L & M Energy
Kahili Exploration Wellsite
Monitoring Programme Report
2013

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Executive summary

L & M Energy re-entered an established hydrocarbon exploration site located on Kohete Road, Inglewood, in the Waitara river catchment. The site is called Kahili wellsite. This report covers the period from February 2013-July 2013. During this period a well was drilled, and tested. The well has been plugged and abandoned. No sub-surface wellhead are currently on the wellsite.

This report for L & M Energy describes the monitoring programme implemented by the Taranaki Regional Council (the Council) to assess L & M Energy's environmental performance in relation to drilling operations at the Kahili wellsite during the period under review, and the results and environmental effects of L & M Energy's activities.

L & M Energy holds a total of 6 resource consents for the activities at the Kahili wellsite, which include a total of 76 consent conditions setting out the requirements that L & M Energy must satisfy. L & M Energy holds consent **9361-1** to take groundwater; consent **9358-1** to discharge emissions to air associated with exploration activities; consent **9356-1** to discharge stormwater and sediment from earthworks during construction onto and into land; consent **9360-1** to discharge produced water, stormwater from hydrocarbon exploration into land; **9359-1** to discharge emissions to air associated with production activities; and consent **9357-1** to discharge drilling muds, drilling cuttings and drilling wastes onto and into land, via mixed-bury-cover.

The Council's monitoring programme for the period under review included 8 inspections of the site and surrounding environment, at approximately fortnightly intervals. In total 9 stormwater samples were collected for chemical analysis.

The monitoring showed that, in general, reasonable processes and procedures were implemented. A strong focus on the environment by all personnel ensured that the site was mostly clean and tidy.

Any spills on-site were quickly cleaned up to avoid the potential for a contaminant to travel to surface water. The site's stormwater system worked effectively.

Owing to the distance of the wellsite to the nearest stream being approximately 90 m, the stream was visually inspected by an Inspecting Officer on each occasion. A bio-monitoring survey was un-necessary as no evidence of effects on the stream environment was observed by the Inspecting Officer.

Staff on-site were cooperative with requests made by officers of the Council, but some required works were not completed as quickly as was desirable.

The drilling fluids and cuttings were disposed off site.

On three separate occasions, samples of discharges of site water from the site found excessive levels of suspended solids. There was no evidence of impacts in the receiving waters (confirmed by inspections and on one occasion by chemical analysis). The discharge was to land.

Given the three events, during the monitoring period L & M Energy demonstrated a poor level of environmental performance and compliance with the resource consents. The site was generally neat, tidy, and well maintained.

This report includes recommendations for future drilling operations at this and other sites.

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1. Introduction

1.1 Compliance monitoring programme reports and the Resource Management Act 1991

1.1.1 Introduction

This report is for the period February 2013-July 2013 by the Taranaki Regional Council (the Council) on the monitoring programme associated with recourse consent held by L & M Energy. During the period under review the Company drilled a single well at the previously established Kahili wellsite. The site had been established 10 years earlier by Indo Pacific (NZ) Limited.

This report covers the results and findings of the monitoring programme implemented by the Council in respect of the consents held by L & M Energy that relate to exploration activities at Kahili wellsite located off Kohete Road, Inglewood, in the Waitara catchment.

One of the intents of the Resource Management Act 1991 (the Act) 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 L & M Energy's use of water, land, and air. This is the second report by the Council for the site.

1.1.2 Structure of this report

Section 1 of this report is a background section. It sets out general information about compliance monitoring under the Act and the Council's obligations and general approach to monitoring sites through annual programmes, the resource consents held by L & M Energy in the Waitara 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 Kahili wellsite during exploration activities.

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

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

Section 4 presents recommendations to be implemented during future drilling operations.

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

1.1.3 The Resource Management Act (1991) and monitoring

The Resource Management Act 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 a discharger, and may include cultural and socio-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 (eg, 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 Taranaki Regional Council is recognising the comprehensive meaning of `effects' in as much as is appropriate for each discharge source. Monitoring programmes are not only based on existing permit conditions, but also on the obligations of the Resource Management Act to assess the effects of the exercise of consents. In accordance with section 35 of the Resource Management Act 1991, the Council undertakes compliance monitoring for consents and rules in regional plans; and maintains an overview of performance of resource users against regional plans and consents. Compliance monitoring, including impact monitoring, also enables the Council to continuously assess its own performance in resource management as well as that of resource users particularly consent holders. It further enables the Council to continually re-evaluate its approach and that of consent holders to resource management, and, ultimately, through the refinement of methods, to move closer to achieving sustainable development of the region's resources.

1.1.4 Evaluation of environmental and consent performance

Besides discussing the various details of the performance and extent of compliance by the consent holder during the period under review, this report also assigns an overall rating. The categories used by the Council, and their interpretation, are as follows:

- a **high** level of environmental performance and compliance indicates that essentially there were no adverse environmental effects to be concerned about, and no, or inconsequential (such as data supplied after a deadline) non-compliance with conditions.

- a **good** level of environmental performance and compliance indicates that adverse environmental effects of activities during the monitoring period were negligible or minor at most, or, 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, or, there were perhaps some items noted on inspection notices for attention but these items were not urgent nor critical, and follow-up inspections showed they have been dealt with, and any inconsequential non compliances with conditions were resolved positively, co-operatively, and quickly.

- **improvement required (environmental)** or **improvement required (administrative compliance)** (as appropriate) indicates that the Council may have been obliged to record a verified unauthorised incident involving measurable environmental impacts, and/or, there were measurable environmental effects arising from activities and intervention by Council staff was required and there were matters that required urgent intervention, took some time to resolve, or remained unresolved at the end of the period under review, and/or, there were on-going issues around meeting resource consent conditions even in the absence of environmental effects. Abatement notices may have been issued.

- **poor performance (environmental)** or **poor performance (administrative compliance)** indicates generally that the Council was obliged to record a verified unauthorised incident involving significant environmental impacts, or there were material failings to comply with resource consent conditions that required significant intervention by the Council even in the absence of environmental effects. Typically there were grounds for either a prosecution or an infringement notice.

For reference, in the 2012-2013 year, 35% 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 59% demonstrated a good level of environmental performance and compliance with their consents.

1.2 Process description

Site management
L & M Energy holds a 5 year Petroleum Mining Permit No. 51154 to prospect, explore, and mine for condensate, gas, LPG, oil and petroleum within an area of 96.100 Km^2. The Kahili wellsite is one of many sites within this area that have been established in order to explore, evaluate and produce hydrocarbons.

The Kahili wellsite is located approximately 4 km along Kohete Road, approximately 15 km from Inglewood.

The Kahili wellsite was established in 2004 and involved the removal of topsoil to create a firm level platform on which to erect a drilling rig and house 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 flare pit; and
- Other on-site facilities such as accommodation, parking and storage.

The nearest residence is approximately 1 km away from the wellsite. Bunding, earthworks and good site location helped minimise any potential for off-site effects for the neighbours.

Well creation
The process of drilling a well can take a few weeks to several months, depending 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 pressurized 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.

Management of stormwater, wastewater and solid drilling waste
The Kahili wellsite is located approximately 90m to the east of the nearest waterbody which is an unnamed tributary of the Mangaone stream in the Waitara catchment.

Management systems were put in place to avoid any adverse effects on the surrounding environment from exploration and production 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, within the Waitara 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.

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].

Photo 1 Aerial view showing the location of Kahili wellsite

1.3 Resource consents

1.3.1 Background

L & M Energy holds 6 resource consents related to exploration activities at the Kahili wellsite site, as follows:

- Water Permit **9361-1** granted; 26 September 2012
- Discharge Permit **9356-1** granted; 7 September 2012
- Discharge Permit **9358-1** granted; 26 September 2012
- Discharge Permit **9359-1granted**; 26 September 2012
- Discharge Permit **9357-1** granted; 7 September 2012 and
- Discharge Permit **9360-1** granted; 26 September 2012

Each of the consent applications were processed on a non-notified basis as L & M Energy obtained the landowner approvals as an affected party, and the Council were satisfied that the environmental effects of the activity would be minor. The consents are discussed in further detail below.

Copies of the consents and the Council reports describing the associated activities are contained within Appendix I of this report.

1.3.2 Water abstraction permit (groundwater)

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

The Council determined that the application to take groundwater fell within Rule 49 of the Regional Freshwater Plan for Taranaki (RFWP) as the rate and daily volume of the groundwater abstraction might exceed that of the permitted activity (Rule 48). Rule 49 provides for groundwater abstraction as a controlled activity, subject to two conditions:

- *The abstraction shall cause not more than a 10% lowering of static water-level by interference with any adjacent bore;*
- *The abstraction shall not cause the intrusion of saltwater into any fresh water aquifer.*

L & M Energy holds water permit **9361-1** to take groundwater that may be encountered as produced water during exploration and production operations at the Kahili wellsite.

Any produced water would be from reserves far below that which is used for domestic or farm purposes. There are 3 known groundwater abstractions within a radial distance of 100 m from the wellsite. Shallow groundwater (which does not have any saltwater content) was to be protected by casing within the bore hole. Given these factors, the abstraction would not cause the above effects.

In granting the consent it was considered that the taking of groundwater was unlikely to have any adverse effect on the environment.

The Council was satisfied that the proposed activity would meet all the standards for a controlled activity. It was therefore obliged to grant the consent but imposed conditions in respect of those matters over which it reserved control. Those matters over which the Council reserved its control were:

- Volume and rate of abstraction;
- Daily timing of abstraction;
- Effects on adjacent bores, the aquifer, river levels, wetlands and sea water intrusion;
- Fitting of equipment to regulate flows and to monitor water volumes, levels, flows and pressures;
- Payment of administrative charges;
- Monitoring and report requirements;
- Duration of consent; and
- Review of the conditions of consent and the timing and purpose of the review.

This permit was issued by the Council on 26 September 2012 under Section 87(d) of the Act. It is due to expire on 1 June 2027.

Consent conditions were imposed on L & M Energy to ensure that adverse effects were avoided in the first instance. A summary of conditions can be viewed within Table **5**, Section 3.3.

A copy of the permit is attached to this report in Appendix 1.

1.3.3 Water discharge permit (treated stormwater and treated produced water)

Section 15(1)(a) of the Act 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 Council determined that the application to discharge treated stormwater, treated produced water and surplus drill water fell within Rule 44 of the RFWP, which provides for a discharge as a discretionary activity.

The discharge of stormwater may result in contaminants (e.g. sediment, oil) entering surface water. These contaminants have the potential to smother or detrimentally affect in-stream flora and fauna. On-site management of stormwater, as discussed in 1.2 above, is necessary to avoid/remedy any adverse effects on water quality.

L & M Energy holds water discharge permit **9360-1** to discharge treated stormwater and produced water from hydrocarbon exploration and production operations at the Kahili wellsite onto and into land.

Consent conditions were imposed on L & M Energy to ensure that adverse effects were avoided in the first instance. A summary of conditions can be viewed in Table **8**, Section 3.3.

This permit was issued by the Council on 26 September 2012 under Section 87(e) of the Act. It is due to expire on 1 June 2027.

A copy of 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 Act 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.

Council considered that the application fell under Rule 27 of the RFWP as a controlled activity (which may be non-notified without written approval), subject to one standard/term/condition to be met:

- *A site erosion and sediment control management plan shall be submitted to the Taranaki Regional Council.*

L & M Energy supplied a site erosion and sediment control management plan in support of the application.

The Council was satisfied that the activity would meet all the standards for a controlled activity. It was therefore obliged to grant the consent but imposed conditions in respect of those matters over which it reserved control. Those matters over which the Council reserved its control were:

- Approval of a site erosion and sediment control management plan and the matters contained therein;
- Setting of conditions relating to adverse effects on water quality and the values of the waterbody;
- Timing of works;
- Any measures necessary to reinstate the land following the completion of the activity;
- Monitoring and information requirements;
- Duration of consent;
- Review of conditions of consent and the timing and purpose of the review; and
- Payment of administrative charges and financial contributions.

L & M Energy holds water discharge permit **9356-1** to discharge stormwater and sediment from earthworks during construction of the Kahili wellsite onto and into land.

This permit was issued by the Council on 7 September 2012 under Section 87(e) of the Resource Management Act. It is due to expire on 7 June 2017.

Consent conditions were imposed on L & M Energy to ensure that adverse effects are avoided in the first instance. A summary of conditions can be viewed in Table **9**, Section 3.3.

A copy of the permit is attached to this report in Appendix I.

1.3.5 Air discharge permit (exploration activities)

Section 15(1)(c) of the Act 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 Council determined that the application to discharge emissions to air associated with the exploration activities at the Kahili wellsite fell within Rule 9 of the Regional Air Quality Plan (RAQP).

The standard/term/conditions associated with Rule 9are as follows:

- *Flare or incinerator point is at least 300 metres from any dwelling house;*
- *The discharge to air from the flare must not last longer than 15 days cumulatively, including of testing, clean-up, and completion stages of well development or work-over, per zone to be appraised; and*
- *No material to be flared or incinerated, other than those derived from or entrained in the well steam.*

Provided the activities were conducted in accordance with the applications and in compliance with the recommended special conditions, then no significant effects were anticipated.

L & M Energy holds air discharge permit **9358-1** to discharge emissions to air from hydrocarbon exploration activities including flaring or incineration of petroleum at the Kahili wellsite.

This permit was issued by the Council on 26 September 2012 under Section 87(e) of the Act. It is due to expire on 1 June 2027.

Consent conditions were imposed on L & M Energy to ensure that adverse effects are avoided in the first instance. A summary of conditions can be viewed in Table **7**, Section 3.3.

A copy of the permit is attached to this report in Appendix I.

1.3.6 Air discharge permit (production activities)

Section 15(1)(c) of the Act 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 Council determined that the application to discharge emissions to air associated with the production activities at the Kahili wellsite fell within Rule 11 of the RAQP.

The standard/term/condition of Rule 11 states that the:

- *Flare or incinerator point is a distance equal to or greater than 300 metres from any dwelling house.*

L & M Energy holds air discharge permit **9359-1** to discharge emissions to air associated with production activities at the Kahili wellsite including flaring associated with emergencies and maintenance and minor emissions from other miscellaneous activities.

This permit was issued by the Council on 26 September 2012 under Section 87(e) of the Act. It is due to expire 1 June 2027.

Consent conditions were imposed on L & M Energy to ensure that adverse effects are avoided in the first instance. A summary of conditions can be viewed in Table **6**, Section 3.3.

A copy of the permit is attached to this report in Appendix I.

1.3.7 Mix-Bury-Cover

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

The discharge of drilling muds, drilling cuttings and drilling wastes onto or into land from hydrocarbon exploration is a discretionary activity under Rule 42 of the RFWP.

Rule 42 of the RFWP has four standards/terms/conditions to be met:

- *The discharge shall not result or be liable to result in any contaminant entering surface water;*
- *The discharger must at all times adopt the best practicable option to prevent or minimise any adverse effects of the discharge or discharges to any water body or soil;*
- *The discharge shall contain less than 15 mg/kg oil and grease; and*
- *There shall be no adverse chemical effects on groundwater beyond the site.*

Provided the activity was conducted in a manner consistent with good industry practice, and in accordance with the recommended special conditions, then no significant effects were anticipated.

L & M Energy holds discharge permit **9357-1** to discharge solid drilling wastes (drilling cuttings and residual drilling fluids) from hydrocarbon exploration activities onto and into land via mix-bury-cover.

This permit was issued by the Taranaki Regional Council on 7 September 2012 under Section 87(e) of the Act. It is due to expire on 1 June 2017.

Consent conditions were imposed on L & M Energy to ensure that adverse effects are avoided in the first instance. A summary of conditions can be viewed in Table **10**, Section 3.3.

A copy of the permit is attached to this report in Appendix I.

1.4 Monitoring programme

1.4.1 Introduction

Section 35 of the Act sets out obligation/s upon the Council to: gather information, monitor, and conduct research on the exercise of resource consent and the effects arising, within the Taranaki region and report upon these.

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 exploration well sites consists of seven primary components. They are:

- Programme liaison and management;
- Site inspections;
- Chemical sampling;
- Solid wastes monitoring;
- Air quality monitoring;
- Discharges to land; and
- Ecological surveys.

The monitoring programme for the Kahili wellsite focused primarily on programme liaison and management, site inspections, and chemical sampling of site water discharges. However, all 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 reviews, renewals, or new consents, advice on the Council's environmental management strategies and the content of regional plans, and consultation on associated matters.

1.4.3 Site inspections

Inspection and examination of wellsites is a fundamental and effective means of monitoring and are 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;
- 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 may undertake sampling of discharges from site and from sites upstream and downstream of the discharge point to ensure that resource consent special conditions are complied with. A number of samples of discharges and the potential receiving waterway were collected.

1.4.5 Solid wastes

The Council monitors any disposal of drill cuttings on-site via mix-bury-cover to ensure compliance with resource consent conditions.

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

1.4.6 Air quality monitoring

Air quality monitoring is carried out in association with the well testing and clean-up phase, where flaring can occur.

Assessments are made by Inspecting Officers of the Council during site inspections to ensure that operators undertake all practicable steps to mitigate any effects from flaring gas.

Inspecting Officers check that the plant equipment is working effectively, that there is the provision of liquid and solid separation, and that staff onsite have regard to wind direction and speed at the time of any flaring.

The flare pit is also inspected to ensure that solid and liquid hydrocarbons are not combusted within the flare pit.

It is also a requirement that the Council and immediate land owners are notified prior to any gas being flared. This requirement was checked to ensure compliance with the conditions.

1.4.7 Ecological surveys

Ecological surveys in any nearby streams may be carried out pre and post occupation of the well site to assess whether the activities carried out on-site, and associated discharges have had any effect on ecosystems. However, as the visual inspections of the receiving water didn't show any effects from the discharges, no ecological surveys have been undertaken during this monitoring period.

2. Results

2.1 Water

2.1.1 Inspections

The Kahili wellsite, adjacent land and streams were inspected 8 times during this monitoring period.

Below is a copy of the comments that were noted on the day of each inspection.

14 February 2013
There were no stormwater discharges, odours, or flaring activity occurring onsite at the time of inspection. The site was found to be secure.

26 March 2013
No activity was occurring onsite at the time of inspection. A new access track had been created for the site. Metal had been added to the site. One of the two existing sumps had been filled in. The ring drains had been scraped. A sample was collected from both skimmer pits. The second skimmer pit contained tadpoles. There was no discharge of stormwater from the second skimmer pit at the time of inspection.

Advice was given to ensure that all stormwater/produced water discharged from the skimmer pit would discharge onto land only. The current location of the discharge point would allow stormwater to flow directly to the head of a waterway.

17 April 2013
Drilling was occurring on site. The site was found to be clean and tidy with bunding in place about the drill rig. Chemicals were stored in a Curtain Sider trailer unit so that they were protected from the weather. The ring drain was inspected and was in a working order. Advice was given to ensure the ring drains were free of debris and were large enough to contain and direct stormwater from site. These matters were addressed onsite by the site manager. The second skimmer pit had been pumped out since last visit. Samples were taken from the second skimmer pit to ensure that the discharge would comply with consent conditions should a discharge occur.

3 May 2013
It was raining at the time of inspection. The site was tidy. Water was tracking into the ring drains from the lease and travelling into the skimmer pits where it was discharging onto land. Hay bales had been placed in the ring drains to collect and settle out sediment. Stormwater was being contained on site. However there were a couple of areas where improvements to the ring drain system were required. These requirements were voiced to staff onsite. A new flare box had been brought onto site. A sample of the discharge from the skimmer pit system was taken for analysis. The drilling waste disposal area was being well managed. No flaring was occurring at the time of inspection.

30 May 2013
There was little activity onsite. The majority of the drilling equipment had been removed from the site. The skimmer pits were full and discharging at the time of inspection. Samples were taken from the skimmer pit discharge to ensure that it complies with resource consent conditions. The ring drains were inspected and they were found to be not sufficient to contain and direct all stormwater from the site to the skimmer pits.

Pipe running under one of the access tracks appeared blocked causing water to pond in the ring drain. A trench had been dug in the ring drain which would allow stormwater to discharge offsite during a wet period, without being directed for treatment in the skimmer pit system. The ring drain leading to the skimmer pits also needed to be repaired and increased in size. An abatement notice and an infringement notice were issued.

21 June 2013
The site was inspected in relation to the abatement notice. Inspection found that there were no persons or activity on site at the time of the inspection. The ring drains had been cleared allowing site discharge to flow through the ring drain system. The ring drain running to the skimmer pits had been built up a little more in order to cope with reasonable wet periods.

The skimmer pits were full and discharging at the time of the inspection. A discharge sample was taken.

Inspection found that a trench from the ring drain leading off site was still in place and had not been covered in. This was allowing discharge from the ring drains to travel along the trench and flow off-site where it travelled a short distance overland before entering an external pipe/drainage system. Samples were taken of this unauthorised discharge. An abatement notice and an infringement notice were issued.

1 July 2013
The site inspection was carried out to check the compliance with the abatement notice that had been issued. Inspection found that the cellar for the well had been removed and the concrete currently piled on site. The ring drains were working and skimmer pits were full but not discharging at the time of the inspection. The trench that had been dug through the ring drain allowing site water to discharge from site without passing through the skimmer pit treatment system was still present with evidence to suggest that site runoff had been discharging via the trench.

4 July 2013
The site inspection was completed to check the compliance with the abatement notice following the completion of earthworks. Site inspection found that the trench leading off site from the ring drain had been filled in allowing all stormwater to be directed to the skimmer pit treatment system. The site inspection found that the site was clean and tidy with no further works required. The abatement notice was being complied with at the time of the inspection. Skimmer pits were full and discharging at the time of the inspection. Samples were taken from the discharge to ensure compliance with consent conditions.

2.1.2 Results of abstraction and discharge monitoring

During the period under review, stormwater was observed discharging from the skimmer pits on 5 occasions. Samples were collected during the review period for this report and chemical analysis of the stormwater was carried out. On other inspections it was observed that stormwater had recently discharged from the site, by way of an unauthorised discharge. There were 3 skimmer pit stormwater samples collected. Two of the stormwater samples were collected from the second skimmer pit and 1 stormwater sample was collected from the first skimmer pit at the Kahili wellsite. On 21 June 2013 an unauthorised discharge sample was collected for

chemical analysis. The results showed that the suspended solids were over the consented limit and an infringement notice was issued to L & M Energy.

Analysis of the samples collected from the skimmer pits showed that all of the discharges would have been in compliance with resource consent conditions should a discharge have occurred. Analysis of the samples collected from the discharge pipe on 3 May 2013 showed that chloride levels were over twice the consented limit and suspended solids were over the consented limits. The discharge was not compliant with resource consent conditions and resulted in an infringement notice being issued to L & M Energy. Analysis of the samples collected from the discharge pipe on 30 May 2013 showed that the suspended solids were over the consented limit and were not compliant with resource consent conditions. For this non-compliance an infringement notice was issued to L & M Energy. Analysis of the samples collected from the unauthorised discharge on 21 June 2013 showed that suspended solids were over twice the consented limit (see further below).

All sewage was directed for treatment through a septic tank system and removed by contractor to a licensed disposal facility. Inspections of the stormwater discharge found it to be mostly clear. No odours were found to be associated with the discharge.

Table 1 Results of water samples taken from the discharge pipe on four occasions during the monitoring period

Parameters	Consent limit	3 May 2013	30 May 2013	21 June 2013	4 July 2013
Chloride (g/m^3)	**50**	**108**	19.7	12.3	6.1
pH	**6-9**	7.0	7.6	7.2	7.8
Suspended solids (g/m^3)	**100**	**110**	**170**	18	18
Hydrocarbon (g/m^3)	**15**	<0.5	0.6	<0.5	<0.5

Table 2 Results of water samples taken from the unauthorised discharge on 21 June 2013

Parameters	Consent limit	21 June 2013
Chloride (g/m^3)	**50**	17.1
pH	**6-9**	7.0
Suspended solids (g/m^3)	**100**	**220**
Hydrocarbon (g/m^3)	**15**	1.0

Table 3 Results of water samples taken down stream of the unauthorised discharge on 21 June 2013

Parameters	Consent limit (Discharge)	21 June 2013
Chloride (g/m^3)	**50**	10.5
pH	**6-9**	6.3
Suspended solids (g/m^3)	**100**	<2
Hydrocarbon (g/m^3)	**15**	<0.5

Table 4 Results of water samples taken from the first and second skimmer pit on two occasions during the monitoring period

		1st skimmer pit	2nd skimmer pit	2nd skimmer pit
Parameters	**Consent limit**	**26 March 2013**	**26 March 2013**	**17 April 2013**
Chloride (g/m^3)	**50**	4.3	5.4	6.9
pH	**6-9**	9.0	8.2	6.9
suspended solids (g/m^3)	**100**	27	17	15
Hydrocarbon ($g/m^{3)}$	**15**	<0.5	0.6	<0.5

2.1.3 Results of receiving environment monitoring

The authorised discharges offsite were onto land from the skimmer pits. It is considered that the discharge was unlikely to reach a surface water body due to the small catchment area of the site. Table 3 above confirms this consideration, as it indicates the discharge was having no effect in the potential receiving waters.

The receiving surface water body was visually inspected in conjunction with site inspections. No effects were observed and the stream appeared clear with no visual change in colour or clarity. There was also no odour, oil, grease films, scum, foam or suspended solids observed in the stream during the monitoring period.

2.2 Air

2.2.1 Inspections

Air quality monitoring inspections were carried out in conjunction with general compliance monitoring inspections. See Section 2.1.1 above for comments concerning site inspections.

2.2.2 Results of discharge monitoring

L & M Energy hold resource consents **9359-1** (air discharge associated with production) and **9358-1** (air discharge associated with exploration). These consents were not were exercised during the monitoring period under review.

2.2.3 Results of receiving environment monitoring

No monitoring of the receiving environment was carried out as inspections found no offensive or objectionable odours, smoke or dust that was associated with activities at the site.

No chemical monitoring of air quality was undertaken at the Kahili wellsite as the controls implemented by L & M Energy did not give rise to any concerns with regard to air quality. No flaring was undertaken at the wellsite.

During monitoring inspections of the site the Inspecting Officers found there were no offensive or objectionable odours, smoke or dust associated with activities at the Kahili wellsite.

2.2.4 Other ambient monitoring

No other ambient air sampling was undertaken, as the controls implemented by L & M Energy did not give rise to any concerns with regard to air quality.

2.3 Land

2.3.1 Land status

The well site was constructed on moderate hill country, used mainly for dry stock farming. A reasonably quantity of earthworks were required to construct the site. The land had not been reinstated at the time of the last inspection on 4 July 2013. No well heads are currently permitted onsite, with the single well drilled during this review period being cemented and abandoned sub-surface.

2.4 Contingency plan

L & M Energy provided a general contingency plan, as required by Condition **7** of recourse consent **9360-1** with a site specific map of the Kahili wellsite. The contingency plan has been reviewed and approved by officers of the Council.

2.5 Investigations, interventions and incidents

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 Unauthorised Incident Register (UIR) includes events where the company concerned has itself notified the Council. The register contains details of any investigation and corrective action taken.

Incidents may be alleged to be associated with a particular site. If there is 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 period under review, there were 3 incident recorded by the Inspecting Officers during inspections.

On 3 May 2013 a sample was collected, from a stormwater discharge at the Kahili wellsite. Chemical analysis showed concentrations of chloride and suspended solids were higher than resource consent 9360-1 conditions allowed. An infringement notice was issued.

The second incident was regarding sample results collected on 30 May 2013. The inspecting officer discovered that the ring drains at the Kahili wellsite were not in sufficient condition to satisfy resource consent 9360-1. Works were required to improve ring drains. A sample was non-compliant for suspended solids. An abatement notice and an infringement notice were issued.

The third incident occurred on 21 June 2013, when a sample of a discharge found suspended solids to be present at twice the allowed concentration. There were no downstream impacts. An abatement notice and an infringement notice were issued.

Other minor actual or potential non-compliances with consent conditions were addressed during site inspections. The unauthorised discharge trench took sometime to sort out.

3. Discussion

3.1 Discussion of consent exercise

Of the 6 resource consents relating to the Kahili wellsite, consents **9361-1** (take groundwater), **9360-1** (to discharge treated stormwater and produced water), and **9356-1** (to discharge stormwater and sediment from earthworks during construction), were exercised and actively monitored.

Flaring in association with production activities and flaring associated with exploration activities were not exercised during the monitoring period under review as permitted by resource consents **9359-1** (air discharge associated with production) and **9358-1** (air discharge associated with exploration).

The discharge of drilling muds and cuttings into land via mix-bury-cover was not exercised during the monitoring period as permitted by resource consent **9357-1**. Drilling waste was transported off site to a consented facility.

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

3.2 Environmental effects of exercise of consents

Stormwater

The discharge of stormwater from earthworks has the potential for sediment and other contaminants to enter surface water where it may detrimentally affect in-stream flora and fauna. To mitigate these effects, L & M Energy established perimeter drains during the construction of the wellsite, and care was taken to ensure runoff from disturbed areas was directed into the drains or directed through adequate silt control structures.

Once the well was constructed, attention was given to controlling stormwater that ran off the wellsite and the associated plant and equipment.

Adverse effects on surface water quality can occur if contaminated water escapes through the stormwater system. Interceptor pits are designed to trap sediment and hydrocarbons through gravity separation. Any water that is unsuitable for release via the interceptor pits was directed to the drilling sumps, or removed for off-site disposal.

L & M Energy also undertook the following mitigation measures in order to minimize off-site adverse effects:

- All stormwater was directed via perimeter drains to the skimmer pits for treatment prior to discharge (noting some failures, as described previously);
- Additional bunding was constructed around the bulk fuel tank, chemical storage area, and other areas where runoff from areas containing contaminants could occur;
- Regular inspections of the interceptor pits occurred; and
- Maintenance and repairs were carried out if required.

Interceptor pits do not discharge directly to surface water, instead they discharge onto and into land where the discharge usually soaks into the soil before reaching any surface water. However, if high rainfall had resulted in the discharge reaching the surface water, significant dilution would have occurred.

There are numerous on-site procedures included in drilling and health and safety documentation that are aimed at preventing spills on-site, and further procedures that address clean-up to remedy a spill situation before adverse environmental effects have the opportunity to occur (e.g. bunding of chemicals and bulk fuel).

L & M Energy did not always have the correct systems in place to ensure resource consent conditions were being complied with. On three occasions incidents occurred that could have been avoided if L & M Energy had operated more responsibly.

Groundwater

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.

Flaring

The environmental effects from flaring have been evaluated in monitoring reports prepared by the Council in relation to the flaring emissions from specific wells in the region.

The Council has previously undertaken field studies at two wells (one gas, and the other producing oil and heavier condensates); together with dispersion modelling at a third site[1]. More recently two studies have focused on field investigations and modelling of emissions from flares involving fracturing fluids.[2]

In brief, the previous studies found that measurements of carbon monoxide, carbon dioxide, and methane concentrations to be safe at all points downwind, including within 50 m of the flare pit. Measurements of suspended particulate matter found concentrations typical of background levels, and measurements of PM_{10} found compliance with national standards even in close proximity to the flare. Beyond 120 m from the flare pit, concentrations of polyaromatic hydrocarbons (PAH) approached background levels, as did levels of dioxins beyond 250 m from the flare.

In summary, the studies established that under combustion conditions of high volume flaring of gases with some light entrained liquids etc., atmospheric concentrations of all contaminants had reduced by a distance of 250 m downwind to become essentially typical of or less than elsewhere in the Taranaki environment (e.g. urban areas). These levels are well below any concentrations at which there is any basis for concern over potential health effects.

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[1] Taranaki Regional Council, *Fletcher Challenge Energy Taranaki Ltd, Mangahewa 2 Gas Well Air Quality Monitoring Programme Report 1997 – 98*, August 1998.

[2] Taranaki Regional Council: *Atmospheric Dispersion Modelling of Discharges to Air from the Flaring of Fracturing Fluid*, Backshall, March 2013; and *Investigation of air quality arising from flaring of fracturing fluids -emissions and ambient air quality, Technical Report 2012– 03,* Taranaki Regional Council May 2012.

The measures to be undertaken by L & M Energy to avoid or mitigate actual or potential adverse environmental impacts on air quality included:

- The use of a test separator to separate solids and fluids from the gas during all well clean-ups, and workover activities where necessary, thus reducing emissions to air. In particular, this would reduce the potential for heavy smoke incidents associated with elevated PAH and dioxin emissions;
- Records of flaring events were to be kept by L & M Energy and provided to the Council;
- Every endeavor was to be made by L & M Energy to minimise the total volume of gas flared while ensuring that adequate flow and pressure data was gathered to inform their investment decision; and
- Every endeavor was to be made by L & M Energy to minimise smoke emissions from the flare.

Odour and dust

Suppression of dust with water was to be implemented if it was apparent that dust may be travelling in such a direction to adversely affect off-site parties. Odour may stem from the product, flare, or some of the chemicals used on-site. Care was taken to minimize the potential for odour emissions (e.g. by keeping containers sealed, and ensuring the flare burnt cleanly).

Hazardous substances

The use and storage of hazardous substances on-site has the potential to contaminate surface water and soils in the event of a spill. In the unlikely event of a serious spill or fire, the storage of flammable materials could have resulted in air, soil and water contamination.

L & M Energy was required to implement the following mitigation measures:

- All potentially hazardous material were used and stored in accordance with the relevant Hazardous Substances and New Organisms regulations;
- All areas containing hazardous chemicals were bunded;
- Ignition sources were not permitted on any site;
- Sufficient separation of chemicals from the flare pit were maintained for safety reasons;
- In the unlikely event of a spill escaping from bunded areas, the site perimeter drain and interceptor pit system was to be utilised to provide secondary containment on-site; and
- A spill contingency plan was prepared that sets out emergency response procedures to be followed in the event of a spill.

Summary

There were no environmental effects observed to water, land or air as a result of the exploration drilling during the monitoring period.

3.3 Evaluation of performance

A tabular summary of L & M Energy's compliance record for the period under review is set out in Tables 5- 10.

Table 5 Summary of performance for Consent **9361-1** to take groundwater that may be encountered during exploration and production operations at Kahili wellsite.

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. The abstraction must not cause more than a 10% lowering of static water level by interference with any adjacent bore	Complaints	Yes – no complaints were received
2. The abstraction does not cause the intrusion of salt water into any freshwater aquifer	Water sampling adjacent bores pre/post drilling	N/A –not tested
3. A well log to 1,000 m must be submitted to the Council	Well log to 1,000 m submitted	Yes
4. Consent shall lapse if not implemented by date specified	Notification received and confirmed by inspection	N/A
5. Notice of Council to review consent	Notice of intention /not served	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**

Table 6 Summary of performance for Consent **9359-1** to discharge emissions to air associated with production activities at the Kahili wellsite

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. 24hrs notice of flaring to the Council when flaring is longer than 5 minutes in duration	Notification received 24hrs prior to flaring	N/A – consent not exercised
2. Liquid and solid separation to occur before flaring to minimise smoke emissions	Inspection of flare pit and flare	N/A – consent not exercised
3. Only substances originating from well stream to be combusted in flare pit	Visual inspection of site	N/A – consent not exercised
4. Best practicable option adopted	Visually inspecting site, procedures & processes	N/A – consent not exercised
5. No offensive odour or smoke beyond boundary	Assessment by investigating officer	N/A – consent not exercised
6. All storage tanks to have vapour recovery systems fitted.	Visual inspection of site	N/A – consent not exercised
7. Control of carbon monoxide	Chemical analysis of emissions	N/A – consent not exercised

Condition requirement	Means of monitoring during period under review	Compliance achieved?
8. Control of other emissions	Chemical analysis of emissions	N/A – consent not exercised
9. Analysis of typical gas and condensate stream from field to be made available to the Council	Available upon request	N/A – consent not exercised
10. Log all flare events longer than 5 minutes (10 minutes aggregate or longer than 120 minutes) including time, duration, zone and reason for flare	Inspection of Company records	N/A – consent not exercised
11. Consent shall lapse if not implemented by date specified	Notification of flaring received/not received	N/A – consent not exercised
12. Notice of Council to review consent	No provision for review during period	N/A – consent not exercised
Overall assessment of consent compliance and environmental performance in respect of this consent		**N/A – consent not exercised**

Table 7 Summary of performance for Consent **9358-1** to discharge emissions to air from hydrocarbon exploration at the Kahili Wellsite

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Flaring shall not occur for more than 45 days per zone, for up to six zones per well, for up to 4 wells	Inspection of records	N/A – consent not exercised
2. 24hrs notice of flaring to the Council for initial flare of each zone	Notification received 24hrs prior to flaring	N/A – consent not exercised
3. 24hr notice of flaring to all residents within 1,000 m of the wellsite	Residents confirm 24hr notice provided	N/A – consent not exercised
4. Liquid and solid separation to occur before flaring to minimise smoke emissions	Inspection of flare pit and flare	N/A – consent not exercised
5. The Council to be advised if separation cannot be maintained	Notification received/ complaint received	N/A – consent not exercised
6. No liquid or solid hydrocarbons are to be combusted in the flare pit	Inspection of flare pit and flare	N/A – consent not exercised
7. Best practicable option adopted	Visually inspecting site, procedures & processes	N/A – consent not exercised
8. Only substances originating from well stream to be combusted in flare pit	Visual inspection of site	N/A – consent not exercised
9. No offensive odour or smoke beyond boundary	Assessment by investigating officer	N/A – consent not exercised
10. Control of carbon monoxide	Chemical analysis of emissions	N/A – consent not exercised

Condition requirement	Means of monitoring during period under review	Compliance achieved?
11. Control of nitrogen oxides	Chemical analysis of emissions	N/A – consent not exercised
12. Control of other emissions	Chemical analysis of emissions	N/A – consent not exercised
13. Log all flaring including time, duration, zone and volumes flared	Inspection of Company records	N/A – consent not exercised
14. Consent shall lapse if not implemented by date specified	Notification of flaring received/not received	N/A – consent not exercised
15. Notice of Council to review consent	Notice of intention served/not served	N/A – consent not exercised
Overall assessment of consent compliance and environmental performance in respect of this consent		**N/A – consent not exercised**

Table 8 Summary of performance for Consent **9360-1** to discharge treated stormwater, and produced water from hydrocarbon exploration and production operations at the Kahili wellsite onto and into land

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Consent holder to adopt best practicable option at all times	Visually inspecting site, procedures & processes	No
2. 7 days written notice prior to site works and drilling	Notification received	Yes
3. Max stormwater catchment area 7,500 m^2	Inspection of site and records	Yes
4. All discharges to be directed for treatment through skimmer pit. Stormwater pits to be impermeable	Visual inspection of stormwater system	No
5. Constituents in the discharge shall meet standards	Sampling of discharge	No
6. Discharge of chloride shall not exceed 50 ppm	Sampling of discharge	No
7. Maintain a contingency plan	Contingency plan received and approved	Yes
8. The stormwater system shall be designed, managed and maintained in accordance with information submitted	By comparing submitted & approved plans with the built site inspection	Yes
9. Consent shall lapse if not implemented by date specified	Exercise of consent confirmed by inspection	Yes
10. Notice of Council to review consent	No provision for review during period	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**Poor**

Table 9 Summary of performance for Consent **9356-1** to discharge stormwater and sediment from earthworks during construction of the Kahili wellsite onto and into land.

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Consent holder to adopt best practicable option at all times	Visually inspecting site, procedures & processes	Yes
2. 7 days written notice prior to site earthworks	Notification received	No
3. 7 days written notice prior to site operations and drilling	Notification received	Yes
4. All runoff shall pass through settlement ponds or traps with a minimum capacity of 100 m^3	Site erosion and sediment control plan submitted	Yes
5. Condition 4 will not apply when site is stabilised	Visual inspection	Yes
6. All earth worked areas shall be stabilised as soon as practicable	Visual inspection	Yes
Overall assessment of consent compliance and environmental performance in respect of this consent		**Good**

Table 10 Summary of performance for Consent **9357-1** to discharge solid drilling wastes [drilling cuttings and residual drilling fluids] from hydrocarbon exploration activities onto and into land via mix-bury-cover

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. The discharge is to take place in accordance with information submitted in support of application	Confirming discharges were undertaken in accordance with information submitted	N/A – consent not exercised during the period under review
2. Consent Holder to adopt best practicable option at all times	Visually inspecting site, procedures & processes	N/A – consent not exercised during the period under review
3. The Council to be notified 48hrs prior to and after each mix-bury-cover discharge	Ensure notification is received prior to and after each discharge	N/A – consent not exercised during the period under review
4. Records of composition, volumes and quantities of material to be discharged shall be kept	Inspection of company records	N/A – consent not exercised during the period under review
5. The volume of waste discharged shall not exceed 15,000m^3 waste from each well	Visually inspecting site, procedures & processes	N/A – consent not exercised during the period under review
6. Discharge areas for wastes from individual wells shall be kept separate and distinct	Visually inspecting site, procedures & processes	N/A – consent not exercised during the period under review

Condition requirement	Means of monitoring during period under review	Compliance achieved?
7. Mix-bury-cover discharge shall not occur within 12 months of any previous mix-bury-cover discharge	Inspection of company records	N/A – consent not exercised during the period under review
8. As far as practicable, all fluids shall be removed from the drilling wastes	Visually inspecting site, procedures & processes	N/A – consent not exercised during the period under review
9. All sumps are to be permeable	Visually inspecting sumps	N/A – consent not exercised during the period under review
10. Drilling waste to be mixed with uncontaminated soil	Sampling soil prior to mixing	N/A – consent not exercised during the period under review
11. The mixture of solid drilling wastes and uncontaminated soil shall be covered by at least one metre of uncontaminated soil	Visually inspecting site, procedures & processes	N/A – consent not exercised during the period under review
12. Each mix-bury-cover discharge shall be re-vegetated and maintained with pasture cover	Visual inspection of site	N/A – consent not exercised during the period under review
13. The cover material is to be compacted and contoured so that stormwater is directed away from the mix-bury-cover site.	Visual inspection of site	N/A – consent not exercised during the period under review
14. The mix-bury-cover to be as far above the groundwater table as practicable	Visual inspection of site	N/A – consent not exercised during the period under review
15. The mix-bury-cover must be 30m from any water body, spring or bore	Visual inspection of site	N/A – consent not exercised during the period under review
16. The total loading of trace elements in waste is not to exceed Alberta Energy and Utilities Board, 1996, G-50 guidelines	Inspection of company records	N/A – consent not exercised during the period under review
17. Chloride levels in each mix-bury-cover shall not exceed 1,600kg	Sample mix-bury-cover to ensure compliance	N/A – consent not exercised during the period under review
18. Nitrogen levels in each mix-bury-cover shall not exceed 400kg	Sample mix-bury-cover to ensure compliance	N/A – consent not exercised during the period under review
19. The hydrocarbon content of solid drilling waste shall not exceed 15mg/kg	Sample mix-bury-cover to ensure compliance	N/A – consent not exercised during the period under review
20. Various parameters in the soil covering the mix-bury-cover to be below agreed limits	Sample mix-bury-cover to ensure compliance	N/A – consent not exercised during the period under review

Condition requirement	Means of monitoring during period under review	Compliance achieved?
21. Various metals in the soil covering the mix-bury-cover to be below agreed limits	Sample mix-bury-cover to ensure compliance	N/A – consent not exercised during the period under review
22. Hydrocarbon concentrations in the soil covering the mix-bury-cover shall comply with agreed guideline values	Sample mix-bury-cover to ensure compliance	N/A – consent not exercised during the period under review
23. Level of salts in surface & ground water not to exceed 2,500g/m^3	Sample mix-bury-cover to ensure compliance	N/A – consent not exercised during the period under review
24. Consent shall lapse if not implemented by date specified	Notification received/not received	N/A – consent not exercised during the period under review
25. Notice of Council to review consent	Notice of intention served/not served	N/A – consent not exercised during the period under review
Overall assessment of consent compliance and environmental performance in respect of this consent		**N/A – consent not exercised during the period under review**

During the monitoring period, L & M Energy demonstrated a poor level of environmental performance compliance with one of the resource consents. The site was generally neat, tidy, and well maintained.

3.4 Exercise of optional review of consents

Each resource consent includes a condition which allows the Council to review the consent, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of the resource consent, which were not foreseen at the time the application was considered or which it was not appropriate to deal with at the time. The next provisions for review are in 2015.

Based on the results of monitoring during the period under review, it is considered that there are no grounds that require a review to be pursued.

A recommendation to this effect is presented in section 4.

3.5 Change to any future monitoring programmes

In designing and implementing the monitoring programmes for air and water discharges and water abstractions at well sites in the region, the Council takes into account the extent of information made available by previous and other authorities, its relevance under the Act, the obligations of the Act in terms of monitoring emissions/discharges and effects, and of subsequently reporting to the regional community, the scope of assessments required at the time of renewal of permits, and the need to maintain a sound understanding of well site processes within Taranaki.

The Council has routinely monitored well site activities for more than 20 years in the region. This work has included in the order of hundreds of water samples and bio-monitoring surveys in the vicinity of well sites, and has demonstrated robustly that a monitoring regime based on frequent and comprehensive inspections is rigorous and thorough, in terms of identifying any adverse effects from well site and associated activities. Accordingly the Council had for a time not routinely required the imposition of additional targeted physicochemical and biological monitoring unless a site-specific precautionary approach indicated this would be warranted for certainty and clarity around site effects. In the case of the Kahili site, offsite chemical analyses were implemented to determine effects for a non-compliant event.

The Council has also noted a desire by some community members for a heightened level of information feedback and certainty around the results and outcomes of monitoring at well sites to occur or has occurred. Notwithstanding the long track record of a demonstrable suitability of an inspection-based monitoring programme, the Council has therefore moved to extend the previous regime, to make the sampling and extensive analysis of treated stormwater discharge and bio-monitoring of surface water ecosystems, an integral part of the basic monitoring programme for such activities.

The monitoring of future consented activities at Kahili wellsite shall be extended to include an ecological survey.

A recommendation to this effect is present in section 4 of this report.

4. Recommendations

1. THAT this report be forwarded to the Company, and to any interested parties upon request;

2. THAT the Company be asked to inform the Council of the intention to either drill, test or undertake reinstatement;

3. THAT the monitoring of future consented activities at Kahili wellsite be extended to include an ecological survey of potential receiving waters;

4. THAT, subject to the findings of monitoring of any further activities at the Kahili wellsite consents 9360-1, 9359-1, 9361-1 shall not be reviewed in 2015.

Glossary of common terms and abbreviations

The following abbreviations and terms may have been used within this report:

Al*	aluminium.
As*	arsenic
Biomonitoring	assessing the health of the environment using aquatic organisms
BOD	biochemical oxygen demand. A measure of the presence of degradable organic matter, taking into account the biological conversion of ammonia to nitrate
BODF	biochemical oxygen demand of a filtered sample
Bund	a wall around a tank to contain its contents in the case of a leak
CBOD	carbonaceous biochemical oxygen demand. A measure of the presence of degradable organic matter, excluding the biological conversion of ammonia to nitrate
Cfu	colony forming units. A measure of the concentration of bacteria usually expressed as per 100 millilitre sample
COD	chemical oxygen demand. A measure of the oxygen required to oxidise all matter in a sample by chemical reaction.
Condy	Conductivity, an indication of the level of dissolved salts in a sample, usually measured at 20°C and expressed in mS/m
Cu*	copper
DO	dissolved oxygen
DRP	dissolved reactive phosphorus
E.coli	*Escherichia coli*, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre sample
Ent	Enterococci, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre of sample
F	Fluoride
FC	Faecal coliforms, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre sample
Fresh	elevated flow in a stream, such as after heavy rainfall
g/m^3	grammes per cubic metre, and equivalent to milligrammes per litre (mg/L). In water, this is also equivalent to parts per million (ppm), but the same does not apply to gaseous mixtures
Incident	an event that is alleged or is found to have occurred that may have actual or potential environmental consequences or may involve non-compliance with a consent or rule in a regional plan. Registration of an incident by the Council does not automatically mean such an outcome had actually occurred
Intervention	action/s taken by Council to instruct or direct actions be taken to avoid or reduce the likelihood of an incident occurring
Investigation	action taken by Council to establish what were the circumstances/events surrounding an incident including any allegations of an incident

l/s	litres per second
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.
NH_4	ammonium, normally expressed in terms of the mass of nitrogen (N)
NH_3	unionised ammonia, normally expressed in terms of the mass of nitrogen (N)
NO_3	nitrate, normally expressed in terms of the mass of nitrogen (N)
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)
Pb*	lead
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
PM_{10}	relatively fine airborne particles (less than 10 micrometre diameter
Resource consent	refer Section 87 of the RMA. Resource consent 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 subsequent amendments
SS	suspended solids,
Temp	temperature, measured in °C (degrees Celsius)
Turb	turbidity, expressed in NTU
UI	Unauthorised Incident
UIR	Unauthorised Incident Register – contains a list of events recorded by the Council on the basis that they may have the potential or actual environmental consequences that may represent a breach of a consent or provision in a Regional Plan
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

Appendix I

Resource consents

Discharge Permit

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

Name of Consent Holder:	L & M Energy P O Box 10895 WELLINGTON 6143
Decision Date:	7 September 2012
Commencement Date:	7 September 2012

Conditions of Consent

Consent Granted:	To discharge drilling muds, drilling cuttings and drilling wastes onto and into land, via mix-bury-cover, associated with the construction of the Kahili wellsite at or about (NZTM) 1718281E-5662036N
Expiry Date:	1 June 2017
Site Location:	Kahili wellsite, 171 Kohete Road, Inglewood (Property Owner: S F Longstaff)
Legal Description:	Sec 4 Blk VII Huiroa SD (Discharge source and site)
Catchment:	Waitara
Tributary:	Mangaone

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

General condition

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

Special conditions

1. This consent only authorises the discharge of up to 600 m^3 of water based mud that exists at the site on the date the application was lodged for this consent.

2. Prior to the exercise of this consent, the consent holder shall after consultation with the Chief Executive, Taranaki Regional Council, install a minimum of three groundwater monitoring bores. The bores shall be at locations and to depths that enable monitoring to determine any change in groundwater quality resulting from the exercise of this consent. The bores shall be installed in accordance with NZS 4411:2001 and all associated costs shall be met by the consent holder.

3. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any actual or likely adverse effect on the environment associated with the discharge of contaminants from the site, including but not limited to effects on any water body or soil.

4. The consent holder shall notify the Taranaki Regional Council at least 48 hours prior to the commencement of each mix-bury-cover discharge. Notification shall include:

   a) the consent number;

   b) the volume, and weight or density of the drilling wastes;

   c) the composition of the drilling wastes (including concentrations of nitrogen, chloride, hydrocarbons, and trace elements), to show that the discharge complies with conditions 13 to 18;

   d) the location of the discharge area;

   and be emailed to worknotification@trc.govt.nz.

5. The volume of solid drilling wastes discharged shall not exceed 1500 m^3 per well from up to 8 wells.

6. If the mix-bury-cover discharge is to occur in a lined sump, the impermeable liner shall be perforated or removed where possible.

7. The solid drilling wastes shall be mixed with uncontaminated soil in a mixing ratio of 1 part solid drilling wastes to a minimum of 3 parts uncontaminated soil.

8. The mixture of solid drilling wastes and uncontaminated soil shall be covered by at least one metre of uncontaminated soil.

9. Each mix-bury-cover discharge area shall be re-vegetated, and thereafter maintained with pasture cover:

   a) within 6 months of the completion of the discharge, or

   b) if the discharge area is part of the active wellsite area, upon reinstatement of the site.

10. The consent holder shall compact, contour, and maintain the soil overlying the mix-bury-cover discharge to ensure that stormwater is directed away from the mix-bury-cover discharge area.

11. The mix-bury-cover discharge shall occur as far above the groundwater table as practicable.

12. The edges of the mix-bury-cover discharge area shall be at least 30 metres from any surface water body, spring, or any pre-existing groundwater supply bore.

13. The total loading of trace elements in the solid drilling wastes for each distinct mix-bury-cover discharge area shall not exceed the total loading limits shown in the following table:

Trace element	**Total loading limit**
boron	10 kg
cadmium	3 kg
chromium	200 kg
copper	400 kg
lead	200 kg
nickel	50 kg
vanadium	200 kg
zinc	600 kg

14. The loading of chloride shall not exceed 1,600 kg for each distinct mix-bury-cover discharge area.

15. The loading of nitrogen shall not exceed 400 kg for each distinct mix-bury-cover discharge area.

16. The hydrocarbon content of the solid drilling waste shall not exceed 1000 mg/kg on a dry weight basis

17. Parameters in the soil covering the mix-bury-cover discharge area (less than 0.5 metre depth) shall not exceed the limits shown in the following table:

Parameter	**Limit**
Conductivity	290 mSm^{-1}
Total dissolved salts	2500 $mg\ kg^{-1}$
Sodium	460 $mg\ kg^{-1}$
Chloride	700 $mg\ kg^{-1}$

18. The concentrations of metals in the soil covering the mix-bury-cover discharge area (less than 0.5 metre depth) shall comply with the limits shown in the following table:

Metal	Limit
arsenic	20 mg kg^{-1}
cadmium	1 mg kg^{-1}
chromium	600 mg kg^{-1}
copper	100 mg kg^{-1}
lead	300 mg kg^{-1}
mercury	1 mg kg^{-1}
nickel	60 mg kg^{-1}
zinc	300 mg kg^{-1}

19. The concentrations of hydrocarbons in the soil covering the mix-bury-cover discharge area (less than 0.5 metre depth) shall comply with the guideline values for the appropriate soil type in the surface layer set out in Tables 4.12 and 4.15 of the Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (Ministry for the Environment, 1999), appended to this consent.

20. The exercise of this consent shall not cause the level of total dissolved salts within any surface water or ground water to exceed 2500 gm^{-3}.

Signed at Stratford on 7 September 2012

For and on behalf of
Taranaki Regional Council

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Director-Resource Management

Table 4.12 Tier 1 soil acceptance criteria *Agricultural use* [1,3,6] ALL PATHWAYS (all values mg/kg)

Soil Type/ Contaminant	Depth of contamination		
	Surface (<1m)	1m - 4m	> 4m
SAND			
MAHs			
Benzene	1.1 (v)	1.9 (7,v)	2.4 (7,v)
Toluene	(68) (4,v)	(94) (4,m)	(230) (4,v)
Ethylbenzene	(53) (4,v)	(92) (4,7,v)	(120) (4,v)
Xylenes	(48) (4,v)	(130) (4,7,v)	(180) (4,v)
PAHs			
Naphthalene	7.2 (p)	70 (v)	80 (v)
Non-carc. (Pyrene)	(160) (4,p)	NA (2)	NA (2)
Benzo(a)pyrene eq. (5)	0.027 (p)	(25) (4,m)	NA (2)
SANDY SILT			
MAHs			
Benzene	1.1 (v)	1.9 (v)	2.4 (v)
Toluene	(82) (4,v)	(170) (4,v)	(240) (4,v)
Ethylbenzene	(59) (4,v)	(92) (4,v)	(140) (4,v)
Xylenes	(59) (4,v)	(130) (4,v)	(180) (4,v)
PAHs			
Naphthalene	7.2 (p)	83 (v)	(130) (4,v)
Non-carc. (Pyrene)	(160) (4,p)	NA (2)	NA (2)
Benzo(a)pyrene eq. (5)	0.027 (p)	(25) (4,m)	NA (2)
SILTY CLAY			
MAHs			
Benzene	1.7 (v)	4.6 (v)	12 (v)
Toluene	(210) (4,v)	(950) (4,v)	(3,000) (4,v)
Ethylbenzene	(110) (4,v)	(800) (4,v)	(2,800) (4,v)
Xylenes	(160) (4,v)	(710) (4,v)	(2,200) (4,v)
PAHs			
Naphthalene	7.2 (p)	(330) (4,v)	(1,100) (4,v)
Non-carc. (Pyrene)	(160) (4,p)	NA (2)	NA (2)
Benzo(a)pyrene eq. (5)	0.027 (p)	(25) (4,m)	NA (2)

NOTES:

1. Based on protection of human health. Refer to Table 4.20 for protection of groundwater. Site-specific consideration of aesthetic and ecological impacts is required.
2. NA indicates contaminant not limiting as estimated health-based criterion is significantly higher than that likely to be encountered on site.
3. Surface soil acceptance criteria are based on the lower value of volatilisation criteria (Table 4.16), other pathway criteria (Table 4.18) and criteria for the protection of maintenance workers (Table 4.19). Criteria for soils at 1 m are based on the lower value of those arising from volatilisation and maintenance criteria. Criteria for soils at 4 m are based on volatilisation only.
4. Brackets denote values exceed threshold likely to correspond to formation of residual separate phase hydrocarbons. For further explanation refer to Appendix 4M.
5. Risk associated with mixture of carcinogenic PAHs assessed by comparison with criteria based on benzo(a)pyrene equivalent concentration. Refer to Section 4.4.3 for details of the calculation of Benzo(a)pyrene equivalent concentrations.
6. The following notes indicate the limiting pathway for each criterion: v - Volatilisation, s - Soil Ingestion, d - Dermal, p - Produce, m - Maintenance/Excavation
7. Due to the nature of boundary conditions in volatilisation model, calculated criteria for sandy soils are higher than that for silt soil type. Therefore, the criteria for sand are set equal to the criteria for silt. Refer Appendix 4D for details.

Table 4.12 (CONTINUED)
Tier 1 soil acceptance criteria *Agricultural use* [1,3,6] ALL PATHWAYS (all values mg/kg)

Soil Type/ Contaminant	Depth of contamination		
	Surface (<1m)	1m - 4m	> 4m
CLAY			
MAHs			
Benzene	2.7 [v]	8.8 [v]	(26) [4,v]
Toluene	(320) [4,v]	(2,400) [4,v]	(8,500) [4,v]
Ethylbenzene	(160) [4,v]	NA [2]	NA [2]
Xylenes	(250) [4,v]	(1,800) [4,v]	(6,500) [4,v]
PAHs			
Naphthalene	7.2 [p]	(360) [4,v]	(1,200) [4,v]
Non-carc. (Pyrene)	(160) [4,p]	NA [2]	NA [2]
Benzo(a)pyrene eq. [5]	0.027 [p]	(25) [4,m]	NA [2]
PUMICE			
MAHs			
Benzene	1.2 [v]	2.4 [v]	3.1 [v]
Toluene	(73) [4,v]	(240) [4,v]	(350) [4,v]
Ethylbenzene	(48) [4,v]	(140) [4,v]	(220) [4,v]
Xylenes	(53) [4,v]	(180) [4,v]	(260) [4,v]
PAHs			
Naphthalene	7.2 [p]	140 [v]	(220) [4,v]
Non-carc. (Pyrene)	(160) [4,p]	NA [2]	NA [2]
Benzo(a)pyrene eq. [5]	0.027 [p]	(25) [4,m]	NA [2]
PEATS AND HIGHLY ORGANIC SOILS			
MAHs			
Benzene	5.7 [v]	10 [v]	13 [v]
Toluene	(2,500) [4,v]	(2,900) [4,v]	(3,800) [4,v]
Ethylbenzene	(2,200) [4,v]	(2,500) [4,v]	(3,200) [4,v]
Xylenes	(1,700) [4,v]	(2,000) [4,v]	(2,600) [4,v]
PAHs			
Naphthalene	7.2 [p]	(2,700) [4,v]	(3,500) [4,v]
Non-carc. (Pyrene)	(160) [4,p]	NA [2]	NA [2]
Benzo(a)pyrene eq. [5]	0.027 [p]	(25) [4,m]	NA [2]

NOTES:

1. Based on protection of human health. Refer to Table 4.20 for protection of groundwater. Site-specific consideration of aesthetic and ecological impacts is required.
2. NA indicates contaminant not limiting as estimated health-based criterion is significantly higher than that likely to be encountered on site.
3. Surface soil acceptance criteria are based on the lower value of volatilisation criteria (Table 4.16), other pathway criteria (Table 4.18) and criteria for the protection of maintenance workers (Table 4.19). Criteria for soils at 1 m are based on the lower value of those arising from volatilisation and maintenance criteria. Criteria for soils at 4 m are based on volatilisation only.
4. Brackets denote values exceed threshold likely to correspond to formation of residual separate phase hydrocarbons. For further explanation refer to Appendix 4M.
5. Risk associated with mixture of carcinogenic PAHs assessed by comparison with criteria based on benzo(a)pyrene equivalent concentration. Refer to Section 4.4.3 for details of the calculation of Benzo(a)pyrene equivalent concentrations.
6. The following notes indicate the limiting pathway for each criterion: v - Volatilisation, s - Soil Ingestion, d - Dermal, p - Produce, m - Maintenance/Excavation

Table 4.13 Tier 1 soil acceptance criteria for TPH[1.3.5.6] *Residential use* ALL PATHWAYS (all values in mg/kg)

Soil Type/ Contaminant	Depth of contamination		
	Surface (<1m)	1m - 4m	> 4m
SAND			
C_7-C_9 [4]	120 [m]	120 [m]	(3,800) [7,8,v]
C_{10}-C_{14}	(470) [7,x]	(560) [7,x]	(650) [7,x]
C_{15}-C_{36}	NA [2]	NA [2]	NA [2]
SANDY SILT			
C_7-C_9 [4]	(500) [7,m]	(500) [7,m]	(3,800) [7,v]
C_{10}-C_{14}	(510) [7,x]	(670) [7,x]	(1,000) [7,x]
C_{15}-C_{36}	NA [2]	NA [2]	NA [2]
SILTY CLAY			
C_7-C_9 [4]	(2,700) [7,v]	(7,300) [7,v]	(19,000) [7,v]
C_{10}-C_{14}	(560) [7,x]	(2,700) [7,x]	(8,900) [7,x]
C_{15}-C_{36}	NA [2]	NA [2]	NA [2]
CLAY			
C_7-C_9 [4]	(15,000) [7,v]	NA [2]	NA [2]
C_{10}-C_{14}	(570) [7,x]	(2,900) [7,x]	(9,700) [7,x]
C_{15}-C_{36}	NA [2]	NA [2]	NA [2]
PUMICE			
C_7-C_9 [4]	(810) [7,m]	(810) [7,m]	NA [2]
C_{10}-C_{14}	(400) [7,x]	(1,100) [7,x]	(1,800) [7,x]
C_{15}-C_{36}	NA [2]	NA [2]	NA [2]
PEATS AND HIGHLY ORGANIC SOILS			
C_7-C_9 [4]	(6,700) [7,m]	(6,700) [7,m]	NA [2]
C_{10}-C_{14}	(580) [7,x]	NA [2]	NA [2]
C_{15}-C_{36}	NA [2]	NA [2]	NA [2]

NOTES:

1. Criteria for C10 - C14 and C15 - C36 are based on consideration of aliphatic component of TPH measurement and consideration of TPH as a surrogate measure for PAH, consideration of PAHs completed by extrapolation of PAH content of diesel and PAH criteria (refer Table 4.10)
2. NA indicates estimated criterion exceeds 20,000 mg/kg. At 20,000 mg/kg residual separate phase is expected to have formed in soil matrix. Some aesthetic impact may be noted.
3. Based on protection of human health only. Site specific consideration of aesthetic and ecological impact is required.
4. Based on health effects associated with aliphatic component only. Separate consideration of the health effects associated with the aromatic component (i.e. BTEX) is required.
5. Soil acceptance criteria are based on the lower value of criteria based on volatilisation (Table 4.16), other pathways (Table 4.18), criteria for the protection of maintenance workers (Table 4.19) and TPH criteria developed as surrogates for PAHs (Table 4.22). Surface soils criteria are based on all three pathways, criteria for soils at 1 m are based on volatilisation and maintenance workers, and criteria for soils at 4 m are based on volatilisation only. PAH surrogate considerations apply at all depths.
6. The following notes indicate the limiting pathway for each criterion: v - Volatilisation, s - Soil Ingestion d - Dermal, p - Produce, m - Maintenance/Excavation, x - PAH surrogate
7. Brackets denote values exceed threshold likely to correspond to formation of residual separate phase hydrocarbons. For further explanation refer to Appendix 4M.
8. Due to the nature of boundary conditions in volatilisation model, calculated criteria for sandy soils are higher than that for silt soil type. Therefore, the criteria for sand are set equal to the criteria for silt. Refer Appendix 4D for details.

Discharge Permit

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

Name of Consent Holder:	L & M Energy P O Box 10895 WELLINGTON 6143
Decision Date:	26 September 2012
Commencement Date:	26 September 2012

Conditions of Consent

Consent Granted:	To discharge contaminants to air from hydrocarbon exploration in up to 4 wells at the Kahili wellsite, including combustion involving flaring or incineration of petroleum recovered from the wells, in association with well development or redevelopment and testing or enhancement of well production flow at or about (NZTM) 1718173E-5662038N
Expiry Date:	1 June 2027
Review Date(s):	June 2015, June 2021
Site Location:	Kahili wellsite, 171 Kohete Road, Inglewood (Property Owner: S F Longstaff)
Legal Description:	Sec 4 Blk VII Huiroa SD (Discharge source & site)

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. Flaring shall not occur on more than 45 days, cumulatively, per zone for each well (with a maximum of 4 zones per well), for up to 4 wells.

2. The flare shall be located at NZTM 1718173E-5662038N.

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

4. At least 24 hours before any flaring, other than in emergencies, the consent holder shall provide notification to occupants of all dwellings within 1km of the wellsite of the commencement of flaring. 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 flaring activity.

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

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

7. 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 from the flare, including, but not limited to, having regard to the prevailing and predicted wind speed and direction at the time of initiation of, and throughout, any episode of flaring so as to minimise offsite effects (other than for the maintenance of a pilot flare flame).

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

9. 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.

10. The consent holder shall control all emissions to the atmosphere from the site of contaminants other than those expressly provided for under special condition 9, in order that they do not individually or in combination with other contaminants cause a hazardous, noxious, dangerous, offensive or objectionable effect at or beyond the boundary of the property on which the wellsite is located.

11. 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.

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

13. The consent holder shall record and make available to the Chief Executive, Taranaki Regional Council upon request, a 'flaring log' that includes:

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

    b) the zone from which flaring occurred;

    c) the volume of substances flared;

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

14. This consent shall lapse on 30 September 2017, 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.

15. 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 2015 and/or June 2021, for any of the following purposes:

    a) 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

    b) 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

    c) to alter, add or delete limits on mass discharge quantities or ambient concentrations of any contaminant.

Signed at Stratford on 26 September 2012

For and on behalf of
Taranaki Regional Council

_____

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:	L & M Energy P O Box 10895 WELLINGTON 6143
Decision Date:	26 September 2012
Commencement Date:	26 September 2012

Conditions of Consent

Consent Granted:	To discharge contaminants to air associated with hydrocarbon producing wells at the Kahili wellsite at or about (NZTM) 1718173E-5662038N
Expiry Date:	1 June 2027
Review Date(s):	June 2015, June 2021
Site Location:	Kahili wellsite, 171 Kohete Road, Inglewood (Property Owner: S F Longstaff)
Legal Description:	Sec 4 Blk VII Huiroa SD (Discharge source and site)

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. Other than in emergencies, the consent holder shall notify the Chief Executive, Taranaki Regional Council, whenever the continuous flaring of hydrocarbons (other than purge gas) is expected to occur for more than five minutes in duration. Notification shall be no less than 24 hours before the flaring commences. Notification shall include the consent number and be emailed to worknotification@trc.govt.nz.

2. The flare shall be located at NZTM 1718173E-5662038N.

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

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

5. 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 from the flare, including, but not limited to, having regard to the prevailing and predicted wind speed and direction at the time of initiation of, and throughout, any episode of flaring so as to minimise offsite effects (other than for the maintenance of a pilot flare flame).

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

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

8. 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.

9. The consent holder shall control all emissions to the atmosphere from the site of contaminants other than those expressly provided for under special condition 8, in order that they do not individually or in combination with other contaminants cause a hazardous, noxious, dangerous, offensive or objectionable effect at or beyond the boundary of the property on which the wellsite is located.

10. 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.

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

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

    b) the zone from which flaring occurred;

    c) the volume of substances flared;

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

12. This consent shall lapse on 30 September 2017, 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.

13. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2015 and/or June 2021, for any of the following purposes:

    a) 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

    b) 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

    c) to alter, add or delete limits on mass discharge quantities or ambient concentrations of any contaminant.

Signed at Stratford on 26 September 2012

For and on behalf of
Taranaki Regional Council

_____

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:	L & M Energy P O Box 10895 WELLINGTON 6143
Decision Date (Change):	8 May 2013
Commencement Date (Change):	8 May 2013 (Granted: 26 September 2012)

Conditions of Consent

Consent Granted:	To discharge treated stormwater, treated produced water and surplus drilling water from hydrocarbon exploration and production operations at the Kahili wellsite onto and into land and into an unnamed tributary of the Mangaone Stream
Expiry Date:	1 June 2027
Review Date(s):	June 2015, June 2021
Site Location:	Kahili wellsite, 171 Kohete Road, Inglewood (Property Owner: S F Longstaff)
Legal Description:	Sec 4 Blk VII Huiroa SD (Discharge source and site)
Grid Reference (NZTM)	1718161E-5662052N
Catchment:	Waitara
Tributary:	Mangaone

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. The Chief Executive, Taranaki Regional Council, shall be advised in writing at least 7 working days before any site works commencing, and again in writing at least 7 working days before any well drilling operation commencing. Notification shall include the consent number and a brief description of the activity consented and be emailed to worknotification@trc.govt.nz.

3. Stormwater discharged shall be collected from a catchment area of no more than 6,000 m^2.

4. All stormwater and produced water shall be directed for treatment through the two skimmer pit(s), with capacity of at least 100 m^3 each, before being discharged.

5. All skimmer pits, perimeter drains and any other retention structures shall be lined with an impervious material to prevent seepage through the bed and sidewalls.

6. 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}

7. The consent holder shall prepare and maintain a contingency plan that, to the satisfaction of the Chief Executive, Taranaki Regional Council, 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.

8. 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.

9. 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.

10. 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 emailed to worknotification@trc.govt.nz.

11. This consent shall lapse on 30 September 2017, 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.

12. 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 2015 and/or June 2021, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 8 May 2013

For and on behalf of
Taranaki Regional Council

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Director-Resource Management

Discharge Permit

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

Name of Consent Holder:	L & M Energy P O Box 10895 WELLINGTON 6143
Decision Date:	26 September 2012
Commencement Date:	26 September 2012

Conditions of Consent

Consent Granted:	To discharge treated stormwater and treated produced water from hydrocarbon exploration and production operations at the Kahili wellsite onto and into land at or about (NZTM) 1718161E-5662052N
Expiry Date:	1 June 2027
Review Date(s):	June 2015, June 2021
Site Location:	Kahili wellsite, 171 Kohete Road, Inglewood (Property Owner: S F Longstaff)
Legal Description:	Sec 4 Blk VII Huiroa SD (Discharge source and site)
Catchment:	Waitara
Tributary:	Mangaone

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 to 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. The Chief Executive, Taranaki Regional Council, shall be advised in writing at least 7 working days before any site works commencing, and again in writing at least 7 working days before any well drilling operation commencing. Notification shall include the consent number and a brief description of the activity consented and be emailed to worknotification@trc.govt.nz.

3. Stormwater discharged shall be collected from a catchment area of no more than 6,000 m^2.

4. All stormwater and produced water shall be directed for treatment through the two skimmer pit(s), with capacity of at least 100 m^3 each, before being discharged.

5. All skimmer pits, perimeter drains and any other retention structures shall be lined with an impervious material to prevent seepage through the bed and sidewalls.

6. 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}

7. The consent holder shall prepare and maintain a contingency plan that, to the satisfaction of the Chief Executive, Taranaki Regional Council, 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.

8. 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 emailed to worknotification@trc.govt.nz.

9. This consent shall lapse on 30 September 2017, 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.

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

Signed at Stratford on 26 September 2012

For and on behalf of
Taranaki Regional Council

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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:	L & M Energy P O Box 10895 WELLINGTON 6143
Decision Date:	26 September 2012
Commencement Date:	26 September 2012

Conditions of Consent

Consent Granted:	To take groundwater, which is encountered as produced water during exploration activities associated with up to 4 wells at the Kahili wellsite at or about (NZTM) 1718214E-5662017N
Expiry Date:	1 June 2027
Review Date(s):	June 2015, June 2021
Site Location:	Kahili wellsite, 171 Kohete Road, Inglewood (Property Owner: S F Longstaff)
Legal Description:	Sec 4 Blk VII Huiroa SD (Site of take)
Catchment:	Waitara
Tributary:	Mangaone

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 the completion of drilling. The report shall:

   a) include confirmation of 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; and

   d) identify the true vertical depth to the freshwater-saline water interface in the well.

4. This consent shall lapse on 30 September 2017, 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 2015 and/or June 2021, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 26 September 2012

For and on behalf of
Taranaki Regional Council

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Director-Resource Management