Origin Energy and AR Geary Landfarms Monitoring Programme Annual Report 2015-2016

Technical Report 2016-89

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Executive summary

Origin Energy Resources NZ Limited (Origin Energy) managed four drilling waste landfarming sites, three of the consents associated with these facilities were originally held by Swift Energy NZ Ltd and were transferred to Origin Energy in 2008 (Kauri A, Spence Road and Schrider). The forth consent was held by AR Geary.

The sites are located on Geary Road at Manutahi, in the Waikaikai catchment (Geary, Kauri A and Schrider sites); and on Spence Road, Kakaramea, in the Kaikura catchment. Disposals at the Kauri A site were completed in 2003, while for Geary and Schrider sites were completed in 2006 and 2011 respectively. The areas have since been reinstated to productive farmland. Disposals at the Spence site were completed in 2012. Schrider, Spence and Geary sites were continually monitored and reported on annually.

This report for the period July 2015 to June 2016 describes the monitoring programme implemented by the Taranaki Regional Council (the Council) to assess the environmental performance during the period under review, and the results and environmental effects of their activities.

The Council's monitoring programme for the year under review included four inspections, eight soil samples and a review of soil sampling results undertaken by an environmental consultant in respect of the remediation exercise undertaken on the former landfarm storage area of Spence Road.

Origin Energy held three resource consents, which include a total of 76 conditions setting out the requirements that they must satisfy. AR Geary held one resource consent, which included a total of 27 conditions. These consents allow for the discharge of drilling waste onto and into land via landfarming and are all administered by Origin Energy.

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

All four consents were processed for surrender in this period as analysis undertaken by both Origin Energy and the Council indicated that contaminants of concern were within the limits to allow for the surrender of the consents.

Spence Road specifically underwent remediation of the former storage pit area. The contaminated soil excavated and relocated to the current WRS landfarm of Symes Manawapou, where it will undergo further remediation. Origin Energy brought in clean-fill, post analysis and approvals by the Council, to backfill the former storage pits and return them to pasture.

There were no unauthorised incidents recording non-compliance in respect of this consent holder during the period under review.

During the year, Origin Energy demonstrated a high level of both environmental and administrative performance with their resource consents.

For reference, in the 2015-2016 year, 71% of consent holders in Taranaki monitored through tailored compliance monitoring programmes achieved a high level of environmental

performance and compliance with their consents, while another 24% demonstrated a good level of environmental performance and compliance with their consents.

In terms of overall environmental and compliance performance by the consent holder over the last several years, this report shows that the consent holder's performance has remained at a high level.

This report includes recommendations for the 2016-2017 year.

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1. Introduction

1.1 Compliance monitoring programme reports and the Resource Management Act 1991

1.1.1 Introduction

This annual report is for the period 1 July 2015 to 30 June 2016 by the Taranaki Regional Council (the Council) describing the monitoring programmes associated with resource consents held by Origin Energy Resources NZ Ltd (here after Origin Energy) and AR Geary. Origin Energy operated three drilling waste landfarms situated on Geary Road at Manutahi (Schrider and Kauri A Landfarm), and Spence Road at Kakaramea. They also managed and monitored the Geary landfarm site to ensure that consent conditions are met prior to surrender. The consent for this site is held by the landowner AR Geary.

This report covers the results and findings of the monitoring programmes implemented by the Council in respect of the consents held by Origin Energy and AR Geary, to discharge drilling waste onto and into land via landfarming. This is the 7th combined Technical Report and the 19th report across the three sites, to be prepared by the Council to cover the discharges and their effects.

One of the intents of the *Resource Management Act 1991* (RMA) is that environmental management should be integrated across all media, so that a consent holder's use of water, air, and land should be considered from a single comprehensive environmental perspective.

Accordingly, the Council generally implements integrated environmental monitoring programmes and reports the results of the programmes jointly.

1.1.2 Structure of this report

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

- consent compliance monitoring under the RMA and the Council's obligations;
- the Council's approach to monitoring sites though annual programmes;
- the resource consents held by Origin Energy in the Kaikura, Waikaikai and Mangaroa catchment;
- the nature of the monitoring programme in place for the period under review; and
- a description of the activities and operations conducted in Origin Energy and AR Geary's site/catchment.

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

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

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

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

1.1.3 The Resource Management Act 1991 and monitoring

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

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

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

1.1.4 Evaluation of environmental and administrative performance

Besides discussing the various details of the performance and extent of compliance by Origin Energy and AR Geary, this report also assigns them a rating for their environmental and administrative performance during the period under review.

Environmental performance is concerned with actual or likely effects on the receiving environment from the activities during the monitoring year. **Administrative performance** is concerned with the consent holder's approach to demonstrating consent compliance in site operations and management including the timely provision of information to Council (such as contingency plans and water take data) in accordance with consent conditions.

Events that were beyond the control of the consent holder and unforeseeable (that is a defence under the provisions of the RMA can be established) may be excluded with regard to the performance rating applied. For example loss of data due to a flood destroying deployed field equipment.

The categories used by the Council for this monitoring period, and their interpretation, are as follows:

Environmental Performance

- **High:** No or inconsequential (short-term duration, less than minor in severity) breaches of consent or regional plan parameters resulting from the activity; no adverse effects of significance noted or likely in the receiving environment. The Council did not record any verified unauthorised incidents involving significant environmental impacts and was not obliged to issue any abatement notices or infringement notices in relation to such impacts.

- **Good:** Likely or actual adverse effects of activities on the receiving environment were negligible or minor at most. There were some such issues noted during monitoring, from self reports, or in response to unauthorised incident reports, but these items were not critical, and follow-up inspections showed they have been dealt with. These minor issues were resolved positively, co-operatively, and quickly. The Council was not obliged to issue any abatement notices or infringement notices in relation to the minor non-compliant effects; however abatement notices may have been issued to mitigate an identified potential for an environmental effect to occur.

  For example:

  - High suspended solid values recorded in discharge samples, however the discharge was to land or to receiving waters that were in high flow at the time;
  - Strong odour beyond boundary but no residential properties or other recipient nearby.

- **Improvement required**: Likely or actual adverse effects of activities on the receiving environment were more than minor, but not substantial. There were some issues noted during monitoring, from self reports, or in response to unauthorised incident reports. Cumulative adverse effects of a persistent minor non-compliant activity could elevate a minor issue to this level. Abatement notices and infringement notices may have been issued in respect of effects.

- **Poor:** Likely or actual adverse effects of activities on the receiving environment were significant. There were some items noted during monitoring, from self reports, or in response to unauthorised incident reports. Cumulative adverse effects of a persistent moderate non-compliant activity could elevate an 'improvement required' issue to this level. Typically there were grounds for either a prosecution or an infringement notice in respect of effects.

Administrative performance

- **High:** The administrative requirements of the resource consents were met, or any failure to do this had trivial consequences and were addressed promptly and co-operatively.

- **Good:** Perhaps some administrative requirements of the resource consents were not met at a particular time, however this was addressed without repeated interventions from the Council staff. Alternatively adequate reason was provided for matters such as the no or late provision of information, interpretation of 'best practical option' for avoiding potential effects, etc.

- **Improvement required:** Repeated interventions to meet the administrative requirements of the resource consents were made by Council staff. These matters took some time to resolve, or remained unresolved at the end of the period under review. The Council may have issued an abatement notice to attain compliance.

- **Poor**: Material failings to meet the administrative requirements of the resource consents. Significant intervention by the Council was required. Typically there were grounds for an infringement notice.

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

1.2 Process description

Drilling waste
Waste drilling material is produced during well drilling for hydrocarbon exploration. The primary components of this waste are drilling fluids (muds) and rock cuttings. Drilling fluids are engineered to perform several crucial tasks in the drilling of a hydrocarbon well. These include: transporting cuttings from the drill bit to the well surface for disposal; controlling hydrostatic pressure in the well; supporting the sides of the hole and preventing the ingress of formation fluids; and lubricating and cooling the drill bit and drill pipe in the hole.

Drilling fluids
Oil and gas wells may be drilled with either synthetic based mud (SBM) or water based mud (WBM). As the names suggest, these are fluids with either water (fresh or saline) or synthetic oil as a base material, to which further compounds are added to modify the physical characteristics of the mud (for example mud weight or viscosity). More than one type of fluid may be used to drill an individual well. In the past, oil based muds (diesel/crude oil based) have also been used. Their use has declined since the 1980s due to their ecotoxicity; they have been replaced by SBM. SBM use olefins, paraffins or esters as a base material. While this is technically still a form of oil based fluid, these fluids have been engineered to remove polycyclic aromatic hydrocarbons, reduce the potential for bioaccumulation, and accelerate biodegradation compared with OBM.

Common constituents of WBM and SBM include weighting agents, viscosifiers, thinners, lost circulation materials (LCM), pH control additives, dispersants, corrosion inhibitors, bactericides, filtrate reducers, flocculants and lubricants. Of these, the naturally occurring clay mineral barite (barium sulphate) is generally the most common additive. It is added to most drilling muds as a wetting and weighting agent.

Drilling fluids may be intentionally discharged in bulk for changes to the drilling fluid programme or at the completion of drilling. Depending on operational requirements and fluid type and properties, fluids may be re-used in multiple wells.

Cuttings
Cuttings are produced as the drill bit penetrates the underlying geological formations. They are brought to the surface in the drilling fluid where they pass over a shaker screen that separates the cuttings and drilling fluids. The drilling fluids are recycled for reuse within the drilling process, but small quantities of drilling fluids remain adhered to the cuttings. The cuttings and smaller particle material from the drill fluid treatment units drain into sumps. If sumps cannot be constructed, corrals or special bins are used. During drilling this material is the only continuous discharge.

Landfarming
The landfarming process as implemented in Taranaki has typically been shown to assist the conversion of sandy coastal sites prone to erosion into productive pasture. Results of an independent research project conducted by AgKnowledge Ltd (2013) have indicated that the re-contoured sand dunes, after the inclusion of the drilling wastes (as per the consents), and with the addition of appropriate fertilisers and water (irrigation) are capable of producing high quality clover-based pastures and thus increasing the value of the land from about $3-4000/ha to $30-40,000/ha (2013).

Landfarming uses natural and assisted bioremediation to reduce the concentration of petroleum compounds through degradation. Basic steps in the landfarming process include:

1. Drilling waste is transported from wellsites by truck (cuttings) or tanker (liquids). It may be discharged directly to land or placed in a dedicated storage pit.
2. The required area is prepared by scraping back and stockpiling existing pasture/topsoil and levelling out uneven ground.
3. Waste is transferred to the prepared area by excavator and truck and spread out with a bulldozer. Liquids may be discharged by tanker or a spray system.
4. Waste is allowed to dry sufficiently before being tilled into the soil to the required depth with a tractor and discs.
5. The disposal area is levelled with chains or harrows.
6. Stockpiled or brought in topsoil/clay is applied to aid stability and assist in grass establishment.
7. Fertiliser may be applied and the area is sown in crop or pasture at a suitable time of year.

The landfarming process utilised at the Geary, Schrider, Spence Road and Kauri A sites were on a single application basis. This means dedicated spreading areas each receive only a single application of waste.

1.3 Resource consents

1.3.1 Discharges of wastes to land

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

Table 1 Resource Consents held by Origin Energy and AR Geary

Site	Consent holder	Consent number	Purpose of consent	Issue date	Next review	Expiry
Geary	AR Geary	5325-1	Discharge drilling waste (SBM, WBM & OW)	28/5/1998	-	2016
Schrider	Origin Energy	6135-1	Discharge drilling waste (SBM, WBM, OBM & OW)	6/3/2003	-	2022
Spence Rd	Origin Energy	5935-1.5	Discharge drilling waste (SBM, WBM & OW)	7/12/2001	-	2016
Kauri A	Origin Energy	5734-1	Discharge drilling waste (SBM)	01/12/200	-	2022

OBM = oil based mud
OW = oily waste
SBM = synthetic based mud
WBM = water based mud

1.4 Monitoring programme

1.4.1 Introduction

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

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

The monitoring programme for the Origin Energy landfarms site consisted of three primary components.

1.4.2 Programme liaison and management

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

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

- consultation on associated matters.

1.4.3 Site inspections

The Spence Road site was visited four times during the monitoring period. This included time undertaken to collect samples of soil and to assess the site for effects.

The Kauri A site was visited once for soil sampling and site assessment. The sites at Geary and Schrider were not visited this period, as the long term record of inspection detailed nothing of concern.

1.4.4 Chemical sampling

Chemical analysis of soils was undertaken by the Council this monitoring period in respect of the Origin Energy proposed surrenders of the Spence Road and Kauri A landfarms.

The sampling methodology utilised was adapted from the Guidelines for the Safe Application of Biosolids to Land in New Zealand (2003). This is undertaken through the compositing of 10 soil cores (inserted to 400 mm+/- depth to encompass the zone of application) taken at 10 m intervals along transects through an application area (Photo 1).

Photo 1 An example of an extracted soil core

The initial soil sampling was focussed on validation soil sampling. Validation soil sampling was undertaken to check the compliance of the Origin Energy supplied soil analysis results collected by Origin Energy in respect of the Spence Road Landfarm and the former Kauri C Landfarm. These samples results were compared to the samples collected by the Council.

The Council undertook composite, validation soil sampling of two specific paddocks in relation to the Spence Road facility, and three from the former Kauri A landfarm.

These paddocks which had been utilised for the practice of landfarming by Origin Energy had been sampled by Origin Energy. The rationale from the Council was two sample the same areas to assess the results provided by Origin Energy.

Validation analysis undertaken with respect to the landfarmed paddocks were as follows:

- Total arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc;
- Polycyclic Aromatic Hydrocarbon;
- Benzene, Toluene, Ethylene and Xylene;
- Total Petroleum Hydrocarbon Speciated analysis C_7-C_9, C_{10}-C_{14}, C_{15}-C_{36}.

The Council also collected spot cores from the former storage areas of Spence Road to quantify which of the storage pits would require remediation through excavation. One of the three pits were known to contain contaminants concentrations above the consent limits, however the extent of the other two were unknown. The analysis included:

- Total barium;
- Total sodium;
- Chloride;
- Total arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc;
- BTEX;
- Polycyclic Aromatic Hydrocarbons; and
- Total Petroleum Hydrocarbon Speciated analysis C_7-C_9, C_{10}-C_{14}, C_{15}-C_{36}.

Origin Energy provided the Council in the cases of Schrider, Spence Road and Geary landfarm, paddock specific analysis to meet the specific consent conditions with respect to surrender. This analysis, as well as being provided in the site specific sections of this report, are also provided in Appendix II.

In the case of Kauri A landfarm, minimal recent information was available in terms of soil sampling. Thus agreement was reached to collect soil samples to ascertain compliance with historically provided analysis data from Origin Energy.

2. Geary landfarm

Geary Road, Manutahi (Figure 1), is located on marginal coastal farmland situated on reworked dune fields. The Waikaikai Stream flows approximately through the centre of the site. The proximity of the site to this recognised ecosystem has been taken into account in the setting of buffer distances and location of the stockpiling facilities. The site was active between 2000 and 2006, during which time 45 disposals of water based mud, synthetic based mud and oily waste were undertaken. Oil based cuttings and wastes from the Kauri-E wellsite, located in the southeast corner of the property, were landfarmed at the site in 2004 and 2005.

Figure 1 Geary Landfarm with regional inset

The predominant soil type has been identified as black loamy sand and vegetation growth is primarily pasture. Average annual rainfall for the site is 1,043 mm (taken from the nearby 'Patea' monitoring station). As with the other South Taranaki coastal sites, the Geary site is subject to strong winds.

Site data

Location

Word descriptor:	Geary Road, Manutahi, Taranaki
Map reference: (NZTM)	E 1718754 N 5606372
Mean annual rainfall:	1,043 mm
Mean annual soil temperature:	~15.1°C
Mean annual soil moisture:	~32.9%
Elevation:	~40 m
Geomorphic position:	Cliffed coast / dune backslope
Erosion / deposition:	Erosion
Vegetation:	Pasture, dune grasses
Parent material:	Aeolian deposit
Drainage class:	Free / well draining

Disposals at the site were completed in March 2006 and the area has since been reinstated to productive farmland. Origin Energy took over Swift's operations in 2008; they now monitor the site to ensure that the conditions are met prior to surrender. The consent is held by AR Geary.

2.1 Resource consent

AR Geary holds discharge consent 5325-1, to discharge drilling mud, fluids and cuttings from well drilling operations with water based muds; drilling cuttings from wells drilled with synthetic based muds; and oily waste material from hydrocarbon exploration and production activities; onto and into land. This consent was issued by the Council on 28 May 1998 under Section 87(e) of the RMA. Changes to conditions were made on 2 July 2002, 18 September 2002 and 16 June 2003. It is due to expire on 1 June 2016.

Condition 1 relates to compliance with information supplied.

Condition 2 relates to best practicable option.

Conditions 3, 4, 5 and 7 relate to notification and supply of information to the Council.

Conditions 6 and 8-26 relate to operational and technical requirements.

Condition 27 is a review condition.

The permit is attached to this report in Appendix I.

2.2 Inspections

The final application of material to land at the Geary landfarm was undertaken in March 2006. The Council undertook its final inspection of this facility in June 2014. No further inspections were warranted as the facility was processed for surrender at the beginning of this monitoring period.

The final inspection is provided below.

25 June 2014
No objectionable odours or visible emissions were detected at the time of inspection. No recent disposal activities had occurred and no storage pits were present. Observed pasture cover was complete across all spreading areas and appeared healthy.

Photo 2 Geary landfarm June 2014 final inspection

2.3 Results of discharge monitoring

2.3.1 Council soil sampling

No samples were collected during this monitoring period from the Geary site. The site has been unused and reinstated. Soil samples collected by the Council in the 2011-2013 biennial report as well as samples supplied by Origin Energy in the 2013-2014 indicated compliance with consent conditions with respect to specific parameter compliance.

2.3.2 Origin Energy soil analysis

Origin Energy supplied the Council with 18 soil samples collected in the 2014-2015 year, these soil samples were specifically related to obtaining compliance from the Council with respect to surrendering the portions of the land which had been utilised for the practice of landfarming.

Origin Energy supplied the Council with a surrender application at the beginning of this monitoring period which stated the landfarmed soils were all within consent compliance surrender concentrations. The 18 soil samples analysed for the surrender are detailed in the following Tables 2-4 respectively and the locations of the paddocks are provided in Figure 2 and also Appendix II.

Table 2 Geary landfarm soil compliance analysis G5-G14

Parameter	Unit	*Consent Limit*	Spreading areas sampled					
			G5	G8	G9	G12	G13	G14
Benzene	mg/kg	*1.1*	<0.05	<0.2	<0.05	<0.04	<0.04	<0.05
Toluene	mg/kg	*68*	<0.05	<0.2	<0.05	<0.04	<0.04	<0.05
Ethylbenzene	mg/kg	*53*	<0.05	<0.2	<0.05	<0.04	<0.04	<0.05
m & p Xylene	mg/kg	*48*	<0.10	<0.2	<010	<0.08	<0.08	<0.1
o Xylene	mg/kg	*48*	<0.05	<0.2	<0.05	<0.04	<0.04	<0.05
Benzo(a)pyrene (BAP)	mg/kg	*0.027*	<0.03	<0.02	<0.03	<0.02	<0.02	<0.02
Naphthalene	mg/kg	*7.2*	<0.13	<0.1	<0.12	<0.1	<0.1	<0.12
Pyrene	mg/kg	*160*	<0.03	<0.02	<0.03	<0.02	<0.02	<0.02
Hydrocarbon	mg/kg	-	<60	260	<50	<140	<210	170
C7-C9	mg/kg	*120.0*	<8	<8	<7	<7	<7	<7
C10-C14	mg/kg	*58*	<20	29	<10	<10	<10	<10
C15-C36	mg/kg	*4,000*	<30	230	<30	140	200	170
Arsenic	mg/kg	*20*	<2	<2	<2	<2	<2	<2
Cadmium	mg/kg	*1*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	mg/kg	*600*	16	19	14	16	15	16
Copper	mg/kg	*100*	18	27	12	17	19	19
Lead	mg/kg	*300*	1.50	2.2	1.2	2.4	3.5	3.50
Mercury	mg/kg	*1*	<0.1	<0.1	0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	*60*	8	10	7	8	7	8
Zinc	mg/kg	*300*	73	94	68	80	72	67
Barium	mg/kg	*10,000*	590	5,400	284	588	2,200	1,090
Chloride	mg/kg	*700*	8	19	9	32	38	110
Conductivity	mSm-1	*290*	<10	<10	<10	<10	<10	<10
Sodium	mg/kg	*460*	89	440	420	84	380	410
Soluble salts	mg/kg	*2,500*	<500	<500	<500	<500	<500	<500
Sodium absorption ratio	-	*18*	1.50	0.5	0.5	0.8	0.5	0.80

Table 3 Geary landfarm soil compliance analysis G17-G27

Parameter	Unit	*Consent Limit*	Spreading areas sampled					
			G17	G18	G20	G23	G26	G27
Benzene	mg/kg	*1.1*	<0.03	<0.05	<0.05	<0.04	<0.02	<0.04
Toluene	mg/kg	*68*	<0.06	<0.05	<0.05	<0.04	<0.02	<0.04
Ethylbenzene	mg/kg	*53*	<0.03	<0.05	<0.05	<0.04	<0.02	<0.04
m & p Xylene	mg/kg	*48*	<0.03	<0.10	<0.10	<0.08	<0.02	<0.08
o Xylene	mg/kg	*48*	<0.03	<0.05	<0.05	<0.04	<0.02	<0.04
Benzo(a)pyrene (BAP)	mg/kg	*0.027*	<0.02	<0.03	<0.03	<0.03	<0.03	<0.02
Naphthalene	mg/kg	*7.2*	<0.1	<0.12	<0.12	<0.13	<0.13	<0.1

Parameter	Unit	*Consent Limit*	Spreading areas sampled					
			G17	G18	G20	G23	G26	G27
Pyrene	mg/kg	*160*	0.19	<0.03	<0.03	<0.03	<0.03	<0.02
Hydrocarbon	mg/kg	-	260	<60	430	<60	140	190
C7-C9	mg/kg	*120.0*	<7	<8	<4	<7	<7	<7
C10-C14	mg/kg	*58*	<10	<20	<8	<10	<10	<10
C15-C36	mg/kg	*4,000*	260	<30	40	<30	140	180
Arsenic	mg/kg	*20*	<2	<2	<2	<2	<2	<2
Cadmium	mg/kg	*1*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	mg/kg	*600*	18	18	20	13	13	8
Copper	mg/kg	*100*	14	13	20	12	21	10
Lead	mg/kg	*300*	1.2	1.10	1.90	3	2.70	1.8
Mercury	mg/kg	*1*	0.10	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	*60*	8	8	11	6	7	5
Zinc	mg/kg	*300*	85	76	80	58	59	38
Barium	mg/kg	*10,000*	640	461	173	436	159	149
Chloride	mg/kg	*700*	4	26	10	52	5	16
Conductivity	mSm-1	*290*	115	<10	<10	<10	<10	<10
Sodium	mg/kg	*460*	88	72	330	410	440	70
Soluble salts	mg/kg	*2,500*	<500	<500	<500	<500	<500	<500
Sodium absorption ratio	-	*18*	0.60	0.80	1.10	1.7	0.90	1

Table 4 Geary landfarm soil compliance analysis G30-G40

Parameter	Unit	*Consent Limit*	Spreading areas sampled					
			G30	G33	G37	G38	G39	G40
Benzene	mg/kg	*1.1*	<0.05	<0.02	<0.05	<0.04	<0.04	<0.04
Toluene	mg/kg	*68*	<0.05	<0.02	<0.05	<0.04	<0.04	<0.04
Ethylbenzene	mg/kg	*53*	<0.05	<0.02	<0.05	<0.04	<0.04	<0.04
m & p Xylene	mg/kg	*48*	<0.1	<0.02	<0.09	<0.08	<0.08	<0.08
o Xylene	mg/kg	*48*	<0.05	<0.02	<0.05	<0.04	0.13	<0.04
Benzo(a)pyrene (BAP)	mg/kg	*0.027*	<0.03	<0.02	0.04	<0.03	<0.03	<0.03
Naphthalene	mg/kg	*7.2*	<0.13	<0.1	<0.1	<0.14	<0.1	<0.13
Pyrene	mg/kg	*160*	<0.03	0.05	0.09	<0.03	<0.03	<0.03
Hydrocarbon	mg/kg	-	<60	<50	80	1,400	78	<60
C7-C9	mg/kg	*120.0*	<7	<7	<8	<8	<8	<8
C10-C14	mg/kg	*58*	<10	<10	<20	49	<20	<20
C15-C36	mg/kg	*4,000*	40	<30	74	1,400	78	<30
Arsenic	mg/kg	*20*	<2	<2	<2	<2	<2	<2
Cadmium	mg/kg	*1*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	mg/kg	*600*	14	16	13	11	18	17
Copper	mg/kg	*100*	23	23	15	10	15	23
Lead	mg/kg	*300*	6.50	21.3	48.4	5.2	14.2	4
Mercury	mg/kg	*1*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	*60*	8	8	6	5	8	9
Zinc	mg/kg	*300*	53	80	50	46	67	66
Barium	mg/kg	*10,000*	1,680	750	980	2,800	2,200	140
Chloride	mg/kg	*700*	165	4	356	7	27	22
Conductivity	mSm-1	*290*	<10	<10	<10	<10	<10	<10
Sodium	mg/kg	*460*	440	91	230	330	320	280
Soluble salts	g/100g	*2,500*	<500	<500	<500	<500	<500	<500
Sodium absorption ratio	-	*18*	1.40	1.6	0.8	1.00	1.1	0.70

ID	Mud Type	Date Farmed	Well Name	Easting	Northing	Area (Ha)
SITE A	WBM	Jul 2000 and 2001	Rimu A & B sumps.	1718810	5606289	0.95
SITE B	WBM	Jun 2001	Rimu B	1718702	5606233	0.96
SITE C	WBM	Jul 2001	Rimu A sumps	1718756	5606010	0.85
SITE D	WBM	Jan 2002	Kauri B	1718770	5606410	0.07
G1	SBM	Jul 2002	Kauri A4	1718949	5605332	1.12
G2	SBM	Oct 2002	Kauri A4	1718890	5605338	0.91
G3	OW	Oct 2002	Train derailment fluids/solids	1718847	5605272	0.10
G4	OW	Oct 2002	Waihapa F	1718800	5605338	0.07
G5	WBM	May 2003	Kaimiro G	1719031	5605555	0.68
G5	WBM/OW	May 2003	Kaimiro G	1718857	5605385	0.68
G6	WBM	Jun 2003	Kauri E1	1718767	5605407	0.73
G7	SBM	Jun 2003	Kauri E1	1718878	5605468	0.35
G8	OW	May 2003	Kaimiro G	1718844	5605437	0.37
G9	WBM	Jul 2003	Kauri E2	1718753	5605486	0.66
G10	SBM	Aug 2003	Kauri E2	1718813	5605505	0.48
G11	OW	Nov 2003	Rimu Production Station	1718717	5605537	0.01
G12	SBM	Nov 2003	Tuihu B	1718740	5605552	0.01
G13	WBM	Nov 2003	Surrey 1	1718753	5605562	0.01
G14	WBM	Nov 2003	Tuihu B/Rahotu 7	1718769	5605570	0.01
G15	WBM	Nov 2003	Kauri E3/E4	1718847	5605569	0.01
G16	SBM	Nov 2003	Kauri E3/E4	1718894	5605537	0.01
G17	OBM	May 2004	Kauri E4	1718709	5605637	1.16
G18	WBM	May 2004	Cheal	1719398	5606092	0.86
G20	WBM	May 2004	Honeysuckle	1719361	5606059	0.50
G21	OBM	Jun 2005	Kauri E5	1718759	5605717	2.18
G22	OBM	Aug 2005	Kauri E6	1718708	5605814	1.74
G23	WBM	May 2005	Kauri E8	1719076	5605436	0.21
G24	SBM	Apr 2005	Kauri E7	1719051	5605485	0.22
G25	WBM	Apr 2005	Kauri E7	1719100	5605502	0.50
G26	WBM	May 2005	Kauri E8	1719141	5605537	0.27
G27	SBM	May 2005	Kauri E8	1719202	5605576	0.29
G28	OW	May 2005	Manutahi wells	1719171	5605554	0.11
G29	WBM	Apr 2005	Tariki D	1719245	5605540	0.10
G30	WBM	Jul 2005	Kauri E9	1719113	5605437	0.20
G31	WBM	Jul 2005	Kauri E9	1719154	5605480	0.19
G32	SBM	Jul 2005	Kauri E9	1719150	5605427	0.52
G33	WBM	Aug 2005	Kauri E10 & 10a	1719197	5605509	0.23
G34	SBM	Aug 2005	Kauri E10 & 10a	1718978	5605616	0.29
G35	SBM	Aug 2005	Kauri E10a	1719260	5605575	0.04
G36	OW	Oct 2005	OW	1719539	5606082	0.09
G36	OW	Oct 2005	OW	1719581	5606132	0.05
G37	SBM	Oct 2005	Tawa B	1719486	5606130	1.59
G38	SBM	Oct 2005	Kauri E	1719484	5606036	0.09
G39	SBM	Mar 2006	Kauri E11	1719322	5606173	0.55
G40	WBM	Mar 2006	Kauri E11	1719376	5606195	0.50

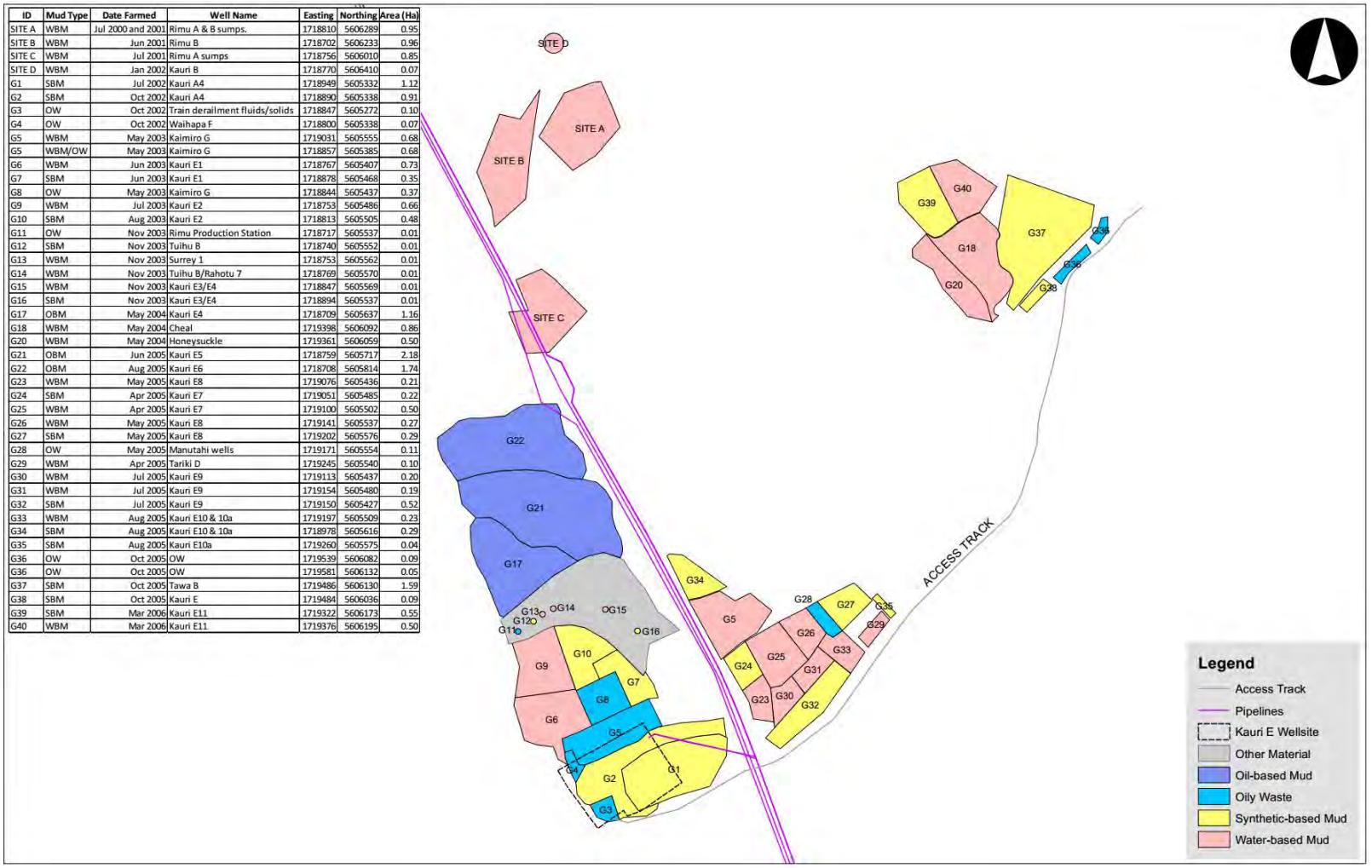

Figure 2 Origin Energy Geary landfarm

The analysis undertaken by Origin Energy in the 2014-2015 monitoring period stated compliance with consent conditions. The remaining locations which were sampled historically comply with the consent conditions; this analysis which states the compliance is provided in Appendix II. An Origin Energy supplied map with specific location references is provided in Figure 2, it is also provided in Appendix II.

3. Schrider landfarm

The Schrider landfarm is located off Geary Road, Manutahi and adjoins the Geary landfarm, as seen in Figure 3. Schrider landfarm is located on marginal coastal farmland situated on reworked dune fields and also consists predominately of black loamy sand, with vegetation growth primarily consisting of pasture. Average annual rainfall for the site is 1,043 mm (taken from the nearby 'Patea' monitoring station). As with the other South Taranaki coastal sites, the Schrider site is subject to strong winds.

Site data

Location

Word descriptor:	Lower Manurau Road, Manutahi, Taranaki
Map reference:	E 1719054
(NZTM)	N 5605073
Mean annual rainfall:	1,043 mm
Mean annual soil temperature:	~15.1°C
Mean annual soil moisture:	~32.9%
Elevation:	~30 m
Geomorphic position:	Cliffed coast / dune backslope
Erosion / deposition:	Erosion
Vegetation:	Pasture, dune grasses
Parent material:	Aeolian deposit
Drainage class:	Free / well draining

Previously part of the site was used to dispose of cuttings from the Kauri-E well. The site was initially used for the disposal of water based and synthetic based muds. Later, consent was granted for the disposal of oil based mud on a trial basis and then oily wastes were also included.

Figure 3 Site location Schrider landfarm

Disposals at the site were completed in March 2011 and the area has since been reinstated. No disposals occurred during the period under review. At the end of this monitoring period Origin Energy applied for a surrender of the consent by providing the Council with analytical evidence (soil analysis) to support their case for surrender.

3.1 Resource consent

Origin Energy holds discharge consent **6135-1** to discharge drilling cuttings and fluids from drilling operations with water based muds, drilling cuttings from wells drilled with synthetic based muds, drilling cuttings from wells drilled with oil based muds, and oily wastes, onto and into land via land farming. This consent was issued by the Council on 6 March 2003 to Swift Energy NZ Ltd, as a resource consent under Section 87(e) of the RMA.

Changes to conditions were made on 19 March 2004, 16 April 2004, 10 June 2004, 23 June 2004, 9 August 2006 and 10 February 2010. The consent was transferred to Origin Energy on 11 April 2008 and is due to expire on 1 June 2022.

Conditions 1 and 2 concern definitions and adoption of the best practical option.

Conditions 3 to 5 relate to notification and sampling requirements prior to discharge.

Conditions 6 to 18 relate to discharge limits and operational requirements.

Conditions 19 to 29 relate to receiving environment limits.

Conditions 30 and 31 concern monitoring and reporting.

Conditions 32 and 33 provide for optional review of the consent.

The consent is attached to this report in Appendix I.

3.2 Inspections

The last application of material to land was undertaken in March 2011 whereby material from the Kauri E wellsite was applied to land. The site was last inspected in February 2015, prior to that, November 2014. The final two inspections have been included below as the site has since been surrendered.

25 November 2014
A brief site inspection was conducted in conjunction with soil sampling in the area which previously was used for oil mud disposal. No site activity has been undertaken in recent years. The samples had no odours or muds present.

04 February 2015
An inspection was conducted in conjunction with soil sampling. The weather was overcast with intermittent showers. The site was inactive at the time of inspection. Two composited soil transects were undertaken through locations H41/42/43 and H39.

Drilling mud was encountered in one core of ten through the H41/42/43 transect. Pasture establishment was good and advanced.

Photo 3 Pasture established Schrider landfarm

3.3 Results of the discharge monitoring

3.3.1 Council soil results

No additional soil samples were collected during the 2015-2016 monitoring period. The last soil samples collected were undertaken in the previous monitoring year 2014-2015. The analysis of the final Council collected soil results is provided in the following Table 5.

Table 5 Council soil results Origin Energy's Schrider landfarm

	Date	Consent	25 Nov 2014	04 Feb 2015	04 Feb 2015
Parameter	**Unit/ Area**	**6135-2**	**H 7/9/11/12**	**H 41/42/43**	**H39**
Calcium	**mg/kg**	**-**	13.5	60.5	13.6
Chloride	**mg/kg**	**700**	21.2	26.2	33.8
Conductivity	**mS/m@20°C**	**290**	14.7	49.4	25.7
Total hydrocarbon	**mg/kg**		344	298	17
Potassium	**mg/kg**	**-**	7.2	9.7	6.5
Moisture factor	**nil**	**-**	1.147	1.158	1.178
Magnesium	**mg/kg**	**-**	2.8	12.1	5.5
Sodium	**mg/kg**	**460**	24.3	36.3	33.3
Ammoniacal nitrogen	**mgN/kg**	**-**	0.31	1.78	1.21
Nitrate/nitrite nitrogen	**mgN/kg**	**-**	3.89	5.14	4.03

	Date	Consent	25 Nov 2014	04 Feb 2015	04 Feb 2015
Parameter	**Unit/ Area**	**6135-2**	**H 7/9/11/12**	**H 41/42/43**	**H39**
pH	**pH**	**-**	6.6	6.6	6.0
Sodium absorption ratio	**None**	**18**	1.57221	1.11452	1.92607
Total soluble salts	**mg/kg**	**2,500**	115.0	386.6	201.1

The analysis collected by the Council in the previous monitoring period indicated no adverse effects in respect of their consent. Analysis detailed no exceedance with respect to consent conditions. Locations of the analysed soil samples are provided in Figure 4 and also in Appendix II.

3.3.2 Origin Energy supplied soil results

In similarity to the Geary landfarm, Origin Energy provided analysis which supported their case to allow the Council to surrender the Schrider landfarm in this monitoring period.

They did so by providing the Council with soil analysis which stated that the areas of land which had been utilised for the practice of landfarming had met the conditional limit for surrender.

Analysis provided by Origin Energy in respect of the landfarmed areas is tabulated in the following Tables 6-10. Note that this analysis was undertaken in the 2013-2014 year.

Each table contains the specific consent limit per parameter to allow the reader to understand the surrender criteria.

Table 6 Origin Energy Schrider Landfarm supplied soil results H1-H6 inclusive

Parameter	Unit	Consent Limit	Spreading areas sampled					
			H1	H2	H3	H4	H5	H6
Benzene	**mg/kg**	**1.1**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.03
Toluene	**mg/kg**	**68**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.06
Ethylbenzene	**mg/kg**	**53**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.03
m & p Xylene	**mg/kg**	**48**	<0.10	<0.10	<0.1	<0.1	<0.1	<0.03
o Xylene	**mg/kg**	**48**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.03
Benzo(a)pyrene (BAP)	**mg/kg**	**0.027**	<0.03	<0.03	<0.03	<0.03	<0.03	<0.01
Naphthalene	**mg/kg**	**7.2**	<0.12	<0.12	<0.13	<0.13	<0.12	<0.07
Pyrene	**mg/kg**	**160**	<0.03	<0.03	<0.03	<0.03	<0.03	0.41
Hydrocarbon	**mg/kg**	**-**	350	290	320	<30	80	<50
C7-C9	**mg/kg**	**120.0**	<4	<7	<7	<4	<8	<7
C10-C14	**mg/kg**	**58**	<8	<10	<10	<8	<20	<10
C15-C36	**mg/kg**	**4,000**	350	290	320	<20	80	<30
Arsenic	**mg/kg**	**20**	<2	<2	<2	<2	<2	<2
Cadmium	**mg/kg**	**1**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	**mg/kg**	**600**	15	14	11	17	14	11
Copper	**mg/kg**	**100**	12	11	11	13	11	11
Lead	**mg/kg**	**300**	1.5	1.6	1.4	2.0	1.3	2.7
Mercury	**mg/kg**	**1**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	**mg/kg**	**60**	8	7	6	9	7	6
Zinc	**mg/kg**	**300**	74	68	57	81	66	62

Parameter	Unit	Consent Limit	Spreading areas sampled					
			H1	H2	H3	H4	H5	H6
Barium	mg/kg	10,000	190	133	171	319	116	78
Chloride	mg/kg	700	22	6	13	49	9	20
Conductivity	mSm-1	290	<10	<10	<10	<10	<10	<10
Sodium	mg/kg	460	29	26	16	24	12	57
Soluble Salts	mg/kg	2,500	<500	<500	<500	<500	<500	<500
Sodium absorption ratio	-	18	1.3	1	0.6	0.9	0.8	1.7

Table 7 Origin Energy Schrider Landfarm supplied soil results H8-H24 non-inclusive

Parameter	Unit	Consent Limit	Spreading areas sampled					
			H8	H20	H21	H22	H23	H24
Benzene	mg/kg	1.1	>0.05	<0.04	<0.04	<0.04	<0.04	<0.04
Toluene	mg/kg	68	<0.05	<0.04	<0.04	<0.04	<0.04	0.17
Ethylbenzene	mg/kg	53	<0.05	<0.04	<0.04	<0.04	<0.04	<0.04
m & p Xylene	mg/kg	48	<0.1	<0.08	<0.08	<0.08	<0.09	0.15
o Xylene	mg/kg	48	<0.05	<0.04	<0.04	<0.04	<0.04	0.07
Benzo(a)pyrene (BAP)	mg/kg	0.027	<0.027	<0.03	<0.03	<0.03	<0.03	<0.02
Naphthalene	mg/kg	7.2	<0.14	<0.12	<0.12	<0.12	<0.12	<0.1
Pyrene	mg/kg	160	<0.027	<0.03	<0.03	<0.03	<0.03	<0.02
Hydrocarbon	mg/kg	-	1230	<60	<60	<60	360	90
C7-C9	mg/kg	120.0	<7	<8	<7	<8	<7	<8
C10-C14	mg/kg	58	15	<20	<20	<20	21	<20
C15-C36	mg/kg	4,000	1,220	<30	<30	<30	340	87
Arsenic	mg/kg	20	<2	<2	<2	<2	<2	<2
Cadmium	mg/kg	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	mg/kg	600	22	17	14	9	18	22
Copper	mg/kg	100	14	12	12	9	11	21
Lead	mg/kg	300	1.8	1.10	1.30	1.2	2.5	22.9
Mercury	mg/kg	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	60	10	8	7	5	8	11
Zinc	mg/kg	300	100	78	66	47	74	77
Barium	mg/kg	10,000	470	190	67	282	340	1,660
Chloride	mg/kg	700	8	200	32	35	38	141
Conductivity	mSm-1	290	<10	<10	<10	<10	<10	100
Sodium	mg/kg	460	90	34	73	57	74	300
Soluble Salts	mg/kg	2,500	<500	1,000	<500	<500	<500	700
Sodium absorption ratio	-	18	0.80	0.50	0.70	0.70	0.5	0.4

Table 8 Origin Energy Schrider Landfarm supplied soil results H28-H36 non-inclusive

Parameter	Unit	Consent Limit	Spreading areas sampled					
			H28	H30	H31	H32	H35	H36
Benzene	mg/kg	1.1	0.06	<0.05	<0.05	<0.05	<0.03	<0.04
Toluene	mg/kg	68	0.39	<0.05	<0.05	<0.05	<0.03	<0.04
Ethylbenzene	mg/kg	53	0.16	<0.05	<0.05	<0.05	<0.03	<0.04
m & p Xylene	mg/kg	48	1	<0.1	<0.1	<0.1	<0.07	<0.08
o Xylene	mg/kg	48	0.35	<0.05	<0.05	<0.05	<0.03	<0.04
Benzo(a)pyrene (BAP)	mg/kg	0.027	<0.03	<0.02	<0.02	<0.03	<0.02	<0.03
Naphthalene	mg/kg	7.2	<0.1	<0.13	<0.13	<0.12	<0.1	<0.1
Pyrene	mg/kg	160	<0.03	<0.02	<0.02	<0.03	<0.02	<0.03
Hydrocarbon	mg/kg	-	270	<60	<60	<60	<60	<60
C7-C9	mg/kg	120.0	<8	<8	<8	<8	<8	<8

Parameter	Unit	Consent Limit	Spreading areas sampled					
			H28	H30	H31	H32	H35	H36
C10-C14	mg/kg	58	37	<20	<20	<20	<20	<20
C15-C36	mg/kg	4,000	230	50	<30	<30	<30	<30
Arsenic	mg/kg	20	<2	<2	<2	<2	<2	<2
Cadmium	mg/kg	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	mg/kg	600	10	12	13	19	16	14
Copper	mg/kg	100	10	11	11	14	12	12
Lead	mg/kg	300	4.3	1.2	1.6	3.1	1.3	1.3
Mercury	mg/kg	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	60	6	7	7	10	7	7
Zinc	mg/kg	300	46	57	61	80	66	63
Barium	mg/kg	10,000	2,500	514	444	194	286	82
Chloride	mg/kg	700	350	38	11	79	54	32
Conductivity	mSm-1	290	26	<10	<10	100	<10	<10
Sodium	mg/kg	460	310	106	135	55	80	104
Soluble Salts	mg/kg	2,500	900	<500	<500	700	<500	<500
Sodium absorption ratio	-	18	0.7	0.6	0.7	0.7	0.6	0.4

Table 9 Origin Energy Schrider Landfarm supplied soil results H41-H46 non-inclusive

Parameter	Unit	Consent Limit	Spreading areas sampled			
			H41	H44	H45	H46
Benzene	mg/kg	1.1	<0.05	<0.05	<0.05	<0.1
Toluene	mg/kg	68	<0.05	<0.05	<0.05	0.20
Ethylbenzene	mg/kg	53	<0.05	<0.05	<0.05	<0.1
m & p Xylene	mg/kg	48	<0.10	<0.09	<0.09	<0.2
o Xylene	mg/kg	48	<0.05	<0.05	<0.05	0.10
Benzo(a)pyrene (BAP)	mg/kg	0.027	<0.03	<0.023	<0.023	0.03
Naphthalene	mg/kg	7.2	<0.13	<0.12	<0.12	0.13
Pyrene	mg/kg	160	<0.03	<0.023	0.054	0.09
Hydrocarbon	mg/kg	-	<60	150	<60	520
C7-C9	mg/kg	120.0	<8	<8	<7	<9
C10-C14	mg/kg	58	<20	<20	<10	40
C15-C36	mg/kg	4,000	<30	150	<30	480
Arsenic	mg/kg	20	<2	<2	<2	<2
Cadmium	mg/kg	1	<0.1	<0.1	<0.1	<0.1
Chromium	mg/kg	600	17	15	16	17
Copper	mg/kg	100	12	12	13	18
Lead	mg/kg	300	1.10	2.20	1.3	4.3
Mercury	mg/kg	1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	60	8	7	8	9
Zinc	mg/kg	300	73	71	78	62
Barium	mg/kg	10,000	150	1,630	51	230
Chloride	mg/kg	700	78	462	18	213
Conductivity	mSm-1	290	<10	<10	<10	145
Sodium	mg/kg	460	102	340	75	202
Soluble Salts	mg/kg	2,500	<500	<500	<500	1,000
Sodium absorption ratio	-	18	1.3	1.0	1.2	2.0

Table 10 Origin Energy Schrider Landfarm supplied soil results H47-H60 non-inclusive

Parameter	Unit	Consent Limit	Spreading areas sampled		
			H47	H48	H60
Benzene	mg/kg	1.1	<0.08	<0.23	<0.050
Toluene	mg/kg	68	0.12	<0.23	0.094
Ethylbenzene	mg/kg	53	<0.08	<0.23	0.097
m & p Xylene	mg/kg	48	0.2	<0.23	3
o Xylene	mg/kg	48	0.09	<0.45	0.88
Benzo(a)pyrene (BAP)	mg/kg	0.027	<0.03	<0.024	<0.03
Naphthalene	mg/kg	7.2	<0.14	<0.12	<0.13
Pyrene	mg/kg	160	<0.03	<0.024	<0.03
Hydrocarbon	mg/kg	-	79	<60	270
C7-C9	mg/kg	120.0	<8	<8	<8
C10-C14	mg/kg	58	20	<20	<20
C15-C36	mg/kg	4,000	59	<30	270
Arsenic	mg/kg	20	<2	<2	2.5
Cadmium	mg/kg	1	<0.1	<0.1	0.17
Chromium	mg/kg	600	16	19	18
Copper	mg/kg	100	16	15	54
Lead	mg/kg	300	2.7	1.1	11.0
Mercury	mg/kg	1	<0.1	<0.1	<0.10
Nickel	mg/kg	60	8	9	10
Zinc	mg/kg	300	86	86	82
Barium*	mg/kg	10,000	511	23	450
Chloride	mg/kg	700	182	20	32
Conductivity	mSm-1	290	<10	<10	<100
Sodium	mg/kg	460	82	73	400
Soluble Salts	mg/kg	2,500	<500	<500	<500
Sodium absorption ratio	-	18	1.7	1.7	0.5

Soil analysis undertaken by Origin Energy in respect of the areas of land utilised for the practice of landfarming at their Schrider site is provided in Tables 6-10 respectively. These tables detailed no exceedance when compared to the specific consent limits and thus the Council was able to surrender the consent with respect to Schrider landfarm. The locations of the landfarmed paddock s are provided in the following Figure 4, this figure is also provided in Appendix II.

Ref.	Mud Type	Date Farmed	Well Name	Easting	Northing	Area m²	Volume m³
H1	WBM	Jun 2004	Manutahi B	1718877	5605117	2890	
H2	WBM	Jun 2004	Manutahi A	1718878	5605077	2488	
H3	WBM	Jul 2004	Manutahi D	1718949	5605075	2996	
H4	WBM	Jun 2004	Kauri E5	1718931	5605019	2984	
H5	WBM	Jul 2004	Manutahi C	1718993	5605039	2917	
H6	OBM	Jul 2004	Manutahi D	1719035	5605098	6943	
H7	OBM	Jun 2004	Manutahi A	1718924	5605143	7965	
H8	OBM	Aug 2004	Kauri C	1718904	5605182	3031	
H9	OBM	Jun 2004	Manutahi B	1718979	5605192	6570	
H11	OBM	Jul 2004	Manutahi G	1719060	5605212	7922	
H12	OBM	Jul 2004	Manutahi C	1719030	5605192	4838	
H20	WBM	Jan 2006	Pohutukawa A	1719526	5604985	4087	
H21	WBM	Mar 2006	Goss A	1719531	5605115	5357	
H22	WBM	Mar 2006	Kauri E12	1719510	5605098	5518	
H23	WBM	Feb 2006	Trapper A	1719479	5605093	5059	
H24	SBM	Feb 2006	Trapper A	1719444	5605035	13480	
H25	SBM	Mar 2006	Kauri E12	1719385	5604947	5323	
H26	OW	Feb 2006	Oily Waste	1719322	5604911	4289	
H26A	OW	Mar 2006	Oily Waste	1719387	5605063	1338	
H27	SBM	Apr 2006	Kauri E12	1719410	5605207	8636	
H28	SBM	Mar 2006	Goss A	1719296	5605056	17012	
H29	OW	Jun 2006	Oily Waste	1719293	5604960	4402	
H30	WBM	Aug 2006	Waihapa C MBC sump	1719350	5605194	925	
H31	WBM	Sept 2006	Waihapa C	1719358	5605273	1645	
H32	WBM	Sept 2006	Waihapa H	1719339	5605249	936	
H33	OW	Oct 2006	Oily Waste	1719184	5605098	662	
H34	OW	Oct 2006	Waihapa C Oily waste	1719160	5605197	1416	
H35	OW	Feb 2007	Rimu PS Glycol OW	1719171	5605202	892	
H36	OW	Dec 2006	Oily Waste	1719203	5605110	308	
H37	WBM	Feb 2007	Trapper A sump	1719295	5605149	8136	
H38	OW	Feb 2007	Oily Waste	1719332	5605201	960	
H39	SBM	Feb 2007	Kauri E12 tank waste	1719215	5605217	7310	
H39A	SBM	Feb 2007	Kauri E12 tank waste	1719235	5605114	2491	
H40	SBM	Feb 2007	Trapper A	1719317	5605292	1709	
H41	WBM	Feb 2007	Goss A sump	1719183	5605323	10487	
H42	WBM	May 2007	Waihapa C Sump	1719287	5605231	1529	
H43	WBM	May 2007	Waihapa H Sump	1719251	5605280	3668	
H44	SBM	Aug 2007	Goss A SBM	1719242	5605410	2061	
H45	OW	Aug 2007	RPS Oily Waste	1719271	5605443	2037	
H46	WBM	Aug 2007	Piakau A	1719109	5604813	9840	
H47	WBM	Aug 2007	Ahuroa B	1719070	5604874	6339	
H48	OW	Sept 2007	WPS Oily Waste	1718982	5604945	1919	
H49	OW	Oct 2007	Oily Waste	1719027	5604928	2187	
H50	OW	May 2008	RPS Oily Waste	1719028	5604992	1255	
H51	OW	July 2008	RPS Glycol Waste	1718982	5604978	237	
H52	OW	July 2008	Oily Waste	1718961	5604965	452	
H53	OW	Sept 2008	Tariki A contaminated metal	1719294	5605495	437	
H54	OW	Sept 2008	Kauri F contaminated metal	1719291	5605507	45	
H55	OW	Sept 2008	Manutahi D contaminated metal	1719287	5605518	24	
H56	OW	Sept 2008	Waihapa Production Station Cleanings	1719311	5605530	648	
H57	OW	Sept 2008	Rimu Production Station	1719336	5605544	1565	
H58	OW	June 2009	Rimu A Contaminated Soil	1719365	5605599	1179	40
H59	OW	June 2009	Rimu A Oily Waste	1719388	5605621	933	20
H60	OW	June 2009	Rimu A Oily Waste	1719415	5605650	1675	100
H61	OW	June 2009	Waihapa Production Station	1719445	5605677	608	30
H62	OW	June 2010	Oily waste from cleaning (various sources)	1719274	5605322	250	3.5
H63	WBM	June 2010	Ahuroa B3	1719600	5606060	9496	768
H64	WBM	June 2010	Kauri F	1719575	5605929	16571	1406
H65	OW	Aug 2009	Oily waste from cleaning old waste pits	1719274	5605322	250	10

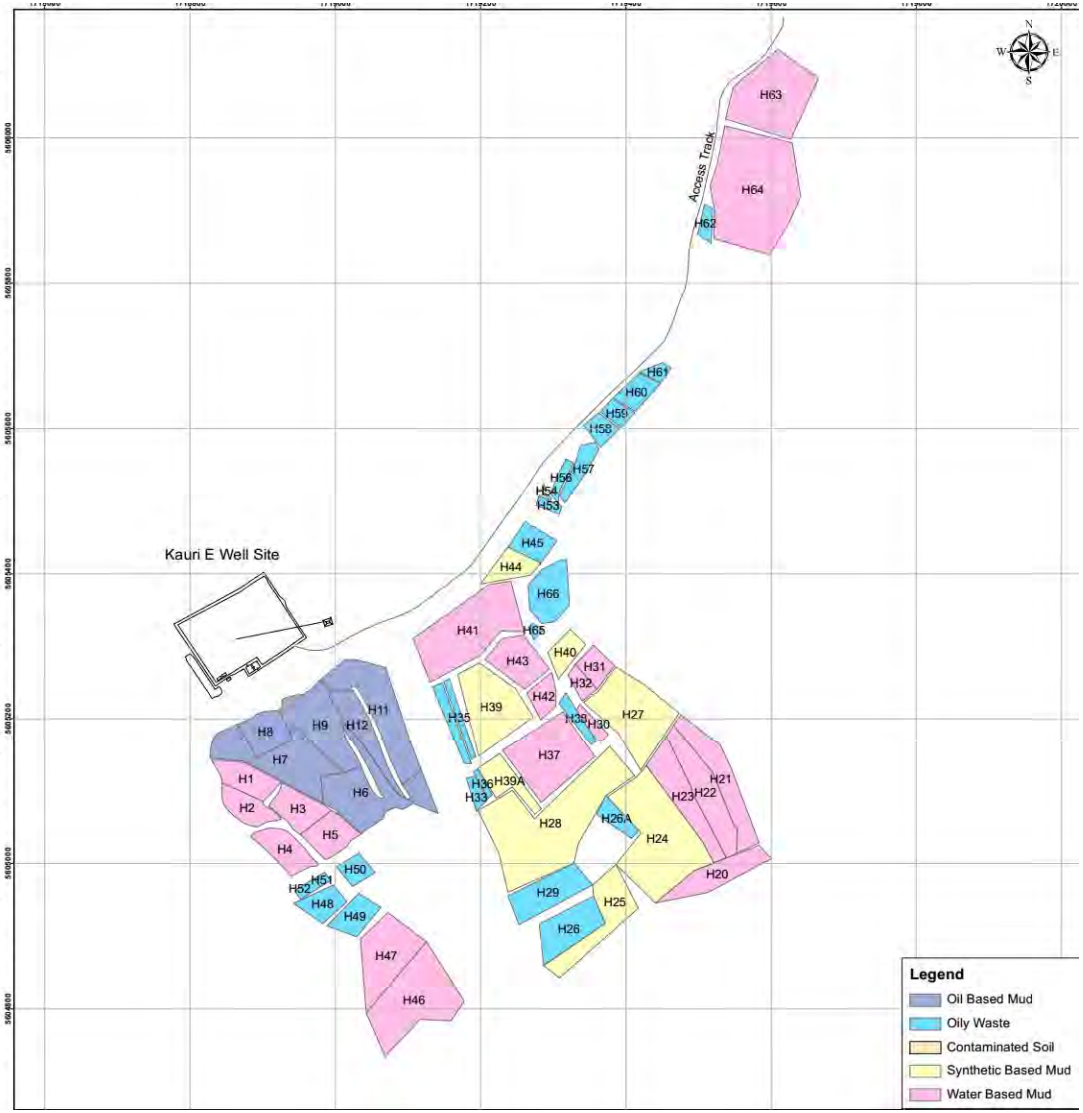

Figure 4 Origin Energy's Schrider landfarm and associated landfarming areas

4. Spence Road Landfarm

The Spence Road (Kauri-C) landfarm is located on Spence Road, Kakaramea, South Taranaki, Figure 5. As with other South Taranaki coastal sites, Spence Road landfarm is located on marginal coastal farmland amongst reworked dune fields. The soil type has been identified as predominately of black loamy sand. Average annual rainfall for this site is 1,043 mm (taken from the nearby 'Patea' monitoring station) and the site is subject to strong winds.

Site data

Location	
Word descriptor:	Spence Road, Kakaramea, Taranaki
Map reference: (NZTM)	E 1722014 N 5601830
Mean annual rainfall:	1,043 mm
Mean annual soil temperature:	~15.1°C
Mean annual soil moisture:	~32.9%
Elevation:	~40 m
Geomorphic position:	Backslope
Erosion / deposition:	Erosion
Vegetation:	Pasture, dune grasses
Parent material:	Aeolian deposit
Drainage class:	Free / well draining

The site was active between 2004 and 2012 when 40 disposals of water based and synthetic based muds and cuttings, and smaller quantities of oily waste were applied to land under the practice of landfarming. Of note the final application of material to land was undertaken in January 2012.

In 2012 Origin Energy was informed that they would be required to line all storage pits with high grade synthetic liners or equivalent prior to any further activity being undertaken at the site, they were also required to undertake the installation of groundwater monitoring wells if they were to continue with further storage and landfarming operations.

The site has remained inactive since the last disposal of material to land in January 2012. Thus no lining of the storage pits or installation of monitoring wells occurred as the site was closed to additional deliveries of material.

In July of 2015, Origin Energy successfully applied to have the site partially surrendered. The surrender limited the area of land which the consent was applied, to that which was specifically the mud storage pits which were located on the edge of the old Kauri C wellsite pad.

A review of the analysis of Origin Energy supplied data revealed all previously landfarmed locations were within consent compliance surrender limits. The Council undertook two compliance samples of the previously spread areas to validate the analysis provided by Origin Energy. This indicated the analysis provided by the consent holder was valid.

However, there still existed a legacy issue in the former pit (storage pits) area whereby further monitoring/ remediation was required. Origin Energy discussed the remediation required with the Council and it was agreed that the best route forward would be to excavate the old storage pit area and have the remaining contaminated soil remediated at another landfarm in the area.

Origin Energy then engaged Waste Remediation Services (WRS), whom with the help of OPUS undertook the remediation of the former storage pit areas of the Kauri C wellsite, Spence Road Landfarm.

In doing so, material was removed from the former storage area and sent to Symes Manawapou landfarm and clean soil was brought in to fill the area where the former storage pits were excavated. WRS/OPUS provided the Council with validation soil samples to prove that the site specific contamination, which was a result of the previously un-lined storage pits, had been sufficiently removed to allow the pits to be back filled with clean material.

The area has since been re-grassed and surrendered.

Figure 5 Spence Road landfarm with regional inset

4.1 Resource consent

Origin Energy holds discharge permit **5935-1**, to discharge waste drilling cuttings, muds and fluids from wells drilled with water based muds, waste drilling cuttings from wells drilled with synthetic based muds and oily wastes, from hydrocarbon exploration and production operations onto and into land. This permit was issued to

Swift Energy NZ Ltd by the Council on 7 December 2001, under Section 87(e) of the RMA. It was varied on 16 April 2004, 30 September 2008 and 10 February 2010. It was transferred to Origin Energy on 11 April 2008 and was due to expire on 1 June 2016.

Resource consent 5935-1 provided for an optional review of the consent in June 2012. A recommendation was made in the 2010-11 Annual Report that this option would not be exercised on the grounds that the conditions are adequate to deal with any significant adverse effects on the environment arising from the exercise of the consents.

Origin Energy applied to vary the consent on 3 February 2012. The variation requested that condition 12 be deleted. This condition required that oily wastes are kept separate from other waste types (SBM and WBM). As volumes of oily waste are typically small (less than 10 m^3) Origin Energy considered it uneconomic to landfarm such small volumes and requested that the condition be removed. The variation also requested that condition 13 be amended to allow for the time period for stock piling wastes on site to be extended from eight months to 12 months. The consent was varied on 7 March 2012.

In July 2015, the consent was varied again to limit the areas of land with which the consent was to apply to. They did so by providing the Council with analytical evidence to support the idea that areas of land which had been utilised for the practice of landfarming had met their conditional limit for surrender. This effectively limited the application of the consent to site specific storage pits, which as discussed required additional remediation.

Prior to the expiry of the consent which occurred in June 2016, Origin Energy engaged the services of WRS/OPUS to undertake the removal and landfarming of the former storage pit area at the Spence Road landfarm. This involved the removal of three storage pits and post excavation analysis provided by OPUS indicated that contaminants of concern with respect to the specific consent conditions were within the required concentrations to allow for the consent to expire without renewal.

Conditions 1, 2 and 3 set out definitions and a requirement for adoption of the best practicable option.

Conditions 4 to 7 set out the requirements for a management plan, notifications, monitoring and reporting.

Conditions 8 and 9 specify discharge limits.

Conditions 10 to 14 are operational requirements.

Conditions 15 to 18 relate to effects on groundwater and surface water.

Conditions 19 to 23 set limits on certain parameters in the soil.

Condition 24 allows for an optional review.

The permit is attached to this report in Appendix I.

4.2 Inspections

Inspections were limited to one scheduled inspection this monitoring period. Origin Energy liaised with the Council and the proposed developments were communicated throughout the monitoring period.

26 January 2016
At the time of inspection the following was observed, the wind was variable west, speed 3 m/s. No objectionable odours or visible emissions were found during the inspection. No recent drilling mud stockpiling or land-farming has occurred at the site. All pits appeared free of muds, groundwater, grasses, rushes and algae, no hydrocarbon sheen present. Areas where muds had previously been spread, had good pasture or crop cover and all vegetation appeared healthy.

17 June 2016
Origin Energy engaged WRS Ltd with the aid of OPUS to undertake removal of the former storage cell area at the former Origin Energy landfarm Spence Road. Two cells were required to be removed. The excavated material was sent to WRS' Symes landfarm at the end of June 2016. OPUS undertook the sampling to ascertain the depth of contamination and provided analysis to support that the site could be backfilled to the satisfaction of the Council.

4.3 Compliance soil sampling

The site at Spence Road has been closed since its last application of material to ground, this final application occurred in January 2012 and since this date the site has been in a remediation phase. In the current year, Origin Energy moved for a partial surrender of the site. This involved the surrender of the areas of the site which had been utilised for landfarming that had since been suitably remediated to below the specific consented requirement for surrender[1].

The Council reviewed the post spread soil analysis provided by Origin Energy and collected two composite validation soil samples.

The main aim of these soil samples was to validate the post spread soil analysis provided by Origin Energy and to ascertain compliance with the consent conditions. The Council selected a paddock which was most recently spread, paddock S31, landfarmed in January 2012 and paddock S11/12 which contained measureable (low) concentrations of hydrocarbons provided by the analysis undertaken by Origin Energy in May 2014.

The analysis of the paddock compliance sampling is provided in the following Table 11. Analysis detailed that the parameter concentrations were within the required concentration to allow for a surrender of the paddocks which had been utilised by Origin Energy for the practice of landfarming. Note that the consented surrender limit has been included to Table 11 to allow the reader easy reference.

[1] Specific surrender criteria is provided in Consent 5935-1 Conditions 18- 22 Appendix I

Table 11 Council compliance soil sampling Spence Road landfarm

Spence Road Compliance Paddock Sampling	Paddock No		S31	S11/S12
Parameter	Unit/Date	Consent Limit	03/08/2015	03/08/2015
Dry Matter	g/100g as rcvd	-	86	88
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn				
Total Recoverable Arsenic	mg/kg dry wt	20	< 2	< 2
Total Recoverable Cadmium	mg/kg dry wt	1	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	600	13	13
Total Recoverable Copper	mg/kg dry wt	100	10	12
Total Recoverable Lead	mg/kg dry wt	300	1.3	1.7
Total Recoverable Nickel	mg/kg dry wt	60	9	10
Total Recoverable Zinc	mg/kg dry wt	300	56	54
BTEX in Soil by Headspace GC-MS				
Benzene	mg/kg dry wt	1.1	< 0.05	< 0.05
Toluene	mg/kg dry wt	68	< 0.05	< 0.05
Ethylbenzene	mg/kg dry wt	53	< 0.05	< 0.05
m&p-Xylene	mg/kg dry wt	48	< 0.10	< 0.10
o-Xylene	mg/kg dry wt	48	< 0.05	< 0.05
Polycyclic Aromatic Hydrocarbons				
Acenaphthene	mg/kg dry wt	-	< 0.03	< 0.03
Acenaphthylene	mg/kg dry wt	-	< 0.03	< 0.03
Anthracene	mg/kg dry wt	-	< 0.03	< 0.03
Benzo[a]anthracene	mg/kg dry wt	-	< 0.03	< 0.03
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.027	< 0.03	< 0.03
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	-	< 0.03	< 0.03
Benzo[g,h,i]perylene	mg/kg dry wt	-	< 0.03	< 0.03
Benzo[k]fluoranthene	mg/kg dry wt	-	< 0.03	< 0.03
Chrysene	mg/kg dry wt	-	< 0.03	< 0.03
Dibenzo[a,h]anthracene	mg/kg dry wt	-	< 0.03	< 0.03
Fluoranthene	mg/kg dry wt	-	< 0.03	< 0.03
Fluorene	mg/kg dry wt	-	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	< 0.03	< 0.03
Naphthalene	mg/kg dry wt	7.2	< 0.13	< 0.12
Phenanthrene	mg/kg dry wt	-	< 0.03	< 0.03
Pyrene	mg/kg dry wt	160	< 0.03	< 0.03
Total Petroleum Hydrocarbons in Soil				
C7 - C9	mg/kg dry wt	120	< 8	< 8
C10 - C14	mg/kg dry wt	58	< 20	< 20
C15 - C36	mg/kg dry wt	4,000	88	< 40
Total hydrocarbons (C7 - C36)	mg/kg dry wt	-	88	< 70

Ref.	Mud Type	Date Farmed	Well Name	Easting	Northing	Area m²	Volume m³
S2	WBM	Oct 2004	Cheal	1721721	5602149	1309	
S3	WBM	June 2004	Kauri C	1721947	5602035	2367	
S4	WBM	Nov 2004	Hihi	1721937	5602075	2530	
S5	WBM	Jan 2005	Miromiro	1722044	5601985	5559	
S6	WBM	May 2005	Karariki	1722009	5602054	2874	
S7	SBM	Sep 2005	Piakau 1	1722051	5601937	1290	
S8	SBM	Sep 2005	Piakau 2	1721665	5601748	840	
S9	WBM	Sep 2005	Piakau 2	1721644	5601728	2485	
S10	SBM	Sep 2005	Piakau 2	1721567	5601806	2365	
S11	WBM	Sep 2005	Piakau 1	1721556	5601790	3014	
S12	WBM	Sep 2005	Piakau 1	1721558	5601768	1795	
S13	WBM	Sep 2005	Piakau 2	1721555	5601752	2073	
S14	WBM	Oct 2005	Ahuroa 1	1721639	5601798	3437	
S15	SBM	Oct 2005	Ahuroa 1	1721971	5601988	2564	
S16	Control Site			1721993	5601940	1657	
S17	SBM	Dec 2005	Kauri F3	1721658	5601828	2426	
S18	WBM	Dec 2005	Kauri F2 & F3	1721648	5601850	2768	
S19	SBM	Dec 2005	Kauri F3	1721757	5601757	2334	
S20	OW	Dec 2005	Oily Waste	1721837	5601713	877	
S21	WBM	Feb 2006	Arakamu	1721809	5601771	4916	
S22	WBM	Jan 2007	Radnor	1721871	5601779	2215	
S23	OW	June 2009	Manutahi A	1722090	5602507	501	30
S24/S25a/b	WBM	July 2010	Ahuroa B & Kauri F	1721558	5601932	23622	4575
S26	OW	June 2011	Ahuroa B	1721904	5601845	1112	
S27/28	OW	June 2011	Rimu Pipeline Link	1721879	5601816	2473	
S29	WBM	June 2011	Manutahi D 2/3/4	1721824	5601977	47863	
S31	WBM	Jan 2012	Manutahi D 2/3/4	1721982	5602150	3032	250

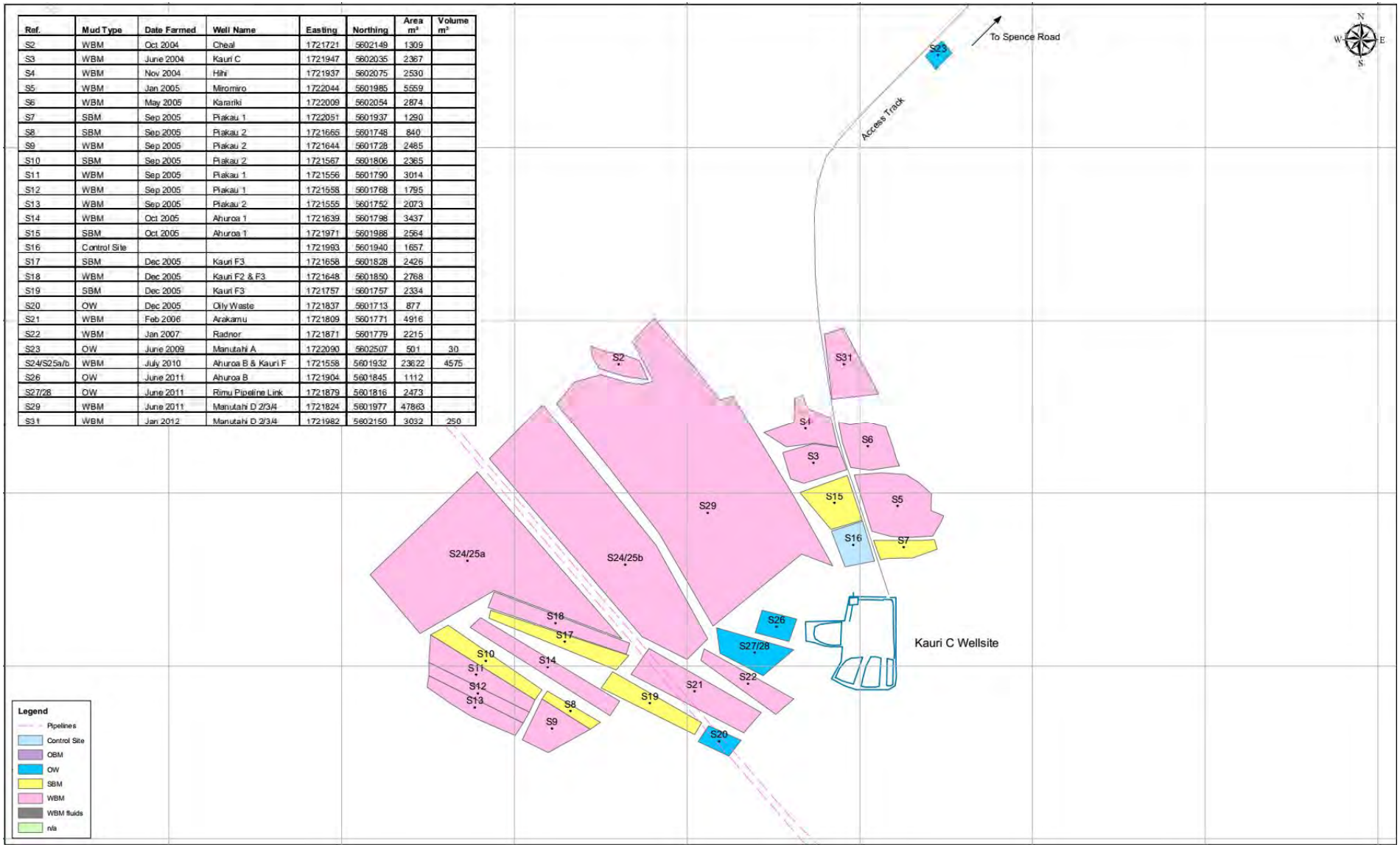

Figure 6 Origin Energy provided site map Spence Road landfarm

4.4 Origin Energy soil samples

Origin Energy soil results for the individual paddocks utilised for the practice of landfarming at Spence Road are provided in the following Tables 12-16. Each table contains information as to the date the paddock was landfarmed and also the date the paddock was sampled by Origin Energy. The consented surrender limit has been included to allow the reader easy reference.

Table 12 Origin Energy Spence Road soil compliance results paddocks S2-S6

	Location ID	S2 WBM	S3 WBM	S4 WBM	S5 WBM	S6 WBM
Parameter	Date Farmed	Oct 2004	Jun 2004	Nov 2004	Jan 2005	May 2005
Date of last sample	Consent Limits	01/05/2014	01/05/2014	01/05/2014	01/05/2014	01/05/2014
Conductivity mSm-1	290	<0.2	<0.2	<0.2	<0.2	<0.2
Recov Barium mg/kg dry wt	10,000	240	63	48	276	122
Recov Cl mg/kg dry wt	700	71	8	323	80	10
Recov Sodium mg/kg dry wt	460	90	82	94	170	98
Soluble Salts g/100g dry wt	2,500	<0.05	<0.05	<0.05	<0.05	<0.05
Sodium Absorption Ratio SAR	18	0.90	1.5	0.7	2.1	1.3
Arsenic mg/kg dry wt	20	<2	<2	<2	<2	<2
Cadmium mg/kg dry wt	1	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium mg/kg dry wt	600	10	13	13	14	13
Copper mg/kg dry wt	100	10	10	17	18	23
Lead mg/kg dry wt	300	1.30	0.8	2.2	2.7	3.3
Mercury mg/kg dry wt	1	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel mg/kg dry wt	60	7	6	7	8	8
Zinc mg/kg dry wt	300	49	58	61	65	64
C7-C9 mg/kg dry wt	120.0	<8	<7	<7	<7	<7
C10-C14 mg.kg dry wt	58	<20	<10	<10	<10	<10
C15-C36 mg/kg dry wt	4,000	<30	<30	<30	40	70
Total HC's mg/kg dry wt	--	<60	<50	<50	<50	<50
Benzene mg/kg dry wt	1.1	<0.02	<0.05	<0.02	<0.02	<0.02
Toluene mg/kg dry wt	68	<0.02	<0.05	<0.02	<0.02	<0.02
Ethylbenzene mg/kg dry wt	53	<0.02	<0.05	<0.02	<0.02	<0.02

	Location ID	S2 WBM	S3 WBM	S4 WBM	S5 WBM	S6 WBM
Parameter	**Date Farmed**	**Oct 2004**	**Jun 2004**	**Nov 2004**	**Jan 2005**	**May 2005**
Date of last sample	**Consent Limits**	**01/05/2014**	**01/05/2014**	**01/05/2014**	**01/05/2014**	**01/05/2014**
m & p-xylene mg/kg dry wt	**48**	<0.02	<0.10	<0.02	<0.02	<0.02
o-Xylene mg/kg dry wt	**48**	<0.02	<0.05	<0.02	<0.02	<0.02
Benzo(a)pyrene (BAP)	**0.027**	<0.03	<0.03	<0.03	<0.03	<0.03
Naphthalene	**7.2**	0.13	0.13	0.13	0.13	0.13
Pyrene	**160**	0.03	0.03	0.03	0.03	0.03

Table 13 Origin Energy Spence Road soil compliance results paddocks S7-S14

	Location ID	S7 SBM	S8/10 SBM	S9/13 WBM	S11/12 WBM	S14 WBM
Parameter	**Date Farmed**	**Sep 2005**	**Sep 2005**	**Sep 2005**	**Sep 2005**	**Oct 2005**
Date of last sample	**Consent Limits**	**18/06/2010**	**18/03/2014**	**27/11/2012**	**06/05/2014**	**01/05/2014**
Conductivity mSm-1	**290**	<0.2	<0.2	<0.2	<0.2	<0.2
Recov Barium mg/kg dry wt	**10,000**	460	1,650	410	2,700	430
Recov Cl mg/kg dry wt	**700**	7	2	5	35	24
Recov Sodium mg/kg dry wt	**460**	330	14	340	350	103
Soluble Salts g/100g dry wt	**2,500**	<0.05	<0.05	<0.05	<0.05	<0.05
Sodium Absorption Ratio SAR	**18**	0.60	0.60	1.20	0.8	1.10
Arsenic mg/kg dry wt	**20**	<2	<2	<2	<2	<2
Cadmium mg/kg dry wt	**1**	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium mg/kg dry wt	**600**	11	11	13	25	15
Copper mg/kg dry wt	**100**	12	17	12	21	19
Lead mg/kg dry wt	**300**	9.0	71.5	6.1	31.4	6.5
Mercury mg/kg dry wt	**1**	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel mg/kg dry wt	**60**	7	7	7	12	8
Zinc mg/kg dry wt	**300**	50	46	56	108	61
C7-C9 mg/kg dry wt	**120.0**	<8	<8	<8	<8	<8
C10-C14 mg.kg dry wt	**58**	<20	<20	<20	30	<20
C15-C36 mg/kg dry wt	**4,000**	35	93	210	1,070	43

	Location ID	S7 SBM	S8/10 SBM	S9/13 WBM	S11/12 WBM	S14 WBM
Parameter	**Date Farmed**	**Sep 2005**	**Sep 2005**	**Sep 2005**	**Sep 2005**	**Oct 2005**
Date of last sample	**Consent Limits**	**18/06/2010**	**18/03/2014**	**27/11/2012**	**06/05/2014**	**01/05/2014**
Total HC's mg/kg dry wt	**--**	<60	96	210	1,100	<60
Benzene mg/kg dry wt	**1.1**	<0.02	<0.04	<0.04	<0.04	<0.04
Toluene mg/kg dry wt	**68**	<0.02	<0.04	<0.04	<0.04	<0.04
Ethylbenzene mg/kg dry wt	**53**	<0.02	<0.04	<0.04	<0.04	<0.04
m & p-xylene mg/kg dry wt	**48**	<0.02	<0.08	<0.08	<0.08	<0.08
o-Xylene mg/kg dry wt	**48**	<0.02	<0.04	<0.04	<0.04	<0.04
Benzo(a)pyrene (BAP)	**0.027**	<0.03	<0.03	<0.03	<0.03	0.03
Naphthalene	**7.2**	<0.12	<0.1	<0.12	<0.13	0.12
Pyrene	**160**	<0.03	0.13	<0.03	<0.03	0.03

Table 14 Origin Energy Spence Road soil compliance results S15-S21

	Location ID	S15 SBM	S17&19 SBM	S18 WBM	S20 OW	S21 WBM
Parameter	**Date Farmed**	**Oct 2005**	**Dec 2005**	**Dec 2005**	**Dec 2005**	**Feb 2006**
Date of last sample	**Consent Limits**	**18/03/2014**	**06/05/2014**	**01/05/2014**	**18/03/2014**	**01/05/2014**
Conductivity mSm-1	**290**	<0.2	<0.2	0.20	<0.02	<0.02
Recov Barium mg/kg dry wt	**10,000**	1,830	248	920	1,170	245
Recov Cl mg/kg dry wt	**700**	10	37	81	18	127
Recov Sodium mg/kg dry wt	**460**	400	113	260	410	145
Soluble Salts g/100g dry wt	**2,500**	<0.05	<0.05	0.06	<0.05	<0.05
Sodium Absorption Ratio SAR	**18**	0.6	0.8	1.00	2	1.9
Arsenic mg/kg dry wt	**20**	<2	<2	<2	<2	<2
Cadmium mg/kg dry wt	**1**	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium mg/kg dry wt	**600**	11	19	16	19	15
Copper mg/kg dry wt	**100**	15	15	25	19	11
Lead mg/kg dry wt	**300**	13.6	2.1	4.20	20.1	1.7
Mercury mg/kg dry wt	**1**	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel mg/kg dry wt	**60**	8	9	9	10	7

	Location ID	S15 SBM	S17&19 SBM	S18 WBM	S20 OW	S21 WBM
Parameter	**Date Farmed**	**Oct 2005**	**Dec 2005**	**Dec 2005**	**Dec 2005**	**Feb 2006**
Date of last sample	**Consent Limits**	**18/03/2014**	**06/05/2014**	**01/05/2014**	**18/03/2014**	**01/05/2014**
Zinc mg/kg dry wt	**300**	47	81	66	78	59
C7-C9 mg/kg dry wt	**120.0**	<8	<8	<8	<8	<7
C10-C14 mg.kg dry wt	**58**	<20	<20	<20	<20	<10
C15-C36 mg/kg dry wt	**4,000**	110	210	<30	<30	40
Total HC's mg/kg dry wt	**--**	110	220	<60	<60	50
Benzene mg/kg dry wt	**1.1**	<0.04	<0.04	<0.04	<0.04	<0.04
Toluene mg/kg dry wt	**68**	<0.04	<0.04	<0.04	<0.04	<0.04
Ethylbenzene mg/kg dry wt	**53**	<0.04	<0.04	<0.04	<0.04	<0.04
m & p-xylene mg/kg dry wt	**48**	<0.08	<0.08	<0.07	0.15	<0.08
o-Xylene mg/kg dry wt	**48**	<0.04	<0.04	<0.04	0.08	<0.04
Benzo(a)pyrene (BAP)	**0.027**	<0.02	<0.02	<0.03	<0.02	<0.03
Naphthalene	**7.2**	<0.1	<0.1	<0.14	<0.1	0.14
Pyrene	**160**	0.05	<0.02	<0.03	0.06	0.03

Table 15 Origin Energy Spence Road soil compliance results S22-S26

	Location ID	S22 WBM	S23 OW	S24/25 WBM	S26 OW
Parameter	**Date Farmed**	**Jan 2007**	**Jun 2009**	**Jul 2010**	**Jun 2011**
Date of last sample	**Consent Limits**	**06/05/2014**	**03/09/2010**	**01/09/2011**	**01/04/2011**
Conductivity mSm-1	**290**	<0.2	<0.20	<0.2	<0.2
Recov Barium mg/kg dry wt	**10,000**	2200	36	194	194
Recov Cl mg/kg dry wt	**700**	9	5	12	12
Recov Sodium mg/kg dry wt	**460**	410	300	270	270
Soluble Salts g/100g dry wt	**2,500**	<0.05	<0.05	<0.05	<0.05
Sodium Absorption Ratio SAR	**18**	2.5	0.8	1.2	1.2
Arsenic mg/kg dry wt	**20**	<2	<2	<2	<2
Cadmium mg/kg dry wt	**1**	<0.1	<0.10	<0.10	<0.10

	Location ID	S22 WBM	S23 OW	S24/25 WBM	S26 OW
Parameter	**Date Farmed**	**Jan 2007**	**Jun 2009**	**Jul 2010**	**Jun 2011**
Date of last sample	**Consent Limits**	**06/05/2014**	**03/09/2010**	**01/09/2011**	**01/04/2011**
Chromium mg/kg dry wt	**600**	20	16	14	14
Copper mg/kg dry wt	**100**	18	33	12	12
Lead mg/kg dry wt	**300**	2.1	5.9	1.5	1.5
Mercury mg/kg dry wt	**1**	<0.1	<0.10	<0.10	<0.10
Nickel mg/kg dry wt	**60**	10	8	7	7
Zinc mg/kg dry wt	**300**	80	99	67	67
C7-C9 mg/kg dry wt	**120.0**	<8	<8	<8	<8
C10-C14 mg.kg dry wt	**58**	<20	<20	<20	<20
C15-C36 mg/kg dry wt	**4,000**	<30	<40	<40	<40
Total HC's mg/kg dry wt	**--**	<60	<60	<70	<70
Benzene mg/kg dry wt	**1.1**	<0.05	<0.05	<0.05	<0.05
Toluene mg/kg dry wt	**68**	<0.05	<0.05	<0.05	<0.05
Ethylbenzene mg/kg dry wt	**53**	<0.05	<0.05	<0.05	<0.05
m & p-xylene mg/kg dry wt	**48**	<0.10	<0.10	<0.10	<0.10
o-Xylene mg/kg dry wt	**48**	<0.05	<0.05	<0.05	<0.05
Benzo(a)pyrene (BAP)	**0.027**	<0.03	<0.025	<0.03	<0.03
Naphthalene	**7.2**	<0.12	<0.13	<0.12	<0.12
Pyrene	**160**	<0.03	0.15	<0.03	<0.03

Table 16 Origin Energy Spence Road soil compliance results paddocks S27-S31

	Location ID	S27/28 OW	S29 WBM	S31 WBM/OW
Parameter	**Date Farmed**	**Jun 2011**	**Jun 2011**	**Jan 2012**
Date of last sample	**Consent Limits**	**01/08/2011**	**30/06/2012**	**30/06/2012**
Conductivity mSm-1	**290**	<0.20	<0.02	<0.02
Recov Barium mg/kg dry wt	**10,000**	450	49	17
Recov Cl mg/kg dry wt	**700**	22	22	11
Recov Sodium mg/kg dry wt	**460**	350	320	250

	Location ID	S27/28 OW	S29 WBM	S31 WBM/OW
Parameter	**Date Farmed**	**Jun 2011**	**Jun 2011**	**Jan 2012**
Date of last sample	**Consent Limits**	**01/08/2011**	**30/06/2012**	**30/06/2012**
Soluble Salts g/100g dry wt	**2,500**	<0.05	<0.05	<0.05
Sodium Absorption Ratio SAR	**18**	1.1	1.5	1.1
Arsenic mg/kg dry wt	**20**	<2	<2	<2
Cadmium mg/kg dry wt	**1**	<0.10	<.10	<.10
Chromium mg/kg dry wt	**600**	12	13	13
Copper mg/kg dry wt	**100**	14	11	11
Lead mg/kg dry wt	**300**	2.1	1.1	1.1
Mercury mg/kg dry wt	**1**	<0.10	<.10	<.10
Nickel mg/kg dry wt	**60**	6.0	6	7
Zinc mg/kg dry wt	**300**	57	58	59
C7-C9 mg/kg dry wt	**120.0**	<8	<8	<8
C10-C14 mg.kg dry wt	**58**	<20	<20	<20
C15-C36 mg/kg dry wt	**4,000**	<40	<40	<40
Total HC's mg/kg dry wt	**--**	<70	<70	<70
Benzene mg/kg dry wt	**1.1**	<0.05	<0.05	<0.05
Toluene mg/kg dry wt	**68**	<0.05	<0.05	<0.05
Ethylbenzene mg/kg dry wt	**53**	<0.05	<0.05	<0.05
m & p-xylene mg/kg dry wt	**48**	<0.10	<0.10	<0.10
o-Xylene mg/kg dry wt	**48**	<0.05	<0.05	<0.05
Benzo(a)pyrene (BAP)	**0.027**	<0.03	<0.03	<0.03
Naphthalene	**7.2**	<0.12	<0.12	<0.12
Pyrene	**160**	<0.03	<0.03	<0.03

The analysis detailed no exceedance with respect to the consent conditions.

4.5 Storage pit remediation

Once the Council had undertaken the validation sampling with respect to the individual paddocks utilised for landfarming. The Council then issued a variation in consent, which meant the consent only applied to the storage pits on site, of which there were three.

The site specific storage cells were historically unlined, thus there existed a legacy in terms of localised soil contamination around the storage cells. One of the three storage cells was known to contain measureable contamination (Pit1) and the Council were asked to validate which of the other two pits would also require remediation.

The analysis of the former storage pits is provided in Table 17 below. The analysis detailed that heavy metals were within consent limits for land application. However the concentrations of hydrocarbons, specifically Total Petroleum Hydrocarbons were above surrender criteria, thus further remediation was required

Table 17 Kauri C (Spence Road Landfarm) storage pit 2 and 3 analysis

Sample Type: Soil		13/04/2016	13/04/2016	13/04/2016	13/04/2016	13/04/2016	13/04/2016
	Sample Name:	2A_130416	2B_130416	2C_130416	3A_130416	3B_130416	3C_130416
Dry Matter	g/100g as rcvd	68	62	62	80	60	51
Total Recoverable Barium	mg/kg dry wt	58	630	730	2,200	440	870
Total Recoverable Sodium	mg/kg dry wt	580	550	450	540	480	550
Chloride	mg/kg dry wt	33	97	90	37	42	53
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	< 0.09	< 0.09	< 0.09	< 0.07	< 0.09	< 0.11
Heavy Metals with Mercury, Screen Level							
Total Recoverable Arsenic	mg/kg dry wt	< 2	3	2	4	4	4
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	8	12	15	17	52	38
Total Recoverable Copper	mg/kg dry wt	10	15	17	32	29	30
Total Recoverable Lead	mg/kg dry wt	1.3	4.3	4.8	26	7.8	7.9
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	0.15	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	5	7	8	10	31	24
Total Recoverable Zinc	mg/kg dry wt	42	64	76	60	51	71
BTEX in Soil by Headspace GC-MS							
Benzene	mg/kg dry wt	< 0.07	< 0.08	< 0.08	< 0.05	< 0.08	< 0.10
Toluene	mg/kg dry wt	< 0.07	< 0.08	< 0.08	< 0.05	< 0.08	< 0.10
Ethylbenzene	mg/kg dry wt	< 0.07	0.1	0.11	< 0.05	0.22	< 0.10
m&p-Xylene	mg/kg dry wt	< 0.14	0.59	0.5	< 0.10	< 0.16	< 0.2
o-Xylene	mg/kg dry wt	< 0.07	0.2	0.17	< 0.05	< 0.08	< 0.10
Polycyclic Aromatic Hydrocarbons Screening in Soil							
Acenaphthene	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.03	< 0.04	< 0.05
Acenaphthylene	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.03	< 0.04	< 0.05
Anthracene	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.03	< 0.04	< 0.05
Benzo[a]anthracene	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.03	< 0.04	< 0.05
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.04	0.04	0.04	< 0.03	< 0.04	< 0.05

Sample Type: Soil		13/04/2016	13/04/2016	13/04/2016	13/04/2016	13/04/2016	13/04/2016
	Sample Name:	2A_130416	2B_130416	2C_130416	3A_130416	3B_130416	3C_130416
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	< 0.04	0.09	0.09	< 0.03	< 0.04	< 0.05
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.03	< 0.04	< 0.05
Benzo[k]fluoranthene	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.03	< 0.04	< 0.05
Chrysene	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.03	< 0.04	< 0.05
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.03	< 0.04	< 0.05
Fluoranthene	mg/kg dry wt	< 0.04	0.09	0.09	< 0.03	< 0.04	< 0.05
Fluorene	mg/kg dry wt	< 0.04	0.07	0.07	< 0.03	< 0.04	< 0.05
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.03	< 0.04	< 0.05
Naphthalene	mg/kg dry wt	< 0.17	0.29	0.27	< 0.14	< 0.18	< 0.3
Phenanthrene	mg/kg dry wt	< 0.04	0.13	0.15	< 0.03	< 0.04	< 0.05
Pyrene	mg/kg dry wt	< 0.04	0.14	0.15	< 0.03	< 0.04	< 0.05
Total Petroleum Hydrocarbons in Soil							
C7 - C9	mg/kg dry wt	< 11	11	< 11	< 9	< 11	< 13
C10 - C14	mg/kg dry wt	1,670	1,160	1,030	1,600	< 30	< 30
C15 - C36	mg/kg dry wt	5,000	5,500	5,100	3,300	78	< 60
Total hydrocarbons (C7 - C36)	mg/kg dry wt	6,600	6,700	6,100	4,900	78	< 100

In light of the storage pit sampling undertaken by the Council (Table 17), Origin Energy engaged the services of WRS, whom with the aid of OPUS to validate, undertook the removal of contaminated soil from the former storage pit area.

Origin Energy then provided to the satisfaction of the Council, analysis of the remediated storage pits which had been excavated to remove the contaminated soil. The excavated material was then delivered to the current WRS Symes Manawapou landfarm where it will undergo further remediation.

The analysis provided by Origin Energy in respect of their remediated storage pits is attached in Appendix II.

5. Kauri A landfarm

5.1 Kauri A background

Origin Energy requested the surrender of the Kauri A landfarm, located in Manutahi, South Taranaki. This had been an asset acquired property.

Kauri A was a former landfarm adjacent to Kauri A wellsite (which is still active under Westside). Landfarming at this wellsite was undertaken by BTW on behalf of Swift Energy. The consent was granted in 2000. The consent was then transferred to Origin Energy in 2008. As the facility was no longer operational and the application of material was last applied to land in 2004, Origin Energy had requested a surrender of the site in terms of the landfarmed areas.

Figure 7 Kauri A Wellsite and associated consented landfarm area

5.2 Resource consent

Origin Energy held resource consent **5734-1**, to discharge drilling mud, fluids and cuttings from well drilling operations with water based muds, and to discharge drilling cuttings from wells drilled with synthetic based muds onto and into land. The consent was granted in December 2000 to the then Swift Energy, prior to be transferred to Origin Energy in 2003. The consent was recently surrendered.

The consent 5734-1 contains 20 conditions which stipulated the following:

Condition 1 requires the consent holder to undertake as the consent requires.

Condition 2 is for best practicable option.

Condition 3 is a notification related condition.

Condition 4, 5, 6 are management conditions.

Condition 7-17 are discharge limits, boundary conditions and assessment criteria.

Condition 18 is the surrender/ renewal/ expiry condition.

Condition 19 is for the practicable re-sowing of grass post application.

Condition 20 is a groundwater protection condition.

Condition 21 is any adverse effect condition.

Condition 22 is a review condition.

A copy of this consent is provided in Appendix I.

5.3 Council compliance soil analysis

The main rationale for undertaking soil sampling at this location was due to the gap between when the site was last assessed by Council and the request from Origin Energy surrender the landfarm consent at this location.

As there had been minimal sampling work undertaken in this locality, the Council proposed five soil sample transects (with ten cores per transect to 40 cm) to characterise the condition of the soil across the site with respect to the consented surrender criteria.

The initial site walk over concluded that only three soil sample transects would be required as the Northern portions of the site indicated that they were not processed for landfarming

A site walkover was undertaken of the landfarmed areas as defined in Figure 7 above. The site was split in to five distinct parcels. The two northern portions were not indicative of an area which had been utilised for the practice of landfarming. Not indicative, as they consisted of a grass covered dune field which were quite undulated when compared to the central and southern parcels of land which had been levelled to allow for the application of material to land.

Three composite soil samples were collected from three parcels of land which had been utilised for landfarming. Method of collection is outlined in Section 1.4.4 Chemical sampling.

Soil cores were indicative of mixed, aged drilling mud which had diminished as expected, considering the last application occurred 12 years ago in 2004, a soil core from the survey is provided in Figure 8.

Figure 8 Soil core collected from the Kauri A landfarm August 2015

5.4 Soil results

The analysis undertaken by the Council in respect of the Kauri A landfarmed areas is provided in the following Table 18.

Table 18 Kauri A soil sample results

Sample Type: Soil	Location ID		K1	K2	K3
Parameter	Unit/ Date	Consent Limit	17-Aug-15	17-Aug-15	17-Aug-15
Dry Matter	g/100g as rcvd	-	91	92	93
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn					
Total Recoverable Arsenic	mg/kg dry wt	20	< 2	< 2	< 2
Total Recoverable Cadmium	mg/kg dry wt	1	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	600	13	12	13
Total Recoverable Copper	mg/kg dry wt	100	11	10	11
Total Recoverable Lead	mg/kg dry wt	300	1.7	1.2	1.8
Total Recoverable Nickel	mg/kg dry wt	60	11	10	12
Total Recoverable Zinc	mg/kg dry wt	300	58	54	60
BTEX in Soil by Headspace GC-MS					
Benzene	mg/kg dry wt	1.1	< 0.05	< 0.05	< 0.05
Toluene	mg/kg dry wt	68	< 0.05	< 0.05	< 0.05
Ethylbenzene	mg/kg dry wt	53	< 0.05	< 0.05	< 0.05
m&p-Xylene	mg/kg dry wt	48	< 0.10	< 0.10	< 0.10
o-Xylene	mg/kg dry wt	48	< 0.05	< 0.05	< 0.05
Polycyclic Aromatic Hydrocarbons					
Acenaphthene	mg/kg dry wt	-	< 0.03	< 0.03	< 0.03
Acenaphthylene	mg/kg dry wt	-	< 0.03	< 0.03	< 0.03
Anthracene	mg/kg dry wt	-	< 0.03	< 0.03	< 0.03
Benzo[a]anthracene	mg/kg dry wt	-	< 0.03	< 0.03	< 0.03

Sample Type: Soil	Location ID		K1	K2	K3
Parameter	Unit/ Date	Consent Limit	17-Aug-15	17-Aug-15	17-Aug-15
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.027	< 0.03	< 0.03	< 0.03
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	-	< 0.03	< 0.03	< 0.03
Benzo[g,h,i]perylene	mg/kg dry wt	-	< 0.03	< 0.03	< 0.03
Benzo[k]fluoranthene	mg/kg dry wt	-	< 0.03	< 0.03	< 0.03
Chrysene	mg/kg dry wt	-	< 0.03	< 0.03	< 0.03
Dibenzo[a,h]anthracene	mg/kg dry wt	-	< 0.03	< 0.03	< 0.03
Fluoranthene	mg/kg dry wt	-	< 0.03	< 0.03	< 0.03
Fluorene	mg/kg dry wt	-	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	< 0.03	< 0.03	< 0.03
Naphthalene	mg/kg dry wt	7.2	< 0.12	< 0.12	< 0.12
Phenanthrene	mg/kg dry wt	-	< 0.03	< 0.03	< 0.03
Pyrene	mg/kg dry wt	160	< 0.03	< 0.03	< 0.03
Total Petroleum Hydrocarbons					
C7 - C9	mg/kg dry wt	120	< 8	< 8	< 8
C10 - C14	mg/kg dry wt	58	< 20	< 20	< 20
C15 - C36	mg/kg dry wt	4,000	< 40	< 40	< 40
Total hydrocarbons (C7 - C36)	mg/kg dry wt	-	< 70	< 70	< 70

All analytes were within there specific surrendering criteria as stipulated by the consent. The site was processed for surrender in September 2015.

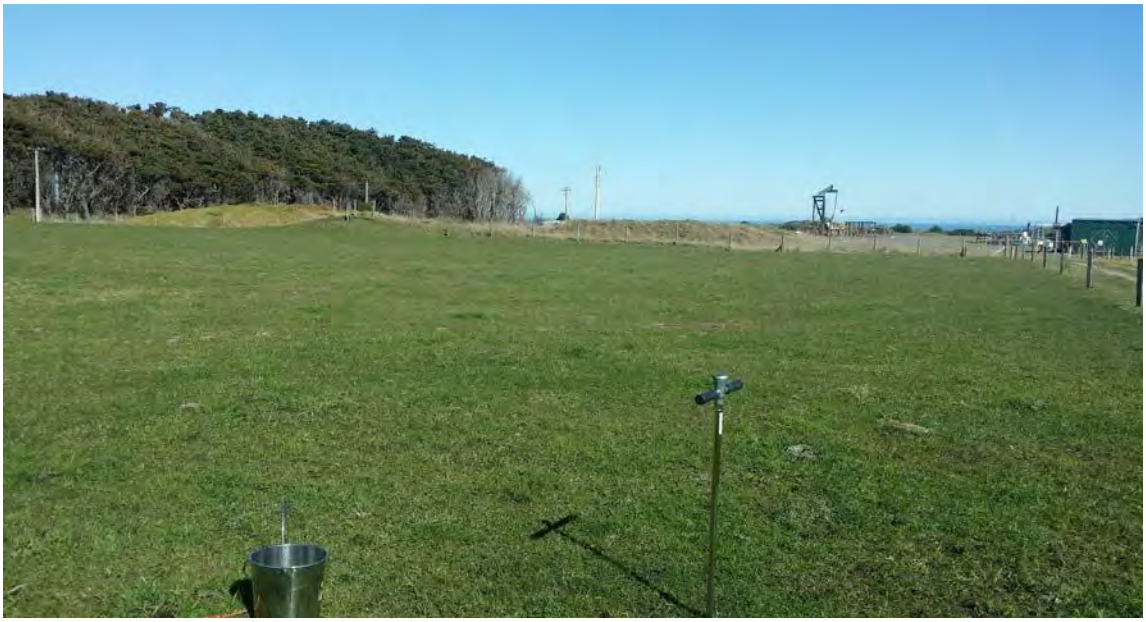

Photo 4 Kauri A landfarm post application

5.5 Investigations, interventions, and incidents

The monitoring programme for the year was based on what was considered to be an appropriate level of monitoring, review of data, and liaison with the consent holder. During the year matters may arise which require additional activity by the Council, for example provision of advice and information, or investigation of potential or actual causes of non-compliance or failure to maintain good practices. A pro-active approach that in the first instance avoids issues occurring is favoured.

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

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

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

6. Discussion

6.1 Discussion of site performance

Geary landfarm
The facility has been closed with the final application of material to land undertaken in March 2006. The site has since been reinstated. The analysis undertaken over the years detailed no exceedance with consent conditions.

Analysis of the long term record of inspections detailed no non-compliance as far back as 01 July 2004 when an overland discharge of material was within 8 m of the Waikaikai Stream. Since this date the management and the performance of the facility has been in compliance with consent conditions. No issues with site performance were noted in this monitoring period.

Origin Energy provided the Council with analytical analysis of the areas of land which had been utilised for the practice landfarming, this analysis provided evidence that the areas of land were within there consented concentrations to allow for the Council to surrender the facility. The site has since been surrendered.

Schrider landfarm
Disposals of material to land at the Schrider landfarm were completed in 2011. The site has now been reinstated. There have been no incidents since 11 June 2004 when management of the application depth of material was cited as an issue. In this monitoring period there were no issues with site performance.

In similarity to the Geary landfarm, Origin Energy provided the Council with analytical analysis to support the surrender of the facility which occurred in this monitoring period.

Spence Road landfarm
This facility was the last of the Origin Energy managed landfarms to receive material in January 2012. Origin Energy were informed that if the operations were to continue they would be required to undertake significant redevelopment of their existing storage pit area by means of installing fit for purpose synthetic liners and in addition, the installation of groundwater monitoring wells. As such operations in terms of storage of material ceased, with the site moving towards a remediation stage and monitoring of the bio-degradation rates became the primary purpose of the site.

In the previous monitoring period the Council met with Origin Energy representatives to discuss the proposition of surrender. It was discussed that there remained a legacy issue; whereby the former storage pit area would require further monitoring prior to be considered for surrender, or to be excavated and remediated elsewhere.

Origin Energy chose the second option; to excavate the contaminated soil and to have it remediated by a third party landfarming operation. This was undertaken by WRS, with the aid of OPUS whom undertook soil testing, excavated the contaminated soil from the three former storage pits at the Spence Road and sent them to WRS's Symes Manawapou landfarm.

Post excavation, OPUS performed soil testing to quantify the remaining contaminates of concern with respect to the former storage pit area. This analysis was provided to the Council. It met the surrender criteria and Origin Energy were allowed to infill the former pit area with clean fill. This area has since been re-vegetated and the site has now been surrendered.

Origin Energy engaged with the Council throughout the process and the Council was satisfied with work which was undertaken.

Kauri A landfarm
The recent analysis undertaken by the Council in respect of the former Kauri A landfarm was undertaken in response to Origin Energy's request for its surrender. As discussed in Section 5, the site undertook its final application of material in 2004. As the Council had limited soil analysis since this date, discussion with Origin Energy resulted in the Council undertaking three compliance samples.

The purpose of the compliance samples was to ascertain the concentrations of analytes within the soil and to check these were within the required concentrations to allow for a surrender of the consent.

The analysis detailed no exceedance when compared to the consent conditions and the site was surrendered.

6.2 Environmental effects of exercise of consents

All sites surrendered.

6.3 Evaluation of performance

A tabular summary of the consent holder's compliance record for the year under review is set out in Tables 19-24.

Table 19 Evaluation of performance in respect of consent 5325-1

Purpose*: To discharge: drilling mud, fluids and cuttings from well drilling operations with water based muds; drilling cuttings from wells drilled with synthetic based muds; and oily waste material from hydrocarbon exploration and production activities; onto and into land. (Geary Landfarm)*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Comply with documentation submitted for application	No disposals during monitoring period	N/A
2. Prevent or minimise any likely adverse effects on the environment	Inspection	Yes
3. Notify TRC in writing prior to waste disposal	No disposals during monitoring period	N/A
4. Notify TRC prior to disposal of stockpiled waste	No disposals during monitoring period	N/A

Purpose*: To discharge: drilling mud, fluids and cuttings from well drilling operations with water based muds; drilling cuttings from wells drilled with synthetic based muds; and oily waste material from hydrocarbon exploration and production activities; onto and into land. (Geary Landfarm)*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
5. Provide written notice and a chemical analysis for disposal of waste with greater than 5% hydrocarbon content	No disposals during monitoring period	N/A
6. Keep areas of disposal of water based drilling wastes separate from synthetic mud based drilling waste. Keep disposal areas for individual wells separate	No disposals during monitoring period	N/A
7. Maintain records of wastes for: a. each well b. stockpiling and disposal areas c. composition and volume of waste d. times of discharge e. treatments applied	No disposals during monitoring period	Yes
8. Limited to wastes generated within Taranaki	No disposals during monitoring period	Yes
9. No discharge within 25 m of surface water or property boundaries, or within 6 m of pipelines	No discharges during monitoring period	N/A
10. No destabilisation of neighbouring land	Site reinstated	Yes
11. Discharge depth limited to 150 mm for waste with less than 5% hydrocarbons, or 50 mm for waste with greater than 5% hydrocarbons	No discharges during monitoring period	N/A
12. If waste has greater than 5% hydrocarbons, incorporate waste into the soil so that the surface 250 mm contains less than 5% hydrocarbons	No discharges during monitoring period	N/A
13. Electroconductivity must be less than 400 mSm^{-1}. If background soil has an electroconductivity of greater than 400 mSm^{-1}, then electroconductivity after disposal shall not exceed Origin Energy al electroconductivity by more than 100 mSm^{-1}	Supplied soil samples show continued compliance	Yes
14. Sodium absorption ratio (SAR) must be less than 18.0. If background soil has an SAR of greater than 18.0, then SAR after disposal shall not exceed Origin Energy al SAR by more than 1.0	Supplied soil samples show continued compliance	Yes
15. Maximum rate of chloride application after discharge must not exceed 800 kgCl/ha/yr	No discharges during monitoring period	N/A

Purpose*: To discharge: drilling mud, fluids and cuttings from well drilling operations with water based muds; drilling cuttings from wells drilled with synthetic based muds; and oily waste material from hydrocarbon exploration and production activities; onto and into land. (Geary Landfarm)*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
16. Maximum rate of nitrogen application after discharge must not exceed 200 kgN/ha/yr	No discharges during monitoring period	N/A
17. Prior to expiry/cancellation of consent soil hydrocarbon content must comply with Ministry for the Environment guidelines	Consent not surrendered or expired	N/A
18. Levels of metals must comply with Ministry of Health guidelines	Supplied soil samples show continued compliance	Yes
19. Total dissolved salts shall not exceed 2,500 g/m^3	No soil samples obtained during monitoring period	N/A
20. Prior to expiry/cancellation of consent these levels must not be exceeded: a. conductivity, 290 mSm^{-1} b. dissolved salts, 2,500 g/m^3 c. sodium, 460 g/m^3 d. chloride, 700 g/m^3	Consent surrendered	Yes
21. Discharge area shall be tilled and resown to pasture/crop as soon as possible after completion	No discharges during monitoring period. Pasture has been re-established	Yes
22. Disposal of waste shall never lead to contamination of any surface water	Inspection – no effects noted	Yes
23. Disposal of waste shall never result in any adverse effects on ground or surface water	Inspection – no effects noted	Yes
24. Stockpiling limited to 5,000 m^3 and discharged within two months	No stockpiling or discharges during monitoring period	N/A
25. No offensive dust beyond the site boundary	Site reinstated	Yes
26. No offensive odour beyond the site boundary	Site reinstated	Yes
27. Optional review provision re environmental effects	No further options for review prior to expiry	N/A
Overall assessment of environmental performance in respect of this consent		**High**
Overall assessment of administrative performance in respect of this consent		**High**

AR Geary achieved a high environmental and a high administrative performance in respect to the conditions of consent 5325-1.

Table 20 Summary of performance for consent 6135-1

Purpose*: To discharge drilling cuttings and fluids from drilling operations with water based muds, drilling cuttings from wells drilled with synthetic based muds, drilling cuttings from wells drilled with oil based muds, and oily wastes, onto and into land via land farming. Schrider Landfarm*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Definitions	Not applicable	N/A
2. Adoption of best practicable option	Inspection and sampling	Yes
3. Notify the Council 48 hrs prior stockpiling	No stockpiling at site during monitoring period	N/A
4. Notify the Council 48 hrs prior to landfarming	No disposals during monitoring period	N/A
5. Provide specified data for OBM disposals	Provision of data - no OBM disposals	N/A
6. Rate of discharge/application depths	Inspection, sampling and company records	Yes
7. Incorporate wastes so that hydrocarbon content in top 250 mm is: < 5 % for WBM & SBM < 1.5 % for oily wastes & OBM	Sampling	Yes
8. Resow into pasture	Inspection	Yes
9. Wastes from individual wells to be kept separate & distinct	No stockpiling at site during monitoring period	N/A
10. Oily waste & OBM's to be kept separate & distinct	No stockpiling at site during monitoring period	N/A
11. No discharge near surface water, boundaries or pipelines	Inspection	Yes
12. Wastes restricted to Taranaki Region	Inspection and company records	Yes
13. Max stockpiled volume of 2,000 m^3 & must be discharged within 8 mths	No stockpiling at site during monitoring period	N/A
14. No stockpiling of oily wastes or OBM's	No stockpiling at site during monitoring period	N/A
15. OBM only from certain wells	No OBM disposals	N/A
16. Limited area for disposal of OBM	No OBM disposals	N/A
17. Limit on nitrogen application rates	No disposals during monitoring period	N/A
18. No destabilisation of neighbouring land	Inspection	Yes
19. Electroconductivity limits	Sampling	Yes
20. Sodium absorption ratio limits	Sampling	Yes

Purpose*: To discharge drilling cuttings and fluids from drilling operations with water based muds, drilling cuttings from wells drilled with synthetic based muds, drilling cuttings from wells drilled with oil based muds, and oily wastes, onto and into land via land farming. Schrider Landfarm*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
21. Limits on concentration of metals	Sampling	Yes
22. Hydrocarbon levels prior to expiry	Sampling	N/A
23. Conductivity, TDS, sodium and chloride limits prior to expiry	Sampling	N/A
24. Level of total dissolved salts in surface and groundwater	Sampling – surface water not sampled, groundwater not assessed	Not tested during period under review
25. No contamination of surface water bodies	No surface water	N/A
26. No impacts upon groundwater or surface water	No groundwater monitoring wells associated with this facility	N/A
27. No effects on surface water	No surface water	N/A
28. Limits on dust generation	Inspection	Yes
29. No offensive or objectionable odour	Inspection and complaint register	Yes
30. Monitoring requirements	Provision of data	Yes
31. Post application analysis for OBM's	Provision of results – no OBM disposals	N/A
32. Consent review	Next option for review in June 2016	N/A
Overall assessment of environmental performance and compliance in respect of this consent		**High**
Overall assessment of administrative performance in respect of this consent		**High**

Origin Energy demonstrated a high environmental performance and a high administration performance with respect to this consent.

Table 21 Summary of performance for consent 5935-1

Purpose*: To discharge waste drilling cuttings, muds and fluids from wells drilled with water based muds and waste drilling cuttings from wells drilled with synthetic based muds from hydrocarbon exploration and production operations onto and into land. (Spence Road Landfarm)*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Definitions	Not applicable	N/A
2. Best practicable option to be adopted	Inspections and liaison with consent holder	Yes
3. Management plan	Site management information provided	Yes
4. Notification of Council prior to any discharge	Notification received	Not applicable in this period

Purpose*: To discharge waste drilling cuttings, muds and fluids from wells drilled with water based muds and waste drilling cuttings from wells drilled with synthetic based muds from hydrocarbon exploration and production operations onto and into land. (Spence Road Landfarm)*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
5. Notification of Council prior to discharging stockpiled material	Notification received	Not applicable in this period
6. Records to be kept and made available to Council	Consent holder's records	Yes
7. Limit on application depth of waste	Inspection and consent holder's records	Yes
8. Incorporation of wastes	Inspection and sampling	Yes
9. Buffer distances	Inspection	Yes
10. Only wastes generated in Taranaki to be disposed of	Consent holder's records	Yes
11. Discharge not to cause destabilisation of neighbouring land	Inspection	Yes
12. Stockpiling and disposal areas for oily wastes to be kept separate	Inspection and consent holder's records	Yes
13. Material to be incorporated within eight months	Inspection and consent holder's records	No additional material brought on to the site
14. Discharge area to be tilled and resown as soon as practicable after discharge	Inspection	Yes
15. No contaminants to enter a surface water body	Inspection	Not assessed
16. There are to be no adverse effects on groundwater or surface water	Inspection - no surface water, groundwater not assessed	Not assessed
17. Discharge not to give rise to certain effects in receiving waters	Inspection	Not assessed
18. Limit on level of total dissolved salts in surface or groundwater	Not assessed as no groundwater monitoring wells, no surface water in the vicinity	Not assessed
19. Limit on electroconductivity of soil/waste layer post application	Sampling	Yes
20. Limit on sodium absorption ratio of soil/waste layer post application	Sampling	Yes
21. Limits on levels of metals in soil	Sampling	Yes
22. Limits on levels of certain parameters in soil prior to expiry/surrender	Sampling	Yes

Purpose*: To discharge waste drilling cuttings, muds and fluids from wells drilled with water based muds and waste drilling cuttings from wells drilled with synthetic based muds from hydrocarbon exploration and production operations onto and into land. (Spence Road Landfarm)*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
23. Limit on levels of hydrocarbons in soil prior to expiry/surrender	Sampling	Yes
24. Provision for review	Not exercised	N/A
Overall assessment of environmental performance in respect of this consent		**High**
Overall assessment of administrative performance in respect of this consent		**High**

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

Table 22 Evaluation of performance in respect of consent 5734-1

Purpose*: To discharge waste drilling cuttings, muds and fluids from wells drilled with water based muds and waste drilling cuttings from wells drilled with synthetic based muds from hydrocarbon exploration and production operations onto and into land. Kauri A*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Definitions	Abide by the conditions, inspection and records	N/A
2. Best practicable option to be adopted	Inspections and liaison with consent holder	Yes
3. Notification of Council prior to any discharge	Notification received	Yes
4. Separate disposal areas		Not applicable in this period
5. Records to be kept and made available to Council	Notification received	Not applicable in this period
6. Waste generated in Taranaki Region	Consent holder's records	Yes
7. Discharge limit water courses	Inspection and consent holder's records	Yes
8. No destabilisation of neighbouring land	Inspection	Yes
9. Discharge rate	Inspection	Not assessed in this period
10. Maximum 5% Hydrocarbon in soil	Inspection	Not assessed in this period
11. Limit on electroconductivity of soil/waste layer post application	Inspection	Yes

Purpose*: To discharge waste drilling cuttings, muds and fluids from wells drilled with water based muds and waste drilling cuttings from wells drilled with synthetic based muds from hydrocarbon exploration and production operations onto and into land. Kauri A*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
12. Limit on sodium absorption ratio of soil/waste layer post application	Inspection and consent holder's records	Yes
13. Maximum chloride application	Inspection and consent holder's records	Not assessed in this period
14. Maximum nitrogen rate	Inspection	Not assessed in this period
15. Limits on levels of certain parameters in soil prior to expiry/surrender	Inspection and sample analysis	Yes
16. Limits on levels of metals in soil	Sample analysis undertaken	Yes
17. Limit on level of total dissolved salts in surface or groundwater	No groundwater monitoring wells	Not assessed
18. Limits on levels of certain parameters in soil prior to expiry/surrender	Soil sampling	Yes
19. Discharge shall be tilled and resown to pasture as soon as practicable	Sampling	Yes
20. Exercise of this consent shall not be liable to contaminating a water body	No surface water in the direct locality	Yes
21. Exercise of consent shall cause adverse effects in aquatic ecosystems		Not assessed in this period
22. Provision for review		Not required
Overall assessment of environmental performance in respect of this consent		**High**
Overall assessment of administrative performance in respect of this consent		**High**

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

Ratings are as defined in Section 1.1.4

6.4 Recommendations from the 2014-2015 Annual Report

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

1. THAT monitoring of consented activities at the Geary landfarm in the 2015-2016 year be amended from that undertaken in 2014-2015, Origin Energy / AR Geary will submit the site for surrender.

2. THAT monitoring of consented activities at the Schrider landfarm in the 2015-2016 year be amended from that undertaken in 2014-2015, Origin Energy will submit the site for surrender.

3. THAT monitoring of the consented activities at the Spence Road landfarm in the 2015-2016 monitoring year continue inline with the 2014-2015 monitoring programme, unless Origin Energy supply sufficient evidence to suggest that the areas of land which have been utilised for the practice of landfarming have met the conditional value for surrender. Note: additional validation soil sampling is required to check a slight variation in the Origin Energy and the Council soil analysis.

   The recommendations above were implemented during the 2015-2016 monitoring year.

7. Recommendations

7.1 Alterations to monitoring programmes for 2016-2017

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

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

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

The monitoring programmes for all four sites are no longer required as all of the applicable consents have been surrendered.

Therefore for the 2016-2017 year it is recommended that no further monitoring of these sites be routinely programed

8. Recommendations

1. THAT the routine monitoring of consented activities at Origin Energy Ltd landfarms of Schrider, Spence and Kauri A be discontinued in the 2016-2017 monitoring year

2. THAT the routine monitoring of consented activities at AR Geary landfarm be discontinued in the 2016-2017 monitoring year.

Glossary of common terms and abbreviations

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

As*	Arsenic.
Bund	A wall around a tank to contain its contents in the case of a leak.
cfu	Colony forming units. A measure of the concentration of bacteria usually expressed as per 100 millilitre sample.
Conductivity	Conductivity, an indication of the level of dissolved salts in a sample, usually measured at 20°C and expressed in mS/m.
Cu*	Copper.
Cumec	A volumetric measure of flow- 1 cubic metre per second (1 m^3s^{-1}).
DO	Dissolved oxygen.
DRP	Dissolved reactive phosphorus.
Fresh	Elevated flow in a stream, such as after heavy rainfall.
$g/m^2/day$	grams/metre^2/day.
g/m^3	Grams per cubic metre, and equivalent to milligrams per litre (mg/L). In water, this is also equivalent to parts per million (ppm), but the same does not apply to gaseous mixtures.
Incident	An event that is alleged or is found to have occurred that may have actual or potential environmental consequences or may involve non-compliance with a consent or rule in a regional plan. Registration of an incident by the Council does not automatically mean such an outcome had actually occurred.
Intervention	Action/s taken by Council to instruct or direct actions be taken to avoid or reduce the likelihood of an incident occurring.
Investigation	Action taken by Council to establish what were the circumstances/events surrounding an incident including any allegations of an incident.
Incident register	The Iincident register contains a list of events recorded by the Council on the basis that they may have the potential or actual environmental consequences that may represent a breach of a consent or provision in a Regional Plan.
L/s	Litres per second.
m^2	Square Metres.
MCI	Macroinvertebrate community index; a numerical indication of the state of biological life in a stream that takes into account the sensitivity of the taxa present to organic pollution in stony habitats.
mS/m	Millisiemens per metre.
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.
Resource consent	Refer Section 87 of the RMA. Resource consents include land use consents (refer Sections 9 and 13 of the RMA), coastal permits (Sections 12, 14 and 15), water permits (Section 14) and discharge permits (Section 15).
RMA	*Resource Management Act 1991* and including all subsequent amendments.
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.

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Taranaki Regional Council, 2008: A R Geary Monitoring Programme Annual Report 2006-2007. Technical Report 2007-65.

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Schrider Landfarm

Taranaki Regional Council, 2005: Swift Energy New Zealand Limited, Schrider Landfarm Monitoring Programme Annual Report 2004-2005. Technical Report 2005-01.

Taranaki Regional Council, 2006: Swift Energy New Zealand Limited, Schrider Landfarm Monitoring Programme Annual Report 2005-2006. Technical Report 2006-27.

Taranaki Regional Council, 2008: Swift Energy New Zealand Limited, Schrider Landfarm Monitoring Programme Annual Report 2006-2007. Technical Report 2007-64.

Taranaki Regional Council, 2009: Origin Energy Resources New Zealand Limited, Schrider Landfarm Monitoring Programme Annual Report 2007-2008. Technical Report 2008-89.

Spence Road Landfarm

Taranaki Regional Council, 2006: Swift Energy NZ Limited Kauri C Land Treatment Monitoring Programme Biennial Report 2004-2006. Technical Report 2006-82.

Taranaki Regional Council, 2008: Swift Energy NZ Limited Kauri C Land Treatment Monitoring Programme Annual Report 2006-2007. Technical Report 2007-60.

Taranaki Regional Council, 2009: Origin Energy Resources New Zealand Limited, Spence Road (Kauri C) Landfarm Monitoring Programme Annual Report 2007-2008. Technical Report 2008-87.

Kauri A landfarm

BTW Surveyors Ltd, 2003: Kauri Te Pakakohi A- Disposal Sites Monitoring Report for Swift Energy New Zealand Ltd

Appendix I

Resource consents held by Origin Energy Resources NZ Limited and AR Geary

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

Discharge Permit

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

Name of Consent Holder:	AR Geary Geary Road R D 2 PATEA
Change To Conditions Date:	16 June 2003 [Granted: 28 May 1998]

Conditions of Consent

Consent Granted:	To discharge: drilling mud, fluids and cuttings from well drilling operations with water based muds; drilling cuttings from wells drilled with synthetic based muds; and oily waste material from hydrocarbon exploration and production activities; onto and into land at or about GR: Q21:288-681
Expiry Date:	1 June 2016
Review Date(s):	June 2003, June 2004, June 2006, June 2010
Site Location:	Geary Road, Manutahi, Patea
Legal Description:	Road Reserve, Lot 2 DP 5346 Pt Sec 485 Lots 1, 9, 10, 13 DP 14551 Patea Dist Blk I Carlyle SD
Catchment:	Waikaikai

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

General conditions

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

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

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

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

Special conditions

1. The exercise of this consent shall be undertaken generally in accordance with the documentation submitted in support of applications 1816 and 2049 and 2405 and to ensure that the conditions of this consent are met at all times.

2. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects on the environment from the exercise of this consent.

3. The consent holder shall notify the Taranaki Regional Council in writing at least 48 hours prior to commencement of each operation involving transfer of wastes from a drilling waste holding receptacle, to the disposal property for discharge onto or into land via stockpiling, spreading, tilling, and/or layering.

4. The consent holder shall notify the Taranaki Regional Council in writing at least 12 hours prior to discharging stockpiled material onto or into land [for the purpose of this condition ‘discharging’ means spreading, tilling or layering].

5. Prior to disposal of wastes with hydrocarbon content equal or greater than 5%, the consent holder shall provide the Chief Executive, Taranaki Regional Council, with a chemical analysis of the wastes, including the results of leachate testing.

6. The consent holder shall ensure that areas for the stockpiling and disposing onto and into land of water based drilling wastes are kept separate and distinct from areas utilised for the stockpiling and disposing onto and into land of cuttings from wells drilled with synthetic based muds which in turn are kept separate from areas for the stockpiling and disposing onto and into land of oily wastes. Further, disposal areas for individual wells shall also be kept separate and distinct. For the purpose of this consent condition ‘disposing’ means spreading, tilling or layering.

7. The consent holder shall keep records of the following:

   - wastes from each individual well [including records of all additives used at the wellsite during the drilling process];
   - stockpiling area[s];
   - disposal area[s];
   - composition of material [including concentrations of nitrogen, chloride and hydrocarbons];
   - volumes of material stockpiled;
   - volumes of material disposed;
   - date of commencement and completion of stockpiling events;
   - dates and times of commencement and completion of discharge events [including stockpiling and/or disposal]; and
   - treatments applied;

   and shall make the records available to the Chief Executive, Taranaki Regional Council upon request.

8. The exercise of this consent is limited to wastes generated within the Taranaki region.

9. No discharge [including but not limited to stockpiling on land and/or application onto or into land] shall take place within 25 metres of surface water or property boundaries.

10. The exercise of this consent shall not result in the destabilisation of neighbouring land.

11. The rate of discharge onto or into land via spreading, tilling or layering shall be limited to an application depth of 150 mm for waste solids with hydrocarbon content less than 5%, or, if hydrocarbon content of waste solids is equal or greater than 5% the application depth shall be limited to 50 mm of waste solids.

12. The hydrocarbon content in the waste prior to disposal onto or into land via spreading, tilling or layering, at the site shall be less than 5%, or, if hydrocarbon level in the waste is equal or greater than 5% the waste to be incorporated into the soil so that the hydrocarbon content in the soil/waste mix shall be less than 5% anywhere in the surface 250 mm of soil after mixing.

13. The electroconductivity of the soil/waste layer after disposal [for the purpose of this condition 'disposal' means spreading, tilling or layering but excludes stockpiling] shall be less than 400 mSm^{-1}, or alternatively, if the background soil electroconductivity exceeds 400 mSm^{-1}, the disposal of waste shall not increase the soil electroconductivity within the upper 20 cm by more than 100 mSm^{-1}.

14. The sodium absorption ratio [SAR] of the soil/waste layer after disposal [for the purpose of this condition 'disposal' means spreading, tilling or layering but excludes stockpiling] shall be less than 18.0, or alternatively if the background soil SAR exceeds 18.0, the disposal of waste shall not increase the SAR by more than 1.0.

15. The maximum rate of chloride application after disposal [for the purpose of this condition 'disposal' means spreading, tilling or layering, but excludes stockpiling] into the soil shall not exceed 800 kg Cl/ha/year.

16. The maximum rate of nitrogen application after disposal [for the purpose of this condition 'disposal' means spreading, tilling or layering, but excludes stockpiling] to the soil shall not exceed 200 kg N/ha/year.

17. Prior to the expiry, cancellation, or surrender of this consent the levels of hydrocarbons in the soil shall comply with the guideline values for sandy soil in the surface layer [less than 1 metre depth] 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].

18. At any time the levels of metals in the soil shall comply with the guidelines for heavy metals in soil set out in the Department of Health's Guidelines for the Disposal of Sewerage Sludge to Land [1992].

19. As far as is practicable the consent holder shall adopt the best practicable option, and in any case prior to the expiry, cancellation, or surrender of this consent, to ensure that the exercise of this consent shall not result in a level of total dissolved salts within any surface or groundwater of more than 2500 gm^{-3}.

20. Prior to the expiry, cancellation, or surrender of this consent soil levels will not exceed the following limits: conductivity, 290 mSm^{-1}; total dissolved salts, 2500 gm^{-3}; sodium, 460 gm^{-3}; and chloride, 700 gm^{-3}.

21. As soon as practicable following completion of disposal of material as authorised by this consent, the consent holder shall till and resow the areas into pasture [or into crop] following completion of each application. If revegetation can not be established within two months of the disposal, the consent holder shall undertake appropriate land stabilisation measures to minimise wind and/or stormwater erosion.

22. The exercise of this consent, including the design, management and implementation of the discharge [including but not limited to stockpiling on land and/or disposal onto or into land] shall not lead or be liable to lead to contaminants entering a surface water body by direct surface overland flow.

23. The exercise of this consent shall not result in any adverse impacts on groundwater as a result of leaching, or on surface water including aquatic ecosystems, and/or result in a change to the suitability of use of the receiving water as determined by the Chief Executive, Taranaki Regional Council.

24. The stockpiling of material authorised by this consent shall be limited to a maximum volume of 5000 cubic metres at any one time on the property. In any case all stockpiled material must be disposed onto and into land within two months of being brought onto the site [for the purpose of this condition 'disposed' means spreading, tilling or layering].

25. The discharges authorised by this consent shall not give rise to suspended or deposited dust at or beyond the boundary of the site that, in the opinion of at least one enforcement officer of the Taranaki Regional Council, is offensive or objectionable. For the purpose of this condition, discharges in excess of the following limits are deemed to be offensive or objectionable:

    a) dust deposition rate 0.13 g/m^2/day; and/or
    b) suspended dust level 0.15 mg/m^3.

26. The discharges authorised by this consent shall not give rise to an odour at or beyond the boundary of the site that, in the opinion of at least one enforcement officer of the Taranaki Regional Council, is offensive or objectionable.

27. 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 2003 and/or June 2004 and/or June 2006 and/or June 2010, 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 16 June 2003

For and on behalf of
Taranaki Regional Council

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Chief Executive

Discharge Permit

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

Name of Consent Holder:	Origin Energy Resources NZ [Rimu] Limited Private Bag 2022 NEW PLYMOUTH 4342
Change To Conditions Date:	20 February 2003 [Granted: 1 December 2000]

Conditions of Consent

Consent Granted:	To discharge drilling mud, fluids and cuttings from well drilling operations with water based muds, and to discharge drilling cuttings from wells drilled with synthetic based muds onto and into land at or about (NZTM) 1719755E-5604273N
Expiry Date:	1 June 2022
Review Date(s):	June 2004, June 2010, June 2016
Site Location:	Kauri-A disposal site, Adjacent to Kauri Te Pakakohi-A Wellsite, Lower Ball Road, Kakaramea [Property owner: MJ & RD Le Prou; M & P Stevenson; MJ & BJ Stevenson]
Legal Description:	Lot 4 DP 14552 Blk I Carlyle SD
Catchment:	Mangaroa

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

General conditions

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

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

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

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

Special conditions

1. The exercise of this consent shall be undertaken generally in accordance with the documentation submitted in support of the application and to ensure that the conditions of this consent are met at all times.

2. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects on the environment from the exercise of this consent.

3. The consent holder shall notify the Taranaki Regional Council in writing at least 48 hours prior to commencement of each discharge operation at the site.

4. The consent holder shall ensure that areas for the disposal of water based drilling wastes are kept separate and distinct from areas utilised for the disposal of cuttings from wells drilled with synthetic based muds. Further, disposal areas for individual wells shall also be kept separate and distinct.

5. The consent holder shall keep records of the wastes from each individual well [including records of all additives used at the wellsite during the drilling process], the disposal area[s], composition [including concentrations of nitrogen, chloride and hydrocarbons] and volumes of material discharged, times of discharge events, and treatments applied, and shall make the records available to the Chief Executive, Taranaki Regional Council upon request.

6. The exercise of this consent is limited to wastes generated within the Taranaki region.

7. No discharge shall take place within 25 metres of surface water or property boundaries.

8. The exercise of this consent shall not result in the destabilisation of neighbouring land.

9. The rate of discharge shall be limited to an application depth of 50 mm of waste solids.

10. The hydrocarbon content in the waste prior to application shall be no more than 5%, or alternatively, if the hydrocarbon level in the waste is more than 5% the waste will be tilled within 7 days following application so that the hydrocarbon content in the soil waste mix shall be less than 5% in the surface 250 mm of soil after mixing.

11. The electroconductivity of the soil/waste layer after application shall be less than 400 mSm^{-1}, or alternatively, if the background soil electroconductivity exceeds 400 mSm^{-1}, the application of waste shall not increase the soil electroconductivity within the upper 20 cm by more than 100 mSm^{-1}.

12. The sodium absorption ratio [SAR] of the soil/waste layer after application shall be less than 18.0, or alternatively of the background soil SAR exceeds 18.0, the application of waste shall not increase the SAR by more than 1.0.

13. The maximum rate of chloride application after discharge into the soil shall not exceed 800 kg Cl/ha/year.

14. The maximum rate of nitrogen application after discharge to the soil shall not exceed 200 kgN/ha/year.

15. Prior to the expiry, cancellation, or surrender of this consent the levels of hydrocarbons in the soil shall comply with the guideline values for sandy soil in the surface layer [less than 1 metre depth] 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, 1997].

16. The levels of metals in the soil shall comply with the guidelines for heavy metals in soil set out in the Department of Health's Guidelines for the Disposal of Sewerage Sludge to Land [1992].

17. The exercise of this consent shall not result in a level of total dissolved salts within any surface or groundwater of more than 2500 gm^{-3}.

18. Prior to the expiry, cancellation, or surrender of this consent soil levels will not exceed the following limits: conductivity, 290 mSm^{-1}; total dissolved salts, 2500 gm^{-3}; sodium, 460 gm^{-3}; and chloride, 700 gm^{-3}.

19. The discharge area shall be tilled and resown to pasture [or into crop] as soon as practicable following completion of the discharge.

20. The exercise of this consent, including the design, management and implementation of the discharge, shall not lead or be liable to lead to contaminants entering a surface water body.

21. The exercise of this consent shall not result in any adverse impacts on groundwater as a result of leaching, or on surface water including aquatic ecosystems, and/or result in a change to the suitability of use of the receiving water as determined by the Chief Executive, Taranaki Regional Council.

22. 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 2004 and/or June 2010 and/or 2016, 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.

Transferred at Stratford on 1 December 2008

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:	Origin Energy Resources NZ (Rimu) Limited Sustainability Manager Private Bag 2022 New Plymouth 4342
Decision Date (Change):	28 August 2015
Commencement Date (Change):	28 August 2015 Granted Date: 07 December 2001

Conditions of Consent

Consent Granted:	To discharge drilling waste and associated oily waste from the former storage cells on the site onto and into the land.
Expiry Date:	01 June 2016
Site Location:	Kauri-C wellsite, Spence Road, Kakaramea
Legal Description:	Lot 1 DP 3758 Secs 486 & 680 Pt Sec 461 SBDNS 4 & 5 of Sec 637 (site of discharge)
Grid Reference (NZTM)	1722010E - 5601830N
Catchment:	Kaikura

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. Discharge shall only occur within the area shown in Appendix 1 attached.

2. For the purposes of this consent the following definitions shall apply:

    a) stockpiling means a discharge of drilling wastes from vehicles, tanks, or other containers onto land, but without subsequently spreading, or incorporating the discharged material into the soil within 24 hours; and
    b) landfarming means the discharge of drilling waste onto land, subsequent spreading and incorporation into the soil, and includes any stripping and relaying of topsoil.

3. The consent holder shall adopt the best practicable option [as defined section 2 of the Resource Management Act 1991] to prevent or minimise any actual or potential effects on the environment arising from the discharge.

Management plan, notification, monitoring and reporting

4. The consent holder shall maintain, to the written satisfaction of the Chief Executive, Taranaki Regional Council, a management plan to confirm that the activity will be conducted to comply with all of the conditions of this consent. The management plan shall include as a minimum:

    a) procedures for notification to Taranaki Regional Council of disposal activities;
    b) procedures for the receipt and stockpiling of drilling wastes onto the site;
    c) methods used for the mixing and testing of different waste types;
    d) procedures for landfarming drilling wastes [including means of transfer from stockpiling area, means of spreading, and incorporation into the soil];
    e) procedures for sowing landfarmed areas;
    f) contingency procedures;
    g) sampling regime and methodology;
    h) post-landfarming management, monitoring and site reinstatement; and
    i) control of site access.

5. The consent holder shall notify the Chief Executive, Taranaki Regional Council, [by emailing worknotification@trc.govt.nz.] at least 48 hours prior to permitting drilling wastes onto the site for stockpiling, from each well drilled. Notification shall include the following information:

    a) the consent number;
    b) the name of the well[s] from which the waste was generated;
    c) the type of waste to be stockpiled;
    d) the volume of waste to be stockpiled; and

e) for oily wastes the concentration of total petroleum hydrocarbons [C_6-C_9, C_{10}-C_{14}, and C_{15}-C_{36}], polycyclic aromatic hydrocarbons [PAH], and benzene, toluene, ethylbenzene and xylenes [BTEX].

6. The consent holder shall notify the Chief Executive, Taranaki Regional Council, [by emailing worknotification@trc.govt.nz.] at least 48 hours prior to landfarming stockpiled material. Notification shall include the following information:

a) the consent number;
b) the name of the well[s] from which the waste was generated;
c) the type of waste to be landfarmed;
d) the volume and weight of the waste to be landfarmed;
e) the concentration of chlorides, nitrogen and total petroleum hydrocarbons in the waste; and
f) the specific location and area over which the waste will be landfarmed.

7. The consent holder shall keep records of the following:

a) wastes from each individual well [including records of all additives used at the wellsite during the drilling process];
b) composition of wastes [including concentrations of chloride, nitrogen and total petroleum hydrocarbons];
c) stockpiling area[s];
d) volumes of material stockpiled
e) landfarming area[s], including a map showing individual disposal areas with GPS co-ordinates;
f) volumes and weights of wastes landfarmed;
g) dates of commencement and completion of stockpiling and landfarming events;
h) dates of sowing landfarmed areas;
i) treatments applied;
j) details of monitoring, including sampling locations, sampling methods and the results of analysis;

and shall make the records available to the Chief Executive, Taranaki Regional Council.

Discharge limits

8. For the purposes of landfarming, drilling wastes shall be applied to land in a layer not exceeding:

a) 100 mm thick for wastes with a hydrocarbon concentration less than 50,000 mg/kg dry weight; or
b) 50 mm thick for wastes with a hydrocarbon concentration equal to or greater than 50,000 mg/kg dry weight; and
c) in a rate and manner such that no ponded liquids remain after one hour, for all wastes;

prior to incorporation into the soil.

9. As soon as practicable following the application of drilling wastes to land in accordance with condition 8 of this consent, the consent holder shall incorporate the wastes into the soil to a depth of at least 250 mm, so that the hydrocarbon concentration in the soil/waste mix is less than:

    a) 50,000 mg/kg dry weight , anywhere in the 250 mm layer below the topsoil layer, for water based drilling wastes and drilling cuttings from wells drilled with synthetic based muds; or
    b) 15,000 mg/kg dry weight, anywhere in the 250 mm layer below the topsoil layer, for oily wastes, or drilling cuttings from wells drilled with oil based muds.

Operational requirements

10. No discharge shall take place within 25 metres of surface water or property boundaries, or within 6 horizontal metres of the existing gas pipelines.

11. The exercise of this consent is limited to wastes generated within the Taranaki region.

12. The exercise of this consent shall not result in the destabilisation of neighbouring land.

13. All material must be landfarmed as soon as practicable, but no later than twelve months after being brought onto the site.

14. As soon as practicable following landfarming, areas shall be sown into pasture [or into crop]. The consent holder shall monitor revegetation and if adequate establishment is not achieved within two months of sowing, shall undertake appropriate land stabilisation measures to minimise wind and stormwater erosion.

Receiving environment limits - water

15. The exercise of this consent, including the design, management and implementation of the discharge, shall not lead or be liable to lead to contaminants entering a surface water body.

16. The exercise of the resource consent shall not result in any adverse impacts to groundwater as a result of leaching, and surface water including aquatic ecosystems, and/or result in a change to the suitability of use of the receiving water as determined by the Chief Executive, Taranaki Regional Council.

17. The discharge shall not give rise to any of the following effects in the adjacent surface water body of the Kaikura Stream:

    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.

18. The exercise of this consent shall not result in a level of total dissolved salts within any surface or groundwater of more than 2500 gm-3.

Receiving environment limits - soil

19. The conductivity of the soil/waste layer after application shall be less than 400 mSm-1, or alternatively, if the background soil conductivity exceeds 400 mSm-1, the application of waste shall not increase the soil conductivity within the upper 20 cm by more than 100 mSm-1.

20. The sodium absorption ratio [SAR] of the soil/waste layer after application shall be less than 18.0, or alternatively if the background soil SAR exceeds 18.0, the application of waste shall not increase the SAR by more than 1.0.

21. At any time the levels of metals in the soil shall comply with the guidelines for heavy metals in soil set out in Table 7.1, Section 7 of the Ministry for the Environment and New Zealand Water & Wastes Association's Guidelines for the safe application of biosolids to land in New Zealand [2003].

22. At the time of expiry, cancellation, or surrender of this consent soil levels shall not exceed the following limits: conductivity, 290 mSm-1; total soluble salts, 2500 mg/kg; sodium, 460 mg/kg; and chloride, 700 mg/kg.

23. At the time of expiry, cancellation, or surrender of this consent the levels of hydrocarbons in the soil shall comply with the guideline values for sandy soil in the surface layer [less than 1 metre depth] 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].

Review

24. 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 2010 and/or June 2012, 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 28 August 2015

For and on behalf of
Taranaki Regional Council

_____

A D McLay
Director - Resource Management

Discharge Permit

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

Name of Consent Holder:	Origin Energy Resources NZ [Rimu] Limited Private Bag 2022 NEW PLYMOUTH 4342
Change To Conditions Date:	10 February 2010 [Granted: 6 March 2003]

Conditions of Consent

Consent Granted:	To discharge drilling cuttings and fluids from drilling operations with water based muds, drilling cuttings from wells drilled with synthetic based muds, drilling cuttings from wells drilled with oil based muds, and oily wastes, onto and into land via land farming at or about (NZTM) 1719054E-5605073N
Expiry Date:	1 June 2022
Review Date(s):	June 2010, June 2012, June 2016
Site Location:	Kauri-F wellsite, Corner of Lower Manutahi Road and Lower Taumaha Road [both unformed], Manutahi [Property owners: N Schrider & P Campbell]
Legal Description:	Road Reserve & Lot 3 DP 14551 & Lot 8 DP 14552 Blk I Carlyle SD
Catchment:	Waikaikai

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 [the Council] all the administration, monitoring and supervision costs of this consent, fixed in accordance to section 36 of the Resource Management Act.

Special conditions

1. For the purposes of this consent the following definitions shall apply:

    a) stockpiling means a discharge of drilling wastes from vehicles, tanks, or other containers onto land, but without subsequently spreading, or incorporating the discharged material into the soil within 24 hours; and
    b) landfarming means the discharge of drilling waste onto land, subsequent spreading and incorporation into the soil, and includes any stripping and relaying of topsoil.

2. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects on the environment from the exercise of this consent.

Notification and sampling requirements prior to discharge

3. The consent holder shall notify the Chief Executive, Taranaki Regional Council, [by emailing worknotification@trc.govt.nz.] at least 48 hours prior to permitting drilling wastes onto the site for stockpiling, from each well drilled. Notification shall include the following information:

    a) the consent number;
    b) the name of the well[s] from which the waste was generated;
    c) the type of waste to be stockpiled; and
    d) the volume of waste to be stockpiled.

4. The consent holder shall notify the Chief Executive, Taranaki Regional Council, [by emailing worknotification@trc.govt.nz.] at least 48 hours prior to landfarming stockpiled material. Notification shall include the following information:

    a) the consent number;
    b) the name of the well[s] from which the waste was generated;
    c) the type of waste to be landfarmed;
    d) the volume and weight of the waste to be landfarmed;
    e) the concentration of chlorides, nitrogen and total petroleum hydrocarbons hydrocarbons in the waste;
    f) for oily wastes the concentration of total petroleum hydrocarbons [C6-C9, C10-C14, and C15-C36], polycyclic aromatic hydrocarbons [PAH], and benzene, toluene, ethylbenzene and xylenes [BTEX]; and
    g) the specific location and area over which the waste will be landfarmed.

5. Prior to discharge/disposal of drilling cuttings from wells drilled with oil based muds from any well, the consent holder shall provide the Chief Executive, Taranaki Regional Council:

   a) information on location of discharge area;
   b) records of all additives used during the drilling process;
   c) a representative chemical analysis of the material to be discharged from each well [from a composite sample, including: concentrations of nitrogen, chloride, pH, K, Ca, Mg, Na, total petroleum hydrocarbon [TPH] composition in the ranges C_6-C_9, C_{10}-C_{14} and C_{15}-C_{36}, polynuclear aromatic hydrocarbon [PAH] composition, density, and BTEX]; and
   d) results of leachate testing.

Discharge Limits

6. For the purposes of landfarming, drilling wastes shall be applied to land in a layer not exceeding:

   a) 100 mm thick for wastes with a hydrocarbon concentration less than 50,000 mg/kg dry weight; or
   b) 50 mm thick for wastes with a hydrocarbon concentration equal to or greater than 50,000 mg/kg dry weight;
   c) 20 mm thick for drilling cuttings from wells drilled with oil based muds [once mixed 1:1 with an absorbent material such as sawdust] regardless of the hydrocarbon concentration; and
   d) in a rate and manner such that no ponded liquids remain after one hour, for all wastes;

   prior to incorporation into the soil.

7. As soon as practicable following the application of drilling wastes to land in accordance with condition 6 of this consent, the consent holder shall incorporate the wastes into the soil to a depth of at least 250 mm, so that the hydrocarbon concentration in the soil/waste mix is less than:

   a) 50,000 mg/kg dry weight , anywhere in the 250 mm layer below the topsoil layer, for water based drilling wastes and drilling cuttings from wells drilled with synthetic based muds; or
   b) 15,000 mg/kg dry weight, anywhere in the 250 mm layer below the topsoil layer, for oily wastes, or drilling cuttings from wells drilled with oil based muds.

Operational requirements

8. As soon as practicable following landfarming, areas shall be sown into pasture [or into crop]. The consent holder shall monitor revegetation and if adequate establishment is not achieved within two months of sowing, shall undertake appropriate land stabilisation measures to minimise wind and stormwater erosion.

9. The consent holder shall ensure that areas used for the stockpiling and disposal of water based drilling wastes are kept separate and distinct from areas utilised for the stockpiling and disposal of cuttings from wells drilled with synthetic based muds. Further, stockpile and disposal areas for individual wells shall also be kept separate and distinct. For the purpose of this consent condition 'disposal' means spreading, tilling or layering.

10. The consent holder shall ensure that areas for the disposal of oily wastes and drilling cuttings from wells drilled with oil based muds are kept separate and distinct, with either a buffer or bunding, from areas utilised for the stockpiling and disposal of wastes from wells drilled with water based mud and/or cuttings from wells drilled with synthetic based muds.

11. No discharge shall take place within 25 metres of surface water or property boundaries [with the exception of the northwest property boundary where discharge may take place right up to that boundary], or within 6 horizontal metres of the existing gas pipelines.

12. The exercise of this consent is limited to wastes generated within the Taranaki region.

13. The stockpiling of material authorised by this consent shall be limited to a maximum volume of 2000 cubic metres at any one time on the property. In any case all stockpiled material must be landfarmed within eight months of being brought onto the site.

14. There shall be no stockpiling of oily wastes, or drilling cuttings from wells drilled with oil based muds.

15. The discharge of drilling cuttings from wells drilled with oil based muds, is limited, in the first instance, to wastes generated at the Manutahi-A, Manutahi-B, Manutahi-C, Manutahi-D, Manutahi-G, and Kauri-C wellsites. The discharge of wastes from other wells drilled with oil based muds shall not be allowed until such time that the Chief Executive, Taranaki Regional Council, has received all information required under special conditions 5 and 30, and considered the need for a review under special condition 31.

16. The area used for disposal of drilling cuttings from wells drilled with oil based muds is limited to 10,000 square metres per well.

17. The maximum rate of nitrogen application [excluding stockpiling] shall not exceed 200 kg/ha.

18. The exercise of this consent shall not result in the destabilisation of neighbouring land.

Receiving environment limits - soil

19. The conductivity of the soil/waste layer after landfarming shall be less than 400 mSm^{-1}, or alternatively, if the background soil conductivity exceeds 400 mSm^{-1}, the application of waste shall not increase the soil conductivity by more than 100 mSm^{-1}.

20. The sodium absorption ratio [SAR] of the soil/waste layer containing the discharge shall be less than 18.0, or alternatively if the background soil SAR exceeds 18.0, the application of waste shall not increase the SAR by more than 1.0.

21. At any time the levels of metals in the soil shall comply with the guidelines for heavy metals in soil set out in Table 7.1, Section 7 of the Ministry for the Environment and New Zealand Water & Wastes Assoication's Guidelines for the Disposal for the safe application of biosolids to land in New Zealand [2003].

22. At the time of expiry, cancellation, or surrender of this consent the levels of hydrocarbons in the soil shall comply with the guideline values for sandy soil in the surface layer [less than 1 metre depth] 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].

23. At the time of expiry, cancellation, or surrender of this consent soil levels shall not exceed the following limits: conductivity, 290 mSm^{-1}; total soluble salts, 2500 mg/kg; sodium, 460 mg/kg; and chloride, mg/kg.

Receiving environment limits - water

24. The exercise of this consent shall not result in a level of total dissolved salts within any surface water or groundwater of more than 2500 gm^{-3}.

25. The exercise of this consent, including the design, management and implementation of the discharge [including but not limited to stockpiling on land and/or discharge onto and into land], shall not lead or be liable to lead to contaminants entering a surface water body by direct surface overland flow.

26. The exercise of this consent shall not result in any adverse impacts on groundwater as a result of leaching, or on surface water including aquatic ecosystems, and/or result in a change to the suitability of use of the receiving water as determined by the Chief Executive, Taranaki Regional Council.

27. The exercise of this consent shall not result in any of the following effects on surface water:

    a) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended material;
    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.

Receiving environment limits - air

28. The discharges authorised by this consent shall not give rise to suspended or deposited dust at or beyond the boundary of the site that, in the opinion of at least one enforcement officer of the Taranaki Regional Council, is offensive or objectionable. For the purpose of this condition, discharges in excess of the following limits are deemed to be offensive or objectionable:

    a) dust deposition rate 0.13 $g/m^2/day$; and/or
    b) suspended dust level 0.15 mg/m^3.

29. The discharges authorised by this consent shall not give rise to an odour at or beyond the boundary of the site that, in the opinion of at least one enforcement officer of the Taranaki Regional Council, is offensive or objectionable.

Monitoring and reporting

30. The consent holder shall keep records of the following:

a) wastes from each individual well [including records of all additives used at the wellsite during the drilling process]. For oily wastes, records shall include source, date collected, waste description and volume;
b) stockpiling area[s];
c) landfarming area[s], including a map showing individual disposal areas with GPS co-ordinates;
d) composition of material [including concentrations of nitrogen, chloride and total hydrocarbons];
e) PAH composition of oily wastes, and drilling cuttings from each well drilled with oil based muds;
f) volumes of material stockpiled;
g) volumes and weights of material landfarmed;
h) dates of commencement and completion of stockpiling and landfarming;
i) dates of sowing landfarmed areas;
j) treatments applied;
k) details of monitoring, including sampling locations, sampling methods and the results of analysis;

and shall make the records available to the Chief Executive, Taranaki Regional Council, upon request.

31. The consent holder shall collect and analyse a composite representative sample of the surface soil-waste layer [to a depth of 250 mm] on three occasions after the application drilling cuttings from wells drilled with oil based muds to land. The analysis shall include the analyses listed in condition 6. The three occasions shall be:

a) within one month of the discharge;
b) after three months, but before four months of the discharge; and
c) after six months but before eight months of the discharge.

The results of these analyses shall be provided to the Council within nine months of the exercise of this consent in respect of the disposal of oil based muds, cuttings and wastes from any one well.

Review

32. 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 consent, including the exclusion of drilling cuttings from wells drilled with oil based muds, by giving notice of review within three months of the receipt of any information required under condition 30.

33. 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 2010 and/or June 2012 and/or June 2016, 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 10 February 2010

For and on behalf of
Taranaki Regional Council

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Director-Resource Management

Appendix II

Additional required analysis

Hill Laboratories
BETTER TESTING BETTER RESULTS

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

Tel +64 7 858 2000
Fax +64 7 858 2001
Email mail@hill-labs.co.nz
Web www.hill-labs.co.nz

ANALYSIS REPORT

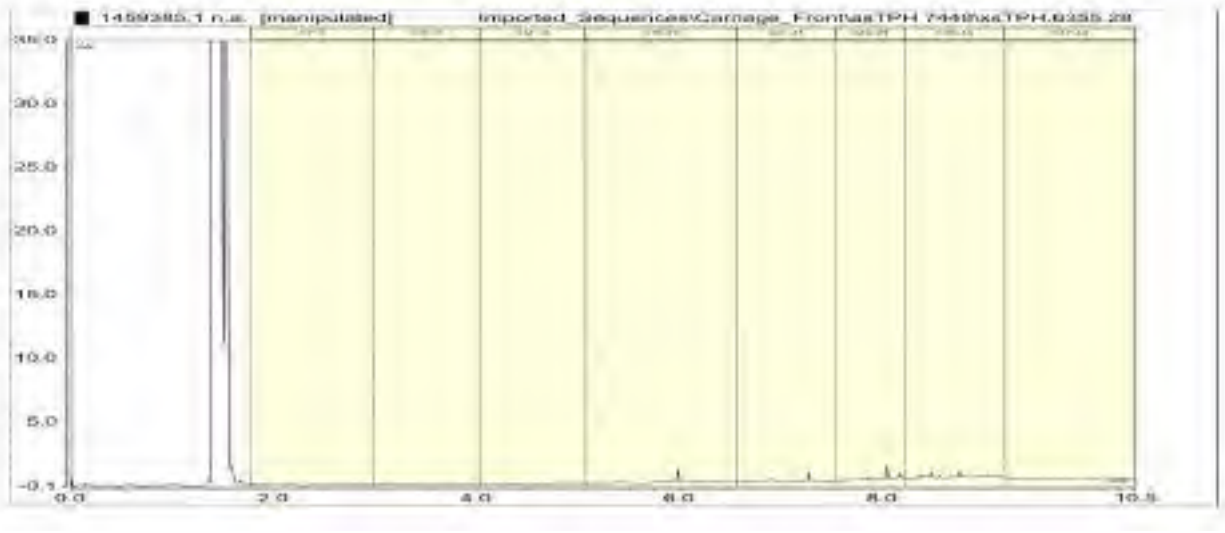
Client:	Taranaki Regional Council	**Lab No:**	1459385 SPv1
Contact:	Rae West	**Date Registered:**	06-Aug-2015
	C/- Taranaki Regional Council	**Date Reported:**	18-Aug-2015
	Private Bag 713	**Quote No:**	
	STRATFORD 4352	**Order No:**	
		Client Reference:	Spence Landfarm Additional Soils
		Submitted By:	Rae West

Sample Type: Soil

Sample Name:		S31 03-Aug-2015 12:00 pm	S11/S12 03-Aug-2015 11:30 am			
Lab Number:		1459385.1	1459385.2			
Individual Tests						
Dry Matter	g/100g as rcvd	86	88	-	-	-
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Recoverable Arsenic	mg/kg dry wt	< 2	< 2	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	-	-	-
Total Recoverable Chromium	mg/kg dry wt	13	13	-	-	-
Total Recoverable Copper	mg/kg dry wt	10	12	-	-	-
Total Recoverable Lead	mg/kg dry wt	1.3	1.7	-	-	-
Total Recoverable Nickel	mg/kg dry wt	9	10	-	-	-
Total Recoverable Zinc	mg/kg dry wt	56	54	-	-	-
BTEX in Soil by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.05	< 0.05	-	-	-
Toluene	mg/kg dry wt	< 0.05	< 0.05	-	-	-
Ethylbenzene	mg/kg dry wt	< 0.05	< 0.05	-	-	-
m&p-Xylene	mg/kg dry wt	< 0.10	< 0.10	-	-	-
o-Xylene	mg/kg dry wt	< 0.05	< 0.05	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	< 0.03	< 0.03	-	-	-
Acenaphthylene	mg/kg dry wt	< 0.03	< 0.03	-	-	-
Anthracene	mg/kg dry wt	< 0.03	< 0.03	-	-	-
Benzo[a]anthracene	mg/kg dry wt	< 0.03	< 0.03	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.03	< 0.03	-	-	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	< 0.03	< 0.03	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.03	< 0.03	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.03	< 0.03	-	-	-
Chrysene	mg/kg dry wt	< 0.03	< 0.03	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.03	< 0.03	-	-	-
Fluoranthene	mg/kg dry wt	< 0.03	< 0.03	-	-	-
Fluorene	mg/kg dry wt	< 0.03	< 0.03	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.03	< 0.03	-	-	-
Naphthalene	mg/kg dry wt	< 0.13	< 0.12	-	-	-
Phenanthrene	mg/kg dry wt	< 0.03	< 0.03	-	-	-
Pyrene	mg/kg dry wt	< 0.03	< 0.03	-	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 8	< 8	-	-	-
C10 - C14	mg/kg dry wt	< 20	< 20	-	-	-
C15 - C36	mg/kg dry wt	88	< 40	-	-	-

Sample Type: Soil						
Sample Name:	S31 03-Aug-2015 12:00 pm	S11/S12 03-Aug-2015 11:30 am				
Lab Number:	1459385.1	1459385.2				
Total Petroleum Hydrocarbons in Soil						
Total hydrocarbons (C7 - C36) mg/kg dry wt	88	< 70	-	-	-	

1459385.1
S31 03-Aug-2015 12:00 pm
Client Chromatogram for TPH by FID



SUMMARY OF METHODS

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

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-2
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	0.10 - 4 mg/kg dry wt	1-2
BTEX in Soil by Headspace GC-MS	Solvent extraction, Headspace GC-MS analysis US EPA 8260B. Tested on as received sample [KBIs:5782,26687,3629]	0.05 - 0.10 mg/kg dry wt	1-2
Polycyclic Aromatic Hydrocarbons Screening in Soil	Sonication extraction, Dilution or SPE cleanup (if required), GC-MS SIM analysis (modified US EPA 8270). Tested on as received sample. [KBIs:5786,2805,2695]	0.010 - 0.05 mg/kg dry wt	1-2
Total Petroleum Hydrocarbons in Soil*	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	1-2
TPH + PAH + BTEX profile	Sonication extraction, SPE cleanup, GC & GC-MS analysis	0.010 - 60 mg/kg dry wt	1-2
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. US EPA 3550. (Free water removed before analysis).	0.10 g/100g as rcvd	1-2
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1-2

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

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

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Ara Heron BSc (Tech)
Client Services Manager - Environmental Division

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ANALYSIS REPORT

Client:	Taranaki Regional Council	**Lab No:**	1464337	SPv1
Contact:	Nathan Crook	**Date Registered:**	19-Aug-2015	
	C/- Taranaki Regional Council	**Date Reported:**	31-Aug-2015	
	Private Bag 713	**Quote No:**		
	STRATFORD 4352	**Order No:**		
		Client Reference:	Kauri - A Soils	
		Submitted By:	Rae West	

Sample Type: Soil

Sample Name:		K1 17-Aug-2015 1:20 pm	K2 17-Aug-2015 1:50 pm	K3 17-Aug-2015 12:40 pm		
Lab Number:		1464337.1	1464337.2	1464337.3		
Individual Tests						
Dry Matter	g/100g as rcvd	91	92	93	-	-
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Recoverable Arsenic	mg/kg dry wt	< 2	< 2	< 2	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	-	-
Total Recoverable Chromium	mg/kg dry wt	13	12	13	-	-
Total Recoverable Copper	mg/kg dry wt	11	10	11	-	-
Total Recoverable Lead	mg/kg dry wt	1.7	1.2	1.8	-	-
Total Recoverable Nickel	mg/kg dry wt	11	10	12	-	-
Total Recoverable Zinc	mg/kg dry wt	58	54	60	-	-
BTEX in Soil by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	-	-
Toluene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	-	-
Ethylbenzene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	-	-
m&p-Xylene	mg/kg dry wt	< 0.10	< 0.10	< 0.10	-	-
o-Xylene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	-
Acenaphthylene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	-
Anthracene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	-
Benzo[a]anthracene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	-
Chrysene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	-
Fluoranthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	-
Fluorene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	-
Naphthalene	mg/kg dry wt	< 0.12	< 0.12	< 0.12	-	-
Phenanthrene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	-
Pyrene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 8	< 8	< 8	-	-
C10 - C14	mg/kg dry wt	< 20	< 20	< 20	-	-
C15 - C36	mg/kg dry wt	< 40	< 40	< 40	-	-

Sample Type: Soil						
Sample Name:	K1 17-Aug-2015 1:20 pm	K2 17-Aug-2015 1:50 pm	K3 17-Aug-2015 12:40 pm		
Lab Number:	1464337.1	1464337.2	1464337.3		
Total Petroleum Hydrocarbons in Soil					
Total hydrocarbons (C7 - C36) mg/kg dry wt	< 70	< 70	< 70	-	-

SUMMARY OF METHODS

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

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-3
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	0.10 - 4 mg/kg dry wt	1-3
BTEX in Soil by Headspace GC-MS	Solvent extraction, Headspace GC-MS analysis US EPA 8260B. Tested on as received sample [KBIs:5782,26687,3629]	0.05 - 0.10 mg/kg dry wt	1-3
Polycyclic Aromatic Hydrocarbons Screening in Soil	Sonication extraction, Dilution or SPE cleanup (if required), GC-MS SIM analysis (modified US EPA 8270). Tested on as received sample. [KBIs:5786,2805,2695]	0.010 - 0.05 mg/kg dry wt	1-3
Total Petroleum Hydrocarbons in Soil	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	1-3
TPH + PAH + BTEX profile	Sonication extraction, SPE cleanup, GC & GC-MS analysis	0.010 - 60 mg/kg dry wt	1-3
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. US EPA 3550. (Free water removed before analysis).	0.10 g/100g as rcvd	1-3
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1-3

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

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

Ara Heron BSc (Tech)
Client Services Manager - Environmental Division

Soil sample analysis for Kauri C pit 1

										Heavy Metals								TPH				BTEX					PAH		
Site/Source	P&ID reading (ppm)	sample depth (metres below ground level - mbgl)	Sample date	Conductivity mSm-1	Recov Ba mg/kg dry wt	Recov Cl mg/kg dry wt	Total Sodium (SPLP Extract) g/m³ (* = Total Recoverable Sodium mg/kg dry wt	Soluble Salts g/100g dry wt	Sodium Absorption Ratio SAR	Arsenic mg/kg dry wt	Cadium mg/kg dry wt	Chromium mg/kg dry wt	Copper mg/kg dry wt	Lead mg/kg dry wt	Mercury mg/kg dry wt	Nickel mg/kg dry wt	Zinc mg/kg dry wt	C7-C9 mg/kg dry wt	C10-C14 mg kg dry wt	C15-C36 mg/kg dry wt	Total HCs mg/kg dry wt	Benzene mg/kg dry wt	Toluene mg/kg dry wt	Ethylbenzene mg/kg dry wt	m & p-xylene mg/kg dry wt	o-Xylene mg/kg dry wt	Benzo(a)pyrene (BAP)	Naphthalene	Pyrene
Consent Limits				290	10000	700	460.00	2500	18	20	1	600	100	300	1	60	300	<1m 120 1-4m 120	<1m 58 1-4m 560	<1m 4000 1-4m NA	--	1.1	68	53	48	48	0.027	7.2	160
Pit1-1	0.2	3.0	26/05/2016	<0.2	9	<3	290*	<0.05	1.9	<2	<0.10	6	6	1.0	<0.10	4	23	<8	<20	43	<70	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.12	<0.03
Pit1-3	0.0	0.5	26/05/2016	<0.2	49	7	490*	<0.05	3.4	<2	<0.10	13	9	1.2	<0.10	7	58	<8	<20	<40	<70	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.12	<0.03
Pit1-5	0.2	1.5	26/05/2016	<0.2	27	6	550*	<0.05	5.5	<2	<0.10	12	12	2.5	<0.10	6	59	<9	<20	<40	<70	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.14	<0.03
Pit1-9	0.0	0.5	26/05/2016	<0.2	15	<3	330*	<0.05	1.8	<2	<0.10	9	8	0.9	<0.10	5	44	<8	<20	<40	<70	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.12	<0.03
Pit1-10	1.3	3.0	26/05/2016	<0.2	1130	14	500*	<0.05	0.7	<2	<0.10	9	9	4.5	<0.10	5	42	<8	121	1150	1270	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.14	<0.03
Pit1-14	0.3	1.5	26/05/2016	<0.2	106	5	350*	<0.05	1.7	<2	<0.10	14	13	1.5	<0.10	6	58	<8	<20	<40	<70	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.12	<0.03
Pit1-16	0.4	3.0	26/05/2016	<0.2	123	7	510*	<0.05	1.4	<2	<0.10	8	9	1.4	<0.10	5	39	<8	<20	105	105	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.14	<0.03
Pit1-19	21.8	3.0	26/05/2016	<0.2	20	4	520*	<0.05	1.0	<2	<0.10	5	8	1.1	<0.10	4	31	<8	41	680	720	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.13	0.03
Pit1-20	0.7	1.5	26/05/2016	<0.2	19	<3	430*	<0.05	2.1	<2	<0.10	12	9	1.2	<0.10	6	55	<8	<20	<40	<70	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.12	<0.03
Pit1-22	0.5	0.5	26/05/2016	<0.2	35	3	500*	<0.05	0.9	<2	<0.10	7	8	1.1	<0.10	5	31	<8	<20	530	530	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.13	<0.03
Pit1-27	0.1	0.5	26/05/2016	<0.2	27	<3	300*	<0.05	1.8	<2	<0.10	18	10	1.3	<0.10	8	85	<8	<20	<40	<70	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.12	<0.03
Pit1-29	0.1	1.5	26/05/2016	<0.2	14	<3	440*	<0.05	2.8	<2	<0.10	8	10	1.3	<0.10	6	43	<8	<20	<40	<70	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.12	<0.03
Pit1-31	2.5	3.5	26/05/2016	<0.2	27	4	450*	<0.05	1.4	<2	<0.10	7	10	1.1	<0.10	4	38	<9	<20	320	320	<0.05	<0.05	<0.05	<0.10	<0.05			
Pit1-32	0.5	3.5	26/05/2016	<0.2	21	13	510*	<0.05	1.5	<2	<0.10	8	8	1.0	<0.10	4	33	<8	<20	<40	<70	<0.05	<0.05	<0.05	<0.10	<0.05			
Pit1-33	0.4	3.5	26/05/2016	<0.2	37	7	480*	<0.05	1.4	<2	<0.10	8	7	1.0	<0.10	5	36	<8	<20	174	174	<0.05	<0.05	<0.05	<0.10	<0.05			

Soil sample analysis for Kauri C pit & 2

Site/Source	P&ID reading (ppm)	sample depth (metres below ground level - mbgl)	Sample date	Conductivity mSm-1	Recov Ba mg/kg dry wt	Recov Cl mg/kg dry wt	Total Sodium (SPLP Extract) g/m3 (* = Total Recoverable Sodium mg/kg dry wt	Soluble Salts g/100g dry wt	Sodium Absorption Ratio SAR	Heavy Metals: Arsenic mg/kg dry wt	Cadium mg/kg dry wt	Chromium mg/kg dry wt	Copper mg/kg dry wt	Lead mg/kg dry wt	Mercury mg/kg dry wt	Nickel mg/kg dry wt	Zinc mg/kg dry wt	TPH: C7-C9 mg/kg dry wt	C10-C14 mg/kg dry wt	C15-C36 mg/kg dry wt	Total HC's mg/kg dry wt	BTEX: Benzene mg/kg dry wt	Toluene mg/kg dry wt	Ethylbenzene mg/kg dry wt	m & p-xylene mg/kg dry wt	o-Xylene mg/kg dry wt	PAH: Benzo(a)pyrene (BAP)	Naphthalene	Pyrene
Consent Limits				290	10000	700	460.00	2500	18	20	1	600	100	300	1	60	300	<1m 120 1-4m 120	<1m 58 1-4m 560	<1m 4000 1-4m NA	--	1.1	68	53	48	48	0.027	7.2	160
Pit2-3	3.8	0.5	14/06/2016	<0.2	43	4	310*	<0.05	NT	<2	<0.10	13	12	1.8	<0.10	7	60	<8	<20	<40	<70	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.12	<0.03
Pit2-6	5.4	0.5	14/06/2016	<0.2	138	4	340*	<0.05	NT	<2	<0.10	13	17	1.7	<0.10	6	62	<8	<20	<40	<70	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.13	<0.03
Pit2-7	3.7	3.0	14/06/2016	<0.2	15	18	520*	<0.05	NT	<2	<0.10	7	8	0.9	<0.10	4	32	<8	<20	<40	<70	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.13	<0.03
Pit2-9	4.7	0.5	14/06/2016	<0.2	28	<3	350*	<0.05	NT	<2	<0.10	9	7	0.8	<0.10	4	36	<8	<20	<40	<70	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.11	<0.03
Pit2-10	3.3	3.0	14/06/2016	<0.2	20	12	590*	<0.05	NT	<2	<0.10	6	9	0.9	<0.10	5	32	<8	<20	<40	<70	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.14	<0.03
Pit2-13	2.0	3.0	14/06/2016	<0.2	17	7	460*	<0.05	NT	<2	<0.10	7	8	1.0	<0.10	5	33	<8	<20	<40	<70	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.13	<0.03
Pit2-16	4.3	3.0	14/06/2016	<0.2	72	11	290*	<0.05	NT	<2	<0.10	9	7	1.0	<0.10	5	38	<9	<20	<40	<70	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.14	<0.03
Pit2-19	6.1	3.0	14/06/2016	<0.2	198	11	420*	<0.05	NT	<2	<0.10	8	7	1.4	<0.10	5	33	<8	<20	260	260	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.14	<0.03
Pit2-22	6.1	3.0	14/06/2016	<0.2	360	9	410*	<0.05	NT	<2	<0.10	11	9	1.3	<0.10	5	46	<9	<20	<40	<70	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.14	<0.03
Pit2-26	3.8	1.5	14/06/2016	<0.2	28	4	340*	<0.05	NT	<2	<0.10	13	8	1.4	<0.10	6	61	<8	<20	66	<70	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.12	<0.03
Pit2-29	4.5	1.5	14/06/2016	<0.2	18	7	400*	<0.05	NT	<2	<0.10	11	7	1.1	<0.10	6	49	<8	<20	<40	<70	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.12	<0.03
Pit2-31	7.6	3.0	14/06/2016	<0.2	58	7	610*	<0.05	NT	<2	<0.10	6	9	1.1	<0.10	5	28	<8	36	460	490	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.14	<0.03
Pit2-32	17.9	1.5	14/06/2016	<0.2	46	6	390*	<0.05	NT	<2	<0.10	13	10	1.5	<0.10	7	51	<8	<20	<40	<70	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.13	<0.03
Pit2-34	7.4	3.0	14/06/2016	<0.2	102	16	550*	<0.05	NT	<2	<0.10	7	10	1.3	<0.10	5	33	<8	<20	49	<70	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.13	<0.03
Pit2-36	4.1	0.5	14/06/2016	<0.2	43	<3	280*	<0.05	NT	<2	<0.10	10	8	0.9	<0.10	4	38	<8	<20	<40	<70	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.12	<0.03
Pit2-37	5.6	3.5	14/06/2016	<0.2	33	14	600*	<0.05	NT	<2	<0.10	7	10	1.1	<0.10	4	33	<9	<20	<40	<70	<0.06	<0.06	<0.06	<0.11	<0.06	<0.03	<0.15	<0.03
Pit2-38	29.0	3.5	14/06/2016	<0.2	350	6	430*	<0.05	NT	<2	<0.10	12	10	1.8	<0.10	6	52	<9	78	450	520	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.14	<0.03
Pit2-39	16.4	3.5	14/06/2016	<0.2	250	11	390*	<0.05	NT	<2	<0.10	11	8	1.3	<0.10	5	42	<8	28	186	210	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.13	<0.03

Attachment A: Landfarm Site Map

ID	Mud Type	Date Farmed	Well Name	Easting	Northing	Area (Ha)
SITE A	WBM	Jul 2000 and 2001	Rimu A & B sumps.	1738610	5606209	0.95
SITE B	WBM	Jun 2001	Rimu B	1738702	5606233	0.96
SITE C	WBM	Jul 2001	Rimu A sumps	1738756	5606010	0.85
SITE D	WBM	Jan 2002	Kauri B	1738770	5606410	0.07
G1	SBM	Jul 2002	Kauri A4	1738949	5605332	1.12
G2	SBM	Oct 2002	Kauri A4	1738890	5605338	0.93
G3	OW	Oct 2002	Train derailment fluids/solids	1738847	5605272	0.10
G4	OW	Oct 2002	Waihapa F	1738800	5605338	0.07
G5	WBM	May 2003	Kaimiro G	1739031	5605555	0.68
G5	WBM/OW	May 2003	Kaimiro G	1738857	5605385	0.68
G6	WBM	Jun 2003	Kauri E1	1738767	5605407	0.73
G7	SBM	Jun 2003	Kauri E1	1738878	5605468	0.35
G8	OW	May 2003	Kaimiro G	1738844	5605437	0.37
G9	WBM	Jul 2003	Kauri E2	1738753	5605486	0.66
G10	SBM	Aug 2003	Kauri E2	1738813	5605505	0.48
G11	OW	Nov 2003	Rimu Production Station	1738717	5605537	0.01
G12	SBM	Nov 2003	Tuihu B	1738740	5605552	0.01
G13	WBM	Nov 2003	Surrey 1	1738753	5605562	0.01
G14	WBM	Nov 2003	Tuihu B/Rahotu 7	1738769	5605570	0.01
G15	WBM	Nov 2003	Kauri E3/E4	1738847	5605568	0.01
G16	SBM	Nov 2003	Kauri E3/E4	1738894	5605537	0.01
G17	OBM	May 2004	Kauri E4	1738709	5605637	1.16
G18	WBM	May 2004	Cheal	1739398	5606092	0.86
G20	WBM	May 2004	Honeysuckle	1739361	5606059	0.50
G21	OBM	Jun 2005	Kauri E5	1738759	5605717	2.38
G22	OBM	Aug 2005	Kauri E6	1738708	5605814	1.74
G23	WBM	May 2005	Kauri E8	1739076	5605436	0.23
G24	SBM	Apr 2005	Kauri E7	1739051	5605485	0.22
G25	WBM	Apr 2005	Kauri E7	1739100	5605502	0.50
G26	WBM	May 2005	Kauri E8	1739141	5605537	0.27
G27	SBM	May 2005	Kauri E8	1739202	5605576	0.29
G28	OW	May 2005	Manutahi wells	1739171	5605554	0.11
G29	WBM	Apr 2005	Tariki D	1739245	5605540	0.10
G30	WBM	Jul 2005	Kauri E9	1739113	5605437	0.20
G31	WBM	Jul 2005	Kauri E9	1739154	5605480	0.19
G32	SBM	Jul 2005	Kauri E9	1739150	5605427	0.52
G33	WBM	Aug 2005	Kauri E10 & 10a	1739197	5605500	0.23
G34	SBM	Aug 2005	Kauri E10 & 10a	1738978	5605616	0.29
G35	SBM	Aug 2005	Kauri E10a	1739260	5605575	0.04
G36	OW	Oct 2005	OW	1739539	5606082	0.09
G36	OW	Oct 2005	OW	1739581	5606132	0.05
G37	SBM	Oct 2005	Tawa B	1739486	5606130	1.59
G38	SBM	Oct 2005	Kauri E	1739434	5606036	0.09
G39	SBM	Mar 2006	Kauri E11	1739322	5606173	0.55
G40	WBM	Mar 2006	Kauri E11	1739376	5606195	0.50

Attachment B: Sample Analysis Results

Compilation of soil sample analysis for Geary Landfarm

(Analysis results are from samples taken from date of spreading until all parameters met consent limits - with the latest result for each parameter shown)

										Heavy Metals								TPH				BTEX					PAH		
Site	Type	Date Farmed	Date of last sample	Conductivity mSm-1	Recov Ba mg/kg dry wt	Recov Cl mg/kg dry wt	Recov Na mg/kg dry wt	Soluble Salts g/100g dry wt	Sodium Absorption Ratio SAR	Arsenic mg/kg dry wt	Cadmium mg/kg dry wt	Chromium mg/kg dry wt	Copper mg/kg dry wt	Lead mg/kg dry wt	Mercury mg/kg dry wt	Nickel mg/kg dry wt	Zinc mg/kg dry wt	C7-C9 mg/kg dry wt	C10-C14 mg/kg dry wt	C15-C36 mg/kg dry wt	Total HCs mg/kg dry wt	Benzene mg/kg dry wt	Toluene mg/kg dry wt	Ethylbenzene mg/kg dry wt	m & p-Xylene mg/kg dry wt	o-Xylene mg/kg dry wt	Benzo(a)pyrene (BAP)	Naphthalene	Pyrene
Consent Limits				250	10000	700	450	2500	15	20	1	600	100	300	1	60	300	120	58	3000	--	1.1	68	50	48	48	0.027	7.2	160
Site A	WBM	Jul 2000-1	11/11/2012	0.10	69	18	0.31	<0.05	1.40	<2	<0.1	12.00	9.00	4.80	<0.1	5.00	49.00	<5	<5	<5	<5	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.12	<0.03
Site B	WBM	Jun 2001	11/11/2012	0.01	287	25	0.08	<0.05	1.20	<2	<0.1	15	13.00	8.70	<0.1	7.00	61.00	<5	<5	<5	<5	<0.05	<0.05	<0.05	<0.10	<0.05	<0.09	<0.14	<0.09
Site C	WBM	Jul 2001	11/11/2012	0.11	848	26	0.37	<0.05	1.00	<2	<0.1	16	12.00	4.80	<0.1	8.00	67.00	<5	<5	<5	<5	<0.05	<0.05	<0.05	<0.10	<0.05	<0.09	<0.12	<0.09
Site D	WBM/fluids	Jan 2002	11/11/2012	<0.2	340	16.00	310.00	<0.05	1.10	<2	<0.1	19.00	11.00	3.00	<0.1	7.00	82.00	<8	20	<40	<70	<0.05	<0.05	<0.05	<0.10	<0.05	<0.09	<0.13	<0.09
G1	SBM	Jul 2002	11/11/2012	0.17	1760	29	2.20	<0.05	1.20	<2	<0.1	15.00	18.00	2.00	<0.1	7.00	72.00	<8	<20	<40	<70	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.12	<0.03
G2	SBM	Oct 2002	30/06/2014	<0.02	480	4	193	<0.05	1.90	<2	<0.1	14	13	1.5	<0.1	7	89	<7	<10	<30	<50	<0.02	<0.02	<0.02	<0.02	<0.02	<0.023	<0.12	<0.023
G3	OW	Oct 2002	11/11/2012	0.07	852	64	0.25	<0.05	2.90	<2	<0.1	15	81.00	7.90	<0.1	10.00	77.00	<5	<7	120.00	110.00	<0.5	<1	<0.5	<0.5	<0.5	<0.03	<0.12	<0.03
G4	OW	Oct 2002	5/02/2010	<0.02	380	12	238	<0.05	1.4	<2	<0.1	18	16	3.0	<0.1	3	159	<7	<10	<30	<50	<0.2	<0.2	<0.2	<0.2	<0.2	<0.02	<0.1	<0.02
G5	WBM/OW	May 2003	1/05/2014	<0.02	600	8	89	<0.05	1.50	<2	<0.1	18	18	1.50	<0.1	8	73	<8	<20	<30	<60	<0.05	<0.05	<0.05	<0.10	<0.05	<0.09	<0.13	<0.09
G6	WBM	Jun 2003	1/09/2014	<0.02	405	11	206	<0.05	0.6	<2	<0.1	15	12	1.1	<0.1	7	89	<7	<10	100	100	<0.05	<0.05	<0.05	<0.10	<0.05	<0.09	<0.13	<0.09
G7	SBM	Jun 2003	1/08/2014	<0.02	3900	12	208	<0.05	0.4	<2	<0.1	16	32	3.8	<0.1	8	75	<7	15	260	270	<0.04	<0.04	<0.04	<0.08	<0.04	<0.02	<0.1	<0.02
G8	WBM	May 2003	18/03/2014	<0.02	4300	19	440	<0.05	0.5	<2	<0.1	19	27	2.2	<0.1	10	94	<8	29	230	260	<0.2	<0.2	<0.2	<0.2	<0.2	<0.02	<0.1	<0.02
G9	WBM	Jul 2003	1/09/2013	<0.02	284	9	420	<0.05	0.5	<2	<0.1	14	12	1.2	0.1	7	58	<7	<10	<30	<50	<0.05	<0.05	<0.05	<010	<0.05	<0.03	<0.12	<0.03
G10	SBM	Aug 2003	1/05/2013	<0.02	2930	6	190	<0.05	0.5	<2	<0.1	12	24	2.5	<0.1	6	80	<4	12	100	110	<0.05	<0.05	<0.05	<0.10	<0.05	<0.02	<0.1	<0.02
G11	OW	Nov 2003	14/09/2007	<0.02	438	12	1	<0.05	1.8	<2	<0.1	15	11	1.3	<0.1	7	80	<7	<10	<30	<50	<0.2	<0.2	<0.2	<0.2	<0.2	<0.02	<0.1	<0.02
G12	SBM	Nov 2003	6/05/2014	<0.02	588	32	84	<0.05	0.8	<2	<0.1	16	17	2.4	<0.1	8	90	<7	<10	140	<140	<0.04	<0.04	<0.04	<0.08	<0.04	<0.02	<0.1	<0.02
G13	SBM	Nov 2003	18/03/2014	<0.02	2200	38	380	<0.05	<0.04	<2	<0.1	15	19	3.5	<0.1	7	72	<7	<10	200	<210	<0.04	<0.04	<0.04	<0.08	<0.04	<0.02	<0.1	<0.02
G14	WBM	Nov 2003	6/05/2014	<0.02	1090	110	410	<0.05	0.80	<2	<0.1	16	19	3.50	<0.1	8	87	<7	<10	170	170	<0.05	<0.05	<0.05	<0.1	<0.05	<0.02	<0.12	<0.02
G15	WBM	Nov 2003	1/08/2014	<0.02	445	15	204	<0.05	0.9	<2	<0.1	14	14	1.6	<0.1	7	86	<7	<10	<30	<50	<0.04	<0.04	<0.04	<0.07	<0.04	<0.03	<0.13	<0.03
G16	SBM	Nov 2003	1/09/2013	<0.02	408	7	202	<0.05	1	<2	<0.1	16	18	2.9	<0.1	7	88	<7	<10	<30	<50	<0.04	<0.04	<0.04	<0.08	<0.04	<0.02	<0.1	<0.02
G17	OBM	May 2004	6/05/2014	0.23	577	4	68	<0.05	0.90	<2	<0.1	18	14	1.2	0.10	6	85	<7	<10	260	260	<0.03	<0.06	<0.03	<0.03	<0.03	<0.02	<0.1	0.19
G18	WBM	May 2004	1/05/2014	<0.02	481	26	72	<0.05	0.80	<2	<0.1	18	13	1.10	<0.1	8	76	<8	<20	<30	<60	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.12	<0.03
G20	WBM	May 2004	30/09/2013	<0.02	173	10	330	<0.05	1.10	<2	<0.1	20	20	1.90	<0.1	11	80	<4	<8	40	40	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.12	<0.03
G21	OBM	Jun 2005	1/06/2013	<0.02	60	16	197	<0.05	0.80	<2	<0.1	18	15	1.3	<0.1	8	87	<8	<20	180	180	<0.03	<0.06	<0.03	<0.03	<0.03	<0.02	<0.1	<0.02
G22	OBM	Aug 2005	28/08/2012	<0.02	810	20	440	<0.05	0.90	<2	<0.1	13	10	1.0	<0.1	6	81	<8	23	1200	1200	<0.03	<0.03	<0.03	<0.06	<0.03	<0.02	<0.1	0.06
G23	WBM	May 2005	1/10/2013	<0.02	436	62	440	<0.05	1.7	<2	<0.1	13	12	3	<0.1	6	58	<7	<10	<30	<60	<0.04	<0.04	<0.01	<0.08	<0.04	<0.03	<0.13	<0.03
G24	SBM	Apr 2005	28/08/2011	<0.02	370	10	320	<0.05	0.70	<2	<0.1	9	12	9.2	<0.1	5	37	<7	<10	<30	<50	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01	<0.03
G25	WBM	Apr 2005	1/10/2014	<0.02	90	10	225	<0.05	3.7	<2	<0.1	10	11	1.2	<0.1	6	48	<8	<20	<30	<60	<0.04	<0.04	<0.04	<0.08	<0.04	<0.03	<0.13	<0.03
G26	WBM	May 2005	1/10/2013	<0.02	159	5	440	<0.05	0.90	<2	<0.1	13	21	2.70	<0.1	7	59	<7	<10	140	140	<0.02	<0.02	<0.02	<0.02	<0.02	<0.03	<0.13	<0.03
G27	SBM	May 2005	6/05/2014	<0.02	140	16	70	<0.05	1	<2	<0.1	8	10	1.8	<0.1	5	38	<7	37	310	350	<0.04	<0.04	<0.04	<0.08	<0.04	<0.02	<0.1	<0.02
G28	OW	May 2005	28/08/2011	<0.02	283	5	410	<0.05	0.90	<2	<0.1	12	15	2.2	<0.1	6	56	<7	<10	<30	<60	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.1	<0.02
G29	WBM	Apr 2005	28/11/2014	<0.02	110	5	214	<0.05	1.6	<2	<0.1	10	8	1.1	<0.1	6	46	<7	<10	<30	<50	<0.04	<0.04	<0.04	<0.08	<0.04	<0.03	<0.13	<0.03
G30	WBM	Jul 2005	18/03/2014	<0.02	1200	165	440	<0.05	1.40	<2	<0.1	14	23	6.50	<0.1	8	53	<7	<10	40	<60	<0.05	<0.05	<0.1	<0.05	<0.05	<0.09	<0.13	<0.09
G31	OW	Jul 2005	14/09/2007	<0.02	489	12	1	<0.05	1.9	<2	<0.1	14	11	1.3	<0.1	7	89	<7	<10	<30	<50	<0.2	<0.2	<0.2	<0.2	<0.2	<0.02	<0.1	<0.02
G32	SBM	Jul 2005	9/07/2007	<0.02	381	8	448	<0.05	1.6	<2	<0.1	17	21	8.8	<0.1	9	58	<7	71	530	600	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.1	<0.02
G33	WBM	Aug 2005	6/05/2014	<0.02	750	4	91	<0.05	1.6	<2	<0.1	16	23	21.3	<0.1	8	80	<7	<10	<30	<50	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.1	0.05
G34/35	SBM	Aug 2005	18/06/2013	0.37	163	42	170	<0.05	1.6	<2	<0.1	8	7	1.4	<0.1	5	33	<5	<20	<30	<60	<0.04	<0.04	<0.04	<0.07	<0.04	<0.02	<0.1	<0.02
G36	OW	Oct 2005	1/11/2013	<0.02	1400	9	390	<0.05	0.50	<2	<0.1	14	12	13.9	<0.1	6	50	<7	<10	<30	<60	<0.04	<0.04	<0.04	<0.07	<0.04	<0.02	<0.1	0.21
G37	SBM	Oct 2005	18/03/2014	<0.02	980	356	290	<0.05	0.8	<2	<0.1	13	15	48.4	<0.1	6	50	<8	<20	74	80	<0.05	<0.05	<0.05	<0.09	<0.05	<0.09	<0.1	0.09
G38	SBM	Oct 2005	18/03/2014	<0.02	2800	7	330	<0.05	1.00	<2	<0.1	11	10	5.2	<0.1	5	46	<8	49	1400	1400	<0.04	<0.04	<0.04	<0.08	<0.04	<0.03	<0.14	<0.03
G39	SBM	Mar 2006	18/09/2014	<0.02	2200	27	320	<0.05	1.1	<2	<0.1	18	15	14.2	<0.1	8	87	<8	<20	78	78	<0.04	<0.04	<0.04	<0.08	0.13	<0.09	<0.1	<0.09
G40	WBM	Mar 2006	18/09/2013	<0.02	140	22	280	<0.05	0.70	<2	<0.1	17	23	4	<0.1	9	86	<8	<20	<30	<60	<0.04	<0.04	<0.04	<0.08	<0.04	<0.03	<0.13	<0.03

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ANALYSIS REPORT

Client:	Taranaki Regional Council	**Lab No:**	1567589	SPv1
Contact:	Nathan Crook	**Date Registered:**	14-Apr-2016	
	C/- Taranaki Regional Council	**Date Reported:**	27-Apr-2016	
	Private Bag 713	**Quote No:**	76248	
	Stratford 4352	**Order No:**		
		Client Reference:	Storage Pit Samples	
		Submitted By:	Nathan Crook	

Sample Type: Soil

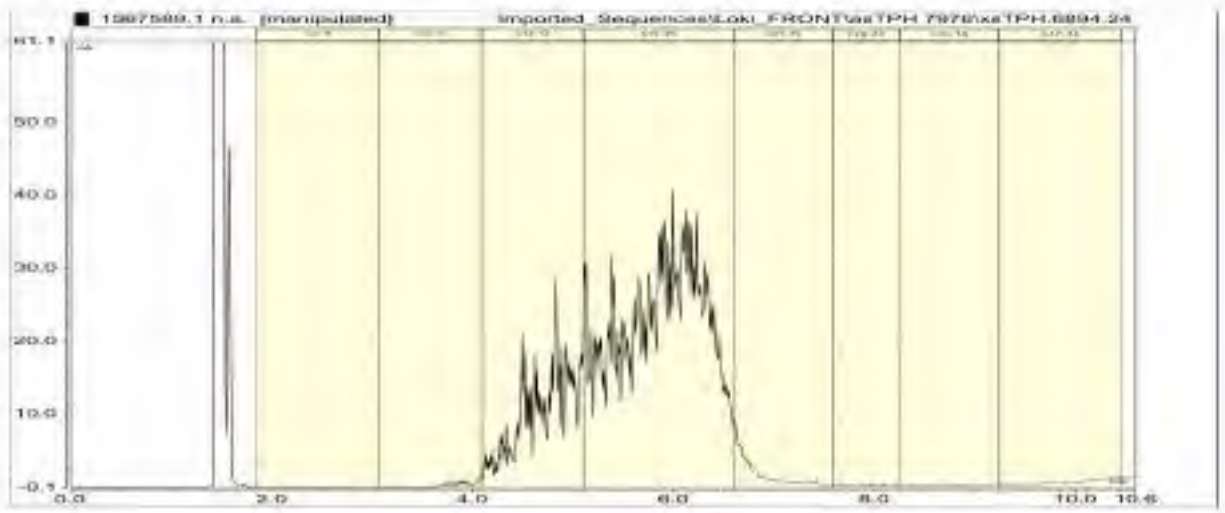
Sample Name:		2A_130416 13-Apr-2016 12:00 pm	2B_130416 13-Apr-2016 12:15 pm	2C_130416 13-Apr-2016 12:30 pm	3A_130416 13-Apr-2016 12:45 pm	3B_130416 13-Apr-2016 1:00 pm
Lab Number:		1567589.1	1567589.2	1567589.3	1567589.4	1567589.5
Individual Tests						
Dry Matter	g/100g as rcvd	68	62	62	80	60
Total Recoverable Barium	mg/kg dry wt	58	630	730	2,200	440
Total Recoverable Sodium	mg/kg dry wt	580	550	450	540	480
Chloride*	mg/kg dry wt	33	97	90	37	42
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	< 0.09	< 0.09	< 0.09	< 0.07	< 0.09
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	< 2	3	2	4	4
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	8	12	15	17	52
Total Recoverable Copper	mg/kg dry wt	10	15	17	32	29
Total Recoverable Lead	mg/kg dry wt	1.3	4.3	4.8	26	7.8
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	0.15	< 0.10
Total Recoverable Nickel	mg/kg dry wt	5	7	8	10	31
Total Recoverable Zinc	mg/kg dry wt	42	64	76	60	51
BTEX in Soil by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.07	< 0.08	< 0.08	< 0.05	< 0.08
Toluene	mg/kg dry wt	< 0.07	< 0.08	< 0.08	< 0.05	< 0.08
Ethylbenzene	mg/kg dry wt	< 0.07	0.10	0.11	< 0.05	0.22
m&p-Xylene	mg/kg dry wt	< 0.14	0.59	0.50	< 0.10	< 0.16
o-Xylene	mg/kg dry wt	< 0.07	0.20	0.17	< 0.05	< 0.08
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.03	< 0.04
Acenaphthylene	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.03	< 0.04
Anthracene	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.03	< 0.04
Benzo[a]anthracene	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.03	< 0.04
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.04	0.04	0.04	< 0.03	< 0.04
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.04	0.09	0.09	< 0.03	< 0.04
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.03	< 0.04
Benzo[k]fluoranthene	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.03	< 0.04
Chrysene	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.03	< 0.04
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.03	< 0.04
Fluoranthene	mg/kg dry wt	< 0.04	0.09	0.09	< 0.03	< 0.04
Fluorene	mg/kg dry wt	< 0.04	0.07	0.07	< 0.03	< 0.04
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.03	< 0.04
Naphthalene	mg/kg dry wt	< 0.17	0.29	0.27	< 0.14	< 0.18

Sample Type: Soil						
Sample Name:		2A_130416 13-Apr-2016 12:00 pm	2B_130416 13-Apr-2016 12:15 pm	2C_130416 13-Apr-2016 12:30 pm	3A_130416 13-Apr-2016 12:45 pm	3B_130416 13-Apr-2016 1:00 pm
Lab Number:		1567589.1	1567589.2	1567589.3	1567589.4	1567589.5
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Phenanthrene	mg/kg dry wt	< 0.04	0.13	0.15	< 0.03	< 0.04
Pyrene	mg/kg dry wt	< 0.04	0.14	0.15	< 0.03	< 0.04
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 11	11	< 11	< 9	< 11
C10 - C14	mg/kg dry wt	1,670	1,160	1,030	1,600	< 30
C15 - C36	mg/kg dry wt	5,000	5,500	5,100	3,300	78
Total hydrocarbons (C7 - C36)	mg/kg dry wt	6,600	6,700	6,100	4,900	78

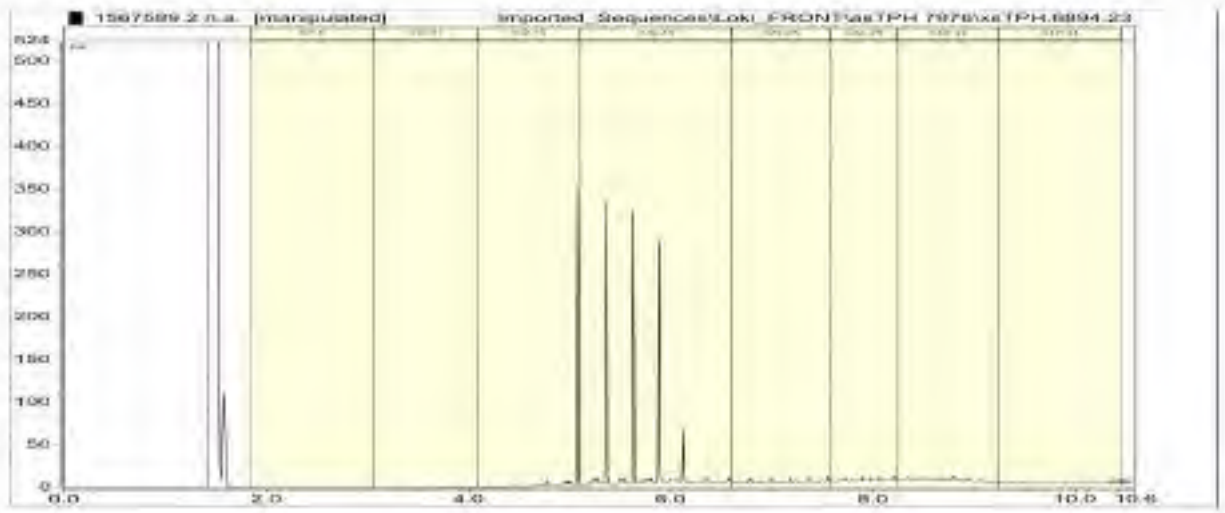
Sample Name:		3C_130416 13-Apr-2016 1:15 pm				
Lab Number:		1567589.6				
Individual Tests						
Dry Matter	g/100g as rcvd	51	-	-	-	-
Total Recoverable Barium	mg/kg dry wt	870	-	-	-	-
Total Recoverable Sodium	mg/kg dry wt	550	-	-	-	-
Chloride*	mg/kg dry wt	53	-	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	< 0.11	-	-	-	-
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	4	-	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	-	-	-	-
Total Recoverable Chromium	mg/kg dry wt	38	-	-	-	-
Total Recoverable Copper	mg/kg dry wt	30	-	-	-	-
Total Recoverable Lead	mg/kg dry wt	7.9	-	-	-	-
Total Recoverable Mercury	mg/kg dry wt	< 0.10	-	-	-	-
Total Recoverable Nickel	mg/kg dry wt	24	-	-	-	-
Total Recoverable Zinc	mg/kg dry wt	71	-	-	-	-
BTEX in Soil by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.10	-	-	-	-
Toluene	mg/kg dry wt	< 0.10	-	-	-	-
Ethylbenzene	mg/kg dry wt	< 0.10	-	-	-	-
m&p-Xylene	mg/kg dry wt	< 0.2	-	-	-	-
o-Xylene	mg/kg dry wt	< 0.10	-	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	< 0.05	-	-	-	-
Acenaphthylene	mg/kg dry wt	< 0.05	-	-	-	-
Anthracene	mg/kg dry wt	< 0.05	-	-	-	-
Benzo[a]anthracene	mg/kg dry wt	< 0.05	-	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.05	-	-	-	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	< 0.05	-	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.05	-	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.05	-	-	-	-
Chrysene	mg/kg dry wt	< 0.05	-	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.05	-	-	-	-
Fluoranthene	mg/kg dry wt	< 0.05	-	-	-	-
Fluorene	mg/kg dry wt	< 0.05	-	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.05	-	-	-	-
Naphthalene	mg/kg dry wt	< 0.3	-	-	-	-
Phenanthrene	mg/kg dry wt	< 0.05	-	-	-	-
Pyrene	mg/kg dry wt	< 0.05	-	-	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 13	-	-	-	-
C10 - C14	mg/kg dry wt	< 30	-	-	-	-

Sample Type: Soil						
Sample Name:		3C_130416 13-Apr-2016 1:15 pm				
Lab Number:		1567589.6				
Total Petroleum Hydrocarbons in Soil						
C15 - C36	mg/kg dry wt	< 60	-	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 100	-	-	-	-

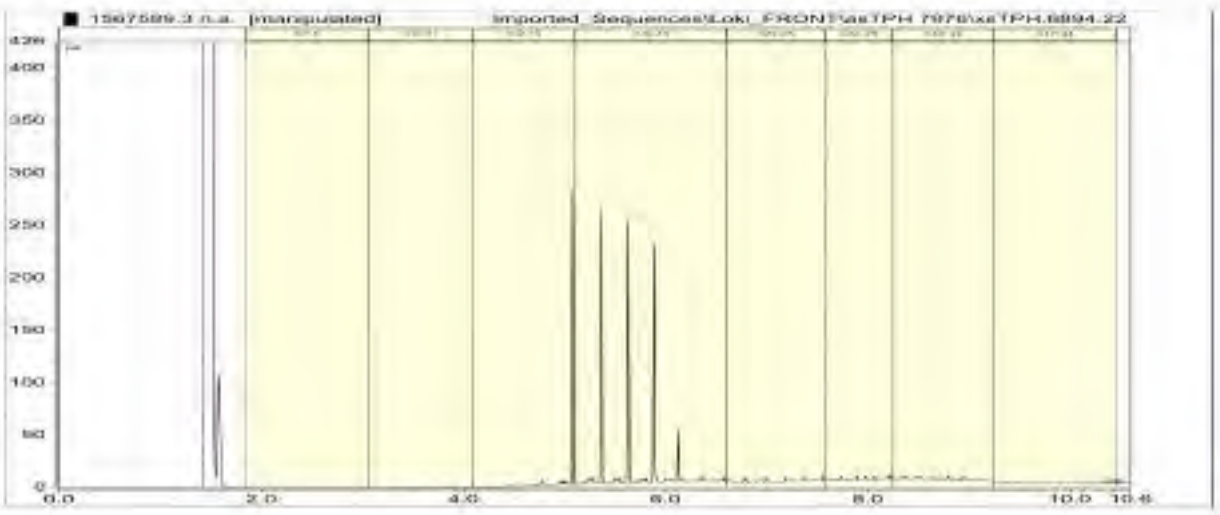
1567589.1
2A_130416 13-Apr-2016 12:00 pm
Client Chromatogram for TPH by FID



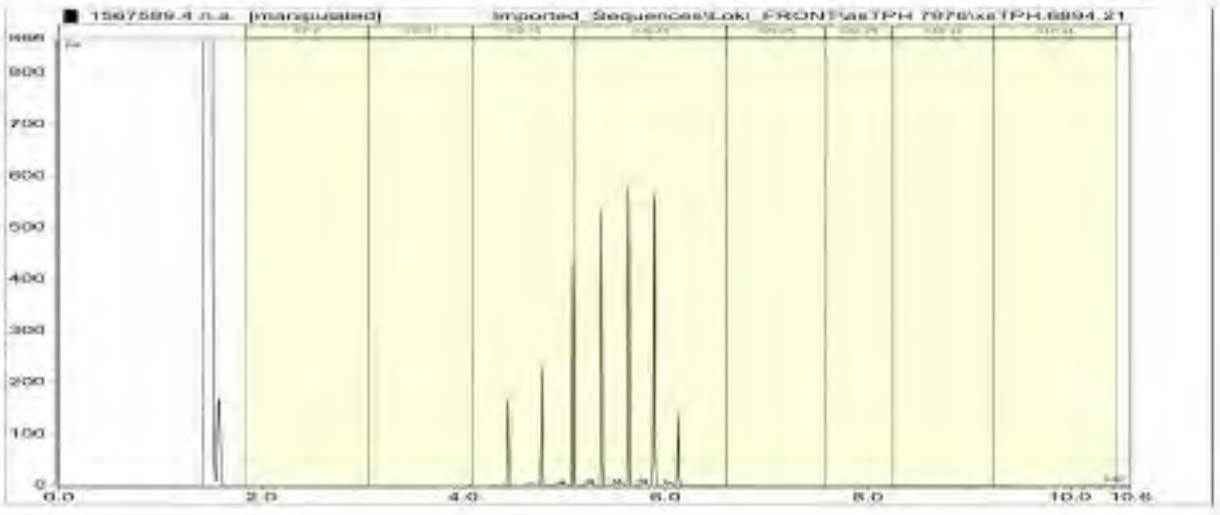
1567589.2
2B_130416 13-Apr-2016 12:15 pm
Client Chromatogram for TPH by FID



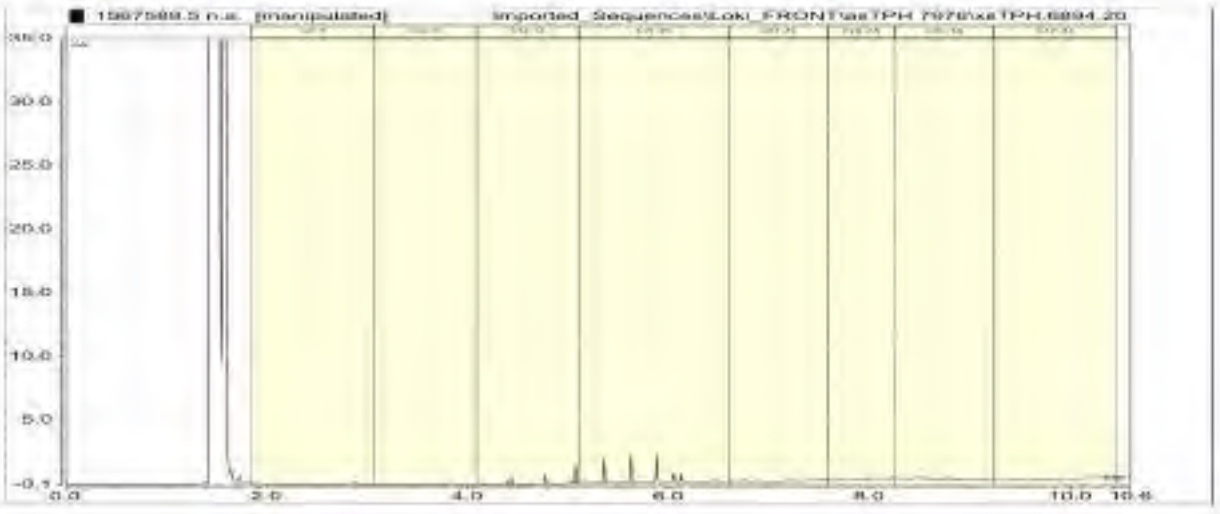
1567589.3
2C_130416 13-Apr-2016 12:30 pm
Client Chromatogram for TPH by FID



1567589.4
3A_130416 13-Apr-2016 12:45 pm
Client Chromatogram for TPH by FID



1567589.5
3B_130416 13-Apr-2016 1:00 pm
Client Chromatogram for TPH by FID



Analyst's Comments

It was noted that Security Seals were applied and intact on receipt at the laboratory.

SUMMARY OF METHODS

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

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1-6
BTEX in Soil by Headspace GC-MS	Solvent extraction, Headspace GC-MS analysis US EPA 8260B. Tested on as received sample [KBIs:5782,26687,3629]	0.05 - 0.10 mg/kg dry wt	1-6
Polycyclic Aromatic Hydrocarbons Screening in Soil	Sonication extraction, Dilution or SPE cleanup (if required), GC-MS SIM analysis (modified US EPA 8270). Tested on as received sample. [KBIs:5786,2805,2695]	0.010 - 0.05 mg/kg dry wt	1-6
Total Petroleum Hydrocarbons in Soil*	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	1-6
TPH + PAH + BTEX profile	Sonication extraction, SPE cleanup, GC & GC-MS analysis	0.010 - 60 mg/kg dry wt	1-6
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. US EPA 3550. (Free water removed before analysis).	0.10 g/100g as rcvd	1-6
esICextn*	(1:5) ratio of sample (g):0.02M potassium dihydrogen ortho-phosphate extractant (mL), analysis by Ion Chromatography. In House.	-	1-6
Total Recoverable Barium	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	0.4 mg/kg dry wt	1-6
Total Recoverable Sodium	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	40 mg/kg dry wt	1-6
Chloride*	Ion Chromatography determination of es potassium phosphate extraction.	3 mg/kg dry wt	1-6
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from Benz(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1 + Chrysene x 0.01 + Dibenz(a,h)anthracene x 1 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	1-6

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

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

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

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TO	Keith Brodie
COPY	Amanda Lambert
FROM	Ray Forrest
DATE	2 June 2016
FILE	5-N8245.00 001NP
SUBJECT	Kauri C Well Site Sampling Methodology

Hi Keith,

The sampling methodology for soils collected from Pit 1 and Pit 3 on 26 May 2016 is as follows.

- The walls and bases of the pits were scraped until visually assessed to be clear of drilling muds by WRS Ltd prior to soil sampling.
- Steps were dug into the north end of each pit to allow for safe access.
- Sample locations were initially selected so as to have an even spacing around the walls and over the base of each pit. At each location three samples were selected spaced vertically to categorise the shallow and deeper soils present. Where conditions at the selected location were not suitable for sample collection (due to access restrictions caused by water or potentially unsafe footing conditions), the sample locations were moved to the nearest accessible location.
- 33 sample locations were chosen in each pit. These comprised 10 shallow samples (<1m bgl), 20 deeper samples (1.5 – 3.0 m bgl) and 3 samples from the base of each pit (3.5 m bgl)
- A Photo Ionisation Detector (PID) calibrated to 100 ppm of Isobutylene was used to obtain index readings of Volatile Organic Compounds (VOCs) in the soil.
- Soil from each sample location was placed into a plastic zip lock bag and left for between 10 to 15 minutes after which time the PID was used to take a headspace reading from each bag. The VOC readings from each sample were recorded in the field notebook.
- The PID readings in both pits ranged from 0.0 ppm to 2.5 ppm, with one sample in the west wall of Pit 1 at a depth of 3.0 m bgl having a reading of 21.8 ppm
- Soil from locations with the highest PID readings were preferentially sampled for laboratory testing.

- Additional laboratory test samples were obtained from locations with low PID readings from the walls and base of each pit in order to confirm the low readings and possibly aid correlation of PID readings across the site with hydrocarbon content.

- Each sample was collected by hand and placed into clean laboratory prepared sample jars (Glass 350 ml and Plastic 250 ml) to be sent for analysis at Hill Laboratories in Hamilton.

- Sterile nitrile disposable gloves were worn to collect samples and were discarded between each sample to minimise the risk of potential cross contamination.

- Samples were placed on ice in chilly bins provided by Hill Laboratories.

- All soil samples obtained were submitted to Hills Laboratory Hamilton under chain of custody documentation.

Please find attached a sample location plan, and photographs of the pits 1 and 3.

If there are any further questions, please don't hesitate to ask.

Kind Regards,

Ray Forrest

OPUS

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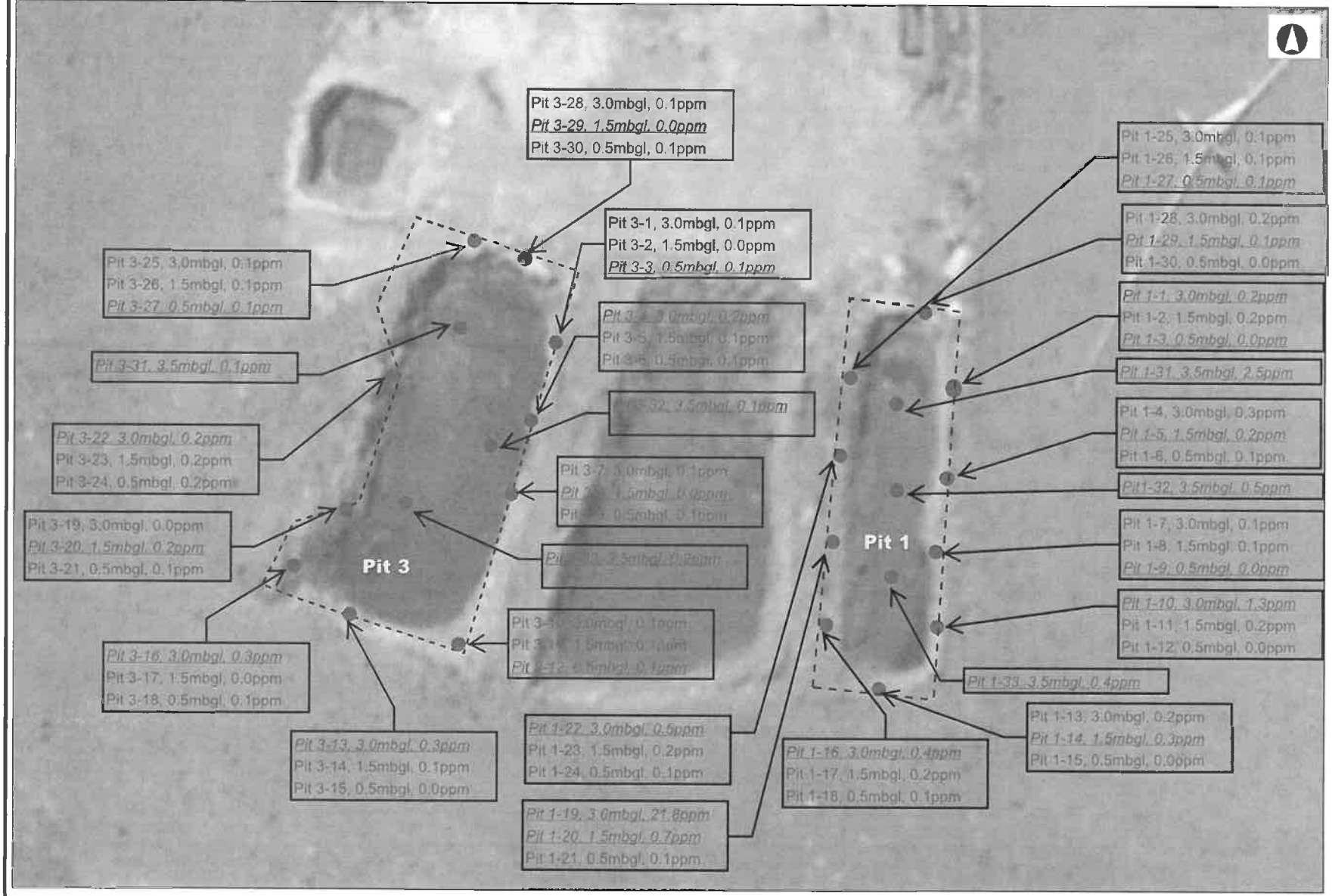
Kauri C Well site

Date Printed: 02-June-2016



Legend

- Land Parcel Boundari
- Layers
- Sample Location
- Approximate pit area

Sample tested for VOCs only

Sample sent to Lab

SCALE 1: 500

25.4 0 25.4

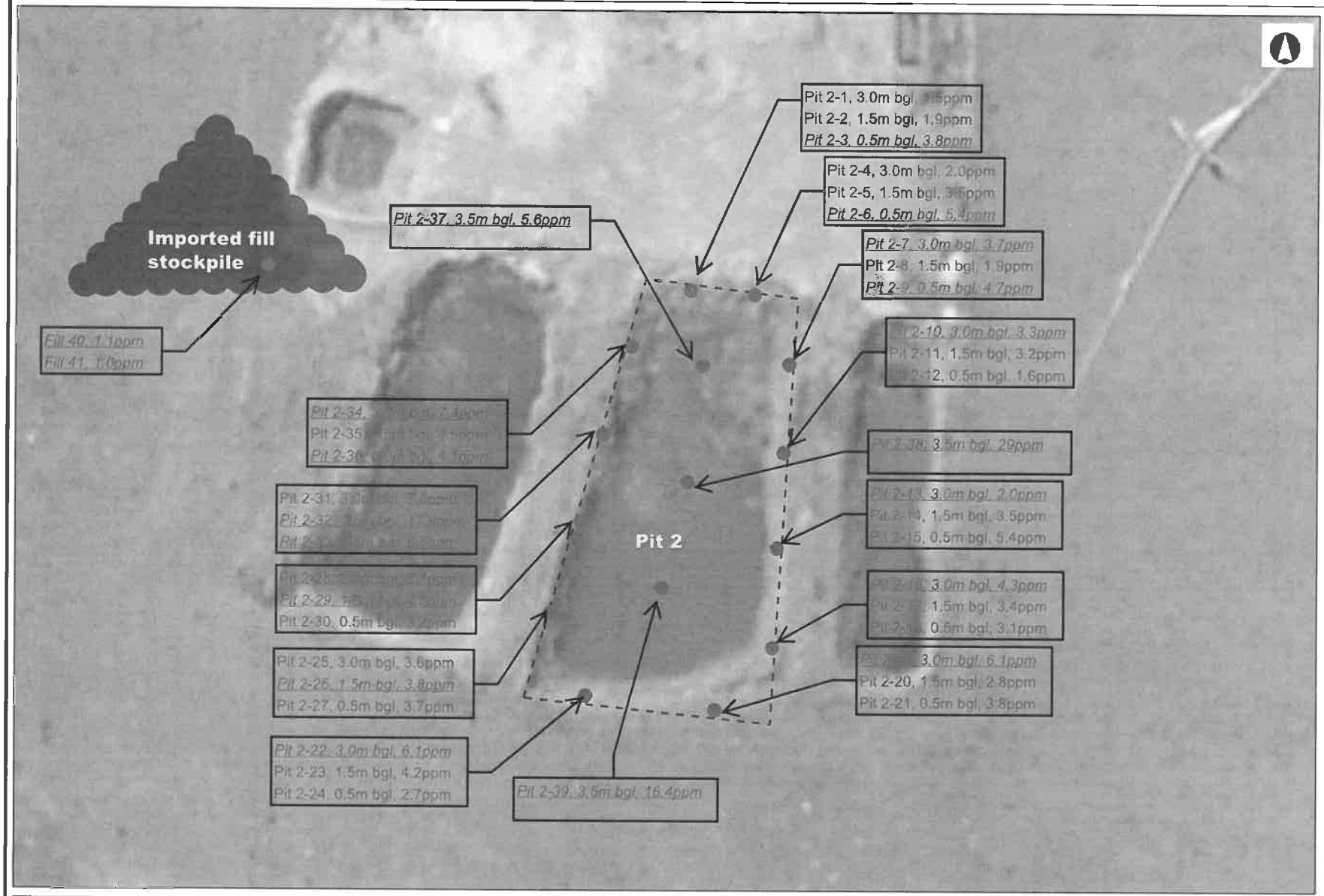
Meters

Projection: NZGD_2000_New_Zealand_Transverse_Mercator

Taranaki Regional XPLORER

Kauri C Well site

Date Printed: 02-June-2016



Legend

- Sample Location
- Approximate pit area
- Sample tested for VOCs only
- *Sample sent to lab*
- Imported fill material

SCALE 1: 500

25.4 0 25.4

Meters

Projection: NZGD_2000_New_Zealand_Transverse_Mercator

Taranaki Regional XPLORER

Hill Laboratories
BETTER TESTING BETTER RESULTS

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Hamilton 3240, New Zealand

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Fax +64 7 858 2001
Email mail@hill-labs.co.nz
Web www.hill-labs.co.nz

ANALYSIS REPORT

Client:	Waste Remediation Services Limited (WRS)	**Lab No:**	1591034 SPv7
Contact:	Keith Brodie	**Date Registered:**	27-May-2016
	PO Box 77	**Date Reported:**	17-Jun-2016
	Oakura 4345	**Quote No:**	77512
	TARANAKI	**Order No:**	KB5670
		Client Reference:	Kauri-C
		Submitted By:	Keith Brodie

Sample Type: Soil

Sample Name:		Kauri C/Pit3-3 26-May-2016	Kauri C/Pit3-4 26-May-2016	Kauri C/Pit3-8 26-May-2016	Kauri C/Pit3-12 26-May-2016	Kauri C/Pit3-15 26-May-2016
Lab Number:		1591034.1	1591034.2	1591034.3	1591034.4	1591034.5
Individual Tests						
Dry Matter	g/100g as rcvd	94	79	88	92	88
Soluble Salts*	g/100g dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Electrical Conductivity (EC)*	mS/cm	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Total Recoverable Barium	mg/kg dry wt	32	610	43	28	122
Total Recoverable Sodium	mg/kg dry wt	330	390	420	420	500
Chloride*	mg/kg dry wt	< 3	18	4	9	4
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	< 2	< 2	< 2	< 2	< 2
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	13	18	12	10	8
Total Recoverable Copper	mg/kg dry wt	9	13	9	8	9
Total Recoverable Lead	mg/kg dry wt	1.2	2.7	1.3	1.0	1.3
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	6	10	7	6	6
Total Recoverable Zinc	mg/kg dry wt	57	54	51	45	35
BTEX in Soil by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.05	< 0.06	< 0.05	< 0.05	< 0.05
Toluene	mg/kg dry wt	< 0.05	< 0.06	< 0.05	< 0.05	< 0.05
Ethylbenzene	mg/kg dry wt	< 0.05	< 0.06	< 0.05	< 0.05	< 0.05
m&p-Xylene	mg/kg dry wt	< 0.10	< 0.11	< 0.10	< 0.10	< 0.10
o-Xylene	mg/kg dry wt	< 0.05	< 0.06	< 0.05	< 0.05	< 0.05
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Anthracene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[a]anthracene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[k]fluoranthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Chrysene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluorene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Naphthalene	mg/kg dry wt	< 0.12	< 0.14	< 0.13	< 0.12	< 0.13

Sample Type: Soil						
Sample Name:		Kauri C/Pit3-3 26-May-2016	Kauri C/Pit3-4 26-May-2016	Kauri C/Pit3-8 26-May-2016	Kauri C/Pit3-12 26-May-2016	Kauri C/Pit3-15 26-May-2016
Lab Number:		1591034.1	1591034.2	1591034.3	1591034.4	1591034.5
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Phenanthrene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Pyrene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 8	< 9	< 8	< 8	< 8
C10 - C14	mg/kg dry wt	< 20	< 20	< 20	< 20	< 20
C15 - C36	mg/kg dry wt	< 40	< 40	< 40	< 40	< 40
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	< 70	< 70	< 70	< 70

Sample Name:		Kauri C/Pit3-16 26-May-2016	Kauri C/Pit3-20 26-May-2016	Kauri C/Pit3-22 26-May-2016	Kauri C/Pit3-29 26-May-2016	Kauri C/Pit3-27 26-May-2016
Lab Number:		1591034.6	1591034.7	1591034.8	1591034.9	1591034.10
Individual Tests						
Dry Matter	g/100g as rcvd	84	92	85	90	88
Soluble Salts*	g/100g dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Electrical Conductivity (EC)*	mS/cm	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Total Recoverable Barium	mg/kg dry wt	240	199	460	81	790
Total Recoverable Sodium	mg/kg dry wt	510	400	400	380	450
Chloride*	mg/kg dry wt	6	< 3	9	< 3	4
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	< 2	< 2	< 2	< 2	< 2
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	10	9	10	9	10
Total Recoverable Copper	mg/kg dry wt	10	8	11	9	9
Total Recoverable Lead	mg/kg dry wt	1.7	1.3	2.0	1.4	2.1
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	6	5	5	5	5
Total Recoverable Zinc	mg/kg dry wt	45	39	43	40	40
BTEX in Soil by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Toluene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Ethylbenzene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
m&p-Xylene	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
o-Xylene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Anthracene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[a]anthracene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[k]fluoranthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Chrysene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluorene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Naphthalene	mg/kg dry wt	< 0.14	< 0.12	< 0.14	< 0.12	< 0.12
Phenanthrene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Pyrene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 9	< 8	< 8	< 8	< 8
C10 - C14	mg/kg dry wt	< 20	< 20	< 20	< 20	< 20
C15 - C36	mg/kg dry wt	< 40	< 40	< 40	< 40	< 40
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	< 70	< 70	< 70	< 70

Sample Type: Soil						
	Sample Name:	Kauri C/Pit3-16 26-May-2016	Kauri C/Pit3-20 26-May-2016	Kauri C/Pit3-22 26-May-2016	Kauri C/Pit3-29 26-May-2016	Kauri C/Pit3-27 26-May-2016
	Lab Number:	1591034.6	1591034.7	1591034.8	1591034.9	1591034.10
	Sample Name:	Kauri C/Pit3-31 26-May-2016	Kauri C/Pit3-32 26-May-2016	Kauri C/Pit3-33 26-May-2016	Kauri C/Pit 1 - 1 [1591033.1]	Kauri C/Pit 1 - 3 [1591033.2]
	Lab Number:	1591034.11	1591034.12	1591034.13	1591034.14	1591034.15
Individual Tests						
Dry Matter	g/100g as rcvd	80	83	76	93	92
Soluble Salts*	g/100g dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Electrical Conductivity (EC)*	mS/cm	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Total Recoverable Barium	mg/kg dry wt	16.3	370	72	9.0	49
Total Recoverable Sodium	mg/kg dry wt	400	480	990	290	490
Chloride*	mg/kg dry wt	4	12	14	< 3	7
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	< 2	< 2	< 2	< 2	< 2
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	7	9	6	6	13
Total Recoverable Copper	mg/kg dry wt	7	11	9	6	9
Total Recoverable Lead	mg/kg dry wt	0.8	1.7	1.1	1.0	1.2
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	5	6	4	4	7
Total Recoverable Zinc	mg/kg dry wt	29	39	32	23	58
BTEX in Soil by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.06	< 0.05	< 0.06	< 0.05	< 0.05
Toluene	mg/kg dry wt	< 0.06	< 0.05	< 0.06	< 0.05	< 0.05
Ethylbenzene	mg/kg dry wt	< 0.06	< 0.05	< 0.06	< 0.05	< 0.05
m&p-Xylene	mg/kg dry wt	< 0.11	< 0.10	< 0.11	< 0.10	< 0.10
o-Xylene	mg/kg dry wt	< 0.06	< 0.05	< 0.06	< 0.05	< 0.05
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Anthracene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[a]anthracene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[k]fluoranthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Chrysene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluorene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Naphthalene	mg/kg dry wt	< 0.14	< 0.13	< 0.15	< 0.12	< 0.12
Phenanthrene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Pyrene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 9	< 8	< 9	< 8	< 8
C10 - C14	mg/kg dry wt	< 20	< 20	< 20	< 20	< 20
C15 - C36	mg/kg dry wt	< 40	< 40	< 40	43	< 40
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	< 70	< 70	< 70	< 70

	Sample Name:	Kauri C/Pit 1 - 5 [1591033.3]	Kauri C/Pit 1 - 9 [1591033.4]	Kauri C/Pit 1 - 10 [1591033.5]	Kauri C/Pit 1 - 14 [1591033.6]	Kauri C/Pit 1 - 16 [1591033.7]
	Lab Number:	1591034.16	1591034.17	1591034.18	1591034.19	1591034.20
Individual Tests						
Dry Matter	g/100g as rcvd	83	95	84	90	81
Soluble Salts*	g/100g dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Electrical Conductivity (EC)*	mS/cm	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Total Recoverable Barium	mg/kg dry wt	27	15.2	1,130	106	126

Sample Type: Soil						
	Sample Name:	Kauri C/Pit 1 - 5 [1591033.3]	Kauri C/Pit 1 - 9 [1591033.4]	Kauri C/Pit 1 - 10 [1591033.5]	Kauri C/Pit 1 - 14 [1591033.6]	Kauri C/Pit 1 - 16 [1591033.7]
	Lab Number:	1591034.16	1591034.17	1591034.18	1591034.19	1591034.20
Individual Tests						
Total Recoverable Sodium	mg/kg dry wt	550	330	500	350	510
Chloride*	mg/kg dry wt	6	< 3	14	5	7
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	< 2	< 2	< 2	< 2	< 2
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	12	9	9	14	8
Total Recoverable Copper	mg/kg dry wt	12	8	9	13	9
Total Recoverable Lead	mg/kg dry wt	2.5	0.9	4.5	1.5	1.4
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	6	5	5	6	5
Total Recoverable Zinc	mg/kg dry wt	59	44	42	58	39
BTEX in Soil by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Toluene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Ethylbenzene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
m&p-Xylene	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
o-Xylene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Anthracene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[a]anthracene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[k]fluoranthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Chrysene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluorene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Naphthalene	mg/kg dry wt	< 0.14	< 0.12	< 0.14	< 0.12	< 0.14
Phenanthrene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Pyrene	mg/kg dry wt	< 0.03	< 0.03	0.03	< 0.03	< 0.03
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 9	< 8	< 8	< 8	< 8
C10 - C14	mg/kg dry wt	< 20	< 20	121	< 20	< 20
C15 - C36	mg/kg dry wt	< 40	< 40	1,150	< 40	105
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	< 70	1,270	< 70	105

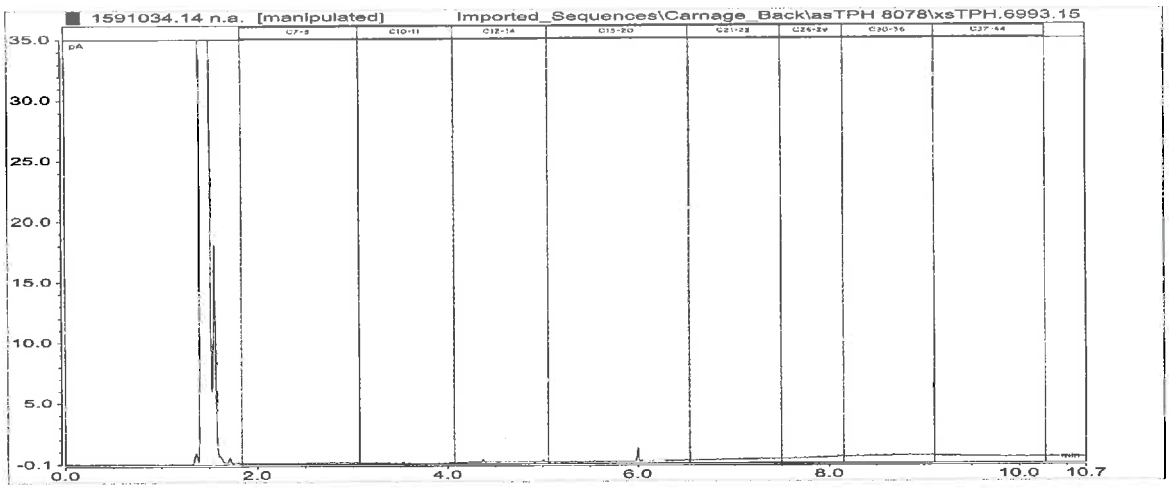
	Sample Name:	Kauri C/Pit 1 - 19 [1591033.8]	Kauri C/Pit 1 - 20 [1591033.9]	Kauri C/Pit 1 - 22 [1591033.10]	Kauri C/Pit 1 - 27 [1591033.11]	Kauri C/Pit 1 - 29 [1591033.12]
	Lab Number:	1591034.21	1591034.22	1591034.23	1591034.24	1591034.25
Individual Tests						
Dry Matter	g/100g as rcvd	88	93	90	92	92
Soluble Salts*	g/100g dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Electrical Conductivity (EC)*	mS/cm	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Total Recoverable Barium	mg/kg dry wt	20	18.5	35	27	14.2
Total Recoverable Sodium	mg/kg dry wt	520	430	500	300	440
Chloride*	mg/kg dry wt	4	< 3	3	< 3	< 3
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	< 2	< 2	< 2	< 2	< 2
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	5	12	7	18	8
Total Recoverable Copper	mg/kg dry wt	8	9	8	10	10

Sample Type: Soil						
Sample Name:		Kauri C/Pit 1 - 19 [1591033.8]	Kauri C/Pit 1 - 20 [1591033.9]	Kauri C/Pit 1 - 22 [1591033.10]	Kauri C/Pit 1 - 27 [1591033.11]	Kauri C/Pit 1 - 29 [1591033.12]
Lab Number:		1591034.21	1591034.22	1591034.23	1591034.24	1591034.25
Heavy Metals with Mercury, Screen Level						
Total Recoverable Lead	mg/kg dry wt	1.1	1.2	1.1	1.3	1.3
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	4	6	5	8	6
Total Recoverable Zinc	mg/kg dry wt	31	55	31	85	43
BTEX in Soil by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Toluene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Ethylbenzene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
m&p-Xylene	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
o-Xylene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Anthracene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[a]anthracene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[k]fluoranthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Chrysene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluorene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Naphthalene	mg/kg dry wt	< 0.13	< 0.12	< 0.13	< 0.12	< 0.12
Phenanthrene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Pyrene	mg/kg dry wt	0.03	< 0.03	< 0.03	< 0.03	< 0.03
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 8	< 8	< 8	< 8	< 8
C10 - C14	mg/kg dry wt	41	< 20	< 20	< 20	< 20
C15 - C36	mg/kg dry wt	680	< 40	530	< 40	< 40
Total hydrocarbons (C7 - C36)	mg/kg dry wt	720	< 70	530	< 70	< 70

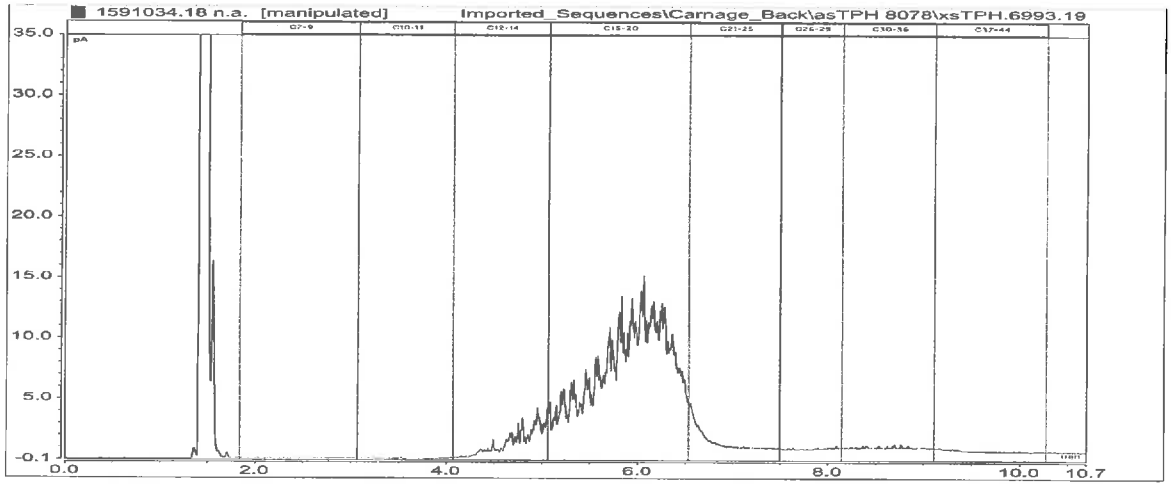
Sample Name:		Kauri C/Pit 1 - 31 [1591033.13]	Kauri C/Pit 1 - 32 [1591033.14]	Kauri C/Pit 1 - 33 [1591033.15]		
Lab Number:		1591034.26	1591034.27	1591034.28		
Individual Tests						
Dry Matter	g/100g as rcvd	81	84	83	-	-
Soluble Salts*	g/100g dry wt	< 0.05	< 0.05	< 0.05	-	-
Electrical Conductivity (EC)*	mS/cm	< 0.2	< 0.2	< 0.2	-	-
Total Recoverable Barium	mg/kg dry wt	27	21	37	-	-
Total Recoverable Sodium	mg/kg dry wt	450	510	480	-	-
Chloride*	mg/kg dry wt	4	13	7	-	-
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	< 2	< 2	< 2	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	-	-
Total Recoverable Chromium	mg/kg dry wt	7	8	8	-	-
Total Recoverable Copper	mg/kg dry wt	10	8	7	-	-
Total Recoverable Lead	mg/kg dry wt	1.1	1.0	1.0	-	-
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	-	-
Total Recoverable Nickel	mg/kg dry wt	4	4	5	-	-
Total Recoverable Zinc	mg/kg dry wt	38	33	36	-	-
BTEX in Soil by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	-	-
Toluene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	-	-

Sample Type: Soil						
Sample Name:		Kauri C/Pit 1 - 31 [1591033.13]	Kauri C/Pit 1 - 32 [1591033.14]	Kauri C/Pit 1 - 33 [1591033.15]		
Lab Number:		1591034.26	1591034.27	1591034.28		
BTEX in Soil by Headspace GC-MS						
Ethylbenzene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	-	-
m&p-Xylene	mg/kg dry wt	< 0.10	< 0.10	< 0.10	-	-
o-Xylene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	-
Acenaphthylene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	-
Anthracene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	-
Benzo[a]anthracene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	-
Chrysene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	-
Fluoranthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	-
Fluorene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	-
Naphthalene	mg/kg dry wt	< 0.14	< 0.13	< 0.14	-	-
Phenanthrene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	-
Pyrene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 9	< 8	< 8	-	-
C10 - C14	mg/kg dry wt	< 20	< 20	< 20	-	-
C15 - C36	mg/kg dry wt	320	< 40	174	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	320	< 70	174	-	-

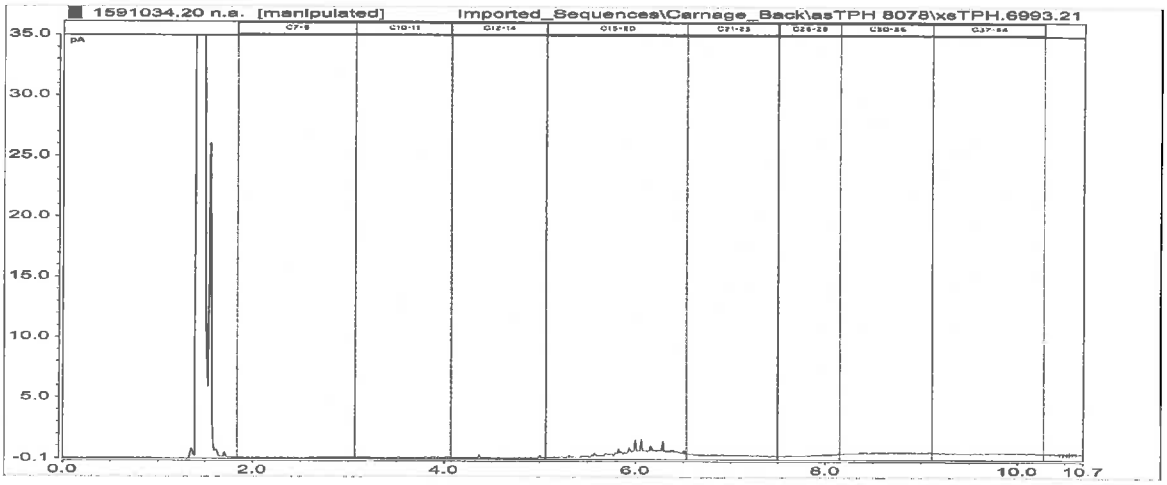
1591034.14
Kauri C/Pit 1 - 1 [1591033.1]
Client Chromatogram for TPH by FID



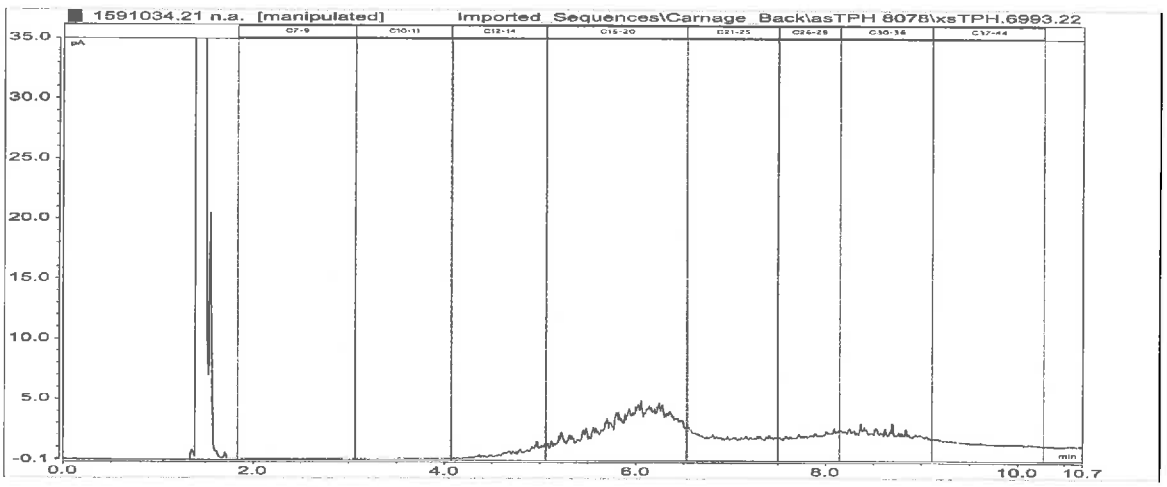
1591034.18
Kauri C/Pit 1 - 10 [1591033.5]
Client Chromatogram for TPH by FID



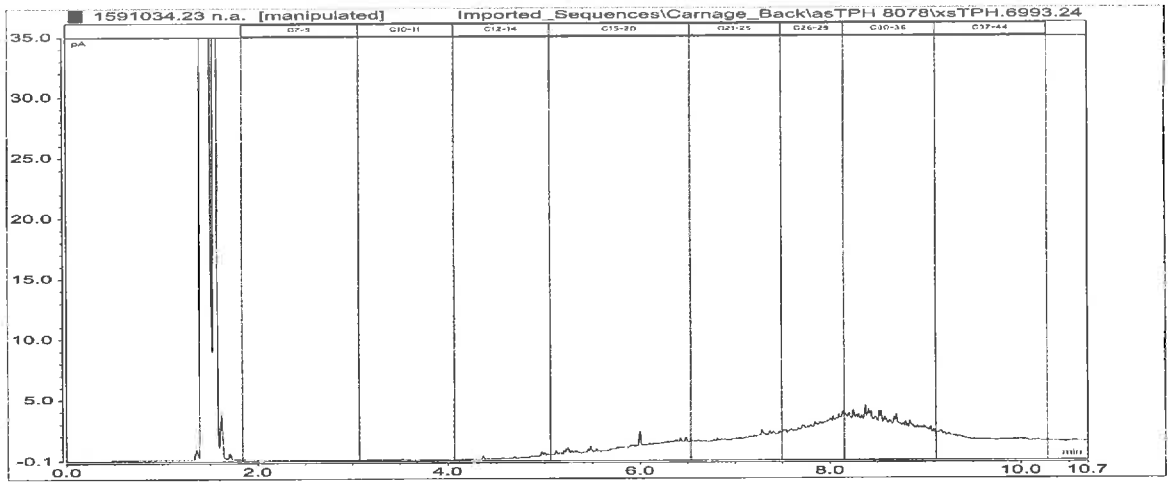
1591034.20
Kauri C/Pit 1 - 16 [1591033.7]
Client Chromatogram for TPH by FID



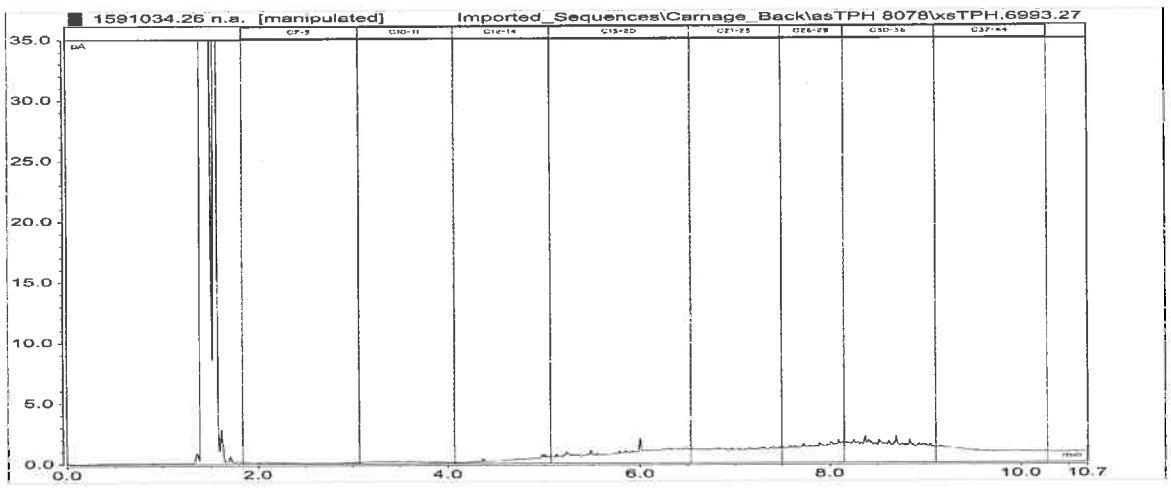
1591034.21
Kauri C/Pit 1 - 19 [1591033.8]
Client Chromatogram for TPH by FID



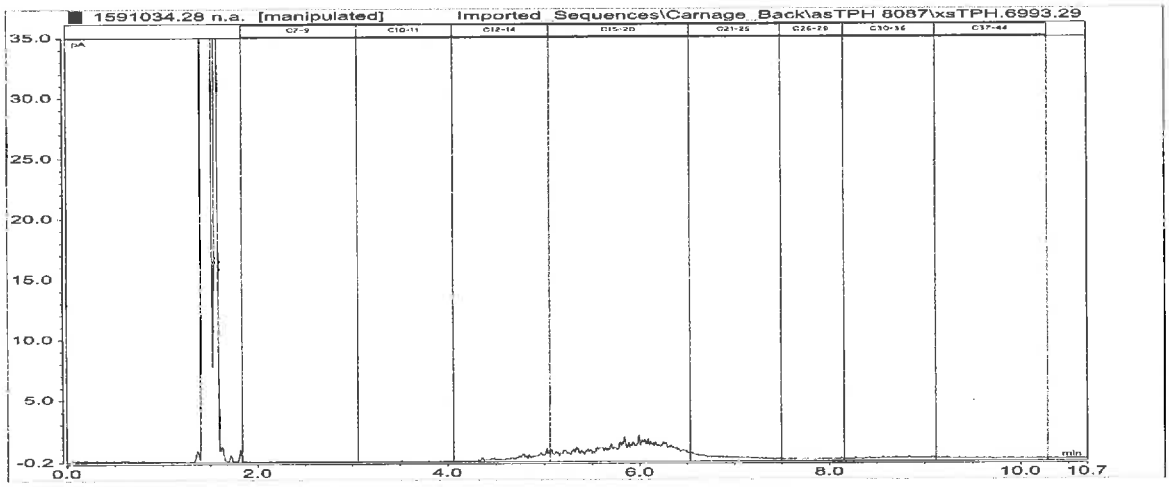
1591034.23
Kauri C/Pit 1 - 22 [1591033.10]
Client Chromatogram for TPH by FID



1591034.26
Kauri C/Pit 1 - 31 [1591033.13]
Client Chromatogram for TPH by FID



1591034.28
Kauri C/Pit 1 - 33 [1591033.15]
Client Chromatogram for TPH by FID



SUMMARY OF METHODS

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

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Soil Prep Dry & Sieve for Agriculture	Air dried at 35°C and sieved, <2mm fraction.	-	1-28
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1-28
BTEX in Soil by Headspace GC-MS	Solvent extraction, Headspace GC-MS analysis US EPA 8260B. Tested on as received sample [KBIs:5782,26687,3629]	0.05 - 0.10 mg/kg dry wt	1-28
Polycyclic Aromatic Hydrocarbons Screening in Soil	Sonication extraction, Dilution or SPE cleanup (if required), GC-MS SIM analysis (modified US EPA 8270). Tested on as received sample. [KBIs:5786,2805,2695]	0.010 - 0.05 mg/kg dry wt	1-28
Total Petroleum Hydrocarbons in Soil	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	1-28
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. US EPA 3550. (Free water removed before analysis).	0.10 g/100g as rcvd	1-28
esICextn*	(1:5) ratio of sample (g):0.02M potassium dihydrogen ortho-phosphate extractant (mL), analysis by Ion Chromatography. In House.	-	1-28
Soluble Salts*	1:5 soil:water extraction followed by potentiometric determination of conductivity. SS=EC*0.35 Calculated from EC measurement.	0.05 g/100g dry wt	1-28
Conductivity from soluble salts*	1:5 soil:water extraction, potentiometric conductivity determination (Soluble salts/0.35).	0.2 mS/cm	1-28
Total Recoverable Barium	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	0.4 mg/kg dry wt	1-28
Total Recoverable Sodium	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	40 mg/kg dry wt	1-28
Chloride*	Ion Chromatography determination of es potassium phosphate extraction.	3 mg/kg dry wt	1-28

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

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

Peter Robinson MSc (Hons), PhD, FNZIC
Client Services Manager - Environmental

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ANALYSIS REPORT

Client:	Waste Remediation Services Limited (WRS)	**Lab No:**	1600311 SPv2
Contact:	Keith Brodie	**Date Registered:**	15-Jun-2016
	PO Box 77	**Date Reported:**	23-Jun-2016
	Oakura 4345	**Quote No:**	77512
	TARANAKI	**Order No:**	KB5670
		Client Reference:	Kauri-C
		Submitted By:	Keith Brodie

Sample Type: Soil

Sample Name:		Kauri-C Pit 2-3 14-Jun-2016 12:35 pm	Kauri-C Pit 2-6 14-Jun-2016 12:40 pm	Kauri-C Pit 2-7 14-Jun-2016 12:50 pm	Kauri-C Pit 2-9 14-Jun-2016 12:50 pm	Kauri-C Pit 2-10 14-Jun-2016 12:55 pm
Lab Number:		1600311.1	1600311.2	1600311.3	1600311.4	1600311.5
Individual Tests						
Dry Matter	g/100g as rcvd	90	88	85	96	81
Soluble Salts*	g/100g dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Electrical Conductivity (EC)*	mS/cm	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Total Recoverable Barium	mg/kg dry wt	43	138	15.0	28	19.6
Total Recoverable Sodium	mg/kg dry wt	310	340	520	350	590
Chloride*	mg/kg dry wt	4	4	18	< 3	12
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	< 2	< 2	< 2	< 2	< 2
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	13	13	7	9	6
Total Recoverable Copper	mg/kg dry wt	12	17	8	7	9
Total Recoverable Lead	mg/kg dry wt	1.8	1.7	0.9	0.8	0.9
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	7	6	4	4	5
Total Recoverable Zinc	mg/kg dry wt	60	62	32	36	32
BTEX in Soil by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Toluene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Ethylbenzene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
m&p-Xylene	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
o-Xylene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Anthracene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[a]anthracene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[k]fluoranthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Chrysene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluorene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Naphthalene	mg/kg dry wt	< 0.12	< 0.13	< 0.13	< 0.11	< 0.14

Sample Type: Soil						
Sample Name:		Kauri-C Pit 2-3 14-Jun-2016 12:35 pm	Kauri-C Pit 2-6 14-Jun-2016 12:40 pm	Kauri-C Pit 2-7 14-Jun-2016 12:50 pm	Kauri-C Pit 2-9 14-Jun-2016 12:50 pm	Kauri-C Pit 2-10 14-Jun-2016 12:55 pm
Lab Number:		1600311.1	1600311.2	1600311.3	1600311.4	1600311.5
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Phenanthrene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Pyrene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 8	< 8	< 8	< 8	< 8
C10 - C14	mg/kg dry wt	< 20	< 20	< 20	< 20	< 20
C15 - C36	mg/kg dry wt	< 40	< 40	< 40	< 40	< 40
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	< 70	< 70	< 70	< 70

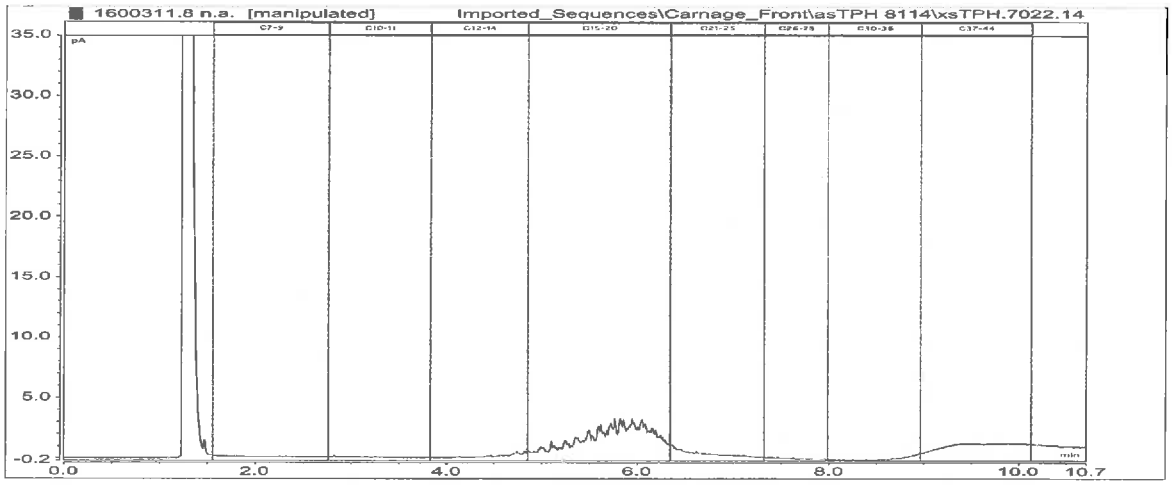
Sample Name:		Kauri-C Pit 2-13 14-Jun-2016 1:00 pm	Kauri-C Pit 2-16 14-Jun-2016 1:00 pm	Kauri-C Pit 2-19 14-Jun-2016 1:10 pm	Kauri-C Pit 2-22 14-Jun-2016 1:10 pm	Kauri-C Pit 2-26 14-Jun-2016 1:15 pm
Lab Number:		1600311.6	1600311.7	1600311.8	1600311.9	1600311.10
Individual Tests						
Dry Matter	g/100g as rcvd	83	82	83	79	89
Soluble Salts*	g/100g dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Electrical Conductivity (EC)*	mS/cm	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Total Recoverable Barium	mg/kg dry wt	16.6	72	198	360	28
Total Recoverable Sodium	mg/kg dry wt	460	290	420	410	340
Chloride*	mg/kg dry wt	7	11	11	9	4
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	< 2	< 2	< 2	< 2	< 2
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	7	9	8	11	13
Total Recoverable Copper	mg/kg dry wt	8	7	7	9	8
Total Recoverable Lead	mg/kg dry wt	1.0	1.0	1.4	1.3	1.4
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	5	5	5	5	6
Total Recoverable Zinc	mg/kg dry wt	33	38	33	46	61
BTEX in Soil by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Toluene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Ethylbenzene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
m&p-Xylene	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
o-Xylene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Anthracene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[a]anthracene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[k]fluoranthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Chrysene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluorene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Naphthalene	mg/kg dry wt	< 0.13	< 0.14	< 0.14	< 0.14	< 0.12
Phenanthrene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Pyrene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 8	< 9	< 8	< 9	< 8
C10 - C14	mg/kg dry wt	< 20	< 20	< 20	< 20	< 20

Sample Type: Soil						
Sample Name:		Kauri-C Pit 2-13 14-Jun-2016 1:00 pm	Kauri-C Pit 2-16 14-Jun-2016 1:00 pm	Kauri-C Pit 2-19 14-Jun-2016 1:10 pm	Kauri-C Pit 2-22 14-Jun-2016 1:10 pm	Kauri-C Pit 2-26 14-Jun-2016 1:15 pm
Lab Number:		1600311.6	1600311.7	1600311.8	1600311.9	1600311.10
Total Petroleum Hydrocarbons in Soil						
C15 - C36	mg/kg dry wt	< 40	< 40	260	< 40	66
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	< 70	260	< 70	< 70

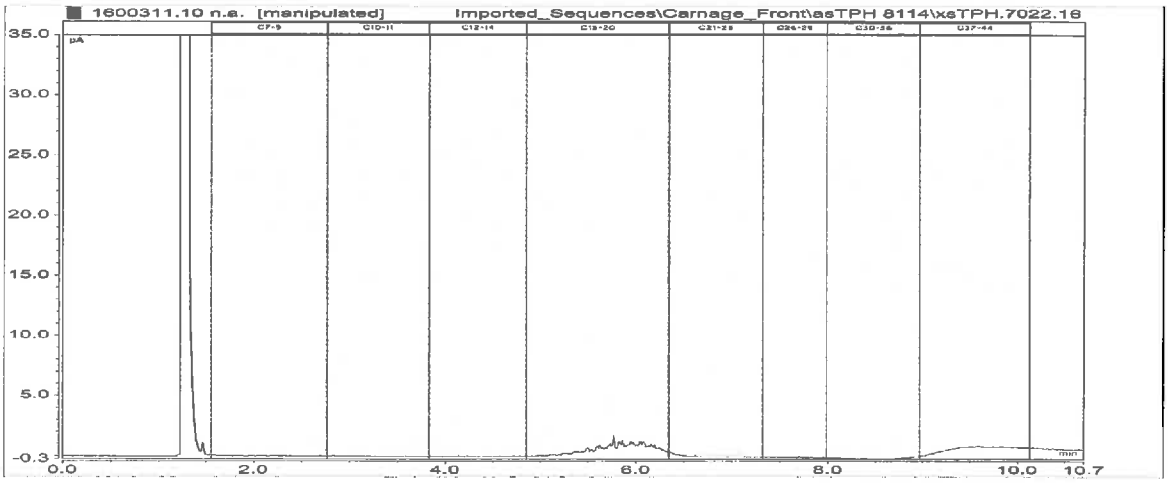
Sample Name:		Kauri-C Pit 2-29 14-Jun-2016 1:25 pm	Kauri-C Pit 2-31 14-Jun-2016 1:30 pm	Kauri-C Pit 2-32 14-Jun-2016 1:35 pm	Kauri-C Pit 2-34 14-Jun-2016 1:40 pm	Kauri-C Pit 2-36 14-Jun-2016 1:40 pm
Lab Number:		1600311.11	1600311.12	1600311.13	1600311.14	1600311.15
Individual Tests						
Dry Matter	g/100g as rcvd	95	86	87	87	96
Soluble Salts*	g/100g dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Electrical Conductivity (EC)*	mS/cm	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Total Recoverable Barium	mg/kg dry wt	18.4	58	46	102	43
Total Recoverable Sodium	mg/kg dry wt	400	610	390	550	280
Chloride*	mg/kg dry wt	7	7	6	18	< 3
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	< 2	< 2	< 2	< 2	< 2
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	11	6	13	7	10
Total Recoverable Copper	mg/kg dry wt	7	9	10	10	8
Total Recoverable Lead	mg/kg dry wt	1.1	1.1	1.5	1.3	0.9
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	6	5	7	5	4
Total Recoverable Zinc	mg/kg dry wt	49	28	51	33	38
BTEX in Soil by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Toluene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Ethylbenzene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
m&p-Xylene	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
o-Xylene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Anthracene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[a]anthracene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[k]fluoranthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Chrysene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluorene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Naphthalene	mg/kg dry wt	< 0.12	< 0.14	< 0.13	< 0.13	< 0.12
Phenanthrene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Pyrene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 8	< 8	< 8	< 8	< 8
C10 - C14	mg/kg dry wt	< 20	36	< 20	< 20	< 20
C15 - C36	mg/kg dry wt	< 40	460	< 40	49	< 40
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	490	< 70	< 70	< 70

Sample Type: Soil						
	Sample Name:	Kauri-C Pit 2-37 14-Jun-2016	Kauri-C Pit 2-38 14-Jun-2016 1:50 pm	Kauri-C Pit 2-39 14-Jun-2016 1:50 pm	Kauri-C Pit 2-40 14-Jun-2016 1:55 pm	Kauri-C Pit 2-41 14-Jun-2016 2:00 pm
	Lab Number:	1600311.16	1600311.17	1600311.18	1600311.19	1600311.20
Individual Tests						
Dry Matter	g/100g as rcvd	77	82	82	95	94
Soluble Salts*	g/100g dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Electrical Conductivity (EC)*	mS/cm	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Total Recoverable Barium	mg/kg dry wt	33	350	250	12.7	12.1
Total Recoverable Sodium	mg/kg dry wt	600	430	390	210	230
Chloride*	mg/kg dry wt	14	6	11	< 3	< 3
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	< 2	< 2	< 2	< 2	< 2
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	7	12	11	16	17
Total Recoverable Copper	mg/kg dry wt	10	10	8	7	8
Total Recoverable Lead	mg/kg dry wt	1.1	1.8	1.3	0.8	0.8
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	4	6	5	6	7
Total Recoverable Zinc	mg/kg dry wt	33	52	42	56	56
BTEX in Soil by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.06	< 0.05	< 0.05	< 0.05	< 0.05
Toluene	mg/kg dry wt	< 0.06	< 0.05	< 0.05	< 0.05	< 0.05
Ethylbenzene	mg/kg dry wt	< 0.06	< 0.05	< 0.05	< 0.05	< 0.05
m&p-Xylene	mg/kg dry wt	< 0.11	< 0.10	< 0.10	< 0.10	< 0.10
o-Xylene	mg/kg dry wt	< 0.06	< 0.05	< 0.05	< 0.05	< 0.05
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Anthracene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[a]anthracene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[k]fluoranthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Chrysene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluorene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Naphthalene	mg/kg dry wt	< 0.15	< 0.14	< 0.13	< 0.12	< 0.12
Phenanthrene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Pyrene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 9	< 9	< 8	< 8	< 8
C10 - C14	mg/kg dry wt	< 20	78	28	< 20	< 20
C15 - C36	mg/kg dry wt	< 40	450	186	< 40	< 40
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	520	210	< 70	< 70

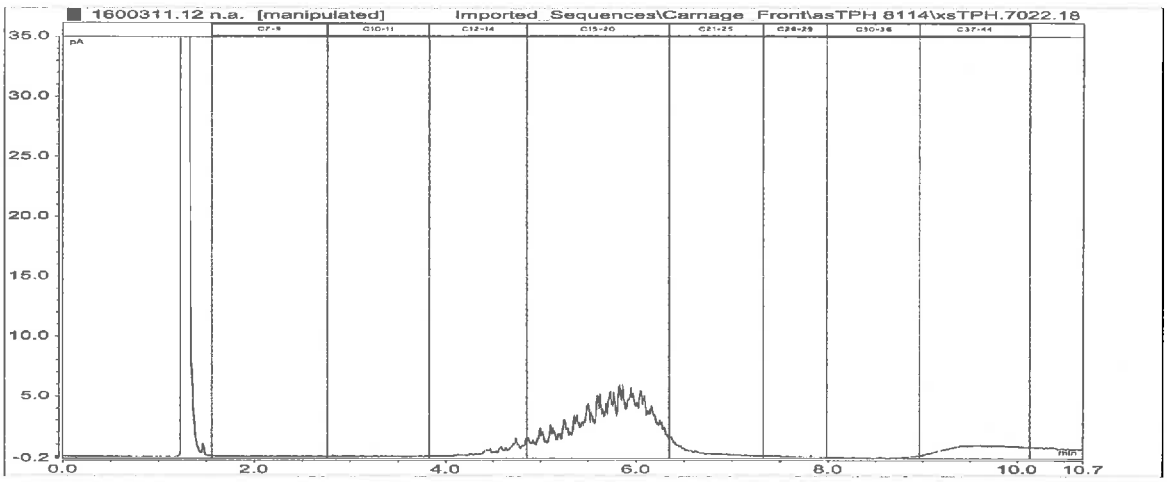
1600311.8
Kauri-C Pit 2-19 14-Jun-2016 1:10 pm
Client Chromatogram for TPH by FID



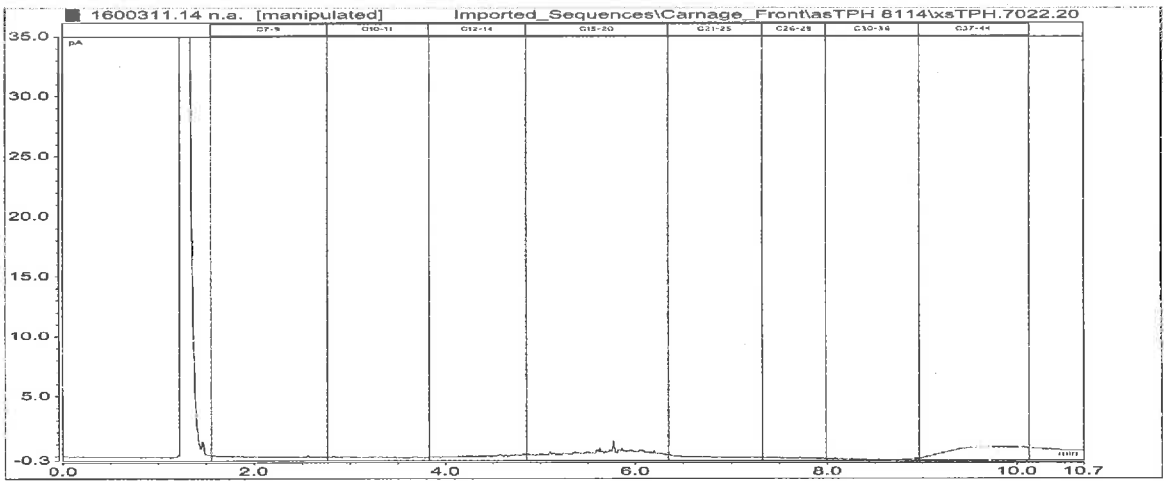
1600311.10
Kauri-C Pit 2-26 14-Jun-2016 1:15 pm
Client Chromatogram for TPH by FID



1600311.12
Kauri-C Pit 2-31 14-Jun-2016 1:30 pm
Client Chromatogram for TPH by FID



1600311.14
Kauri-C Pit 2-34 14-Jun-2016 1:40 pm
Client Chromatogram for TPH by FID



1600311.17
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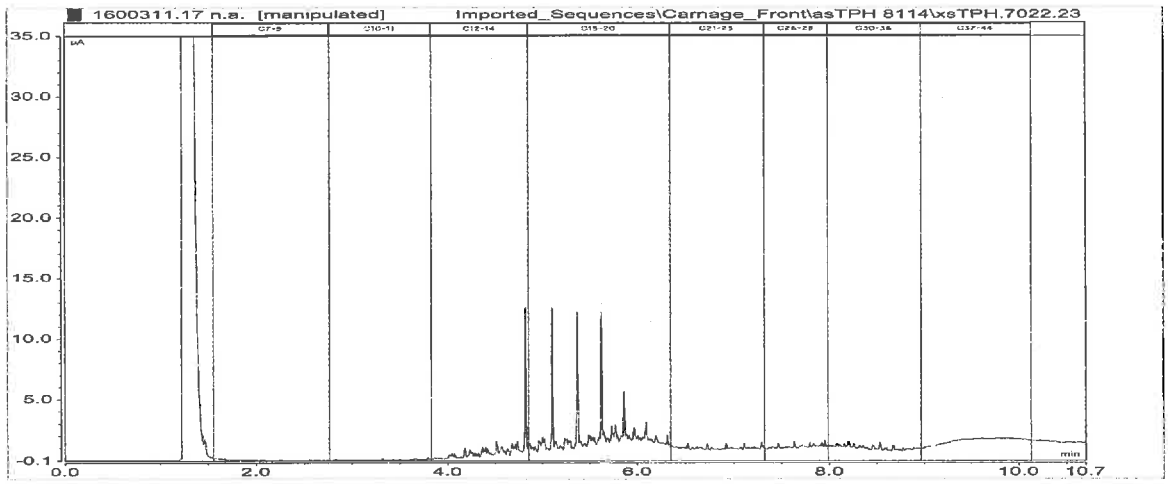
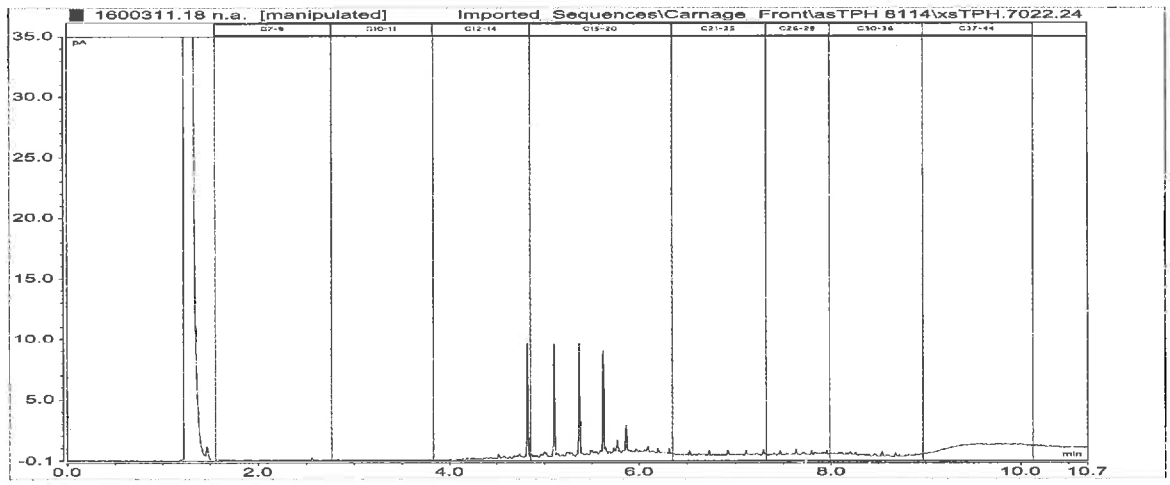
Client Chromatogram for TPH by FID



1600311.18
Kauri-C Pit 2-39 14-Jun-2016 1:50 pm
Client Chromatogram for TPH by FID



SUMMARY OF METHODS

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

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Soil Prep Dry & Sieve for Agriculture	Air dried at 35°C and sieved, <2mm fraction.	-	1-20
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1-20
BTEX in Soil by Headspace GC-MS	Solvent extraction, Headspace GC-MS analysis US EPA 8260B. Tested on as received sample [KBIs:5782,26687,3629]	0.05 - 0.10 mg/kg dry wt	1-20
Polycyclic Aromatic Hydrocarbons Screening in Soil	Sonication extraction, Dilution or SPE cleanup (if required), GC-MS SIM analysis (modified US EPA 8270). Tested on as received sample. [KBIs:5786,2805,2695]	0.010 - 0.05 mg/kg dry wt	1-20
Total Petroleum Hydrocarbons in Soil	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	1-20
TPH + PAH + BTEX profile	Sonication extraction, SPE cleanup, GC & GC-MS analysis	0.010 - 60 mg/kg dry wt	1-20
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. US EPA 3550. (Free water removed before analysis).	0.10 g/100g as rcvd	1-20
esICextn*	(1:5) ratio of sample (g):0.02M potassium dihydrogen ortho-phosphate extractant (mL), analysis by Ion Chromatography. In House.	-	1-20
Soluble Salts*	1:5 soil:water extraction followed by potentiometric determination of conductivity. SS=EC*0.35 Calculated from EC measurement.	0.05 g/100g dry wt	1-20
Conductivity from soluble salts*	1:5 soil:water extraction, potentiometric conductivity determination (Soluble salts/0.35).	0.2 mS/cm	1-20
Total Recoverable Barium	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	0.4 mg/kg dry wt	1-20
Total Recoverable Sodium	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	40 mg/kg dry wt	1-20
Chloride*	Ion Chromatography determination of es potassium phosphate extraction.	3 mg/kg dry wt	1-20

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

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

Peter Robinson MSc (Hons), PhD, FNZIC
Client Services Manager - Environmental

Attachment A: Landfarm Site Map

Ref.	Mud Type	Date Farmed	Well Name	Easting	Northing	Area m²	Volume m³
S2	WBM	Oct 2004	Cheal	1721731	5602149	1309	
S3	WBM	June 2004	Kauri C	1721947	5602035	2387	
S4	WBM	Nov 2004	Hihi	1721937	5602075	2530	
S5	WBM	Jan 2005	Mitomiro	1722044	5601985	5559	
S6	WBM	May 2005	Karariki	1722039	5602054	2874	
S7	SBM	Sep 2005	Plakau 1	1722051	5601937	1290	
S8	SBM	Sep 2005	Plakau 2	1721695	5601748	840	
S9	WBM	Sep 2005	Plakau 2	1721644	5601726	2485	
S10	SBM	Sep 2005	Plakau 2	1721557	5601806	2365	
S11	WBM	Sep 2005	Plakau 1	1721556	5601790	3014	
S12	WBM	Sep 2005	Plakau 1	1721538	5601706	1795	
S13	WBM	Sep 2005	Plakau 2	1721555	5601762	2073	
S14	WBM	Oct 2005	Ahuroa 1	1721839	5601798	3437	
S15	SBM	Oct 2005	Ahuroa 1	1721971	5601988	2564	
S16	Control Site			1721993	5601940	1657	
S17	SBM	Dec 2005	Kauri F3	1721658	5601826	2426	
S18	WBM	Dec 2005	Kauri F2 & F3	1721848	5601850	2768	
S19	SBM	Dec 2005	Kauri F3	1721757	5601757	2334	
S20	OW	Dec 2005	Oily Waste	1721837	5601713	877	
S21	WBM	Feb 2006	Arakamu	1721809	5601771	4916	
S22	WBM	Jan 2007	Radnor	1721871	5601779	2215	
S23	OW	June 2009	Manutahi A	1722090	5602507	501	30
S24/S25a/b	WBM	July 2010	Ahuroa B & Kauri F	1721556	5601932	23622	4575
S26	OW	June 2011	Ahuroa B	1721904	5601845	1112	
S27/28	OW	June 2011	Rimu Pipeline Link	1721879	5601816	2473	
S29	WBM	June 2011	Manutahi D 23A4	1721824	5601977	47863	
S31	WBM	Jan 2012	Manutahi D 23A4	1721982	5602160	3032	250

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GENERAL NOTES:
1. Coordinates are in terms of NZGD 2000 Taranaki Mercator

DISCLAIMER:
Boundary information has been imported from external sources. As-laids and dimensions may be subject to scale error. Use of this drawing for other purposes is at the user's risk. Print from PDF scale and accuracy. Pipelines are indicative only.

REV	DATE	BY	CHK	APP	DESCRIPTION
7	08/01/12	JH	PP		Add disposal site S31
6	20/07/11	JH	GJ		Add disposal sites S21, S27/28, S29
5	07/07/11	JH	GJ		Merge disposal areas S24/S25a,b
4	09/10/10	PT	GJ		Adjust disposal area S24/S25a
3	16/09/10	PT	GJ		Add disposal area S24/S25a & S24/S25b
2	10/07/08	PT	GJ		Add disposal area S23
1	30/01/08	PT	GJ		Add disposal area

REVISIONS

DRAWN: TIM CAMPSON 04/11/08
CHECKED: JAMES 01/11/08
PROJECT No: 08327
LOCATION: MANUTAHI
ORIGINAL SIZE: A3
SCALE: 1:4,000

SPENCE ROAD
DISPOSAL SITE PLAN
EXTENTS AS AT JANUARY 2011

Origin energy

DRAWING No: 08327-02-GIS
REVISION: 7

Attachment C: Sample Analysis Results

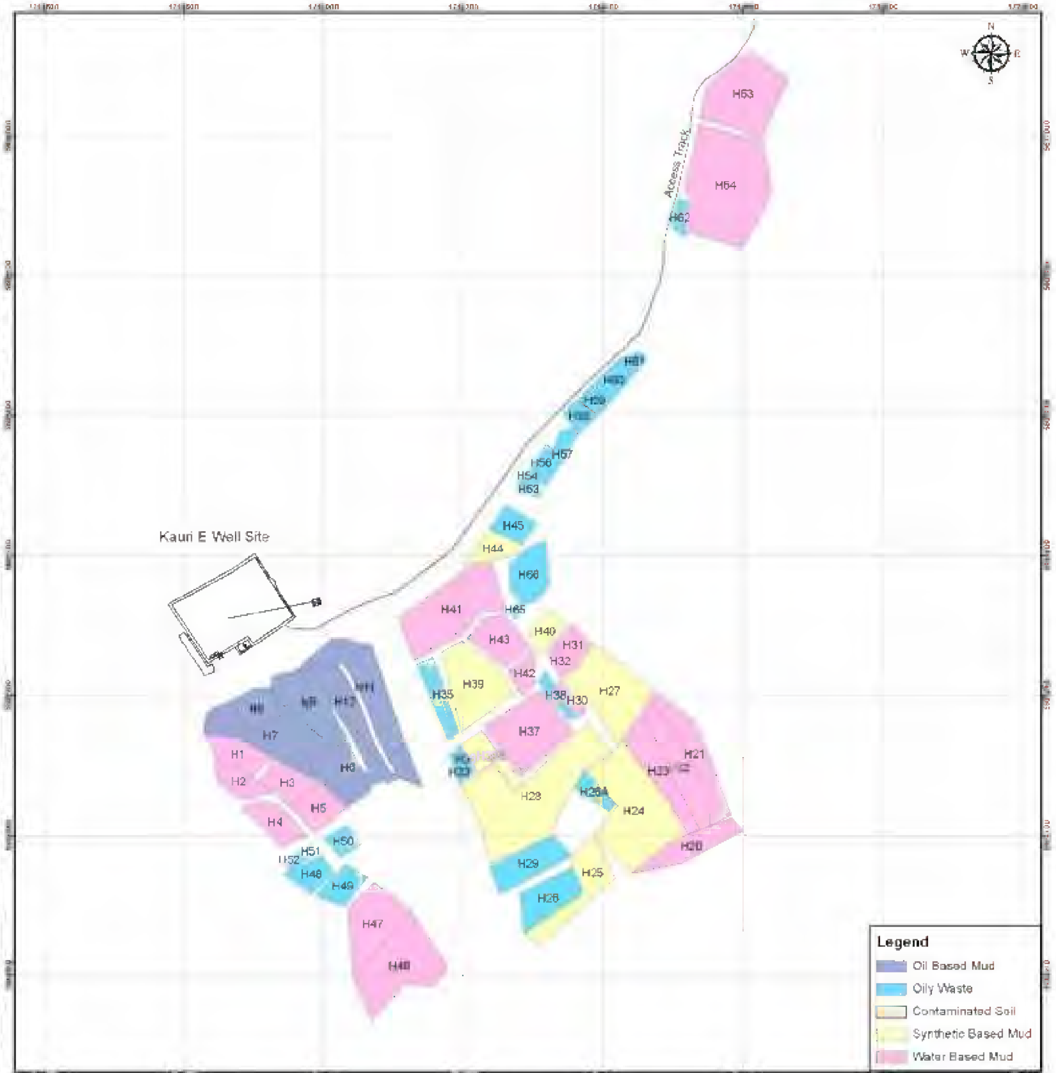
Compilation of soil sample analysis for Spence Road Landfarm

(Analysis results are from samples taken from date of spreading until all parameters met consent limits - with the latest result for each parameter shown)

										Heavy Metals								TPH				STEX					PAH		
Site	Type	Date Farmed	Date of last sample	Conductivity mS/m-1	Recov Be mg/Kg dry wt	Recov Cl mg/Kg dry wt	Recov Na mg/Kg dry wt	Soluble Salts gr/100g dry wt	Sodium Absorption Ratio SAR	Arsenic mg/Kg dry wt	Cadium mg/Kg dry wt	Chromium mg/Kg dry wt	Copper mg/Kg dry wt	Lead mg/Kg dry wt	Mercury mg/Kg dry wt	Nickel mg/Kg dry wt	Zinc mg/Kg dry wt	C7-C9 mg/Kg dry wt	C10-C14 mg/Kg dry wt	C15-C36 mg/Kg dry wt	Total HCs mg/Kg dry wt	Benzene mg/Kg dry wt	Toluene mg/Kg dry wt	Ethylbenzene mg/Kg dry wt	m & p-Xylene mg/Kg dry wt	o-Xylene mg/Kg dry wt	Benzo(a)pyrene (BAP)	Naphthalene	Pyrene
Consent Limits				290	10000	700	460	2500	18	20	1	600	100	300	1	60	300	120.0	58	4000	–	1.1	68	53	48	48	0.027	7.2	160
S2	WBM	Oct 2004	1/05/2014	<0.2	240	71	90	<0.05	0.90	<2	<0.1	10	10	1.30	<0.1	7	49	<8	<20	<30	<60	<0.02	<0.02	<0.02	<0.02	<0.02	<0.03	0.13	0.03
S3	WBM	Jun 2004	1/05/2014	<0.2	63	8	82	<0.05	1.5	<2	<0.1	13	10	0.8	<0.1	6	58	<7	<10	<30	<60	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	0.13	0.03
S4	WBM	Nov 2004	1/05/2014	<0.2	48	323	94	<0.05	0.7	<2	<0.1	13	17	2.2	<0.1	7	61	<7	<10	<30	<60	<0.02	<0.02	<0.02	<0.02	<0.02	<0.03	0.13	0.03
S5	WBM	Jan 2005	1/05/2014	<0.2	276	80	170	<0.05	2.1	<2	<0.1	14	18	2.7	<0.1	8	65	<7	<10	40	<60	<0.02	<0.02	<0.02	<0.02	<0.02	<0.03	0.13	0.03
S6	WBM	May 2005	1/05/2014	<0.2	122	10	98	<0.05	1.3	<2	<0.1	13	23	3.3	<0.1	8	64	<7	<10	70	<60	<0.02	<0.02	<0.02	<0.02	<0.02	<0.03	0.13	0.03
S7	SBM	Sep 2005	18/05/2010	<0.2	460	7	330	<0.05	0.60	<2	<0.1	11	12	9.0	<0.1	7	50	<8	<20	35	<60	<0.02	<0.02	<0.02	<0.02	<0.02	<0.03	<0.12	<0.03
S8/10	SBM	Sep 2005	18/03/2014	<0.2	1650	2	14	<0.05	0.60	<2	<0.1	11	17	71.6	<0.1	7	46	<8	<20	93	93	<0.04	<0.04	<0.04	<0.08	<0.04	<0.03	<0.1	0.13
S9/13	WBM	Sep 2005	27/11/2012	<0.2	410	5	340	<0.05	1.20	<2	<0.1	13	12	6.1	<0.1	7	56	<8	<20	210	210	<0.04	<0.04	<0.04	<0.08	<0.04	<0.03	<0.12	<0.03
S11/12	WBM	Sep 2005	6/05/2014	<0.2	2700	35	350	<0.05	0.8	<2	<0.1	25	21	31.4	<0.1	12	108	<8	30	1070	1100	<0.04	<0.04	<0.04	<0.08	<0.04	<0.03	<0.13	<0.03
S14	WBM	Oct 2005	1/05/2014	<0.2	430	24	103	<0.05	1.10	<2	<0.1	15	19	6.5	<0.1	8	61	<8	<20	43	<60	<0.04	<0.04	<0.04	<0.08	<0.04	<0.03	0.12	0.03
S15	SBM	Oct 2005	18/03/2014	<0.2	1830	10	400	<0.05	0.6	<2	<0.1	11	15	13.6	<0.1	8	47	<8	<20	110	110	<0.04	<0.04	<0.04	<0.08	<0.04	<0.02	<0.1	0.05
S17&19	SBM	Dec 2005	6/05/2014	<0.2	246	37	113	<0.05	0.8	<2	<0.1	19	15	2.1	<0.1	9	81	<8	<20	210	220	<0.04	<0.04	<0.04	<0.08	<0.04	<0.02	<0.1	<0.02
S18	WBM	Dec 2005	1/05/2014	0.20	920	81	260	0.08	1.00	<2	<0.1	16	25	4.20	<0.1	9	66	<8	<20	<30	<60	<0.04	<0.04	<0.04	<0.07	<0.04	<0.03	<0.14	<0.03
S20	OW	Dec 2005	18/03/2014	<0.02	1170	18	410	<0.05	2	<2	<0.1	19	19	20.1	<0.1	10	78	<8	<20	<30	<60	<0.04	<0.04	<0.04	0.15	0.08	<0.02	<0.1	0.06
S21	WBM	Feb 2006	1/05/2014	<0.02	245	127	145	<0.05	1.9	<2	<0.1	15	11	1.7	<0.1	7	59	<7	<10	40	50	<0.04	<0.04	<0.04	<0.08	<0.04	<0.03	0.14	0.03
S22	WBM	Jan 2007	6/05/2014	<0.2	2200	9	410	<0.05	2.5	<2	<0.1	20	18	2.1	<0.1	10	80	<8	<20	<30	<60	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.12	<0.03
S23	OW	Jun 2009	3/09/2010	<0.20	36	5	300	<0.05	0.8	<2	<0.10	16	33	5.9	<0.10	8	99	<8	<20	<40	<60	<0.05	<0.05	<0.05	<0.10	<0.05	<0.025	<0.13	0.15
S24/25	WBM	Jul 2010	1/09/2011	<0.2	194	12	270	<0.05	1.2	<2	<0.10	14	12	1.5	<0.10	7	67	<8	<20	<40	<70	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.12	<0.03
S26	OW	Jun 2011	1/04/2011	<0.2	194	12	270	<0.05	1.2	<2	<0.10	14	12	1.5	<0.10	7	67	<8	<20	<40	<70	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.12	<0.03
S27/28	OW	Jun 2011	1/08/2011	<0.20	450	22	350	<0.05	1.1	<2	<0.10	12	14	2.1	<0.10	6.0	57	<8	<20	<40	<70	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.12	<0.03
S29	WBM	Jun 2011	30/08/2012	<0.02	49	22	320	<0.05	1.5	<2	<.10	13	11	1.1	<.10	6	58	<8	<20	<40	<70	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.12	<0.03
S31	WBM/OW	Jan 2012	30/08/2012	<0.02	17	11	250	<0.05	1.1	<2	<.10	13	11	1.1	<.10	7	59	<8	<20	<40	<70	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.12	<0.03

Attachment A: Landfarm Site Map

Ref	Mud Type	Date Farmed	Well Name	Easting	Northing	Area m²	Volume m³
H1	WBM	Jun 2004	Manutahi B	[illegible]	5605117	2890	
H2	WBM	Jun 2004	Manutahi A	1718878	5605077	2488	
H3	WBM	Jul 2004	Manutahi D	1718949	5605075	2998	
H4	WBM	Jun 2004	Kauri E5	1718931	5605019	2984	
H5	WBM	Jul 2004	Manutahi C	1718993	5605039	2917	
H6	OBM	Jul 2004	Manutahi D	1719035	5605098	6943	
H7	OBM	Jun 2004	Manutahi A	1718924	5605143	7905	
H8	OBM	[illegible] 2004	Kauri C	[illegible]	[illegible]	3031	
H9	OBM	Jun 2004	Manutahi B	1718979	5605192	6570	
H11	OBM	Jul 2004	Manutahi G	1719060	5605212	7922	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	WBM	Jan 2006	Pohutukawa A	1719526	5604986	4037	
[illegible]	WBM	Mar 2005	Goss A	1719531	5605115	5357	
[illegible]	WBM	Mar 2005	Kauri E12	1719510	5605098	5514	
[illegible]	WBM	Feb 2006	Trapper A	[illegible]	5605093	5059	
[illegible]	SBM	Feb 2006	Trapper A	[illegible]	5605035	13480	
[illegible]	SBM	Mar 2006	Kauri E12	1719385	5604947	5323	
[illegible]	OW	Feb 2006	Oily Waste	1719322	5604911	4289	
H26A	OW	Mar 2006	Oily Waste	1719387	5605063	1338	
H27	SBM	Apr 2006	Kauri E12	1719410	5605207	8638	
[illegible]	SBM	Mar 2006	Goss A	1719298	5605056	17012	
[illegible]	OW	Jun 2006	Oily Waste	1719293	5604960	4402	
[illegible]	[illegible]	[illegible]	[illegible]	1719350	[illegible]	[illegible]	
H31	WBM	Sept 2006	Waihapa C	1719358	5605273	1645	
H32	WBM	Sept 2006	Waihapa H	1719339	5605249	936	
[illegible]	OW	Oct 2006	Oily Waste	[illegible]	5605098	662	
[illegible]	OW	Oct 2006	Waihapa C Oily waste	[illegible]	5605197	1416	
[illegible]	OW	Feb 2007	Rimu PS [illegible] OW	1719171	5605202	892	
[illegible]	OW	Dec 2006	Oily Waste	1719203	5605110	309	
[illegible]	[illegible]	[illegible]	[illegible]	1719295	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	Trapper A	[illegible]	[illegible]	[illegible]	
[illegible]	WBM	Feb 2007	Goss A sump	[illegible]	[illegible]	10467	
[illegible]	WBM	May 2007	Waihapa C Sump	1719287	[illegible]	1529	
[illegible]	WBM	May 2007	Waihapa H Sump	1719251	5605280	3666	
[illegible]	[illegible]	[illegible]	[illegible]	1719242	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	OW	Oct 2007	Oily Waste	[illegible]	5604928	2187	
[illegible]	OW	May 2008	RPS [illegible] Waste	1719028	[illegible]	1256	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	Oily Waste	[illegible]	[illegible]	[illegible]	
[illegible]	OW	Sept 2008	Tariki A contaminated metal	[illegible]	5605496	437	
[illegible]	[illegible]	[illegible]	[illegible]	1719291	[illegible]	[illegible]	
[illegible]	OW	Sept 2008	Manutahi D contaminated metal	1719287	5605518	24	
[illegible]	OW	Sept 2008	Waihapa Production Station Cleaning [illegible]	1719311	5605530	648	
[illegible]	OW	Sept 2008	Rimu Production Station	1719336	5605544	1566	
[illegible]	[illegible]	[illegible]	[illegible]	1719365	[illegible]	[illegible]	[illegible]
[illegible]	OW	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	OW	June 2009	Rimu A Oily Waste	[illegible]	5605650	1675	100
[illegible]	OW	June 2009	Waihapa Production Station	[illegible]	5605677	606	30
[illegible]	OW	June 2010	Oily waste from cleaning (various sources)	1719274	5605322	250	3.5
[illegible]	[illegible]	[illegible]	[illegible]	1719600	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	1719576	[illegible]	[illegible]	[illegible]
[illegible]	OW	[illegible] 2009	Oily waste from cleaning old waste pits	1719274	5605322	250	10
[illegible]	OW	March 2011	Kauri E	1719293	5605372	3707	



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Web : www.btwcompany.co.nz

GENERAL NOTES:
1. Coordinates are in terms of NZGD 2000 Transverse Mercator

DISCLAIMER:
Boundary information has been imported from external source. Areas and dimensions may be subject to scale error. Use of this drawing for other purposes is at the user's risk. Printed/PDF scale not accurate.

SCHRIDER DISPOSAL SITE

Origin energy

DRAWING No. 05342-06-GIS

REVISION 7

Attachment B: Sample Analysis Results

Compilation of soil sample analysis for Schrider Landfarm

(Analysis results are from samples taken from date of excavating until all parameters met consent limits – with the latest result for each parameter shown)

Site	Type	Date Farmed	Date of last sample						Heavy Metals								TPH				BTEX					PAH	
				Conductivity mS/cm	Recov Ca mg/kg dry wt	Recov Cl mg/kg dry wt	Recov Na mg/kg dry wt	Soluble Salts g/100g dry wt	Sodium Absorption Ratio S	Arsenic mg/kg dry wt	Cadium mg/kg dry wt	Chromium mg/kg dry wt	Copper mg/kg dry wt	Lead mg/kg dry wt	Mercury mg/kg dry wt	Nickel mg/kg dry wt	Zinc mg/kg dry wt	C7-C9 mg/kg dry wt	C10-C14 mg/kg dry wt	C15-C36 mg/kg dry wt	Total HC's mg/kg dry wt	Benzene mg/kg dry wt	Toluene mg/kg dry wt	Ethylbenzene mg/kg dry wt	m & p-xylene mg/kg dry wt	o-Xylene mg/kg dry wt	Benzo(a)pyrene (BaP)	Naphthalene	Pyrene
Consent Limits				290	10000	700	460	3500	18	20	1	600	100	300	1	60	300	120.0	58	4000	–	1.1	68	50	48	48	0.027	7.2	160
H1	WBM	Jun 2004	6/05/2014	<0.02	77	12	28	<0.05	1.3	<2	<0.1	15	12	1.5	<0.1	8	74	<4	<8	350	350	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.12	<0.03
H2	WBM	Jun 2004	6/05/2014	<0.02	133	6	26	<0.05	1	<2	<0.1	14	11	1.6	<0.1	7	68	<7	<10	290	290	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.12	<0.03
H3	WBM	Jul 2004	6/05/2014	<0.02	171	13	16	<0.05	0.6	<2	<0.1	11	11	1.4	<0.1	6	57	<7	<10	320	320	<0.05	<0.05	<0.05	<0.1	<0.05	<0.03	<0.13	<0.03
H4	WBM	Jun 2004	6/05/2014	<0.02	319	49	24	<0.05	0.9	<2	<0.1	17	13	2.0	<0.1	9	81	<4	<8	<20	<30	<0.05	<0.05	<0.05	<0.1	<0.05	<0.03	<0.13	<0.03
H5	WBM	Jul 2004	6/05/2014	<0.05	116	9	12	<0.05	0.8	<2	<0.1	14	11	1.3	<0.1	7	66	<8	<20	80	80	<0.05	<0.05	<0.05	<0.1	<0.05	<0.03	<0.12	<0.03
H6	OBM	Jul 2004	6/05/2014	<0.02	70	20	57	<0.05	1.7	<2	<0.1	11	11	2.7	<0.1	6	62	<7	<10	<30	<50	<0.03	<0.06	<0.03	<0.03	<0.03	<0.01	<0.07	0.41
H7	OBM	Jun 2004	18/06/2010	<0.02	150	18	260	<0.05	2.1	<2	<0.1	20	14	3.7	<0.1	9	94	<8	<20	<32	<60	<0.03	<0.06	<0.03	<0.03	<0.03	<0.023	<0.12	<0.023
H8	OBM	Aug 2004	6/05/2014	<0.02	470	8	90	<0.05	0.80	<2	<0.1	22	14	1.8	<0.1	10	100	<7	15	1220	1230	>0.05	<0.05	<0.05	<0.1	<0.05	<0.027	<0.14	<0.027
H9	OBM	Jun 2004	18/06/2010	<0.02	530	36	450	<0.05	1.6	<2	<0.1	13	12	9.5	<0.1	6	61	<8	<20	<40	<60	<0.03	0.07	<0.03	<0.06	<0.03	<0.023	<0.12	<0.023
H10/12	OBM	Jul 2004	1/02/2013	<0.02	340	18	199	<0.05	1.7	<2	<0.1	10	12	1.3	<0.1	12	54	<7	26	2190	2220	<0.03	<0.06	<0.03	<0.03	<0.03	<0.023	<0.12	<0.023
H11	OBM	Jul 2004	18/06/2010	<0.02	385	22	340	<0.05	2.1	<2	<0.1	14	17	2.8	<0.1	6	60	<7	22	1150	1170	<0.03	<0.06	<0.03	<0.03	<0.03	<0.01	<0.07	0.39
H20	WBM	Jan 2006	6/05/2014	<0.02	190	200	34	0.10	0.50	<2	<0.1	17	12	1.10	<0.1	8	78	<8	<20	<30	<60	<0.04	<0.04	<0.04	<0.06	<0.04	<0.03	<0.12	<0.03
H21	WBM	Mar 2006	1/05/2014	<0.02	67	32	73	<0.05	0.70	<2	<0.1	14	12	1.30	<0.1	7	66	<8	<20	<30	<60	<0.04	<0.04	<0.04	<0.06	<0.04	<0.03	<0.12	<0.03
H22	WBM	Mar 2006	6/05/2014	<0.02	282	35	57	<0.05	0.70	<2	<0.1	9	9	1.2	<0.1	5	47	<8	<20	<30	<60	<0.04	<0.04	<0.04	<0.06	<0.04	<0.03	<0.12	<0.03
H23	WBM	Feb 2006	6/05/2014	<0.02	340	38	74	<0.05	0.5	<2	<0.1	18	11	2.5	<0.1	8	74	<7	21	340	360	<0.04	<0.04	<0.04	<0.06	<0.04	<0.03	<0.12	<0.03
H24	SBM	Feb 2006	18/03/2014	0.2	1660	141	366	0.07	0.4	<2	<0.1	22	21	22.9	<0.1	11	77	<8	<20	87	90	<0.04	0.17	<0.04	0.15	0.07	<0.02	<0.1	<0.02
H25/27	SBM	Apr/May 2006	18/06/2013	<0.02	305	212	209	<0.05	0.7	<2	<0.1	10	9	2.4	<0.1	8	60	<7	<10	<30	<60	<0.04	<0.04	0.06	0.35	0.14	<0.03	<0.1	<0.03
H26/A	OW	Mar 2006	18/06/2010	<0.02	194	9	370	<0.05	0.5	<2	<0.1	10	9	1.2	<0.1	6	45	<8	30	1190	1210	<0.05	<0.05	<0.05	<0.06	<0.05	<0.02	<0.1	0.04
H28	SBM	Mar 2006	18/03/2014	0.28	2500	350	310	0.09	0.7	<2	<0.1	10	10	4.3	<0.1	8	46	<8	37	230	270	0.06	0.39	0.16	1	0.35	<0.03	<0.1	<0.03
H29	OW	Jun 2006	18/06/2010	<0.20	49	75	430	<0.05	0.8	<2	<0.1	14	11	1.1	<0.1	8	69	<8	<20	<32	<60	<0.04	<0.04	<0.04	<0.08	<0.04	<0.026	<0.13	<0.026
H30	WBM	Aug 2006	6/05/2014	<0.20	514	38	106	<0.05	0.8	<2	<0.1	12	11	1.2	<0.1	7	57	<8	<20	50	<60	<0.05	<0.05	<0.05	<0.1	<0.05	<0.02	<0.13	<0.02
H31	WBM	Sept 2006	6/05/2014	<0.20	444	11	136	<0.05	0.7	<2	<0.1	13	11	1.6	<0.1	7	61	<8	<20	<30	<60	<0.05	<0.05	<0.05	<0.1	<0.05	<0.02	<0.13	<0.02
H32	WBM	Sept 2006	6/05/2014	0.2	194	79	55	0.07	0.7	<2	<0.1	19	14	3.1	<0.1	10	80	<8	<20	<30	<60	<0.05	<0.05	<0.05	<0.1	<0.05	<0.03	<0.12	<0.03
H33	OW	Oct 2006	12/08/2011	<0.20	30	13	370	<0.05	1	<2	<0.1	16	10	0.8	<0.1	7	67	<8	<20	<40	<60	<0.05	<0.05	<0.05	<0.1	<0.05	<0.03	<0.1	<0.03
H34	OW	Oct 2006	14/11/2008	<0.20	47	8	210	<0.05	0.7	<2	<0.1	14	10	0.8	<0.1	6	55	<7	<10	<30	<60	<0.03	<0.03	<0.03	<0.07	<0.03	<0.02	<0.1	<0.02
H35	OW	Feb 2007	6/05/2014	<0.20	286	54	80	<0.05	0.6	<2	<0.1	16	12	1.3	<0.1	7	66	<8	<20	<30	<60	<0.03	<0.03	<0.03	<0.07	<0.03	<0.02	<0.1	<0.02
H36	OW	Dec 2006	6/05/2014	<0.20	82	32	104	<0.05	0.4	<2	<0.1	14	12	1.9	<0.1	7	63	<8	<20	<30	<60	<0.04	<0.04	<0.04	<0.08	<0.04	<0.03	<0.1	<0.03
H37	WBM	Feb 2007	24/08/2011	<0.20	234	23	370	<0.05	0.6	<2	<0.1	15	12	1.3	<0.1	8	69	<7	<10	<30	<60	<0.03	<0.03	<0.03	<0.07	<0.03	<0.02	<0.1	<0.02
H39	OW	Feb 2007	12/09/2011	<0.20	270	160	360	<0.05	1.90	<2	<0.1	20	15	4.0	<0.1	9	80	<8	<20	<30	<60	<0.1	<0.1	<0.1	<0.1	<0.1	<0.022	<0.11	0.05
H39/39A	SBM	Feb 2007	18/06/2010	<0.20	250	193	380	<0.05	0.3	<2	<0.1	12	13	2.2	<0.1	6	57	<8	<20	270	270	<0.03	<0.03	<0.03	<0.07	<0.03	<0.02	<0.1	<0.02
H40	SBM	Feb 2007	1/08/2013	<0.02	310	9	202	<0.05	0.7	<2	<0.1	22	16	1.8	<0.1	8	87	<8	<20	<30	<60	<0.05	<0.05	<0.05	<0.1	<0.05	<0.02	<0.1	<0.02
H41	WBM	Feb 2007	6/05/2014	<0.02	150	78	102	<0.05	1.30	<2	<0.1	17	12	1.10	<0.1	8	73	<8	<20	<30	<60	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.13	<0.03
H42	WBM	May 2007	6/05/2014	8.4	511	33	91	2.24	0.8	4	<0.1	23	47	42.2	<0.1	18	56	<7	<10	<30	<50	<0.04	<0.04	<0.04	<0.08	<0.04	<0.03	<0.13	<0.03
H43	WBM	May 2007	6/05/2014	6.89	241	12	75	2.41	1	<2	<0.1	16	15	1.8	<0.1	8	77	<8	<20	<30	<60	<0.04	<0.04	<0.04	<0.08	<0.04	<0.03	<0.12	<0.03
H44	SBM	Aug 2007	3/09/2010	<0.02	1630	462	340	<0.05	1.00	<2	<0.1	15	12	2.20	<0.1	7	71	<8	<20	150	150	<0.05	<0.05	<0.05	<0.09	<0.05	<0.023	<0.12	<0.023
H45	OW	Aug 2007	6/05/2014	<0.02	51	18	75	<0.05	1.2	<2	<0.1	16	13	1.3	<0.1	8	78	<7	<10	<30	<60	<0.05	<0.05	<0.05	<0.08	<0.05	<0.023	<0.12	0.064
H46	WBM	Aug 2007	1/06/2014	0.29	230	213	202	0.10	2.00	<2	<0.1	17	16	4.3	<0.1	8	95	<9	40	480	520	<0.1	0.20	<0.1	<0.2	0.10	<0.03	<0.13	<0.03
H47	WBM	Aug 2007	1/05/2014	<0.02	511	182	82	<0.05	1.7	<2	<0.1	16	16	2.7	<0.1	8	86	<8	20	59	79	<0.08	0.12	<0.08	0.2	0.09	<0.03	<0.14	<0.03
H48	OW	Sept 2007	6/05/2014	<0.02	23	20	73	<0.05	1.7	<2	<0.1	19	15	1.1	<0.1	9	86	<8	<20	<30	<60	<0.23	<0.23	<0.23	<0.23	<0.45	<0.024	<0.12	<0.024
H49	OW	Oct 2007	24/08/2011	<0.02	51	47	430	<0.05	1.6	<2	<0.1	13	25	4.5	<0.01	6.9	83	<8	<20	210	210	<0.05	<0.05	<0.05	<0.05	<0.1	<0.024	<0.12	<0.024
H50	OW	May 2008	23/02/2009	<0.02	21	14	340	<0.05	2.4	<2	<0.1	18	11	1.1	<0.1	7.65	72.0	<8.2	<20	<30	<60	<0.05	<0.05	<0.05	<0.05	<0.1	<0.024	<0.012	<0.024
H51	OW	Jul 2008	28/05/2008	<0.02	50	12	20	<0.05	1.7	<2	<0.1	19	18	1.8	<0.1	8.8	91	<8	<20	<30	510	<0.05	<0.05	<0.05	<0.1	<0.05	<0.025	<0.13	<0.025
H52	OW	Jul 2008	18/08/2010	<0.02	69	19	410	<0.05	1.5	<2	<0.1	19	16	1.4	<0.1	8.9	100	<9	<20	<40	<60	<0.05	<0.05	<0.05	<0.10	<0.05	<0.025	>0.13	<0.025
H53	OW	Sept 2008	18/05/2010	<0.02	21	5	340	<0.05	0.8	<2	<0.1	18	12	0.9	<0.1	9	71	<8	<20	<30	<60	<0.05	<0.05	<0.05	<0.1	<0.05	<0.024	<0.12	0.1
H54	OW	Sept 2008	18/08/2010	<0.2	48	7	410	<0.05	0.7	<2	<0.1	14	12	1.2	<0.1	7	63	<8	<20	<30	<60	<0.05	<0.05	<0.05	<0.1	<0.05	<0.024	0.12	<0.024
H55	OW	Sept 2008	18/06/2010	<0.2	20	5	410	<0.05	0.7	<2	<0.1	19	13	1.0	<0.1	9	81	<8	<20	<30	<60	<0.05	<0.05	<0.05	<0.1	<0.05	<0.025	<0.13	<0.025
H56	OW	Sept 2008	4/02/2010	<0.2	29	11	380	<0.05	0.9	<2	<0.1	23	18	1.1	<0.1	10	100	<8	<20	<30	<60	<0.05	<0.05	<0.05	<0.1	<0.05	<0.024	<0.12	<0.024
H57	OW	Sept 2008	24/08/2011	<0.2	470	42	320	<0.05	3.1	<2	<0.1	16	15	1.4	<0.1	8	92	<8	25	490	515	<0.05	<0.05	<0.05	<0.10	<0.05	<0.024	<0.12	<0.024
H58	OW	Jun 2009	3/09/2009	<0.2	74	18	410	<0.05	0.9	<2	<0.10	20	34	3.5	<0.1	9	100	<9	<20	<32	<60	<0.05	<0.05	<0.05	<0.1	<0.05	<0.027	<0.14	<0.027
H59	OW	Jun 2009	6/04/2013	<0.2	129	34	229	<0.05	1.5	3	0.30	21	35	5.0	0.10	9	108	<8.7	<20	43	<60	<0.05	<0.05	<0.05	<0.13	<0.05	<0.028	<0.15	<0.028
H60	OW	Jun 2009	6/05/2014	<0.2	450	32	400	<0.05	0.5	2.5	0.17	18	54	11.0	<0.10	10	82	<8	<20	270	270	<0.05	0.094	0.067	3	0.88	<0.03	<0.13	<0.03
H61	OW	Jun 2009	3/09/2010	<0.2	46	15	380	<0.05	0.7	3.1	<0.10	3.9	69	9.7	<0.10	2	44	<8.6	<20	<30	<60	<0.05	<0.05	<0.05	<0.10	<0.05	<0.028	<0.15	<0.028
H62	OW	Jun 2010	17/03/2012	<0.2	56	9	360	<0.05	1.2	<2	<0.10	14	19	1.4	<0.10	8	57	<8	<20	<40	<70	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.12	<0.03
H63	WBM	Jun 2010	24/08/2011	1.3	680	<3	400	0.46	0.5	4.1	0.36	16	34	13.0	<0.10	19	57	<8	<20	100	100	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.12	<0.03
H64	WBM	Jun 2010	19/12/2011	1.1	35	14	310	0.39	0.7	2.9	<0.10	25	21	16.0	<0.10	22	84	<9	<20	<40	<60	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.12	<0.03
H65	OW	Aug 2009	27/11/2012	<0.2	81	4	360	<0.05	1.2	<2	<0.10	18	10	1.1	<0.10	6	72	<8	<20	<40	<60	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.12	<0.03
H66	OW	Mar 2011	24/08/2012	<0.2	57	6	400	<0.05	1.2	<2	<0.10	14	10	1	<0.10	6.0	59	<8	<20	<40	<20	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.12	<0.03