015 to December 2016. During this period, one hydrocarbon well was drilled, tested, plugged and abandoned. This report describes the monitoring programme implemented by the Taranaki Regional Council (the Council) to assess the Company's environmental and consent compliance performance during the period under review. The report also details the results of the monitoring undertaken and assesses the environmental effects of the Company's activities.

The Company holds five resource consents, which include a total of 56 conditions setting out the requirements that the Company must satisfy. The Company holds two consents to allow it to take and use water, two consents to discharge stormwater to land onto where it may enter an unnamed tributary of the Oaoiti Stream, and one consent to discharge emissions into the air at this site.

During the monitoring period, Todd Energy Ltd demonstrated an overall high level of environmental performance.

The Council's monitoring programme for the period under review included 9 inspections, 4 water samples collected for physicochemical analysis, and two biomonitoring surveys of receiving waters.

The monitoring showed that all samples obtained were in compliance with consent conditions. The monitoring indicated there was no effect on the receiving environment from the activities at the Te Kiri North-A wellsite. There were no Unauthorised Incidents recording non-compliance in respect of this consent holder during the period under review. No gas combustion associated with hydrocarbon exploration activities was carried out at the site during this period.

During the year, the Company demonstrated a high level of environmental and administrative performance with the resource consents. During the year under review there were no significant issues with silt or sediment controls, and stormwater from the site was well-managed with no discharges observed by Council officers. Staff site were cooperative with requests made by Council officers, with any required works being completed in a timely and satisfactory manner.

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

This report includes recommendations for future drilling operations at the site.

Table of contents

		Page
1.	Introduction	1
1.1.	Compliance monitoring programme reports and the Resource Management Act 1991	1
1.1.1.	Introduction	1
1.1.2.	Structure of this report	1
1.1.3.	The Resource Management Act 1991 and monitoring	1
1.1.4.	Evaluation of environmental and administrative performance	2
1.2.	Process description	3
1.2.1.	Site Description	3
1.2.2.	Well development	4
1.2.3.	Management of stormwater, wastewater, & solid drilling waste	5
1.2.4.	Hydraulic fracturing	5
1.2.5.	Flaring from exploration activities	6
1.3.	Resource consents	7
1.3.1.	Water abstraction permit (groundwater)	7
1.3.2.	Water abstraction permit (surface water)	7
1.3.3.	Water discharge permit (treated stormwater)	8
1.3.4.	Water discharge permit (stormwater and sediment - earthworks)	8
1.3.5.	Air discharge permit (exploration activities)	8
1.4.	Monitoring programme	9
1.4.1.	Introduction	9
1.4.2.	Programme liaison and management	9
1.4.3.	Site inspections	9
1.4.4.	Chemical sampling	10
1.4.5.	Biomonitoring surveys	10
1.4.6.	Solid wastes	10
2.	Results	11
2.1.	Water	11
2.1.1.	Inspections	11
2.1.2.	Results of discharge monitoring	13
2.1.3.	Results of receiving environment monitoring	14
2.1.4.	Air quality monitoring	16
2.2.	Investigations, interventions, and incidents	16

3. Discussion 17
3.1. Discussion of site performance 17
3.2. Environmental effects of exercise of consents 17
3.4. Evaluation of performance 18
3.5. Alterations to monitoring programmes for 2016-2017 22
3.6. Exercise of optional review of consent 22

4. Recommendations 23

Glossary of common terms and abbreviations 24

Bibliography and references 26

Appendix I Resource consents held by Todd Energy Ltd (For a copy of the signed resource consent please contact the TRC Consents department)

Appendix II Biomonitoring reports

List of tables

Table 1 Stormwater sampling results for Te Kiri North-A wellsite 2015-2016 13
Table 2 Summary of performance for consent 9876-1 18
Table 3 Summary of performance for consent 9877-1 18
Table 4 Summary of performance for consent 9873-1 19
Table 5 Summary of performance for consent 9875-1 20
Table 6 Summary of performance for consent 9875-1 21

List of figures

Figure 1 Aerial view showing location of skimmer pits (red) and discharge point (yellow) 14
Figure 2 Location of biomonitoring sites 15

List of photos

Photo 1 Aerial view of the Te Kiri North-A wellsite, with approximate regional location (inset) 4
Photo 2 Example of a partially-constructed VUMU flarepit, such as was installed at Te Kiri North-A (courtesy of Todd Energy Ltd, 2014). 7

1. Introduction

1.1. Compliance monitoring programme reports and the Resource Management Act 1991

1.1.1. Introduction

This report is for the period January 2015 to December 2016 by the Taranaki Regional Council (the Council) on the monitoring programme associated with resource consents held by Todd Energy Limited (the Company). The Company operates a hydrocarbon wellsite situated on Kina Road at Oaonui, in the Oaoiti catchment.

The report includes the results and findings of the monitoring programme implemented by the Council in respect of the consents held by the Company that relate to abstractions and discharges of water within the Oaoiti catchment, and the air discharge permit held by Todd Energy Ltd to cover emissions to air from the site.

One of the intents of the *Resource Management Act 1991* (RMA) is that environmental management should be integrated across all media, so that a consent holder's use of water, air, and land should be considered from a single comprehensive environmental perspective. Accordingly, the Council generally implements integrated environmental monitoring programmes and reports the results of the programmes jointly. This report discusses the environmental effects of the Company's use of water, land and air, and is the first combined monitoring report by the Council for the Company.

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/companies in the Oaoiti catchment;
- the nature of the monitoring programme in place for the period under review; and
- a description of the activities and operations conducted at the Company's site.

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 2017-2018 monitoring year.

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

1.1.3. The Resource Management Act 1991 and monitoring

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

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

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

1.1.4. Evaluation of environmental and administrative performance

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

1.2. Process description

1.2.1. Site Description

Todd Energy Ltd holds the 10 year Petroleum Mining Permit No. 51149 to prospect, explore, and mine for condensate, gas, LPG, oil and petroleum within an area of 217.3 km^2. The Te Kiri North-A wellsite is one of many sites within this area that have been established in order to explore, evaluate and produce hydrocarbons.

The Te Kiri North-A wellsite is located approximately 1.08 km along Kina Road and approximately 8.4 km from Rahotu, as per Figure 1. The Te Kiri North-A wellsite was established for petrochemical exploration efforts. The establishment of the wellsite involved the removal of topsoil to create a firm level foundation on which to erect the drilling rig and house the associated equipment. Site establishment also involved the installation of:

- Wastewater control, treatment and disposal facilities;
- A system to collect and control stormwater and contaminants;
- A gas combustion system; and
- Other on-site facilities such as accommodation, parking and storage.

The nearest residence is approximately 550 m away from the wellsite. Bunding and earthworks helped minimise any potential for off-site effects for the neighbours.

Photo 1 Aerial view of the Te Kiri North-A wellsite, with approximate regional location (inset)

1.2.2. Well development

The process of drilling a well can take a few weeks to several months. Timing can depend on the depth of the well, the geology of the area, and whether the well is vertical or horizontal.

Drilling fluids, more commonly known as 'drilling muds', are required in the drilling process for a number of reasons, including:

- As a safety measure to ensure that any pressurised liquids encountered in the rock formation are contained;
- To transport drill cuttings to the surface;
- To cool and lubricate the drilling bit;
- To provide information to the drillers about what is happening down hole and the actual geology being drilled; and
- To maintain well pressure and lubricate the borehole wall to control cave-ins and wash-outs.

The well is drilled progressively using different sized drill bits. The width of the well is widest at the surface as smaller drill bits are used as the well gets deeper. Once each section of the well is drilled, a steel casing is installed. Cement is then pumped down the well to fill the annulus (the space between the steel casing and the surrounding country rock). This process is repeated until the target depth is reached, with each section of steel casing interlocked with the next.

Production tubing is then fitted within the steel casing to the target depth. A packer is fitted between the production tubing and casing to stop oil/gas/produced water from entering the annulus. The packer is pressure tested to ensure it is sealed.

The construction aspects that are most important for a leak-free well include the correct composition and quality of the cement used, the installation method, and the setting time. The aim is to ensure that the cement binds tightly to the steel casing and the rock, and leaves no cavities through which liquids and gases could travel.

Once the well is sealed and tested the casing is perforated at the target depth, allowing fluids and gas to flow freely between the formation and the well.

1.2.3. Management of stormwater, wastewater, & solid drilling waste

The Te Kiri North-A wellsite is located approximately 210 m to the south of the nearest waterbody which is an unnamed tributary of the Oaoiti Stream

Management systems were put in place to avoid any adverse effects on the surrounding environment from exploration activities on the wellsite. There are several sources of potential contamination from water and solid waste material which require appropriate management. These include:

- Stormwater from 'clean' areas of the site, e.g. parking areas, which run off during rainfall. There is potential that this runoff will pick up small amounts of hydrocarbons and silt due to the nature of the activities on-site;
- Stormwater which collects in the area surrounding the drilling platform and ancillary drilling equipment. This stormwater has a higher likelihood of contact with potential contaminants, particularly drilling mud;
- Produced water which flows from the producing formation and is separated from the gas and water phase at the surface; and
- Drill cuttings, mud and residual fluid which are separated from the liquid waste generated during drilling.

An important requirement of the site establishment is to ensure that the site is contoured so that all stormwater and any runoff from 'clean' areas of the site flow into perimeter drains. The drains direct stormwater into a skimmer pit system on-site consisting of two settling ponds. Any hydrocarbons present in the stormwater float to the surface and can be removed. The ponds also provide an opportunity for suspended sediment to settle. Treated stormwater is then discharged from the wellsite onto and into land, and consequently into an unnamed tributary in the Oaoiti catchment.

Drilling mud and cuttings brought to the surface during drilling operations are separated out using a shale shaker. The drilling mud and some of the water is then reused for the drilling process. Cuttings were collected in bins located at the base of the shaker and disposed of offsite at a consented facility.

1.2.4. Hydraulic fracturing

In late 2012 the Parliamentary Commissioner for the Environment released an interim report on hydraulic fracturing within New Zealand. The purpose of this report is firstly to assess the environmental risks with hydraulic fracturing, and secondly to assess whether the policies, laws, regulations and institutions in New Zealand are adequate for managing these risks. The following discussion has been based upon this report.

The first known hydraulic fracturing operation was in 1989 at Petrocorp's Kaimiro-2 gas well in Taranaki. Since then, almost all of the hydraulic fracturing that has taken place in New Zealand has been done within the Taranaki region.

By the early 2000's New Zealand started exploring options for more unconventional ways of getting access to natural gas, and especially oil. These are considered to be more expensive than conventional drilling, but as the price of oil has risen and new technologies have been developed, these unconventional methods are growing.

The most common unconventional source of oil and gas in the Taranaki region has been extracting natural gas and oil from 'tight sands'. The boundary between tight sands and conventional reservoirs is ill-defined and generally based on whether the reservoir will have an economic production flow without hydraulic fracturing.

The process of hydraulic fracturing involves using a fracturing fluid, which is primarily water (typically made up of around 95-97% treated water). This fluid also contains various chemicals, including the three main components, which are:

- An inert proppant which keeps the induced fracture open when pumping is stopped, such as medium grained sand, or small ceramic pellets;
- A gelling substance to carry the proppant into the cracks; and
- A de-gelling substance to thin the gel to allow the fracturing fluid to return to the surface while leaving the proppant in the fractures.

The chemicals associated with the fracturing fluid are trucked to the site, stored in concentrated form, and mixed immediately before the hydraulic fracturing commences.

After the casing is perforated at the desired depth, the fracturing fluid is injected under high pressure into the well and is forced through the small holes into the rocks, creating cracks. This high downhole pressure is maintained for a brief period of time (approximately 1 hour) in order to exceed the fracture strength of the reservoir rock and cause artificial fractures.

Once a fracture has been initiated, the fracturing fluid and proppant are carried into the fracture. The placement of proppant in the fractures is assisted by the use of cross-linked gels. These are solutions, which are liquid at the surface but, when mixed, form long-chain polymer bonds and thus become gels that transport the proppant into the formation.

Once in the formation these gels 'break' back with time and temperature to a liquid state and are flowed back to surface as back flow without disturbing the proppant wedge, trapped in the hydraulic fracture. With continued flow, formation hydrocarbon fluids should be drawn into the fracture, through the perforations into the wellbore and to the surface.

Any hydraulic fracturing programmes within the Taranaki region are monitored and reported on in separate hydraulic fracturing reports. No hydraulic fracturing activity took place at the Te Kiri North-A wellsite.

1.2.5. Flaring from exploration activities

It is possible that flaring may occur during the following activities:

- Well testing and clean-up;
- Production testing;
- Emergencies; and
- Maintenance and enhancement activities [well workovers].

However, no flaring took place at the Te Kiri North-A wellsite.

Photo 2 Example of a partially-constructed VUMU flarepit, such as was installed at Te Kiri North-A (courtesy of Todd Energy Ltd, 2014).

1.3. Resource consents

1.3.1. Water abstraction permit (groundwater)

Section 14 of the RMA stipulates that no person may take, use, dam or divert any water, unless the activity is expressly allowed for by a resource consent or a rule in a regional plan, or it falls within some particular categories set out in Section 14.

Todd Energy Ltd holds water permit **9876-1** to take groundwater as 'produced water' during hydrocarbon exploration and production activities. This permit was issued by the Council on 7 May 2014 under Section 87(d) of the RMA. It is due to expire on 1 June 2030.

Conditions 1 and 2 impose limits upon the abstraction rate and significant potential contaminants.

Condition 3 requires submission of a summary well log.

The last two conditions are lapse and review provisions.

The permit is attached to this report in Appendix I.

1.3.2. Water abstraction permit (surface water)

Section 14 of the RMA stipulates that no person may take, use, dam or divert any water, unless the activity is expressly allowed for by a resource consent or a rule in a regional plan, or it falls within some particular categories set out in Section 14.

Todd Energy Ltd holds water permit **9877-1** to take water from an unnamed tributary of the Oaoiti Stream fro wellsite and well frilling activities during hydrocarbon exploration and production operations. This permit was issued by the Council on 23 May 2014 under Section 87(d) of the RMA. It is due to expire on 1 June 2030.

Condition 1 imposes limits upon the abstraction rate.

Conditions 2 to 6 detail requirements related to accurate flow measuring and reporting.

Condition 7 requires the consent holder to adopt the best practicable option.

The last two conditions are lapse and review provisions.

The permit is attached to this report in Appendix I.

1.3.3. Water discharge permit (treated stormwater)

Section 15(1)(a) of the RMA stipulates that no person may discharge any contaminant into water, unless the activity is expressly allowed for by a resource consent or a rule in a regional plan, or by national regulations.

The Company holds water discharge permit **9875-1** to discharge treated stormwater from hydrocarbon exploration and production activities at the Te Kiri North-A wellsite, onto land where it may enter an unnamed tributary of the Oaoiti Stream. This permit was issued by the Council on 7 May 2014 under Section 87(e) of the RMA. A change to the consent commenced on 9 September 2015 and this is due to expire on 1 June 2030.

Condition 1 requires the consent holder to adopt the best practicable option.

Condition 2 sets limits on the discharge area.

Conditions 3 and 4 detail requirements for notification prior to works, and contingency plans.

Conditions 5 to 9 detail requirements of the stormwater and skimmer pit system.

Conditions 10 to 13 detail requirements for the quality of the discharge and its effect on the receiving environment.

Condition 14 requires notification prior to reinstatement of the site.

The last two conditions are lapse and review provisions.

The permit is attached to this report in Appendix I.

1.3.4. Water discharge permit (stormwater and sediment - earthworks)

Section 15(1)(a) of the RMA stipulates that no person may discharge any contaminant into water, unless the activity is expressly allowed for by a resource consent or a rule in a regional plan, or by national regulations.

The Company holds water discharge permit **9879-1** to discharge treated stormwater from hydrocarbon exploration and production activities at the Te Kiri North-A wellsite, onto land where it may enter an unnamed tributary of the Oaoiti Stream. This permit was issued by the Council on 7 May 2014 under Section 87(e) of the RMA. It is due to expire on 1 June 2030.

Condition 1 sets limits on the discharge area.

Condition 2 requires the consent holder to adopt the best practicable option.

Condition 3 requires notification prior to works.

Conditions 4 and 5 detail requirements of sediment control measures.

Condition 6 details requirements for revegetation of earthworked areas.

The permit is attached to this report in Appendix I.

1.3.5. Air discharge permit (exploration activities)

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

The Company holds air discharge permit **9873-1** to discharge contaminants to air from hydrocarbon exploration at the Te Kiri North-A wellsite. This permit was issued by the Council on 6 May 2014 under Section 87(e) of the RMA. It is due to expire on 1 June 2030.

Condition 1 defines terminology related to flaring.

Conditions 2 to 5 detail requirements and set limits for flaring.

Conditions 6 and 7 detail requirements of flaring notifications.

Conditions 8, 9 and 10 set limits on the type of material that can be flared.

Conditions 11 and 12 detail requirements for reporting of information to the Council, and best practice.

Conditions 13, 14 and 15 set limits on the quality and effect of emissions on the receiving environment.

Condition 16, 17 and 18 detail requirements for design, analysis and reporting of the flare system.

The last two conditions are lapse and review provisions.

The permit is attached to this report in Appendix I.

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 Te Kiri North-A wellsite focused primarily on programme liaison and management, site inspections, chemical sampling, discharges to land and biomonitoring surveys. All seven components are discussed below.

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 Te Kiri North-A site was visited nine times during the monitoring period. Inspection and examination of wellsites is a fundamental and effective means of monitoring, which is undertaken to ensure that good environmental practices are adhered to and resource consent special conditions complied with.

The inspections are based on internationally recognised and endorsed wellsite monitoring best-practice checklists developed by the Alberta Energy Resources Conservation Board and the USEPA, adapted for local application.

The inspections also provide an opportunity for monitoring officers to liaise with staff about on-site operations, monitoring and supervision; discuss matters of concern; and resolve any issues in a quick and informal manner.

Inspections pay special attention to the ring drains, mud sumps, treatment by skimmer pits and the final discharge point from the skimmer pit on to land and then any potential receiving waters.

During each inspection the following are checked:

- Weather;
- Flow rate of surface waters in the general vicinity;
- Flow rate of water take;

- Whether pumping of water was occurring;
- General tidiness of site;
- Site layout;
- Ring drains;
- Hazardous substance bunds;
- Treatment by skimmer pits/sedimentation pits;
- Drilling mud;
- Drill cuttings;
- Mud pit capacity and quantity contained in pit;
- Sewage treatment and disposal;
- Cementing waste disposal;
- Surface works;
- Gas combustion systems, whether flaring was in progress, and if there was a likelihood of flaring, whether the Council had been advised;
- Discharges;
- Surface waters in the vicinity for effects on colour and clarity, aquatic life and odour;
- Site records;
- General observations; and
- Odour (a marker for any hydrocarbon and hazardous chemical contamination).

1.4.4. Chemical sampling

The Council undertook water quality sampling from the Te Kiri North-A skimmer pits adjacent to the discharge point on four occasions, which were analysed for hydrocarbons, chlorides, suspended solids, and pH. No discharges from the stormwater system were recorded during the monitoring period.

The Council undertook sampling of both the emissions from the site and the ambient air quality in the neighbourhood.

1.4.5. Biomonitoring surveys

A biological survey was performed on two occasions in an unnamed tributary of the Oaoiti Stream to determine whether or not the discharge of treated stormwater from the site had a detrimental effect upon the communities of the stream.

1.4.6. Solid wastes

The Council monitors any disposal of drill cuttings on site via mix-bury cover to ensure compliance with resource consent conditions and to determine whether site activities were causing any adverse effects within the receiving environment.

In recent times consent holders have opted to remove drilling waste from the site by contractor and dispose of it at licensed disposal areas (landfarming), which are monitored separately.

2. Results

2.1. Water

2.1.1. Inspections

19 January 2015

A site inspection was undertaken at the Te Kiri North-A wellsite in accordance with general compliance monitoring. The inspection found that earthworks were ongoing to construct the site.

The site had been excavated to its final level, with large earth bunds constructed around three sides of the drilling pad. Silt and sediment was being controlled on site by way of silt cloth, which was established along the full length of the down-gradient side of the pad. Excavation had occurred during an extended fine weather spell meaning that although silt and sediment controls were in place they had not yet been tested.

A large amount of natural filtration was also available beyond the silt controls to ensure that any stormwater leaving site would be well treated prior to entry into surface water. Skimmer pits were to be established on site later that week.

4 February 2015

A site inspection was undertaken at the Te Kiri North-A wellsite following a recent period of wet weather.

The inspection found that the construction of the drilling pad and associated ring drains had been completed, with metal being imported onto site. The two-stage skimmer pits were lined and receiving all stormwater from site for treatment prior to the final discharge.

Silt and sediment cloth remained in place about the lower portion of the site to protect the receiving environment. A significant amount of erosion had taken place about the discharge point from the skimmer pits. The sediment had been captured by the silt fence, however, some remedial work was required on the fence to ensure that it would continue to work during any further wet weather. A filter sock had been placed at the point of discharge from the pits to prevent any further erosion.

It was recommended that the installation of further silt controls, on the downstream portion of the culvert at the entry to site, would be required. Stormwater from the access track was entering the creek via this pathway and was eroding the earthen fill above the culvert pipe as a result. Silt fence, rock riprap or further sandbags were some suggestions given by inspecting officers. No significant issues were noted at the time of the inspection however, and in general the site development appeared to have been wellmanaged.

24 February 2015

A site inspection was undertaken during a period of fine weather. All earthmoving equipment had been removed from the site, and approximately three quarters of the pad had been metalled with the remainder of the pad made up of base clay.

Ring drains were in place and all stormwater from the site was being directed to two lined skimmer pits. Discharge from the second pit was via a discharge pipe and then a long length of filter sock to prevent scour erosion of the soil. Stormwater was then further treated by passing through a silt fence prior to final discharge into the receiving environment, which was a swampy paddock.

The silt fence was working well, retaining sediment that had washed off the outside earth bank of the drill pad. Further work had been undertaken about the culvert to ensure that stormwater collected off the access track was being directed through novaflow pipe into the stream rather than being allowed to run over the exposed soil. This reduced the chance of sediment entering the receiving environment.

The cellar and shut off valve to the skimmer pit were yet to be installed on site. Overall the site was in a good order with all stormwater passing through adequate treatment systems prior to final site discharge.

23 December 2015

An inspection was undertaken as part of routine compliance monitoring of the Te Kiri north-A wellsite. The inspection found that the Big Ben drilling rig had been established on site and drilling of the single well had begun. At the time of the inspection the top hole was being drilled.

The site was found to be clear of any spills or signs of contamination. A flare stack was established onsite; however no flaring was anticipated during the drilling stage of the operation. The ring drains were inspected and due to the small size of the site, equipment had been placed right up to the edge of the drains and in some places shipping containers were found to be straddling the ring drain. The bunds surrounding the site and associated ring drains ensured that any spills were directed into the drains and then to the skimmer pits.

Staff were advised to monitor the site during periods of wet weather to ensure that all ring drains were flowing towards the skimmer pits without pooling or ponding. Ponding had the potential be an issue due to the works around the ring drains during the establishment of the rig on site.

The skimmer pits were found to be tidy and clear with no discharge. No adverse effects on the receiving environment were noted at the time of the inspection.

7 January 2016

An inspection was undertaken as part of routine compliance monitoring during a period of fine weather.

The inspection found that drilling was continuing onsite. At the time of inspection, the hole was being cleaned out and prepared for casing. The site was found to be free of any spills. The cuttings tanks had been recently emptied and were near empty.

No flaring had been undertaken during the drilling operation.

The skimmer pits were inspected and found to be free of any sheen. The pits were not discharging and appeared to be visually clean. Samples were taken from the second skimmer pit to ensure compliance with resource consent conditions should a discharge occur.

The receiving environment was inspected and no adverse effects were observed. Ample grass and vegetation was present to filter the discharge prior to entry into surface water.

20 January 2016

An inspection was undertaken at the Te Kiri North-A wellsite as part of routine compliance monitoring. This was undertaken during inclement weather conditions following a period of heavy rain.

The inspection found that drilling operations had reached total depth and the well was to be plugged and abandoned over the coming days. It was uncertain at this stage if the rig was to be relocated to another site or remain stacked onsite for a period of time.

The inspection found that the area about the mud and cuttings tanks was clean and tidy. The ring drains were inspected and minimal ponding was observed within the ring drain system following the recent wet weather. The flare tank remained established onsite, however no flaring had occurred thus far during the drilling operation.

The liner on the skimmer pits was visually inspected and the integrity was found to be good. The pits were full but not discharging at the time of the inspection, however samples were taken from within the second skimmer pit to ensure compliance with resource consent conditions should a discharge occur.

The receiving environment was inspected and no adverse effects were noted. There was ample filtering available for the skimmer pit discharge in the way of long grass and a stand of native bush prior to entry into any surface water. Although the skimmer pits appeared turbid in colour, the filtering available to any discharge meant that the discharge would be well filtered and any suspended solids removed before any discharge to surface occurred.

3 February 2016

An inspection was undertaken as part of routine compliance monitoring. This found that drilling on the site was now completed. The Big Ben drilling rig was remaining onsite, however the mast had been dropped.

A small maintenance crew remained onsite undertaking maintenance work. No further drilling was planned for the immediate future. Drilling muds and all chemicals had been removed from the site.

All ring drains remained in place and a visual inspection of the skimmer pits found them to be clear. Samples were taken from the second skimmer pit to ensure compliance with resource consent conditions should a discharge occur.

23 May 2016

A compliance monitoring inspection was undertaken following a conversation with Nik Pyselman concerning the requirements of TRC to continue to monitor the site. It was found that a rig is being stored onsite.

Maintenance was being carried out onsite. The site appeared to be well-managed with bunding in place where necessary.

The ring drains contained clear stormwater. The skimmer pits were slightly discoloured, however the discharge appeared clear. A stormwater sample was taken at the discharge point in the second skimmer pit to ensure compliance with resource consent conditions should a discharge occur.

Regular inspections of the site were scheduled to occur whilst the rig remained onsite.

18 November 2016

An inspection was carried out as part of routine compliance monitoring in fine weather conditions.

The site was tidy with no issues noted. No works were occurring at the time of inspection. The Big Ben drilling rig and associated equipment were present, still being stored onsite. Maintenance of the rig had been completed and chemicals and hazardous substances had been removed from site.

The ring drains and skimmers pits contained clear stormwater, no samples were collected. The wetland below the site appeared normal and healthy, with no environmental effects observed.

2.1.2. Results of discharge monitoring

During the period under review a total of four stormwater samples were obtained from the second skimmer pit to ensure compliance with consent conditions in anticipation of potential discharges. Stormwater was not observed discharging from the skimmer pits or stormwater system on any occasion.

Analysis of the samples obtained showed that all of the discharges would have complied with resource consent conditions should a discharge have occurred. Results are detailed in Table 1 and sampling locations can be seen in Figure 2.

Table 1 Stormwater sampling results for Te Kiri North-A wellsite 2015-2016

Date	Chloride *g/m3*	Hydrocarbons *g/m3*	pH *pH*	Suspended Solids *g/m3*	Sampling location
07 Jan 2016	6.9	<0.5	8.0	2.9	Second skimmer pit
20 Jan 2016	9.0	<0.5	6.9	51	Second skimmer pit
03 Feb 2016	9.2	0.6	7.2	2.6	Second skimmer pit
23 May 2016	18.9	<0.5	6.9	14	Second skimmer pit

Figure 1 Aerial view showing location of skimmer pits (red) and discharge point (yellow)

2.1.3. Results of receiving environment monitoring

2.1.3.1. Chemical sampling

During the period under review, no discharge was observed from the stormwater system. As a result, no receiving water monitoring samples were obtained from an unnamed tributary of the Oaoiti Stream.

2.1.3.2. Biomonitoring surveys

The Council's "kick-sampling' technique was used to collect samples from three sites in the Oaoiti Stream on two occasions. This has provided data to assess the impact of the stormwater discharge to land from the Te Kiri-A wellsite on the macroinvertebrate communities of the stream. Samples were processed to provide taxa richness, MCI and $SQMCI_s$ scores for each site.

Taxa richnesses were found to be moderate in all instances. When taxa richness is compared between the pre-drill and post-drill surveys, there was an increase in richness for sites 1 and 3 (see Figure 2), and no change at site 2. Where taxa richness increased, it is likely due to seasonal differences that might reasonably be expected in macroinvertebrate communities. Taxa richness is a valuable macroinvertebrate community metric when determining whether a community has been exposed to a toxic discharge, as macroinvertebrates will either drift downstream to avoid the discharge or may be killed. This would result in a reduced taxa richness at the downstream sites. In contrast, the MCI and $SQMCI_S$ scores are a measure of community tolerance to organic pollution, although they can also provide an indication of more subtle influences caused by a poor quality discharge. As the $SQMCI_S$ score takes into account relative abundances of the taxa found in the sample, it provides additional insight to that provided by the MCI score. However, it is also easily influenced by the 'patchiness' of invertebrates on the stream bed, and as such must be considered in the context of all three metrics.

The pre-drill survey provided baseline data which showed that there were no significant differences in invertebrate communities between the three sites prior to drilling activities commencing. The MCI scores of 105, 110 and 102, at sites 1-3 respectively, are not ecologically significantly different from each other and

classifies all three sites as having 'good ecological health, while the $SQMCI_s$ scores of 4.1, 4.2 and 4.0 respectively are statistically similar (Stark 1998) and classify all three sites as having 'fair' ecological health (Stark and Maxted 2007).

The post-drill survey showed wider variation in the MCI scores at these three sites, with scores of 96, 107 and 98 at sites 1-3 respectively. This classifies sites 1 and 3 as having 'fair' ecological health, while site 2 has 'good' stream health. The MCI scores for sites 1 and 2 show a significant increase in stream health from the' control' site to the 'primary impact' site. Site 3 is not significantly different from either site 1 or site 2. The difference in MCI score was caused in part by the presence of one 'highly sensitive taxon', (the cased caddisfly *Beraeoptera*) at site 2 which was absent at site 1, and four 'tolerant' taxa which were rare at site 1 but not present at site 2 (oligochaete worms, nematode worms, and the fly larvae empididae and muscidae). These differences are likely to be a result of micro-habitat variation between the riffles sampled and are unrelated to wellsite activities.

The $SQMCI_s$ scores did not show the same differences between sites as the MCI score, with scores of 5.3, 5.4 and 4.7 for sites 1-3, respectively, recorded at the time of the post-drill survey. These scores are not significantly different from each other (Stark 1998). In contrast to the MCI scores, each site recorded an increase in $SQMCI_s$ score between the pre-drill survey and the post-drill survey. The changes were statistically significant for sites 1 and 2; and for all sites were principally related to reduced abundances of *Maoridiamesa* midge larvae, a direct reflection of reduced algal biomass observed.

The results of this survey do not show significant adverse effects from the stormwater discharge from the Te Kiri-A wellsite on the macroinvertebrate communities of the Oaoiti Stream. There was little change in MCI scores, SQMCIs scores improved for all sites between the pre-drill and post-drill surveys, and the taxa richnesses were either stable or improved during the same period. Furthermore, site 2, the 'primary impact' site recorded the highest MCI and $SQMCI_s$ scores of all sites at the time of both surveys. If the stormwater discharge was impacting upon the macroinvertebrate communities, this site would be expected to show the largest decline in invertebrate metrics between the pre-drill survey and post-drill survey, which was not the case.

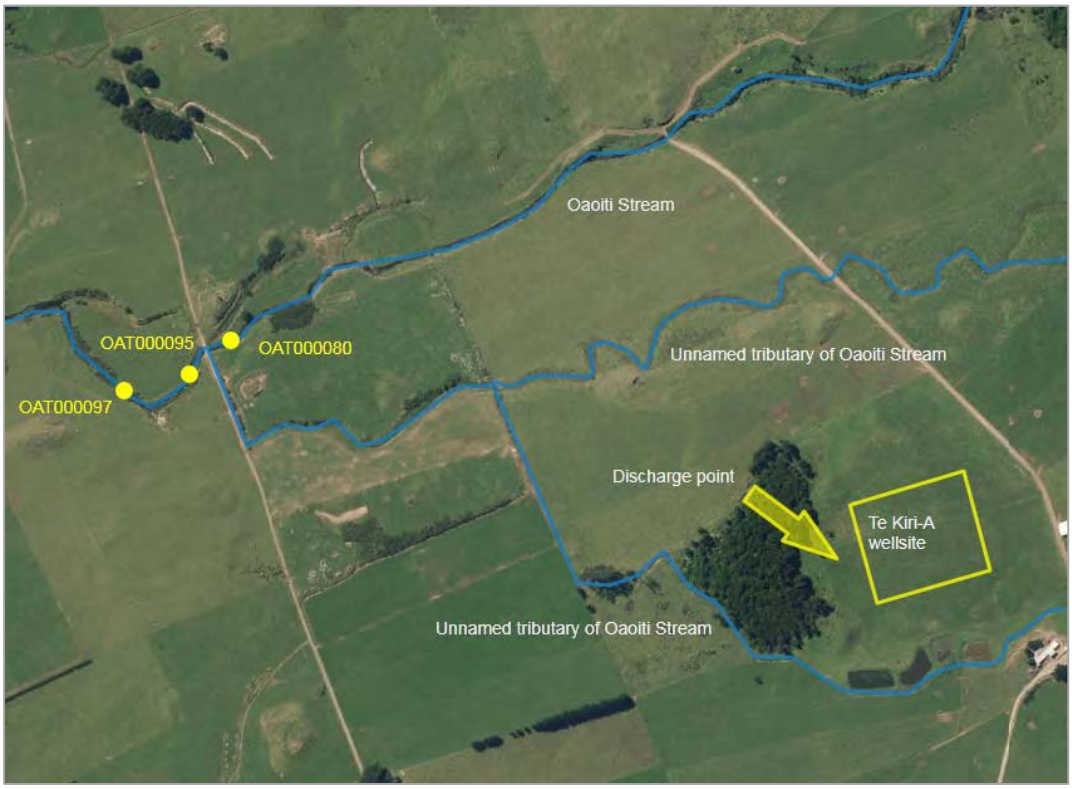

Figure 2 Location of biomonitoring sites

2.1.4. Air quality monitoring

Air quality monitoring is carried out in association with the well testing and clean-up phase, where flaring can occur. The Council also undertakes sampling of the ambient air quality in the neighbourhood associated with this. Assessments are made by Inspecting Officers during site inspections to ensure that operators undertake all practicable steps to mitigate any effects from flaring gas.

No flaring was carried out during the period under review, and no issues regarding air quality associated with the wellsite were noted during the general compliance monitoring inspections (see Section 2.1.1.).

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

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

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

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

3. Discussion

3.1. Discussion of site performance

Monitoring of the Te Kiri North-A wellsite during the period under review found that the site was well managed, with no issues with the silt and sediment controls that were in place. Any minor actual or potential non-compliance with consent conditions were addressed during site inspections. The Company would quickly take steps to ensure that requests made by Council Inspecting Officers were adhered to without delay.

There were no incidents or complaints recorded, and it is considered that all resource consent conditions were complied with during the monitoring period, including the provision of various pieces of information (contingency plan, notifications etc.).

The discharge of solid drilling wastes (drilling cuttings and residual drilling fluids) from hydrocarbon exploration activities was managed by way of disposal at a consented offsite facility.

Monitoring has shown that the management onsite ensured that no effects to the environment occurred during the monitoring period.

3.2. Environmental effects of exercise of consents

Results of stormwater sampling were within the limits prescribed by the consent for the wellsite for all samples. No adverse effects were noted on the receiving environment due to a lack of discharge being observed or sampled.

Compliance with consent conditions during abstraction of surface water from an unnamed tributary of the Oaoiti Stream ensured that this activity did not cause any adverse effects. Small amounts of groundwater may have been encountered as produced water during operations at the wellsite. It was anticipated that the abstraction of groundwater would not impact on any groundwater resource and that the groundwater would not be affected as it would be protected by the well casing from contamination by drilling activities.

There were no adverse effects on the environment resulting from discharges to air at the Te Kiri North-A wellsite. Inspections showed that no flaring took place onsite.

The Company implemented various mitigation measures to ensure the storage and use of hazardous substances onsite did not contaminate surface waters and soils. As a result, there were no issues or adverse effects noted as a result of the use of these substances.

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 2-6.

Table 2 Summary of performance for consent 9876-1

Purpose: *To take groundwater as 'produced water' during hydrocarbon exploration and production activities at the Te Kiri North-A wellsite*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Static water level not lowered by more than 10% by abstraction	Inspection	Yes
2. Limits of abstraction upon saltwater intrusion effects	Inspection	Yes
3. A well log to 1,000 m must be submitted to the Council	Report submitted	Yes
4. Lapse condition	Inspection	Yes
5. Review condition	No provision for review during the period	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**
Overall assessment of administrative performance in respect of this consent		**High**

N/A = not applicable

Table 3 Summary of performance for consent 9877-1

Purpose: *To take water from an unnamed tributary of the Oaoiti Stream for wellsite and well drilling activities during hydrocarbon exploration and production activities at the Te Kiri North-A wellsite*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Limits upon abstraction rate	Inspection	Yes
2. Installation and maintenance of water meter, provision of abstraction records	Inspection, records not requested	Yes
3. Notification and repair of faulty water meter	Notification, inspection	N/A
4. Access to water meter	Inspections	Yes
5. Provision of water meter records	Not requested	N/A
6. Requirements of water meter records	Records not requested	N/A
7. Consent holder to adopt best practicable option	Inspection	Yes
8. Lapse condition	Inspection	Yes
9. Review condition	No provision for review during the period	N/A

Purpose: *To take water from an unnamed tributary of the Oaoiti Stream for wellsite and well drilling activities during hydrocarbon exploration and production activities at the Te Kiri North-A wellsite*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**
Overall assessment of administrative performance in respect of this consent		**High**

Table 4 Summary of performance for consent 9873-1

Purpose: *To discharge contaminants to air from hydrocarbon exploration at the Te Kiri North-A wellsite, including combustion involving flaring or incineration of petroleum recovered from natural deposits, in association with well development and testing or enhancement of well production flows*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Definition of terms	N/A	N/A
2. Limits upon chimney height	Inspection	Yes
3. Requirements of flare pit design	Inspection	Yes
4. Limits upon location of flaring	No flaring occurred- not applicable.	N/A
5. Limits upon duration of flaring	No flaring occurred- not applicable	N/A
6. Notification to TRC of flaring	No flaring occurred – not applicable	N/A
7. Notification to affected parties of flaring	No flaring occurred – not applicable	N/A
8. Limits upon flaring material	No flaring occurred – not applicable	N/A
9. Pre-treatment of flared material	No flaring occurred – not applicable	N/A
10. Conditions on flaring materials when separation not achievable	No flaring occurred – not applicable	N/A
11. Report on flaring associated with condition 10	No flaring occurred – not applicable	N/A
12. Consent holder to adopt best practicable option	Inspection	Yes
13. No offensive odour or smoke beyond the boundary	No flaring occurred- not applicable	N/A
14. Control of contaminants in emissions	No flaring occurred- not applicable	N/A
15. Control of contaminants other than in condition 14	No flaring occurred- not applicable	N/A
16. Gas and condensate analysis	Not requested	N/A
17. Vapour recovery systems to be fitted	Inspection	Yes

Purpose: *To discharge contaminants to air from hydrocarbon exploration at the Te Kiri North-A wellsite, including combustion involving flaring or incineration of petroleum recovered from natural deposits, in association with well development and testing or enhancement of well production flows*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
18. Requirements of combustion recording and reporting	No flaring occurred- not applicable	N/A
19. Lapse condition	Inspection	Yes
20. Review condition	No provision for review during the period	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**
Overall assessment of administrative performance in respect of this consent		**High**

Table 5 Summary of performance for consent 9875-1

Purpose: *To discharge treated stormwater from hydrocarbon exploration and production operations at the Te Kiri North-A wellsite, onto land where it may enter an unnamed tributary of the Oaoiti Stream*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Consent holder to adopt best practicable option	Inspection	Yes
2. Limits on stormwater catchment size	Inspection	Yes
3. Notification of site works	Notification	Yes
4. Requirements of contingency plan	Report submitted	Yes
5. Requirements of stormwater system design	Inspection	Yes
6. Discharges to pass through skimmer pit	Inspection	Yes
7. Requirements of skimmer pit design	Inspection	Yes
8. Requirements of stormwater system construction	Inspection	Yes
9. Requirements of stormwater system installation	Inspection	Yes
10. Limits on discharge quality	Physicochemical sampling	Yes
11. Limits on pH not covered by condition 10	Physicochemical sampling	N/A
12. Limits on effects on receiving waters	Inspection, sampling	Yes
13. Limits on effects on receiving waters no covered by condition 12	Inspection, sampling	Yes

Purpose: *To discharge treated stormwater from hydrocarbon exploration and production operations at the Te Kiri North-A wellsite, onto land where it may enter an unnamed tributary of the Oaoiti Stream*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
14. Notification of site reinstatement	Notification	N/A
15. Lapse condition	Inspection	Yes
16. Review conditions	No provision for review during the period	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**
Overall assessment of administrative performance in respect of this consent		**High**

Table 6 Summary of performance for consent 9875-1

Purpose: *To discharge treated stormwater and sediment, deriving from soil disturbance undertaken for the purpose of constructing the Te Kiri North-A wellsite, onto land where it may enter an unnamed tributary of the Oaoiti Stream*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Limits on earthworks stormwater catchment size	Inspection	Yes
2. Consent holder to adopt best practicable option	Inspection	Yes
3. Notification of earthworks	Notification	Yes
4. Requirements of stormwater system design	Inspection	Yes
5. Requirements of stormwater system construction	Inspection	Yes
6. Requirements upon completion of earthworks	Inspection	Yes
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**
Overall assessment of administrative performance in respect of this consent		**High**

During the year, the Company demonstrated a high level of environmental and high level of administrative performance with the resource consents as defined in Section 1.1.4. During the year under review there were no unauthorised discharges or incidents relating to activities at the wellsites. Compliance monitoring results showed there were no adverse environmental effects as a result of the exercise of the Company's consents for the period under review.

The Company demonstrated a high level of administrative performance, as shown by the timely and satisfactory manner with which they provided required information and responded to requests from Council officers.

Ratings are as defined in Section 1.1.4

3.4. Alterations to monitoring programmes for 2016-2017

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

- the extent of information made available by previous authorities;
- its relevance under the RMA;
- its obligations to monitor emissions/discharges and effects under the RMA; and
- to report to the regional community.

The Council also takes into account the scope of assessments required at the time of renewal of permits, and the need to maintain a sound understanding of industrial processes within Taranaki emitting to the atmosphere/discharging to the environment.

It is proposed that for 2016-2017 and 2017-2018, monitoring of consented activities at the Te Kiri North-A wellsite continue at the same level as in 2015-2016. A recommendation to this effect is attached to this report.

3.5. Exercise of optional review of consent

Resource consents 9873-1, 9875-1, 9876-1, and 9877-1 provide for an optional review of the consent in June 2018. Conditions 20, 16, 5, and 9, respectively, allow the Council to review each consent, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment, or to allow the consent holder to adopt specific practices in order to achieve the best practicable option arising from the exercise of the consent,

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 monitoring of consented activities at Te Kiri North-A wellsite in the 2016-2017 and 2017-2018 year continue at the same level as in 2015-2016.
2. THAT the option for a review of resource consents in June 2018, as set out in the relevant condition of the consent not be exercised, on the grounds that hydrocarbon exploration activities at the wellsite have been concluded and there is no need at this time to review.
3. THAT this report be forwarded to the Company, and to any interested parties upon request.

Glossary of common terms and abbreviations

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

Biomonitoring	Assessing the health of the environment using aquatic organisms.
Bund	A wall around a tank to contain its contents in the case of a leak.
Conductivity	Conductivity, an indication of the level of dissolved salts in a sample, usually measured at 20°C and expressed in mS/m.
g/m^3	Grams per cubic metre, and equivalent to milligrams per litre (mg/L). In water, this is also equivalent to parts per million (ppm), but the same does not apply to gaseous mixtures.
Incident	An event that is alleged or is found to have occurred that may have actual or potential environmental consequences or may involve non-compliance with a consent or rule in a regional plan. Registration of an incident by the Council does not automatically mean such an outcome had actually occurred.
Investigation	Action taken by Council to establish what were the circumstances/events surrounding an incident including any allegations of an incident.
Incident Register	The 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^2	Square Metres.
MCI	Macroinvertebrate community index; a numerical indication of the state of biological life in a stream that takes into account the sensitivity of the taxa present to organic pollution in stony habitats.
mS/m	Millisiemens per metre.
Mixing zone	The zone below a discharge point where the discharge is not fully mixed with the receiving environment. For a stream, conventionally taken as a length equivalent to 7 times the width of the stream at the discharge point.
NTU	Nephelometric Turbidity Unit, a measure of the turbidity of water.
O&G	Oil and grease, defined as anything that will dissolve into a particular organic solvent (e.g. hexane). May include both animal material (fats) and mineral matter (hydrocarbons).
pH	A numerical system for measuring acidity in solutions, with 7 as neutral. Numbers lower than 7 are increasingly acidic and higher than 7 are increasingly alkaline. 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.
Physicochemical	Measurement of both physical properties (e.g. temperature, clarity, density) and chemical determinants (e.g. metals and nutrients) to characterise the state of an environment.
Resource consent	Refer Section 87 of the RMA. Resource consents include land use consents (refer Sections 9 and 13 of the RMA), coastal permits (Sections 12, 14 and 15), water permits (Section 14) and discharge permits (Section 15).
RMA	*Resource Management Act 1991* and including all subsequent amendments.
SS	Suspended solids.
SQMCI	Semi quantitative macroinvertebrate community index.
Temp	Temperature, measured in °C (degrees Celsius).
Turb	Turbidity, expressed in NTU.
UI	Unauthorised Incident.

Zn*	Zinc.

*an abbreviation for a metal or other analyte may be followed by the letters 'As', to denote the amount of metal recoverable in acidic conditions. This is taken as indicating the total amount of metal that might be solubilised under extreme environmental conditions. The abbreviation may alternatively be followed by the letter 'D', denoting the amount of the metal present in dissolved form rather than in particulate or solid form.

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

Bibliography and references

Todd Energy Limited (2014): *Application for resource consent and assessment of environmental effects.* BTW Company Report 13542-TRC AEE Rev 3 3/2014.

Appendix I

Resource consents held by Todd Energy Ltd

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

Discharge Permit

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

Name of Consent Holder:	Todd Energy Limited P O Box 802 NEW PLYMOUTH 4340
Decision Date:	6 May 2014
Commencement Date:	6 May 2014

Conditions of Consent

Consent Granted:	To discharge contaminants to air from hydrocarbon exploration at the Te Kiri North-A wellsite, including combustion involving flaring or incineration of petroleum recovered from natural deposits, in association with well development or redevelopment and testing or enhancement of well production flows
Expiry Date:	1 June 2030
Review Date(s):	June 2018, June 2024 and in accordance with special condition 20
Site Location:	Te Kiri North-A wellsite, 831 Kina Road, Opunake (Property owner: Harvey Agricultural Holdings Limited)
Legal Description:	Lot 7 DP 682 (Discharge source and site)
Grid Reference (NZTM)	1677286E-5644107N

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. For the purposes of this consent:

   (a) 'flaring' means the uncontrolled or partially controlled open air burning of hydrocarbons derived from or entrained in the well stream. 'Flare', as a verb, has the corresponding meaning and, as noun, means the flame produced by flaring.
   (b) 'incineration' means the controlled, enclosed burning of formation hydrocarbons within a device designed for the purpose. 'Incinerate' has the corresponding meaning.
   (c) 'Combustion' means burning generally and includes both flaring and incineration as well as other burning such as fuel in machinery.

2. Incineration shall only occur in a device with a minimum chimney height determined by the method detailed in Appendix VIII of the *Regional Air Quality Plan for Taranaki.*

3. Flaring shall only occur over a pit, or similar containment area, consisting of impermeable material that prevents any liquid from leaking through its base or sidewalls and discharging to land.

4. Flaring and incineration shall only occur within 20 metres of the location defined by NZTM 1677286E-5644107N.

5. Discharges to air from flaring or incineration shall not last longer than 15 days, cumulatively, inclusive of testing, clean-up, and completion stages of well development or work-over, per zone to be appraised, with a maximum of 4 zones per well and 8 wells.

6. The consent holder shall notify the Chief Executive, Taranaki Regional Council, at least 24 hours before the flaring or incineration from each zone commences. Notification shall include the consent number and a brief description of the activity consented and be emailed to worknotification@trc.govt.nz.

7. At least 24 hours before any flaring or incineration, other than in emergencies, the consent holder shall provide notification of the commencement of flaring or incineration to the occupants of all dwellings within 300 metres of the point of flaring or incineration and all landowners within 200 metres. The consent holder shall include in the notification a 24-hour contact telephone number for a representative of the consent holder, and shall keep and make available to the Chief Executive, Taranaki Regional Council, a record of all queries and complaints received in respect of any combustion activity.

8. No material shall be flared or incinerated, other than those derived from or entrained in the well stream.

9. To the greatest extent possible, all gas that is flared or incinerated must first be treated by effective liquid and solid separation and recovery.

10. Only gaseous hydrocarbons originating from the well stream shall be flared or incinerated, except that if, for reasons beyond the control of the consent holder, effective separation can not be achieved and combustion of liquid hydrocarbon is unavoidable, the consent holder shall reinstate effective separation as soon as possible and if separation can not be achieved within 3 hours combustion must cease.

11. If liquid hydrocarbon is combusted in accordance with the exception provided for in condition 10 the consent holder shall prepare a report that details:

    (a) the reasons that separation could not be achieved;

    (b) the date and time that separation was lost and reinstated;

    (c) what was done to attempt to reinstate separation and, if it the attempt was unsuccessful the reasons why.

    The report shall be provided to the Chief Executive, Taranaki Regional Council within 5 working days from the date of combustion of liquid hydrocarbon.

12. The consent holder shall adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any actual or potential effect on the environment arising from any emission to air, including, but not limited to having regard to the prevailing and predicted wind speed and direction at the time of initiation, and throughout, any episode of combustion so as to minimise offsite effects (other than for the maintenance of a pilot flame).

13. The discharge shall not cause any objectionable or offensive odour or any objectionable or offensive smoke at or beyond the boundary of the property where the wellsite is located.

14. The consent holder shall control all emissions of carbon monoxide, nitrogen dioxide, fine particles (PM_{10}) and sulphur dioxide to the atmosphere from the site, in order that the maximum ground level concentration of any of these contaminants arising from the exercise of this consent measured under ambient conditions does not exceed the relevant ambient air quality standard as set out in the Resource Management (National Environmental Standards for Air Quality Regulations, 2004) at or beyond the boundary of the property on which the wellsite is located.

15. The consent holder shall control all emissions of contaminants to the atmosphere from the site, other than those expressly provided for under special condition 14, in order that they do not individually or in combination with other contaminants cause a hazardous, noxious, dangerous, offensive or objectionable effect at a distance greater than 100 metres from the emission source.

16. The consent holder shall make available to the Chief Executive, Taranaki Regional Council, upon request, an analysis of a typical gas and condensate stream from the field, covering sulphur compound content and the content of carbon compounds of structure C_6 or higher number of compounds.

17. All permanent tanks used as hydrocarbon storage vessels, shall be fitted with vapour recovery systems.

18. The consent holder shall record and make available to the Chief Executive, Taranaki Regional Council, a 'combustion log' that includes:

    (a) the date, time and duration of all flaring or incineration episodes;

    (b) the zone from which flaring or incineration occurred;

    (c) the volume of substances flared or incinerated;

    (d) whether there was smoke at any time during the combustion episode and if there was, the time, duration and cause of each 'smoke event'.

19. 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.

20. 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:

    (a) during the month of June 18 and/or June 2024; and/or
    (b) within 1 month of receiving a report provided in accordance with condition 11;

    for any of the following purposes:

    (i) dealing with any significant adverse effect on the environment arising from the exercise of the consent which was not foreseen at the time the application was considered or which it was not appropriate to deal with at the time; and/or
    (ii) requiring the consent holder to adopt specific practices in order to achieve the best practicable option to remove or reduce any adverse effect on the environment caused by the discharge; and/or
    (iii) to alter, add or delete limits on mass discharge quantities or ambient concentrations of any contaminant;
    (iv) reducing emissions or environmental effects that may arise from any loss of separation.

Signed at Stratford on 6 May 2014

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 P O Box 802 NEW PLYMOUTH 4340
Decision Date:	7 May 2014
Commencement Date:	7 May 2014

Conditions of Consent

Consent Granted:	To discharge treated stormwater from hydrocarbon exploration and production operations at the Te Kiri North-A wellsite, onto land where it may enter an unnamed tributary of the Oaoiti Stream
Expiry Date:	1 June 2030
Review Date(s):	June 2019, June 2024
Site Location:	Te Kiri North-A wellsite, 831 Kina Road, Opunake (Property owner: Harvey Agricultural Holdings Limited)
Legal Description:	Lot 7 DP 682 (Discharge source and site)
Grid Reference (NZTM)	1677210E-5644022N
Catchment:	Oaoiti

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 consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any actual or likely adverse effect on the environment associated with the discharge of contaminants from the site.

2. Stormwater discharged shall be collected from a catchment area of no more than 1.6 Ha.

3. At least 5 working days prior, the consent holder shall advise the Chief Executive, Taranaki Regional Council of the date of each of the following events:

   a) commencement of any site works (site works includes the introduction of a drilling rig, drilling equipment or any other associated equipment or facilities to the site for any purpose other than for the construction of the site);
   b) commencement of any well drilling operation; and
   c) recommencement of any site works or drilling operations following a period of inactivity exceeding 30 days.

   If any of these events is rescheduled or delayed, the consent holder shall immediately provide further notice advising of the new date.

   Any advice given in accordance with this condition shall include the consent number and the wellsite name and be emailed to worknotification@trc.govt.nz.

4. The consent holder shall maintain a contingency plan that details measures and procedures to be undertaken to prevent spillage or accidental discharge of contaminants not authorised by this consent and measures to avoid, remedy or mitigate the environmental effects of such a spillage or discharge. The contingency plan shall be certified by the Chief Executive, Taranaki Regional Council prior to discharging from the site, and after any change to the Plan.

5. Subject to the other conditions of this consent the design, management and maintenance of the stormwater system shall be undertaken in accordance with the information submitted in support of the application for this consent, in particular drawing 13542-02 and Appendix J submitted with the application.

6. All discharges from the site, including from any containment pit or hydrocarbon combustion facility (e.g. flare pit, thermal oxidiser), shall flow to a perimeter drain and skimmer pit. Perimeter drains shall be designed, including by having a positive grade and low permeability, to ensure that runoff flows directly to a skimmer pit without ponding.

7. Skimmer pits shall have a combined capacity of no less than 330 m^3 including a 'free board' of no less than 200 m^3, and be designed to retain any hydrocarbons that enter them.

8. All skimmer pits and any other stormwater retention areas shall be lined with an impervious material to prevent seepage through the bed and sidewalls, and all skimmer pits shall have a valve that can be shut off to prevent any discharge from the site.

9. Perimeter drains and skimmer pits necessary to comply with the conditions of this consent shall be installed before any site works commences. Site works includes the introduction of a drilling rig, drilling equipment or any other associated equipment or facilities to the site for any purpose other than for the construction of the site.

10. Subject to condition 11 the constituents in the discharge shall meet the standards shown in the following table.

Constituent	Standard
pH	Within the range 6.0 to 9.0
suspended solids	Concentration not greater than 100 gm^{-3}
total recoverable hydrocarbons	Concentration not greater than 15 gm^{-3} (as determined by infrared spectroscopic technique)
chloride	Concentration not greater than 50 gm^{-3}

11. The pH may exceed 9.0 if the exceedance is a result photosynthetic activity within the skimmer pits, but in any case the discharge shall not result in the pH of the receiving water increasing by more than 0.5 pH units after allowing for a mixing zone of 25 metres.

12. After allowing for a mixing zone of 25 metres, the discharge shall not give rise to an increase in the temperature of the receiving waters of more than 2 degrees Celsius.

13. After allowing for a mixing zone of 25 metres, the discharge shall not give rise to any of the following effects in the receiving water:

    a) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
    b) any conspicuous change in the colour or visual clarity;
    c) any emission of objectionable odour;
    d) the rendering of fresh water unsuitable for consumption by farm animals;
    e) any significant adverse effects on aquatic life.

14. The consent holder shall advise the Chief Executive, Taranaki Regional Council, in writing at least 48 hours prior to the reinstatement of the site and the reinstatement shall be carried out so as to minimise adverse effects on stormwater quality. Notification shall include the consent number and a brief description of the activity consented and be emailed to worknotification@trc.govt.nz.

15. 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.

16. 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 2018 and/or June 2024, 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 May 2014

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 (Change):	9 September 2015	
Commencement Date (Change):	9 September 2015	(Granted Date: 7 May 2014)

Conditions of Consent

Consent Granted:	To discharge treated stormwater from hydrocarbon exploration and production operations at the Te Kiri North-A wellsite, onto land where it may enter an unnamed tributary of the Oaoiti Stream
Expiry Date:	1 June 2030
Review Date(s):	June 2018, June 2024
Site Location:	Te Kiri-A wellsite, 831 Kina Road, Opunake (Property owner: Harvey Agricultural Holding Limited)
Legal Description:	Lot 7 DP 682 (Discharge source & site)
Grid Reference (NZTM)	1677210E-5644022N
Catchment:	Oaoiti

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 consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any actual or likely adverse effect on the environment associated with the discharge of contaminants from the site.

2. Stormwater discharged shall be collected from a catchment area of no more than 1.6 Ha.

3. At least 5 working days prior, the consent holder shall advise the Chief Executive, Taranaki Regional Council of the date of each of the following events:

   a) commencement of any site works (site works includes the introduction of a drilling rig, drilling equipment or any other associated equipment or facilities to the site for any purpose other than for the construction of the site);
   b) commencement of any well drilling operation; and
   c) recommencement of any site works or drilling operations following a period of inactivity exceeding 30 days.

   If any of these events is rescheduled or delayed, the consent holder shall immediately provide further notice advising of the new date.

   Any advice given in accordance with this condition shall include the consent number and the wellsite name and be emailed to worknotification@trc.govt.nz.

4. The consent holder shall maintain a contingency plan that details measures and procedures to be undertaken to prevent spillage or accidental discharge of contaminants not authorised by this consent and measures to avoid, remedy or mitigate the environmental effects of such a spillage or discharge. The contingency plan shall be certified by the Chief Executive, Taranaki Regional Council prior to discharging from the site, and after any change to the Plan.

5. Subject to the other conditions of this consent the design, management and maintenance of the stormwater system shall be undertaken in accordance with the information submitted in support of the application for this consent, in particular drawing 13542-02 and Appendix J submitted with the application.

6. All discharges from the site, including from any containment pit or hydrocarbon combustion facility (e.g. flare pit, thermal oxidiser), shall flow to a perimeter drain and skimmer pit. Perimeter drains shall be designed, including by having a positive grade and low permeability, to ensure that runoff flows directly to a skimmer pit without ponding.

7. Skimmer pits shall have a combined capacity of no less than 330 m^3 including a 'free board' of no less than 200 m^3, and be designed to retain any hydrocarbons that enter them.

8. All skimmer pits and any other stormwater retention areas shall be lined with an impervious material to prevent seepage through the bed and sidewalls, and all skimmer pits shall have a valve that can be shut off to prevent any discharge from the site.

9. Perimeter drains and skimmer pits necessary to comply with the conditions of this consent shall be installed before any site works commences. Site works includes the introduction of a drilling rig, drilling equipment or any other associated equipment or facilities to the site for any purpose other than for the construction of the site.

10. Subject to condition 11 the constituents in the discharge shall meet the standards shown in the following table.

Constituent	Standard
pH	Within the range 6.0 to 9.0
suspended solids	Concentration not greater than 100 gm^{-3}
total recoverable hydrocarbons	Concentration not greater than 15 gm^{-3} (as determined by infrared spectroscopic technique)
chloride	Concentration not greater than 230 gm^{-3}

This condition shall apply before entry of the treated stormwater into the receiving environment at a designated sampling point approved by the Chief Executive, Taranaki Regional Council.

11. The pH may exceed 9.0 if the exceedance is a result photosynthetic activity within the skimmer pits, but in any case the discharge shall not result in the pH of the receiving water increasing by more than 0.5 pH units after allowing for a mixing zone of 25 metres.

12. After allowing for a mixing zone of 25 metres, the discharge shall not cause any of the following effects in the receiving water:

    a) an increase in the temperature of more than 2 degrees Celsius; or
    b) the chloride concentration to exceed 50 gm^{-3}.

13. After allowing for a mixing zone of 25 metres, the discharge shall not give rise to any of the following effects in the receiving water:

    a) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
    b) any conspicuous change in the colour or visual clarity;
    c) any emission of objectionable odour;
    d) the rendering of fresh water unsuitable for consumption by farm animals;
    e) any significant adverse effects on aquatic life.

14. The consent holder shall advise the Chief Executive, Taranaki Regional Council, in writing at least 48 hours prior to the reinstatement of the site and the reinstatement shall be carried out so as to minimise adverse effects on stormwater quality. Notification shall include the consent number and a brief description of the activity consented and be emailed to worknotification@trc.govt.nz.

15. 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.

16. 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 2018 and/or June 2024, 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 9 September 2015

For and on behalf of
Taranaki Regional Council

_____

A D McLay
Director - Resource Management

Advice Note *(included at the request of DITAG)*
The consent holder's attention is drawn to MPI's "New Zealand Code of Practice for the Design and Operation of Farm Dairies (NZCP1) which restricts:

- *the discharge of specified wastes to land used for grazing of milking animals; and*
- *the use of feed from land which has had specified wastes applied to it.*

Should you require further information, please contact a Dairy Industry Technical Advisory Group (DITAG) representative ***or*** *visit http://www.foodsafety.govt.nz/elibrary/industry/dairy-nzcp1-design-code-of practice/amdt-2.pdf (specifically section 6.4 Disposal of effluent and other wastes and section 7.8 Purchased Stock Food)* ***or*** *contact an operating dairy processing company regarding conditions of supply.*

Water 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:	7 May 2014
Commencement Date:	7 May 2014

Conditions of Consent

Consent Granted:	To take groundwater as 'produced water', during hydrocarbon exploration and production activities at the Te Kiri North-A wellsite
Expiry Date:	1 June 2030
Review Date(s):	June 2018, June 2024
Site Location:	Te Kiri North-A wellsite, 831 Kina Road, Opunake (Property owner: Harvey Agricultural Holdings Limited)
Legal Description:	Lot 7 DP 682 (Site of take)
Grid Reference (NZTM)	1677266E-5644009N
Catchment:	Oaoiti

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 consent holder shall ensure the abstraction does not cause more than a 10% lowering of static water-level by interference with any adjacent bore.

2. The consent holder shall ensure the abstraction does not cause the intrusion of salt water into any freshwater aquifer.

3. The consent holder shall submit a summary well log to a depth of 1000 metres within three months of completion of drilling. The report shall:

   (a) include confirmation of the datum from which measurements are referenced;
   (b) provide a log to show the true vertical depth to all geological formation tops intersected within the freshwater zone;
   (c) identify the true vertical depth to, and thickness of, any freshwater aquifers intersected by the well;
   (d) identify the true vertical depth to the freshwater- saline water interface in the well.

4. 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.

5. 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 2018 and/or June 2024, 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 May 2014

For and on behalf of
Taranaki Regional Council

_____

A D McLay
Director-Resource Management

Water 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:	23 May 2014
Commencement Date:	23 May 2014

Conditions of Consent

Consent Granted:	To take water from an unnamed tributary of the Oaoiti Stream for wellsite and well drilling activities during hydrocarbon exploration and production operations at the Te Kiri North-A wellsite
Expiry Date:	01 June 2030
Review Date(s):	June 2018, June 2024
Site Location:	Te Kiri North-A wellsite, 831 Kina Road, Opunake (Property owner: Harvey Agricultural Holding Limited)
Legal Description:	Lot 8 DP 682 (Site of take) Lot 7 DP 682 (Site of use)
Grid Reference (NZTM)	1677287E-5644107N
Catchment:	Oaoiti

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 rate of taking shall not exceed 1.5 litres per second, and the volume taken in any 24 hour period ending at midnight (New Zealand Standard Time) shall not exceed 30 cubic metres.

2. Before exercising this consent the consent holder shall install, and thereafter maintain a water meter at the site of taking (or a nearby site in accordance with Regulation 10 of the *Resource Management (Measurement and Reporting of Water Takes) Regulations 2010*. The water meter shall be tamper-proof and shall measure and record the rate and volume of water taken to an accuracy of ± 5%. Records of the date, the time and the rate and volume of water taken at intervals not exceeding 15 minutes, shall be made available to the Chief Executive, Taranaki Regional Council at all reasonable times.

   Note: Water meters must be installed, and regularly maintained, in accordance with manufacturer's specifications in order to ensure that they meet the required accuracy. Even with proper maintenance water meters have a limited lifespan.

3. If any measuring or recording equipment breaks down, or for any reason is not operational, the consent holder shall advise the Chief Executive, Taranaki Regional Council immediately. Any repairs or maintenance to this equipment must be undertaken by a suitably qualified person.

4. The water meter shall be accessible to Taranaki Regional Council officers at all reasonable times for inspection and/or data retrieval.

5. The consent holder shall maintain a record of the water taken by recording the meter reading and the date of the reading at monthly intervals. This record shall be provided to the Chief Executive, Taranaki Regional Council, no later than 31 July of each year, or earlier upon request.

6. The records of water taken shall:

   (a) be in a format that, in the opinion of the Chief Executive, Taranaki Regional Council, is suitable for auditing;

   (b) specifically record the water taken as 'zero' when no water is taken; and

   (c) for each 12-month period ending on 30 June, be provided to the Chief Executive, Taranaki Regional Council within one month after end of that period.

7. At all times the consent holder shall adopt the best practicable option to prevent or minimise any actual or likely adverse effect on the environment associated with the abstraction of water, including, but not limited to, the efficient and conservative use of water.

8. 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.

9. 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 2018 and/or June 2024 for the purposes of:

   (a) 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; and/or

   (b) to require any data collected in accordance with the conditions of this consent to be transmitted directly to the Taranaki Regional Council's computer system, in a format suitable for providing a 'real time' record over the internet.

Signed at Stratford on 23 May 2014

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 P O Box 802 NEW PLYMOUTH 4340
Decision Date:	7 May 2014
Commencement Date:	7 May 2014

Conditions of Consent

Consent Granted:	To discharge stormwater and sediment, deriving from soil disturbance undertaken for the purpose of constructing the Te Kiri North-A wellsite, onto land where it may enter an unnamed tributary of the Oaoiti Stream
Expiry Date:	1 June 2019
Site Location:	Te Kiri North-A wellsite, 831 Kina Road, Opunake (Property owner: Harvey Agricultural Holdings Limited)
Legal Description:	Lot 7 DP 682 (Discharge source and site)
Grid Reference (NZTM)	1677210E-5644022N
Catchment:	Oaoiti

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

General condition

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

Special conditions

1. This consent authorises the discharge of stormwater from no more than 2.6 ha of land where earthworks is being undertaken for the purpose of establishing the Te Kiri North-A wellsite.

2. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any actual or likely adverse effect on the environment associated with the discharge of contaminants from the site.

3. At least 7 working days before the commencement of earthworks for the purpose of wellsite construction and establishment, the consent holder shall notify the Taranaki Regional Council of the proposed start date for the earthworks. Notification shall include the consent number and a brief description of the activity consented and shall be emailed to worknotification@trc.govt.nz.

4. All run off from any area of exposed soil shall pass through settlement ponds or sediment traps with a minimum total capacity of:

   a) 100 cubic metres for every hectare of exposed soil between 1 November to 30 April; and

   b) 200 cubic metres for every hectare of exposed soil between 1 May to 31 October;

   unless other sediment control measures that achieve an equivalent standard are agreed to by the Chief Executive of the Taranaki Regional Council.

5. The sediment control measures necessary to comply with condition 4 above shall be constructed before soil is exposed for the construction of the wellsite and shall remain in place, in respect of any particular area, until that area is stabilised.

   Note: For the purpose of conditions 5 and 6, "stabilised" in relation to any site or area means inherently resistant to erosion or rendered resistant, such as by using rock or by the application of basecourse, colluvium, grassing, mulch, or another method to the reasonable satisfaction of the Chief Executive, Taranaki Regional Council and as specified in the Taranaki Regional Council's Guidelines for Earthworks in the Taranaki Region, 2006. Where seeding or grassing is used on a surface that is not otherwise resistant to erosion, the surface is considered stabilised once, on reasonable visual inspection by an officer of the Taranaki Regional Council, an 80% vegetative cover has been established.

6. All earthworked areas shall be stabilised vegetatively or otherwise as soon as is practicable and no longer than 6 months after the completion of soil disturbance activities.

Signed at Stratford on 7 May 2014

For and on behalf of
Taranaki Regional Council

_____

A D McLay
Director-Resource Management

Appendix II

Biomonitoring reports

To Job Manager, Callum MacKenzie
From Technical Officer, Katie Blakemore
Document 1665894
Report No. KB001
Date 7 April 2016

Biomonitoring of the Oaoiti Stream in relation to drilling at the Te Kiri-A wellsite

Introduction

A pre-drill biological survey was carried out at the Te Kiri-A wellsite, to provide baseline data on the health of the macroinvertebrate community in the Oaoiti Stream prior to the commencement of drilling activities. A further survey was undertaken upon completion of the drilling to determine whether stormwater discharges onto land near an unnamed tributary of the Oaoiti Stream had a significant adverse impact on the stream macroinvertebrate community.

Methods

The pre-drill survey was completed on 17 December 2015. Three sites were established at the time of the survey (Table 1, Figure 1). These sites were situated in the Oaoiti Stream, with a 'control' site approximately 20m upstream of the confluence with the tributary receiving the discharge (Site 1), a 'primary impact' site 30m downstream of this confluence (Site 2) and a 'secondary impact' site 80m downstream of this confluence (Site 3). A post-drill survey at these same sites was carried out on 29 February 2016.

The standard '400 ml kick-sampling' technique was used to collect streambed macroinvertebrates. This 'kick-sampling' technique is very similar to Protocol C1 (hard-bottomed, semi-quantitative) of the New Zealand Macroinvertebrate Working Group (NZMWG) protocols for macroinvertebrate samples in wadeable streams (Stark et al, 2001).

Table 1 Biomonitoring sites in the Oaoiti Stream in relation to discharges from the Te Kiri-A wellsite

Site number	Site code	Grid reference (NZTM)	Location	Altitude (masl)
1	OAT000080	E1676561 N5653463	20m upstream of confluence with unnamed tributary receiving Te Kiri-A wellsite discharge	170
2	OAT000095	E1676516 N5644217	30m downstream of confluence with tributary receiving Te Kiri-A wellsite discharge	170
3	OAT000097	E1676452 N5644205	80m downstream of confluence with tributary receiving Te Kiri-A wellsite discharge	170

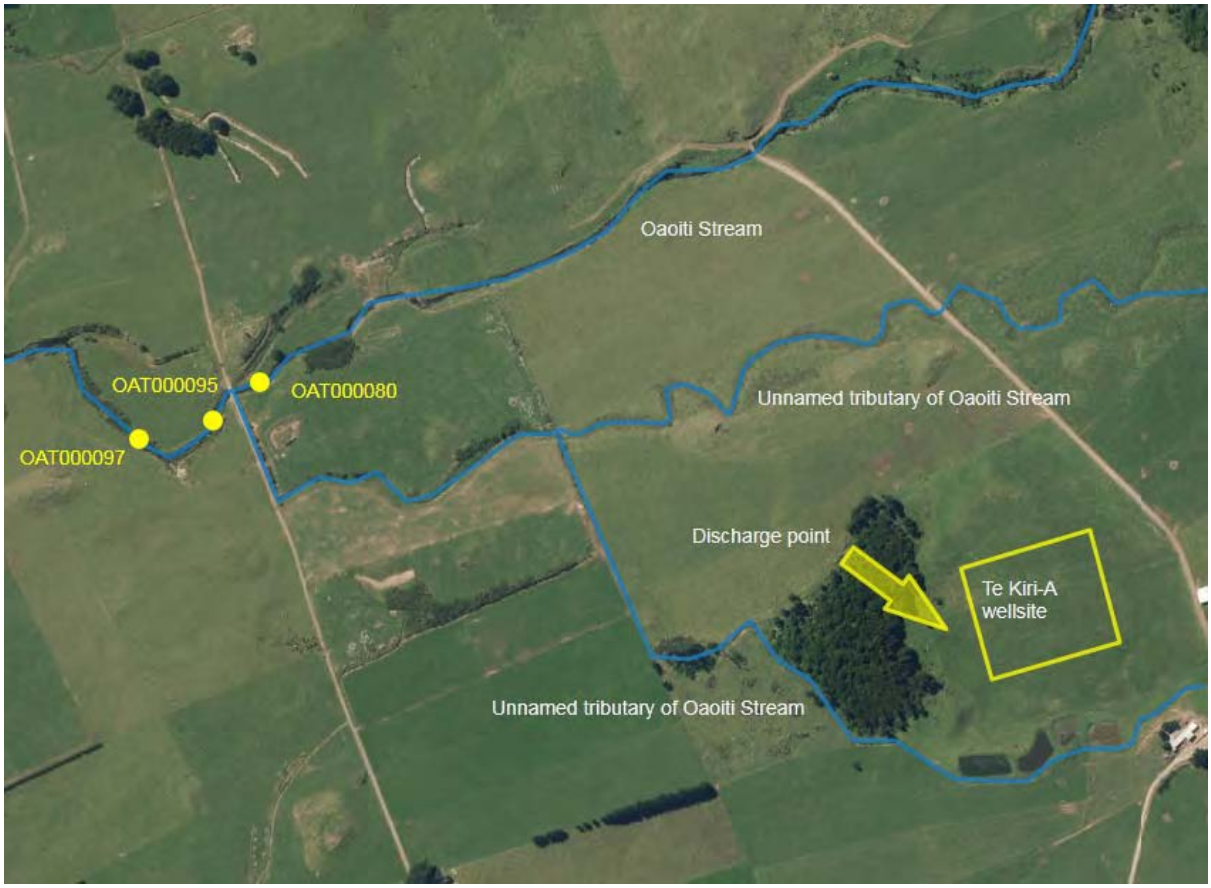

Figure 1 Biomonitoring sites in the Oaoiti Stream in relation to the Te Kiri-A wellsite.

Samples were preserved with Kahle's Fluid for later sorting and identification under a stereomicroscope according to Taranaki Regional Council methodology using protocol P1 of NZMWG protocols for sampling macroinvertebrates in wadeable streams (Stark et al. 2001). Macroinvertebrate taxa abundances found in each sample were recorded based on the categories in Table 2.

Table 2 Macroinvertebrate abundance categories

Abundance category	Number of individuals
R (rare)	1-4
C (common)	5-19
A (abundant)	20-99
VA (very abundant)	100-499
XA (extremely abundant)	>499

Stark (1985) developed a scoring system for macroinvertebrate taxa according to their sensitivity to organic pollution in stony New Zealand streams. Highly 'sensitive' taxa were assigned the highest scores of 9 or 10, while the most 'tolerant' forms scored 1. Sensitivity scores for certain taxa have been modified in accordance with Taranaki experience. By averaging the scores obtained from a list of taxa taken from one site and multiplying by a scaling factor of 20, a Macroinvertebrate Community Index (MCI) value was obtained. The MCI is a measure of the overall sensitivity of macroinvertebrate communities to the effects of organic pollution. A gradation of biological water quality conditions based upon MCI ranges which has been adapted for Taranaki streams and rivers (TRC, 2013) from Stark's classification (Stark, 1985 and Boothroyd and Stark, 2000) (Table 3). More 'sensitive' communities inhabit less polluted waterways. A difference of 11 units or more in MCI values is considered significantly different (Stark 1998).

Table 3 Macroinvertebrate community health based on MCI ranges which has been adapted for Taranaki streams and rivers (TRC, 2013) from Stark's classification (Stark, 1985 and Boothroyd and Stark, 2000)

Grading	MCI
Excellent	>140
Very Good	120-140
Good	100-119
Fair	80-99
Poor	60-79
Very Poor	<60

A semi-quantitative MCI value ($SQMCI_s$) has also been calculated for the taxa present at each site by multiplying each taxon score by a loading factor (related to its abundance), totalling these products, and dividing by the sum of the loading factors (Stark, 1998 and 1999). The loading factors were 1 for rare (R), 5 for common (C), 20 for abundant (A), 100 for very abundant (VA) and 500 for extremely abundant (XA). Unlike the MCI, the $SQMCI_s$ is not multiplied by a scaling factor of 20, so that its corresponding range of values is 20x lower. Macroinvertebrate community health grades can also be assigned from the $SQMCI_S$, although these have not been modified for Taranaki. The grades based on the $SQMCI_s$ are given in Table 4.

Table 4 Macroinvertebrate community health based on $SQMCI_s$ ranges from Stark and Maxted's classification (Stark and Maxted 2007)

Grading	$SQMCI_s$
Excellent	>5.99
Good	5.00-5.99
Fair	4.00-4.99
Poor	<4.00

Results and discussion

At the time of the pre-drill survey being carried out, there was a clear, uncoloured flow with a moderate water level at all three sites. The substrate at all sites was predominantly boulder and cobble. All three sites also had small amounts of sand, fine gravel and coarse gravel. Water temperatures ranged between 15.0 – 15.4 °C at the three sites. The survey was carried out 19 days since a fresh of 3x median flow and 19 days since a fresh of 7x median flow (based on the nearby Kapoaiaia Stream).

All three sites had some periphyton present with patchy mats and widespread filaments recorded for all sites. No leaves, wood or macrophytes were present at any of the sites. Patchy moss was present at sites 2 and 3, but absent at site 1.

The post-drill survey was carried out 10 days after a fresh of 3x median flow and 11 days after a fresh of 7x median flow. At the time of this survey there was a moderate flow at all sites. At site 1 the flow was a slightly cloudy brown colour, while at sites 2 and 3 it was clear tannin stained brown. The substrate was predominantly cobble at all sites, with significant amounts of boulder and coarse gravel. Sand and fine gravel were present in small amounts at all three sites. The water temperatures at the time of this survey ranged between 18.2 - 18.4°C.

There was periphyton present at all three sites at the time of the post-drill survey. Sites 1 and 2 had patchy mats and patchy filaments, while site 3 had patchy mats and widespread filaments. No moss, wood or macrophytes were present at any of the sites, while leaves were patchy at sites 1 and 2 and absent at site 3.

Macroinvertebrate communities

The results of the pre-drill survey are provided in Table 5, and the results of the post-drill survey are provided in Table 6.

Table 5 Macroinvertebrate fauna of the Oaoiti Stream in relation to Te Kiri-A wellsite stormwater discharge sampled on 17 December 2015

axa List	Site Number	MCI score	1	2	3
	Site Code		OAT000080	OAT000095	OAT000097
	Sample Number		FWB15374	FWB15375	FWB15376
ANNELIDA (WORMS)	Oligochaeta	1	C	C	R
	Lumbricidae	5	-	R	-
MOLLUSCA	*Potamopyrgus*	4	R	R	R
CRUSTACEA	Ostracoda	1	-	-	R
	Paracalliope	5	R	-	-
EPHEMEROPTERA (MAYFLIES)	*Austroclima*	7	R	C	A
	Coloburiscus	7	C	A	A
	Deleatidium	8	A	VA	A
	Nesameletus	9	-	A	C
	Rallidens	9	-	-	R
	Zephlebia group	7	R	R	-
PLECOPTERA (STONEFLIES)	*Megaleptoperla*	9	-	R	-
	Spaniocerca	8	R	-	-
	Zelandoperla	8	-	R	-
COLEOPTERA (BEETLES)	Elmidae	6	R	R	C
	Hydraenidae	8	R	-	-
	Ptilodactylidae	8	-	R	-
MEGALOPTERA (DOBSONFLIES)	*Archichauliodes*	7	C	C	A
TRICHOPTERA (CADDISFLIES)	*Hydropsyche (Aoteapsyche)*	4	VA	VA	XA
	Costachorema	7	C	A	A
	Hydrobiosis	5	C	A	A
	Neurochorema	6	-	R	C
DIPTERA (TRUE FLIES)	*Aphrophila*	5	A	A	VA
	Eriopterini	5	R	-	-
	Maoridiamesa	3	VA	XA	XA
	Orthocladiinae	2	C	A	C
	Tanytarsini	3	R	R	-
	Muscidae	3	-	R	R
	Austrosimulium	3	R	C	R
ACARINA (MITES)	Acarina	5	-	-	R
		No of taxa	20	23	20
		MCI	105	110	102
		SQMCIs	4.1	4.2	4.0
		EPT (taxa)	8	11	9
		%EPT (taxa)	40	48	45

'Tolerant' taxa | 'Moderately sensitive' taxa | 'Highly sensitive' taxa

R = Rare C = Common A = Abundant VA = Very Abundant XA = Extremely Abundant

Table 6 Macroinvertebrate fauna of the Oaoiti Stream in relation to Te Kiri-A wellsite stormwater discharge sampled on 29 February 2016

Taxa List	Site Number	MCI score	1	2	3
	Site Code		OAT000080	OAT000095	OAT000097
	Sample Number		FWB16096	FWB16097	FWB16098
PLATYHELMINTHES (FLATWORMS)	*Cura*	3	-	-	R
NEMATODA	Nematoda	3	R	-	-
ANNELIDA (WORMS)	Oligochaeta	1	R	-	-
MOLLUSCA	*Potamopyrgus*	4	C	A	A
CRUSTACEA	*Paracalliope*	5	-	-	R
	Paranephrops	5	-	R	R
EPHEMEROPTERA (MAYFLIES)	*Austroclima*	7	C	C	R
	Coloburiscus	7	C	A	C
	Deleatidium	8	VA	VA	VA
	Nesameletus	9	R	R	C
	Zephlebia group	7	-	R	-
COLEOPTERA (BEETLES)	Elmidae	6	C	C	A
	Hydraenidae	8	R	R	-
MEGALOPTERA (DOBSONFLIES)	*Archichauliodes*	7	C	A	A
TRICHOPTERA (CADDISFLIES)	*Hydropsyche (Aoteapsyche)*	4	VA	VA	VA
	Costachorema	7	R	R	R
	Hydrobiosis	5	C	A	A
	Neurochorema	6	-	-	R
	Beraeoptera	8	-	R	-
	Confluens	5	-	R	R
	Oxyethira	2	R	R	C
	Pycnocentrodes	5	C	A	A
DIPTERA (TRUE FLIES)	*Aphrophila*	5	A	A	A
	Maoridiamesa	3	A	A	A
	Orthocladiinae	2	A	A	VA
	Tanytarsini	3	A	A	A
	Dolichopodidae	3	-	-	R
	Empididae	3	R	-	R
	Muscidae	3	R	-	-
	Sciomyzidae	3	-	R	-
	Austrosimulium	3	R	R	R
ACARINA (MITES)	Acarina	5	R	-	R
		No of taxa	23	23	25
		MCI	96	107	98
		SQMCIs	5.3	5.4	4.7
		EPT (taxa)	8	11	10
		%EPT (taxa)	35	48	40

'Tolerant' taxa | 'Moderately sensitive' taxa | 'Highly sensitive' taxa

R = Rare C = Common A = Abundant VA = Very Abundant XA = Extremely Abundant

Site 1 (Upstream of confluence with tributary receiving discharge)

Moderate taxa richness of 20 taxa was found at this upstream 'control' site at the time of the pre-drill survey, while 23 taxa were found in the post-drill survey. These values are similar to the median value of 21 taxa for a site at this altitude in a ring plain river that rises in the National Park (TRC, 2015).

The pre-drill survey recorded a MCI score of 105 at this site, while the post-drill survey recorded a MCI score of 96. The difference between these scores is not statistically significant. In contrast, the $SQMCI_s$ score increased from 4.1 to 5.3 between the pre-drill and post-drill surveys, a statistically significant improvement (Stark 1998).

The invertebrate community was characterised by four taxa at the time of the pre-drill survey, one 'highly sensitive'mayfly (*Deleatidium*), one 'moderately sensitive' cranefly (*Aphrophila*) and two 'tolerant' taxa [the caddisfly (*Hydropsyche*) and midge (*Maoridiamesa*)]. These four taxa as well as two additional 'tolerant' midges (orthocladiinae and tanytarsini) characterised the community at the time of the post-drill survey.

Site 2 (30m downstream of confluence with tributary receiving discharge)

A moderate taxa richness of 23 taxa was found at this 'primary impact' site on both sampling occasions. This is similar to the median taxa richness of 21 taxa for a site at this altitudinal range in a ring plain river that rises in the National Park (TRC, 2015).

The pre-drill survey recorded a MCI score of 110, whilst the post-drill survey recorded a MCI score of 107, both of which classify the stream as having 'good' ecological health. Both scores are similar to the median score of 108 for similar sites in this altitudinal range (TRC, 2015). There is no statistically significant difference between these scores (Stark 1998). The $SQMCI_s$ scores at this site were 4.2 and 5.4 in the pre-drill and post-drill surveys respectively. This indicates a statistically significant difference in health (Stark 1998).

The macroinvertebrate community at this site was characterised by 9 taxa at the time of the pre-drill survey and by 11 taxa at the time of the post-drill survey. Characteristic taxa in both surveys included one 'highly sensitive' mayfly (*Deleatidium*), three 'moderately sensitive' taxa [cranefly (*Aphrophila*), mayfly (*Coloburiscus*) and caddisfly (*Hydrobiosis*)], and three 'tolerant' taxa [caddisfly (*Hydropsyche*) and two midges (orthocladiinae and *Maoridiamesa*)]. The pre-drill community was characterised further by a 'highly sensitive' mayfly (*Nesameletus*), and a 'moderately sensitive' caddisfly (*Costachorema*); while the post-drill invertebrate community was characterised by two additional 'moderately sensitive' taxa [the toe-biter (*Archicauliodes*) and caddisfly *(Pycnocentrodes*)] and two 'tolerant' taxa [the midge larvae (tanytarsini) and snail (*Potamopyrgus*)].

Site 3 (80m downstream of confluence with tributary receiving discharge)

A moderate taxa richness of 20 taxa was found at this 'secondary impact' site at the time of the pre-drill survey, whilst a moderately high taxa richness of 25 taxa was found in the post-drill survey. Both of these values are similar to the median taxa richness of 21 taxa for similar sites at this altitude. The pre-drill survey recorded an MCI score of 102, with the post-drill survey recording a slightly lower score of 98. This difference is not statistically significant (Stark, 1998). These scores are not significantly different from the median MCI

score of 108 for similar sites in this altitudinal range (TRC, 2015). The $SQMCI_s$ score was 4.0 units for the pre-drill survey and a slightly higher 4.7 units for the post-drill survey.

This site was characterised by a macroinvertebrate community of 9 numerically dominant taxa the time of the pre-drill survey and 11 taxa at the time of the post-drill survey. Characteristic taxa in both surveys were the 'highly sensitive' mayfly (*Deleatidium*), three 'moderately sensitive' taxa [the cranefly (*Aphrophila*), toe-biter (*Archicauliodes*) and caddisfly (*Hydrobiosis*)] and two 'tolerant' taxa [the caddisfly (*Hydropsyche*) and midge (*Maoridiamesa*)]. The pre-drill survey found three additional 'moderately sensitive' characteristic taxa [the mayflies (*Austroclima* and *Coloburiscus*) and caddisfly (*Costachorema*)]. The post-drill survey found five additional characteristic taxa, two 'moderately sensitive' [the beetle (elmidae) and caddisfly (*Pycnocentrodes*)] and three 'tolerant' [the snail (*Potamopyrgus*), and two midges (orthocladiinae and tanytarsini)].

Discussion and conclusions

The Council's "kick-sampling' technique was used to collect samples from three sites in the Oaoiti Stream on two occasions. This has provided data to assess the impact of the stormwater discharge to land from the Te Kiri-A wellsite on the macroinvertebrate communities of the stream. Samples were processed to provide taxa richness, MCI and $SQMCI_s$ scores for each site.

Taxa richnesses were found to be moderate in all instances. When taxa richness is compared between the pre-drill and post-drill surveys, there was an increase in richness for sites 1 and 3, and no change at site 2. Where taxa richness increased, it is likely due to seasonal differences that might reasonably be expected in macroinvertebrate communities. Taxa richness is a valuable macroinvertebrate community metric when determining whether a community has been exposed to a toxic discharge, as macroinvertebrates will either drift downstream to avoid the discharge or may be killed. This would result in a reduced taxa richness at the downstream sites. In contrast, the MCI and $SQMCI_S$ scores are a measure of community tolerance to organic pollution, although they can also provide an indication of more subtle influences caused by a poor quality discharge. As the $SQMCI_S$ score takes into account relative abundances of the taxa found in the sample, it provides additional insight to that provided by the MCI score. However, it is also easily influenced by the 'patchiness' of invertebrates on the stream bed, and as such must be considered in the context of all three metrics.

The pre-drill survey provided baseline data which showed that there were no significant differences in invertebrate communities between the three sites prior to drilling activities commencing. The MCI scores of 105, 110 and 102, at sites 1-3 respectively, are not ecologically significantly different from each other and classifies all three sites as having 'good ecological health, while the $SQMCI_s$ scores of 4.1, 4.2 and 4.0 respectively are statistically similar (Stark 1998) and classify all three sites as having 'fair' ecological health (Stark and Maxted 2007).

The post-drill survey showed wider variation in the MCI scores at these three sites, with scores of 96, 107 and 98 at sites 1-3 respectively. This classifies sites 1 and 3 as having 'fair' ecological health, while site 2 has 'good' stream health. The MCI scores for sites 1 and 2 show a significant increase in stream health from the' control' site to the 'primary impact' site. Site 3 is not significantly different from either site 1 or site 2. The difference in MCI score was caused in part by the presence of one 'highly sensitive taxon', (the cased caddisfly *Beraeoptera*)

at site 2 which was absent at site 1, and four 'tolerant' taxa which were rare at site 1 but not present at site 2 (oligochaete worms, nematode worms, and the fly larvae empididae and muscidae). These differences are likely to be a result of micro-habitat variation between the riffles sampled and are unrelated to wellsite activities.

The $SQMCI_s$ scores did not show the same differences between sites as the MCI score, with scores of 5.3, 5.4 and 4.7 for sites 1-3, respectively, recorded at the time of the post-drill survey. These scores are not significantly different from each other (Stark 1998). In contrast to the MCI scores, each site recorded an increase in $SQMCI_s$ score between the pre-drill survey and the post-drill survey. The changes were statistically significant for sites 1 and 2, and for all sites was principally related to reduced abundances of *Maoridiamesa* midge larvae, a direct reflection of reduced algal biomass observed.

The results of this survey do not show significant adverse effects from the stormwater discharge from the Te Kiri-A wellsite on the macroinvertebrate communities of the Oaoiti Stream. There was little change in MCI scores, $SQMCI_s$ scores improved for all sites between the pre-drill and post-drill surveys, and the taxa richnesses were either stable or improved during the same period. Furthermore, site 2, the 'primary impact' site recorded the highest MCI and $SQMCI_s$ scores of all sites at the time of both surveys. If the stormwater discharge was impacting upon the macroinvertebrate communities, this site would be expected to show the largest decline in invertebrate metrics between the pre-drill survey and post-drill survey, which was not the case.

Summary

Two macroinvertebrate surveys were carried out at three sites near the Te Kiri-A wellsite prior to and following drilling activities, to determine if discharges from the wellsite had had detrimental effects on the stream macroinvertebrate communities. These surveys, undertaken in December 2015 and February 2016, both recorded taxa richnesses that were moderate to moderately high at all three sites.

The pre-drill survey found no significant differences in MCI or $SQMCI_S$ scores between any of the three sites. MCI scores decreased, while the $SQMCI_S$ scores increased at all three sites between the pre-drill and post-drill surveys. These differences in MCI scores were not statistically significant, while the increases in $SQMCI_S$ scores were significant for sites 1 and 2. This is not considered an indication of any ecologically significant deterioration in the communities. Although there was a significant increase in MCI score between site 1 and site 2 at the time of the post-drill survey, this is not considered to be related to the wellsite discharge(s).

References

Stark JD, 1985: A macroinvertebrate community index of water quality for stony streams. Water and Soil Miscellaneous Publication No. 87.

Stark JD, 1998: SQMCI: a biotic index for freshwater macroinvertebrate coded abundance data. New Zealand Journal of Marine and Freshwater Research 32(1): 55-66.

Stark JD, 1999: An evaluation of Taranaki Regional Council's SQMCI biomonitoring index. Cawthron Institute, Nelson. Cawthron Report No. 472.

Stark JD, Boothroyd IKG, Harding JS, Maxted JR, Scarsbrook MR, 2001: Protocols for sampling macroinvertebrates in wadeable streams. New Zealand Macroinvertebrate Working Group Report No. 1. Prepared for the Ministry for the Environment. Sustainable Management Fund Project No. 5103. 57p.

Stark JD, and Maxted JR, 2007; A biotic index for New Zealand's soft-bottomed streams. New Zealand Journal of Marine and Freshwater Research 41(1): 43-61.

TRC, 2015: Some statistics from the Taranaki Regional Council database (Esam) of freshwater macroinvertebrate surveys performed during the period from Januray 1980 to 30 September 2015.

Winterbourn MJ, Gregson KLD, Dolphin CH, 2006. Guide to the aquatic insects of New Zealand. [4th edition]. *Bulletin of the Entomological Society of New Zealand 14*, 108p.