# Origin Energy and AR Geary Landfarms Monitoring Programme Annual Report 2014-2015

Technical Report 2015-107

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# **Executive summary**

Origin Energy Resources NZ Limited (Origin Energy) manage three drilling waste landfarming sites, two of the consents associated with these facilities were originally held by Swift Energy NZ Ltd and were transferred to Origin Energy in 2008. The third consent is held by AR Geary.

The sites are located on Geary Road at Manutahi, in the Waikaikai catchment (Geary and Schrider sites); and on Spence Road, Kakaramea, in the Kaikura catchment. Disposals at the 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. All three sites are continually monitored and reported on annually, as consents have not yet expired or been surrendered.

This report for the period July 2014 to June 2015 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.

Origin Energy holds two resource consents, which include a total of 56 conditions setting out the requirements that they must satisfy. AR Geary holds one resource consent, which includes 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 and AR Geary demonstrated an overall high level of environmental performance.

The Council's monitoring programme for the year under review included nine inspections, and seven soil samples collected for physicochemical analysis. The Council also reviewed Origin Energy provided analytical soil data.

The monitoring showed that the areas utilised for the practice of landfarming at the sites of Geary and Schrider were within the surrender criteria and will likely be submitted for surrender in the up coming monitoring period. The site of Spence Road will require one more round of validation soil sampling to confirm a variation between Origin Energy and Council results in one location. The former storage pit area at Spence Road will continue to be monitored in the upcoming monitoring period. As in previous years, the monitoring indicated the practice of landfarming has been effective at bio remediating drilling muds. In this monitoring period there was zero Unauthorised Incident/s (UI/s) recording non-compliance in respect of this consent holder during the period under review.

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

For reference, in the 2014-2015 year, 75% 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 22% demonstrated a good level of environmental performance and compliance with their consents.

This report includes recommendations for the 2015-2016 year.

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# 1. Introduction

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

# 1.1.1 Introduction

This report is the annual report for the period 1 July 2014 – 30 June 2015 by the Taranaki Regional Council describing the monitoring programmes associated with resource consents held by Origin Energy Resources NZ Limited (here after Origin Energy) and AR Geary. Origin Energy operates two drilling waste landfarms situated on Geary Road at Manutahi (Schrider Landfarm), and Spence Road at Kakaramea. They also manage and monitor 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 6<sup>th</sup> combined Technical Report and the 18<sup>th</sup> report across the three sites, to be prepared by the Taranaki Regional Council to cover the discharges and their effects.

## 1.1.2 Structure of this report

Section 1 of this report is a background section. It sets out general information about compliance monitoring under the RMA and the Council's obligations and general approach to monitoring sites though annual programmes, the resource consents held by the Origin Energy and AR Geary in the Waikaikai catchment, the nature of the monitoring programme in place for the period under review, and a description of the activities and operations conducted in the site/catchment.

Section 2 to 4 presents information on the specific site's location, resource consents, and the results of monitoring during the period under review, including scientific and technical data.

An interpretation of the results and their interpretations, and their significance for the environment are also provided, together with an evaluation of the each sites performance.

Section 5 summarises recommendations to be implemented in the 2015-2016 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);
- (e) risks to the neighbourhood or environment.

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

#### 1.1.4 Evaluation of environmental and administrative performance

Besides discussing the various details of the performance and extent of compliance by the consent holders during the period under review, this report also assigns a rating as to each Company's environmental and administrative performance.

**Environmental performance** is concerned with <u>actual or likely effects</u> on the receiving environment from the activities during the monitoring year. **Administrative performance** is concerned with the Company's approach to demonstrating consent compliance <u>in site operations and management</u> including the timely provision of information n 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 <u>and</u> 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 2014-2015 year, 75% 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 22% demonstrated a good level of environmental performance and compliance with their consents.

# 1.2 Process description

## 1.2.1 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 and Spence Road sites are on a single application basis. This means dedicated spreading areas each receive only a single application of waste.



Photo 1 Landfarming equipment

# 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 includes a summary of consents monitored in this monitoring period.

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	6135-1	Discharge drilling waste (SBM, WBM, OBM & OW)	6/3/2003	2016	2022
Spence Rd	Origin	5935-1	Discharge drilling waste (SBM, WBM & OW)	7/12/2001	-	2016

 Table 1
 Summary of consents held

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

A copy of the consents are attached to this report in Appendix I.

# 1.4 Monitoring programme

## 1.4.1 Introduction

Section 35 of the RMA sets out obligations upon the Council to gather information, monitor, and conduct research on the exercise of resource consents, and the effects arising, within the Taranaki region and report upon these.

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

The monitoring programme for the three sites consisted of four 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

A total of 11 inspections were made of the landfarm sites during the monitoring period, with regard to the consents for the discharge of drilling waste. The main point of interest was to assess the ongoing effects upon soil quality of the land disposal process.

## 1.4.4 Chemical sampling

During the monitoring period the Council collected four composite soil samples from the Spence Road site and another three composite soil samples from the Schrider site. For each sample, 12-15 cores were taken from a diagonal transect at 10 m intervals to a depth of 400 mm, and composited in the field. The samples were analysed for chloride, conductivity, hydrocarbons, pH, sodium and total soluble salts.

## 1.4.5 Review of analytical data

The Council reviewed results provided by Origin Energy. They are required by their consents to take predisposal and receiving environment samples and supply analyses results to the Council to ensure that waste application loading and surrender limits are met for the areas used for disposal.

# 2. Geary landfarm

# 2.1 Site location

Swift Energy New Zealand Limited (Swift) operated a drilling waste landfarm off Geary Road, Manutahi which is shown in Figure 1. This site is located on marginal coastal farm land 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.

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	
TAT	

Word descriptor:	Geary Road, Manutahi, Taranaki
Map reference:	E 1718754
(NZTM)	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.

No disposals occurred during the period under review and the site will be processed for surrender at the beginning of the following monitoring year.

The site is adjacent to a remote cliffed coast with little to no public access.



Figure 1 Aerial photograph of Geary landfarm with regional location inset

# 2.2 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 as a resource consent 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.

# 2.3 Results

## 2.3.1 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 is to be processed for surrender at the beginning of the following 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 at the time of the last inspection

## 2.3.2 Results of receiving environmental monitoring

## 2.3.2.1 Council soil results

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.

## 2.3.2.2 Origin Energy supplied soil results

Origin Energy supplied the Council with 18 soil samples collected in the previous period. They also supplied the Council with a surrender application just outside of the monitoring period of this report which stated the soils were all within consent compliance surrender concentrations. The 18 soils analysed in the previous period are detailed in the following Tables 2-4 respectively.

Deremeter	Linit Consent		Spreading areas sampled						
Falameter	Unit	Limit	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	
Cadium	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 2
 Geary Landfarm soil compliance results 1

Table 3	Geary landfarm	soil compliance	results 2
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Deveryoter	Unit Consent		Spreading areas sampled					
Parameter	Unit	Limit	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
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
Cadium	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

Baramatar	Unit	Consent	Spreading areas sampled						
Falameter	Unit	Limit	G17	G18	G20	G23	G26	G27	
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	results 3
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Devemeter	l lucit	Consent	t Spreading areas sampled					
Parameter	Unit	Limit	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
Cadium	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

The analysis undertaken by Origin Energy in the previous 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 the Origin Energy supplied annual report in Appendix II. A Origin Energy supplied map with specific location references is provided in Figure 2.



**Figure 2** Origin Energy supplied application area map

# 2.4 Evaluation of performance

Table 5	Summary c	of performance for	r consent 5325-1

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.

an	and production activities; onto and into land.								
Co	ndition 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						
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.	<ul> <li>Maintain records of wastes for:</li> <li>a. each well</li> <li>b. stockpiling and disposal areas</li> <li>c. composition and volume of waste</li> <li>d. times of discharge</li> <li>e. treatments applied</li> </ul>	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 6m 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						

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.							
Condition requirement	Means of monitoring during period under review	Compliance achieved?					
<ol> <li>Electroconductivity must be less than 400 mSm<sup>-1</sup>. If background soil has an electroconductivity of greater than 400 mSm<sup>-1</sup>, then electroconductivity after disposal shall not exceed original electroconductivity by more than 100 mSm<sup>-1</sup></li> </ol>	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 original 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					
<ol> <li>Maximum rate of nitrogen application after discharge must not exceed 200 kgN/ha/yr</li> </ol>	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 2500 g/m <sup>3</sup>	No soil samples obtained during monitoring period	N/A					
<ul> <li>20. Prior to expiry/cancellation of consent these levels must not be exceeded:</li> <li>a. conductivity, 290 mSm<sup>-1</sup></li> <li>b. dissolved salts, 2,500 g/m<sup>3</sup></li> <li>c. sodium, 460 g/m<sup>3</sup></li> <li>d. chloride, 700 g/m<sup>3</sup></li> </ul>	Consent to be submitted for surrender in following monitoring period	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 <sup>3</sup> 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					

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.							
Condition requirement	Means of monitoring during period under review	Compliance achieved?					
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 perfor Overall assessment of administrative perfor	High High						

AR Geary achieved a High environmental and a High administrative performance with respect to the conditions of consent 5325-1. The site undertook its last application of material to land in 2006. The site has been unused and monitored since this date. Ar Geary will apply for a surrender of the consent in the following monitoring period as the locations utilised for landfarming have met their conditional consent limit for surrender.

Ratings are as defined in Section 1.1.4

# 3. Schrider landfarm

# 3.1 Site location

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 farm land 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 1043 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.

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.



Figure 3 Schrider landfarm and approximate regional location

# 3.2 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.

# 3.3 Results

## 3.3.1 Inspections

There were a total of two inspections undertaken at the site during this monitoring period. The site was last utilised for an application to land in March 2011 where oily waste associated with the Kauri E wellsite were applied to land. These two inspections were undertaken as part of complaint soil sampling. The final scheduled inspection undertaken in the previous period (25 June 2014) has also been included in the register.

#### 25 June 2014

No objectionable odours or visible emissions were detected at the time of inspection. No recent disposal activities had occurred and no pits were present at the site. Pasture cover was complete across all spreading areas and pasture appeared healthy. The lower spreading area across zones H1-6 had crops sown and was being grazed at the time of inspection (all zones have been shown to meet surrender criteria). No muds were identified within the soil profile or in any test pits dug at the time of inspection by the inspecting officer.

#### 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 establishment Schrider landfarm

## 3.3.2 Results of the receiving environment monitoring

#### 3.3.2.1 Council soil results

The Council collected three composite soil samples during the monitoring period. The methodology is provided in Section 1.1.4. The analysis of the soils is provided in the following Table 6.

Parameter	Unit	25 Nov 2014	04 Feb 2015	04 Feb 2015
Calcium	mg/kg	13.5	60.5	13.6
Chloride	mg/kg	21.2	26.2	33.8
Conductivity	mS/m@20°C	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	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
рН	рН	6.6	6.6	6.0
Sodium absorption ratio	None	1.57221	1.11452	1.92607
Total soluble salts	mg/kg	115.0	386.6	201.1

 Table 6
 Council soil results Schrider landfarm

The analysis collected by the Council in this monitoring period indicated no exceedance with respect to consent compliance conditions.

#### 3.3.2.2 Origin Energy supplied soil results

In line with the proposed surrender of the Geary landfarm discussed in the previous section, Origin Energy will apply for a surrender of this consent. They will accomplish this by providing the Council with analytical evidence that the areas of land which had been utilised for the practice of landfarming have met there conditional surrender limit as dictated by the consent.

The final application of material to land was undertaken and completed in March 2011. Origin Energy and the Council had undertaken sampling across all areas of the site prior to this monitoring period, as such the analysis from the previous period was carried forward. The analysis from the 2013-14 period detailed that the areas were within the specific criteria for surrender. This analysis is provided in the following Tables 7-11. The full supplied results are complied in the Origin Energy supplied annual report in Appendix II.

Deremeter	Unit	Consent	t Spreading areas sampled					
Falameter	Unit	Limit	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
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 supplied soil results Schrider landfarm H1-H6

\*Alberta agricultural limit for barium

Demonstern		Spreading areas sampled						
Parameter	Unit	Limit	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 supplied soil results Schrider landfarm H8-H24(non-inclusive)

\*Alberta agricultural limit for barium

Table 9	Origin Energy supplied soil results Schrider landfarm H28- H36 (non-inclusive)

Devenueter	Consent		Spreading areas sampled					
Parameter	Unit	Limit	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
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

Deremeter	Consent	Spreading areas sampled						
Farameter	Unit	Limit	H28	H30	H31	H32	H35	H36
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

\*Alberta agricultural limit for barium

 Table 10
 Origin Energy supplied soil results Schrider landfarm H41-H46 (non-inclusive)

Deveryoter	11	Consent	Spreading areas sampled				
Parameter	Unit	Limit	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	

\*Alberta agricultural limit for barium

Table 11	Origin Energy supplie	d soil results Schrider	landfarm H47-H60	(non-inclusive)
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Deremeter	Unit	Consent	Spreading areas sampled			
Farameter	Unit	Limit	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	

Devemeter	11::4	Consent	Spreading areas sampled			
Parameter	Unit	Limit	H47	H48	H60	
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	

\*Alberta agricultural limit for barium

Origin Energy provided soil analysis (Tables 7-11) detailed no exceedance with respect to consent conditions. The consent surrender conditions (stated as consent limit in the tables) are provided in each table to allow the reader to compare what was required with what was analysed. The location listings and the constituents which were applied to each individual location are provided in the following Figure 4.

2.01	1.7.36.5	ent service all		A. T	2.6.27	12.00	1.1.1.1.1.1.1.1	171	15000 1710800	1719000	1719200	719400 1719500	1719800 1720000
Ref.	Mud Type	Date Farmed	Well Name	Easting	Northing	Area m <sup>2</sup>	Volume m <sup>a</sup>	11 TE	1	1		T	N
H1	WBM	Jun 2004	Manutahi B	1718877	5605117	2890	1						(h)
H2	WBM	Jun 2004	Manutahi A	1718878	5605077	2488	1. C. S. C. S.					1	W
нз	WBM	Jul 2004	Manutahi D	1718949	5605075	2996	P						N/S
HH .	WBM	Jun 2004	Kauri E5	1718931	5605019	2984	1	6 I.					Ś
LIC	WPM	14 2004	Manutable	1718002	5605020	2017						H63	
10	COLL	14 2004	Mandahiro	1710005	5005058	2011		1.00				14 /	
Hit	OBM	Ju 2004	Manutani D	1719035	5005098	6943		000				*	
H7	OBM	Jun 2004	Manutahi A	1718924	5605143	7965		260				.e	
HB	OBM	Aug 2004	Kauri C	1718904	5605182	3031						50/	
H9	OBM	Jun 2004	Manutahi B	1718979	5605192	6570	protocological and a					50/ 	
HII	OBM	Jul 2004	Manutahi G	1719060	5605212	7922	1						
H12	OBM	14 2004	Manifahi C	1719030	5605192	4838							
120	WOM	lan 2006	Dobubikawa A	1710526	EGO4095	4097		4				H62	
100	WOM	Jan 2000	Concertainte A	1719320	5004303	4007		1.1					
HZ1	WBM	Mar 2006	Goss A	1719531	5605115	535/							
H22	WBM	Mar 2006	Kaun E12	1719510	5605098	5518	1	20					
H23	WBM	Feb 2006	TrapperA	1719479	5605093	5059	· · · · · · ·	38					
H24	SBM	Feb 2006	TrapperA	1719444	5605035	13480							
H25	SBM	Mar 2006	Kauri E 12	1719385	5604947	5323							
H26	OW	Feb 2006	Oly Waster	1719322	5604911	4289							
H26A	ów	Mar 2006	Oly Waste	1719387	5605063	1338	1	511					
107	SPM	Apr2006	Kaul E12	1710440	5605003	86.96	1					AH67	
100	SBM	Apr2000	Naul C 12	17 194 10	5005207	00.00	-					HEO	
HZ8	SEM	Mar 2006	GOSSA	1/19296	5005056	1/012		1년 📖			11		
H29	OW	Jun 2006	Oly Waste	1719293	5604960	4402		000				09	
H30	WBM	Aug 2006	WalhapaC MBC sump	1719350	5605194	925		2605			158		
H31	WBM	Sept 2006	WalhapaC	1719358	5605273	1645	1						
H32	WBM	Sept 2006	Walhapa H	1719339	5605249	936					H57		
HS3	ow	Oct 2006	Oily Waste	1719194	5605098	662		11.			LICA		
HPA	OW	0+2006	Walkana C Oly was to	1710160	5605107	1416		C					
104	014	Cab 2000	Dim Do Charlow	1710100	5005157	1410							
HSS	WU	F e0 2007	Rimu PS Glycol OW	1719171	5605202	892			1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				
H36	wo	Dec 2006	Oly Waste	1719203	5605110	308		011	Kauri E Wel	Site	H45		
H37	WBM	Feb 2007	TrapperA sump	1719295	5605149	8138	-	8	Kaun L Wei	i bite	144		
H38	ow	Feb 2007	Oly Waste	1719332	5605201	960		88		A	151		
H39	SBM	Feb 2007	Kauri E12 tank waste	1719215	5605217	7310	1.7 7-1	-			H66		
H39A	SBM	Feb 2007	Kauri E12 tank waste	1719235	5605114	2491	I Designation of the						
HAD	SBM	Eeb 2007	TrannerA	1710317	5605292	1709	1			10/	H41 -H65		
114.0	WOM	T-1 0007		1710400	5005252	10107		C	1 -		hund		
1161	WBM	Fed 2007	Goss A sump	17 19 163	5605323	10407					H43 H41		
HAZ	WBM	May 2007	Walhapa C Sump	1719287	5605231	1529					Hara		
H43	WBM	May 2007	Walhapa H Sump	1719251	5605280	3666		č. 1.	15	105	H42		
H44	SBM	Aug 2007	Goss A SBM	1719242	5605410	2061	1	200		H11	H39	H27	
H45	WO	Aug 2007	RPS Oily Waste	1719271	5605443	2037		200		H8 H9 H12	DEH SOL		
HKG	WBM	Aug 2007	Piakau A	1719109	5604813	9840		19		1 11 11 1			
H47	WBM	Aug 2007	AhuroaB	1719070	5604874	6339				НТ	H37		
HAR	ów	Sect 2007	WPS Oily Waste	1718982	5604945	1910					THAN HON	H21	
HAO	0W	Oct 2007	Oly Waste	1710007	5604039	2197				HE	Hadrisse	H23H22	
183	OW	14-1000	DDO OWNER	47400000	5004328	4000	1	5		12 H3		(and )	
VGN	UW	may 2008	Krovij Wasie	1719028	0004992	1230					H28 / H2	26.9	
H51	OW	July 2008	RPS Glycol Waste	1718982	5604978	237	-	0.0		H5		H24	
H52	OW	July 2008	Oly Waste	1718961	5604965	452	1	000		HA V			
H53	OW	Sept 2008	Tariki A contaminated metal	1719294	5605495	437	n	2002		(H50)		H20	
H54	WO	Sept 2008	Kauri F contaminated metal	1719291	5605507	45	1	14		H52 H51	H29		
H55	OW	Sept 2008	Manutahi D contaminated metal	1719287	5605518	24				KH48	H	25)	
HSA	0W	Sent 2008	Walkana Production Station Classican	1710311	5605530	649				H49		/	
100	011	0000 2000	Disc. De durdes Oracles	4740000	FCOLET	4505		<ul> <li>1</li> </ul>			H26		
HD/	UW	Sept 2008	Kimu Production Station	1719336	5605544	1565	-			HAT			
H58	OW	June 2009	Rimu A Contaminated Soll	1719365	5605599	1179	40			1447	$\land$		Lowend
H59	OW	June 2009	Rimu A Ol y Waste	1719388	5605621	933	20						Legena
HEO	OW	June 2009	Rimu A Ol y Waste	1719415	5605650	1675	100	8		H46			Oil Based Mud
H61	ow	June 2009	Walhapa Production Station	1719445	5605677	608	30	8		- V ·····		-	
162	OW	June 2010	Oly waste from cleaning (various	1710274	5605222	250	3.5						Ully Waste
nuz		June 2010	sources)	1118214	3003322	200	a.9	<11.					Contaminated Soil
H63	WBM	June 2010	Ahuroa B3	1719600	5606060	9496	768			Y			
H64	WBM	June 2010	Kauri F	1719575	5605929	16571	1406						Synthetic Based Mud
H65	OW	Aug 2009	Oly waste from deaning old waste oils	1719274	5605322	250	10	: II I					Water Based Mud
LIGE	OW	March 2011	Kauri E	1710209	5605372	3707	19		about and a			The second second	incluse
1100	UTT .		noun E	11 13233	J003312	3141		171	1718800	1/12000	1/19200	1719500	1/19800 1720000

Figure 4 Schrider Landfarm

# 3.4 Evaluation of performance

 Table 12
 Summary of performance for consent 6135-1

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.

Condition requirement	Means of monitoring during period under review	Compliance achieved?				
Definitions	Not applicable	N/A				
Adoption of best practicable option	Inspection and sampling	Yes				
Notify TRC 48 hrs prior stockpiling	No stockpiling at site during monitoring period	N/A				
Notify TRC 48 hrs prior to landfarming	No disposals during monitoring period	N/A				
Provide specified data for OBM disposals	Provision of data - no OBM disposals	N/A				
Rate of discharge/application depths	Inspection, sampling and Company records	Yes				
Incorporate wastes ASAP so that hydrocarbon content in top 250 mm is: < 5 % for WBM & SBM < 1.5 % for oily wastes & OBM	Sampling	Yes				
Resow into pasture ASAP	Inspection	Yes				
Wastes from individual wells to be kept separate & distinct	No stockpiling at site during monitoring period	N/A				
Oily waste & OBM's to be kept separate & distinct	No stockpiling at site during monitoring period	N/A				
No discharge near surface water, boundaries or pipelines	Inspection	Yes				
Wastes restricted to Taranaki Region	Inspection and Company records	Yes				
Max stockpiled volume of 2,000 m <sup>3</sup> & must be discharged within 8 mths	No stockpiling at site during monitoring period	N/A				
No stockpiling of oily wastes or OBM's	No stockpiling at site during monitoring period	N/A				
OBM only from certain wells	No OBM disposals	N/A				
Limited area for disposal of OBM	No OBM disposals	N/A				
Limit on nitrogen application rates	No disposals during monitoring period	N/A				
No destabilisation of neighbouring land	Inspection	Yes				
Electroconductivity limits	Sampling	Yes				
Sodium absorption ratio limits	Sampling	Yes				
Limits on concentration of metals	Sampling	Yes				
Hydrocarbon levels prior to expiry	Sampling	N/A				

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.

Condition requirement	Means of monitoring during period under review	Compliance achieved?
Conductivity, TDS, sodium and chloride limits prior to expiry	Sampling	N/A
Level of total dissolved salts in surface and groundwater	Sampling – surface water not sampled, groundwater not assessed	Not tested during period under review
No contamination of surface water bodies	No surface water	N/A
No impacts upon groundwater or surface water	No groundwater monitoring wells associated with this facility	N/A
No effects on surface water	No surface water	N/A
Limits on dust generation	Inspection	Yes
No offensive or objectionable odour	Inspection and complaint register	Yes
Monitoring requirements	Provision of data	Yes
Post application analysis for OBM's	Provision of results – no OBM disposals	N/A
Consent review	Next option for review in June 2016	N/A
Overall assessment of environmental perform Overall assessment of administrative perform	High High	

Overall, Origin Energy demonstrated a High environmental performance and a High administrative performance with respect to this consent. As the site has been decommissioned and reinstated with the soil analysis detailing consent compliance, the site is now ready to be surrendered.

Ratings are as defined in Section 1.1.4.

# 4. Spence Road landfarm

# 4.1 Site location

The Spence Road (Kauri-C) landfarm is located on Spence Road, Kakaramea and is shown in Figure 5. As with other South Taranaki coastal sites, Spence Road landfarm is located on marginal coastal farm land 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 is subject to strong winds.

## Site data

Location	
Word descriptor:	Spence Road, Kakaramea, Taranaki
Map reference:	E 1722014
(NZTM)	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 moved to have the site partially surrendered which was just outside of the monitoring period of this report 1 July 2014- 30 June 2015.

A review of the analysis of Origin Energy supplied data revealed all previously landfarmed locations were within consent compliance surrender limits. However, there still exists a legacy issue in the former pit (storage pits) area whereby further monitoring/ remediation is required. This shall be undertaken by Origin Energy in the following monitoring period.


Figure 5 Spence Road landfarm with regional inset

## 4.2 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, as resource consent 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 is 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<sup>3</sup>) 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.

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

Conditions 3 to 6 set out the requirements for a management plan, notifications, monitoring and reporting.

Conditions 7 and 8 specify discharge limits.

Conditions 9 to 13 are operational requirements.

Conditions 14 to 17 relate to effects on groundwater and surface water.

Conditions 18 to 22 set limits on certain parameters in the soil.

Condition 23 allows for an optional review.

The permit is attached to this report in Appendix I.

## 4.3 Results

## 4.3.1 Inspections

Six inspections were undertaken at the Spence Road site during the 2014-2015 monitoring period.

#### 25 November 2014

A brief site inspection was conducted in conjunction with soil sampling. No recent activity had occurred at the site. All spread areas looked in good condition. There was no evidence of any landfarming and soil samples had no odour or obvious muds present.

#### 08 January 2015

No recent storage or disposal activities had occurred. All pits were free of muds, and the site had installed 'no dumping' signage. The pits were observed to contain storm water only with algal and plant growth observed in all pits. The oily waste bin had been removed from the site. At the time of inspection, irrigators were operating across the historic application areas. Pasture cover was complete across all areas and the pasture appeared healthy. No muds were identified within the soil profile in any test pits which were dug and no mud/hydrocarbon odours were noted.

#### 16 January 2015

The inspection was conducted in conjunction with soil sampling. Spreading area S24/25a was sampled. No drilling muds were evident in soil cores collected. Pasture was described as well-established, mature pasture with good growth.

#### 21 May 2015

The Spence landfarm site was visited with Origin Energy representatives and the Council Officers. A site discussion was focussed on the remediation of the old existing storage pits at the facility. Origin Energy remarked how they had undertaken soil investigations into the base of the storage pits and initially qualitatively analysed the hot spots from each storage pit. The Council agreed that they would need to dig down to understand the depth of the contamination in the pits and could screen soil samples through the use of a photoionisation detector (PID) and then analyse the higher samples via a recognised laboratory.

However due to the time of year, and the inclement weather, it would not be possible to undertake such work until the water level in the storage pits had reduced. The water level was estimated to be at least 1.5 m deep during the site visit.

Some oil was observed on the water surface of one of the pits. This was remarked to be clear of contamination through testing which had previously been undertaken. Some hydrocarbon burnt vegetation was also observed on the corner of the cell, evidence of the wind blown oil mark during periods of high winds and intense rainfall.

A follow up water sample was collected from the pit on 27 May by Origin Energy which was analysed for hydrocarbons. The results were found to be below the limit of detection. This was not considered to be an incident due to the fact Origin Energy plan to undertake reanalysis of the storage pits in the following monitoring period and that the follow up water sample indicated no detectable hydrocarbons.

Origin Energy representatives discussed they intend to surrender both Geary and Schrider landfarms as these locations have been unutilised for a period of years now.

#### 09 June 2015

No recent activity had occurred; all pits appeared free of mud. There was no hydrocarbon sheens present on the storm/groundwater within the pits. All historic application areas had good pasture cover and the soil was stable. Some grass die-off in patches adjacent to the site fenceline on the western end, possibly due to cattle sheltering in bad weather, some similar pasture die off was observed in the same paddock in other areas.

#### 16 June 2015

The inspection was conducted in conjunction with soil sampling. Spreading areas S31 and S27/S28 were sampled. Flecks of weathered mud were encountered in 4 of 10 cores in the S27/S28 transect, soil was described as dark brown, moist sandy soil, with no odour. S31 contained an evident drilling mud layer at approx. 300 mm depth, the top 50 mm was very moist sands with a noticeable sheen and hydrocarbon odour. Good rootlet structure in both transects, and well-developed pasture. Storage pits were also inspected. No evidence of recent hydrocarbon stain around pit perimeters, although some sheen apparent in Pit 1. Plenty of freeboard was available in all pits, no odour was present.

## 4.3.2 Results of receiving environment monitoring

### 4.3.2.1 Council soil results

The Council undertook the collection and analysis of four composite soil samples throughout the 2014-15 monitoring period. The results are provided in Table 13.

Parameter	Unit	S31	S24/25A	S31	S27/28
		25 Nov 2014	16 Jan 2015	16 Jun 2015	16 Jun 2015
Calcium	mg/kg	23.2	23.1	8.1	15.6
Chloride	mg/kg	22.2	32.9	12.5	13.6
Conductivity	mS/m@20°C	19.6	35.7	19.2	23.2
Total Hydrocarbon	mg/kg	1	12	814	188
Potassium	mg/kg	20.3	16.8	23.3	11.1
Moisture factor	nil	1.099	1.067	1.143	1.102
Magnesium	mg/kg	6.2	8.2	3.5	5.0
Sodium	mg/kg	16.3	40.6	17.7	25.7
Ammoniacal Nitrogen	mgN/kg	1.56	2.15	1.22	0.96
Nitrate/Nitrite Nitrogen	mgN/kg	5.34	0.76	1.92	5.50
pН	pН	7.0	6.5	6.7	6.6
SAR	None	0.77644	1.84759	1.30876	1.44939
Total soluble salts	mg/kg	153.4	279.4	150.3	181.6

**Table 13**Council soil samples Spence Road landfarm 2014-15

The analysis results detailed no exceedance with respect to consent conditions. The analysis collected throughout the year did contain variation, especially in the locality of S 31 in terms of total hydrocarbon which led to a re-assessment of that specific location in the following monitoring period. The remaining parameters did not return any results above the consent conditions with respect to surrender criteria.

## 4.3.2.2 Origin Energy supplied soil results

In line with the consent conditions Origin Energy must supply the Council with post application analytical samples of the soil. This is undertaken to ascertain the concentration of specific parameters in the soil which include heavy metal, total petroleum hydrocarbons, mono aromatic hydrocarbons, poly aromatic hydrocarbons as well as salt analysis.

The consent held by Origin Energy dictates exact limits which material may be discharged to land through the practice of landfarming. A copy of the consent is provided in Appendix I. Origin Energy's intention was to submit these results for review by the Council with the objective of gaining surrender of these specific areas. Analysis of the specific locations is provided in the following Tables 14-18.

Parameter	Consent Limits	S2 WBM	S3 WBM	S4 WBM	S5 WBM	S6 WBM
Date Farmed		Oct 2004	Jun 2004	Nov 2004	Jan 2005	May 2005
Date of last sample		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	10000	240	63	48	276	122
Recov CI 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
Cadium 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
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

 Table 14
 Origin Energy provided soil results Spence Road landfarm S2-S6

Parameter	Consent Limits	S2 WBM	S3 WBM	S4 WBM	S5 WBM	S6 WBM
Date Farmed		Oct 2004	Jun 2004	Nov 2004	Jan 2005	May 2005
Date of last sample		01/05/2014	01/05/2014	01/05/2014	01/05/2014	01/05/2014
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 15	Origin Energ	y provided so	il results S	Spence R	oad landfarm	S7-S14

Parameter	Consent Limits	S7 SBM	S8/10 SBM	S9/13 WBM	S11/12 WBM	S14 WBM
Date Farmed		Sep 2005	Sep 2005	Sep 2005	Sep 2005	Oct 2005
Date of last sample		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 CI 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
Cadium 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
Total HC's mg/kg dry wt		<60	96	210	1100	<60
Benzene mg/kg drv wt	1.1	<0.02	<0.04	<0.04	<0.04	<0.04

Parameter	Consent Limits	S7 SBM	S8/10 SBM	S9/13 WBM	S11/12 WBM	S14 WBM
Date Farmed		Sep 2005	Sep 2005	Sep 2005	Sep 2005	Oct 2005
Date of last sample		18/06/2010	18/03/2014	27/11/2012	06/05/2014	01/05/2014
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 16	Origin Energy	provided soil	analysis	Spence	Road lar	ndfarm	S15-S21
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Parameter	Consent Limits	S15 SBM	S17&19 SBM	S18 WBM	S20 OW	S21 WBM
Date Farmed		Oct 2005	Dec 2005	Dec 2005	Dec 2005	Feb 2006
Date of last sample		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	1170	245
Recov CI 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
Cadium 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
Zinc mg/kg dry wt	300	47	81	66	78	59

Parameter	Consent Limits	S15 SBM	S17&19 SBM	S18 WBM	S20 OW	S21 WBM
Date Farmed		Oct 2005	Dec 2005	Dec 2005	Dec 2005	Feb 2006
Date of last sample		18/03/2014	06/05/2014	01/05/2014	18/03/2014	01/05/2014
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 17
 Origin Energy provided soil results Spence Road landfarm S22-S26

Site	Consent	S22	S23	S24/25	S26
Туре	Limits	WBM	OW	WBM	OW
Date Farmed		Jan 2007	Jun 2009	Jul 2010	Jun 2011
Date of last sample		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 CI 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
Cadium mg/kg dry wt	1	<0.1	<0.10	<0.10	<0.10

Site	Consent	\$22	\$23	S24/25	S26
Туре	Limits	WBM	OW	WBM	OW
Date Farmed		Jan 2007	Jun 2009	Jul 2010	Jun 2011
Date of last sample		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

Parameter	Consent Limits	S27/28 OW	S29 WBM	S31 WBM/OW
Date Farmed		Jun 2011	Jun 2011	Jan 2012
Date of last sample		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 CI mg/kg dry wt	700	22	22	11
Recov Sodium mg/kg dry wt	460	350	320	250

Parameter	Consent Limits	S27/28 OW	S29 WBM	S31 WBM/OW
Date Farmed		Jun 2011	Jun 2011	Jan 2012
Date of last sample		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
Cadium 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 drv.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

Origin Energy provided soil results are detailed in Tables 14-18. These tables contain assessments of all the paddocks utilised by Origin Energy. They include the date the area was utilised for application of material to land as well as the date they were analysed. Note that some of these locations were farmed in 2005, with the last area to be farmed in 2012. The results do not detail any exceedance with consent conditions.

When considering a surrender application the Council will assess the Origin Energy provided data and compare it to the compliance analysis undertaken by the Council through out the year, as well as a review the long term record held by the Council. In some cases there may be a slight variation in the values provided by Origin Energy when compared to the Council's analysis. In such a case, further analysis is undertaken by the Council to assess the area in question for further validation.

The Council utlises GPS referencing when undertaking soil sampling, thus if an area requires further analysis the location is known prior to the sample collection.

## 4.4 Evaluation of performance

Consent: 5935-1 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.

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
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

waste drilling cuttings from wells drilled with synthetic based muds from hydrocarbon exploration and production operations onto and into land.			
Condition requirement		Means of monitoring during period under review	Compliance achieved?
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	Yes
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
23.	Limit on levels of hydrocarbons in soil prior to expiry/surrender	Sampling	Yes
24.	Provision for review	Not exercised	
Ove	rall assessment of environmental perfo	ormance in respect of this consent	High
Overall assessment of administrative performance in respect of this consent		High	

Consent: 5935-1 To discharge waste drilling cuttings, muds and fluids from wells drilled with water based muds and

Origin Energy demonstrated a High level of environmental performance and High level of administrative performance with respect to the consent conditions of the Spence Road landfarm. The site is closed and Origin Energy will apply for surrender in the coming period for the locations of the site which were utilised for the practice of landfarming.

Ratings are as defined in Section 1.1.4

# 5. Discussion

# 5.1 Investigations, interventions, and incidents

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

The Council operates and maintains a register of all complaints or reported and discovered excursions from acceptable limits and practices, including non-compliance with consents, which may damage the environment. The Incident Register (IR) includes events where Origin Energy 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 Origin Energy is indeed the source of the incident (or that the allegation cannot be proven).

In the 2014-2015 period, the Council was not required to undertake significant additional investigations and interventions, or record incidents, in association with the Origin Energy's conditions in resource consents or provisions in Regional Plans.

## 5.2 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. The consent will be submitted for surrender in the following monitoring period.

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.

## Schrider landfarm

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

## Spence Road landfarm

This facility was the last of the three Origin Energy managed landfarms to receive material. As previously stated in Section 4, January 2012 marked the last application of material to land. Origin Energy was informed that if the operations was 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 this period the Council met with Origin Energy representative 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. Origin Energy has been transparent with the Council in this regard and will continue to monitor the progress of the pit bioremediation moving forward in the following monitoring year. In this monitoring period there were no issues with site performance.

## 5.3 Environmental effects of exercise of consents

The only measurable environmental effect which exists as a result of the exercise of these consents is centered on a legacy issue in the former storage pit area of the Spence Road landfarm. The legacy is focused on a measurable hydrocarbon concentration analysed in the base of the former storage pits. Origin Energy is aware of the legacy issue and intends to remediate the former pit area in the following monitoring period. In addition, one area in relation to the Spence Road site did contain some variation in terms of hydrocarbon analysis undertaken by Origin Energy, when compared with the Council's soil analysis results. As such, validation sampling will be undertaken in the following period to ascertain the final concentration in relation to this specific area.

## 5.4 Recommendations from the 2013-2014 Annual Report

In the 2013-2014 Annual Report, it was recommended:

- 1. THAT the monitoring programme for consented activities at the Geary landfarm in 2014-2015, remain unchanged from that for 2013-2014.
- 2. THAT the monitoring programme for consented activities at the Schrider landfarm in 2014-2015, remain unchanged from that for 2013-2014.
- 3. THAT the monitoring programme for consented activities at the Spence Road landfarm in the 2014-2015, remain unchanged from that for 2013-2014, unless activity resumes at the site, at which time groundwater sampling should be implemented.
- 4. THAT, if the intention is to permanently discontinue use of the Spence facilities, the Origin Energy investigates options for storage area reinstatement.

## 5.5 Alterations to monitoring programmes for 2015-2016

In designing and implementing the monitoring programmes for discharges in the region, the Council has taken into account the extent of information made available by previous authorities, its relevance under the RMA, its obligations to monitor emissions/discharges and effects under the RMA, and report to the regional community. The Council also takes into account the scope of assessments required at

the time of renewal of permits, and the need to maintain a sound understanding of industrial processes within Taranaki emitting to the atmosphere/discharging to the environment.

It is proposed that for 2015-2016 monitoring year that Origin Energy/ AR Geary will apply for a surrender of the Geary and Schrider landfarms. They will undertake this by providing the Council with analytical evidence to support the idea that areas of land previously utilised for the practice of landfarming have met their conditional concentrations for specific parameters in the soil. The Council will review the information provided by Origin Energy and compare this information to the long term record of analysis the Council has undertaken.

Origin Energy will also allow for the additional validation sampling of the Spence Road site, this analysis will be undertaken in August 2015. Pending the analysis of this follow up validation sampling will dictate whether Origin Energy will be allowed to the partially surrender the Spence Road consent, which will mean the areas of land utilised for landfarming will have reached surrender criteria, with the former storage pit area the only location of the facility still governed by consent conditions.

# 6. Recommendations

- 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.

# **Glossary of common terms and abbreviations**

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

Al*	Aluminium.
As*	Arsenic.
Biomonitoring	Assessing the health of the environment using aquatic organisms.
BOD	Biochemical oxygen demand. A measure of the presence of degradable organic matter, taking into account the biological conversion of ammonia to nitrate.
BODF	Biochemical oxygen demand of a filtered sample.
Bund	A wall around a tank to contain its contents in the case of a leak.
CBOD	Carbonaceous biochemical oxygen demand. A measure of the presence of degradable organic matter, excluding the biological conversion of ammonia to nitrate.
cfu	Colony forming units. A measure of the concentration of bacteria usually expressed as per 100 millilitre sample.
COD	Chemical oxygen demand. A measure of the oxygen required to oxidise all matter in a sample by chemical reaction.
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 <sup>3</sup> s- <sup>1</sup> ).
DO	Dissolved oxygen.
DRP	Dissolved reactive phosphorus.
E.coli	Escherichia coli, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre sample.
Ent	Enterococci, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre of sample.
F	Fluoride.
FC	Faecal coliforms, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre sample.
Fresh	Elevated flow in a stream, such as after heavy rainfall.
g/m²/day	Grams/metre <sup>2</sup> /day.
g/m <sup>3</sup>	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.
IR	The Incident Register contains a list of events recorded by the Council on the basis that they may have the potential or actual environmental consequences that may represent a breach of a consent or provision in a Regional Plan.
L/s	Litres per second.
m <sup>2</sup>	Square Metres.
MCI	Macroinvertebrate community index; a numerical indication of the state of biological life in a stream that takes into account the sensitivity of the taxa present to organic pollution in stony habitats.
mS/m	Millisiemens per metre.
Mixing zone	The zone below a discharge point where the discharge is not fully mixed with the receiving environment. For a stream, conventionally taken as a length equivalent to 7 times the width of the stream at the discharge point.
NH <sub>4</sub>	Ammonium, normally expressed in terms of the mass of nitrogen (N).
NH <sub>3</sub>	Unionised ammonia, normally expressed in terms of the mass of nitrogen (N).
NO <sub>3</sub>	Nitrate, normally expressed in terms of the mass of nitrogen (N).
NTU	Nephelometric Turbidity Unit, a measure of the turbidity of water.
O&G	Oil and grease, defined as anything that will dissolve into a particular organic solvent (e.g. hexane). May include both animal material (fats) and mineral matter (hydrocarbons).
Pb*	Lead.
pН	A numerical system for measuring acidity in solutions, with 7 as neutral. Numbers lower than 7 are increasingly acidic and higher than 7 are increasingly alkaline. The scale is logarithmic i.e. a change of 1 represents a ten-fold change in strength. For example, a pH of 4 is ten times more acidic than a pH of 5.
Physicochemical	Measurement of both physical properties (e.g. temperature, clarity, density) and chemical determinants (e.g. metals and nutrients) to characterise the state of an environment.
$PM_{10}$	Relatively fine airborne particles (less than 10 micrometre diameter).
Resource consent	Refer Section 87 of the RMA. Resource consents include land use consents (refer Sections 9 and 13 of the RMA), coastal permits (Sections 12, 14 and 15), water permits (Section 14) and discharge permits (Section 15).
RMA	Resource Management Act 1991 and including all subsequent amendments.
SS	Suspended solids.
SQMCI	Semi quantitative macroinvertebrate community index.
Temp	Temperature, measured in °C (degrees Celsius).
Turb	Turbidity, expressed in NTU.
UI	Unauthorised Incident.

Zn\* Zinc.

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

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

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- 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.

# Appendix I

# Resource consents held by the company (For a copy of the resource consent please contact the TRC consent department)

#### **DISCHARGE PERMIT**

### Pursuant to the RESOURCE MANAGEMENT ACT 1991 a resource consent is hereby granted by the Taranaki Regional Council

Name of	GEARY ROBERT A & SYLVIA M
Consent Holder:	GEARY ROAD, MANUTAHI, RD2, PATEA

Consent Granted Date:

28 May 1998

### **CONDITIONS OF CONSENT**

- Consent Granted: TO DISCHARGE UP TO 40 CUBIC METRES/DAY OF DRILL CUTTINGS AND FLUIDS FROM OIL WELL DRILLING OPERATIONS AND GREEN REFUSE FROM A WASTE TRANSFER STATION ONTO AND INTO LAND IN THE VICINITY OF THE WAIKAIKAI STREAM AT OR ABOUT GR: Q21:288-681
- Expiry Date: 1 June 2016
- Review Date[s]: June 2004 and June 2010
- Site Location: GEARY ROAD, MANUTAHI, PATEA
- Legal Description: LOT 2 DP5346 PT SEC 485 LOT 1, 9, 10, 13 DP14551 PATEA DIST BLK I CARLYLE SD

Catchment: WAIKAIKAI 346.000

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

#### TRK985325

#### **GENERAL CONDITIONS**

- (a) The consent holder shall provide on request by the General Manager, Taranaki Regional Council, plans, specifications and maintenance programmes of works associated with the exercise of the consent, showing that the conditions of the consent are able to be met.
- (b) The standards, techniques and frequency of monitoring of the consent shall be to the specific approval of the General Manager, Taranaki Regional Council.
- (c) The consent holder shall pay all charges required by the General Manager, Taranaki Regional Council, to enable recovery of the actual and reasonable costs incurred in administration, monitoring and supervision of the consent.

#### **Special conditions**

- 1. THAT the consent holder shall ensure that disposal of the cuttings and green refuse takes place in accordance with the information submitted in support of application 341.
- 2. THAT no waste materials other than green refuse and drill cuttings shall be included in the discharge.
- 3. THAT the consent holder shall keep records of volumes of cuttings and green refuse, and the method of disposal utilised, and shall make the records available to the Taranaki Regional Council upon request.
- 4. THAT the exercise of this consent, including the design, management and implementation of the system, shall not lead or be liable to lead to contaminants entering a surface waterbody.
- 5. THAT no adverse ecological or chemical effects shall occur to groundwater in the vicinity of the discharge, as a result of the exercise of this consent.
- 6. THAT the Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during the month of June 2004 and/or June 2010, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects of the discharge on the environment arising from the exercise of this consent, which were not foreseen at the time the application was considered and which it was not appropriate to deal with at that time.

Signed at Stratford on 28 May 1998

For and on behalf of TARANAKI REGIONAL COUNCIL

DIRECTOR—RESOURCE MANAGEMENT

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

Name of Consent Holder:	Origin Energy Resources NZ [Rimu] Limited Private Bag 2022 NEW PLYMOUTH 4342	
Decision Date (Change):	7 March 2012	
Commencement Date (Change):	7 March 2012	(Granted: 7 December 2001)

# **Conditions of Consent**

Consent Granted:	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 at or about (NZTM) 1722014E-5601830N
Expiry Date:	1 June 2016
Review Date(s):	June 2012
Site Location:	Kauri-C wellsite, Spence Road, Kakaramea (Property owner: G & W Vanner)
Legal Description:	Sec 486 Pt Sec 461 Sbdn 4 of Sec 637 Blk II Carlyle SD (Discharge site)

Catchment: Kaikura

### **General condition**

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

### **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 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

- 3. 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 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.
- 4. 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<sub>6</sub>-C<sub>9</sub>, C<sub>10</sub>-C<sub>14</sub>, and C<sub>15</sub>-C<sub>36</sub>], polycyclic aromatic hydrocarbons [PAH], and benzene, toluene, ethylbenzene and xylenes [BTEX].

- 5. 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; and
  - f) the specific location and area over which the waste will be landfarmed.
- 6. 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**

- 7. 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.

## Consent 5935-1

- 8. As soon as practicable following the application of drilling wastes to land in accordance with condition 7 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**

- 9. No discharge shall take place within 25 metres of surface water or property boundaries, or within 6 horizontal metres of the existing gas pipelines.
- 10. The exercise of this consent is limited to wastes generated within the Taranaki region.
- 11. The exercise of this consent shall not result in the destabilisation of neighbouring land.
- 12. All material must be landfarmed as soon as practicable, but no later than twelve months after being brought onto the site.
- 13. 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**

- 14. 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.
- 15. 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.
- 16. 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.

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<sup>-3</sup>.

### **Receiving environment limits - soil**

- 18. The conductivity of the soil/waste layer after application shall be less than 400 mSm<sup>-1</sup>, or alternatively, if the background soil conductivity exceeds 400 mSm<sup>-1</sup>, the application of waste shall not increase the soil conductivity within the upper 20 cm by more than 100 mSm<sup>-1</sup>.
- 19. 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.
- 20. 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 safe application of biosolids to land in New Zealand [2003].
- 21. At the time of expiry, cancellation, or surrender of this consent soil levels shall not exceed the following limits: conductivity, 290 mSm<sup>-1</sup>; total soluble salts, 2500 mg/kg; sodium, 460 mg/kg; and chloride, 700 mg/kg.
- 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].

#### Review

23. 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 7 March 2012

For and on behalf of Taranaki Regional Council

## **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 Carlyle SD

Catchment: Waikaikai Blk I

## **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<sub>6</sub>-C<sub>9</sub>, C<sub>10</sub>-C<sub>14</sub> and C<sub>15</sub>-C<sub>36</sub>, 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.

## Consent 6135-1

- 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<sup>-1</sup>, or alternatively, if the background soil conductivity exceeds 400 mSm<sup>-1</sup>, the application of waste shall not increase the soil conductivity by more than 100 mSm<sup>-1</sup>.
- 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<sup>-1</sup>; 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<sup>-3</sup>.
- 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  $0.13 \text{ g/m}^2/\text{day}$ ; and/or
  - b) suspended dust level  $0.15 \text{ mg/m}^3$ .

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.

# Consent 6135-1

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

**Director-Resource Management** 

Appendix II

Annual report data



### Attachment A: Landfarm Site Map

		1721200		1721	400			1721600	172	800	1722000	1722	200 1725	2400	1722600
Ref.	Mud Type	Date Farmed	Well Name	Easting	Northing	Area V m² m	lume					To Spence	Road		W
52	WBM	Oct 2004	Cheal	1/21/21	5602149	1309	_					S23			
53	WBM	June 2004	Kaun C	1721947	5602035	2357	_								Ś
54	WBM	Nov 2004	Minomiro	172193/	5601065	2550	_								
55	WBM	May 2005	Karariki	1722044	5602054	2874	_				*				
57	SBM	Sep 2005	Piakau 1	1722060	5601037	1200					Trab				
SR	SBM	Sep 2005	Piakau 2	1721665	5601748	840					-50 <sup>895</sup>				
S9	WBM	Sep 2005	Piakau 2	1721644	5601728	2485					Pro				
8 S10	SBM	Sep 2005	Piakau 2	1721567	5601806	2365				1					
S11	WBM	Sep 2005	Piakau 1	1721556	5601790	3014				/					
S12	WBM	Sep 2005	Piakau 1	1721558	5601768	1795				1					
S13	WBM	Sep 2005	Piakau 2	1721555	5601752	2073				1					
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				Ĩ					
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	_								
521	WBM	rep 2005	Arakamu Radaos	1721809	5601770	4916					~				
522	OW	Jan 2007	Manutabi A	1723000	5602507	501	30								
S24/S254 B	WBM	July 2010	Ahuroa B & Kauri F	1721559	5601932	23622	575		S2		S31				
S26	OW	June 2011	Ahurca 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			54					
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					/		1-		1.1						
							12	C+0	1.1		$h \rightarrow h$				
								518	111 manual	\$26	T'				
								517	1 from	\$27.08	1 1	Kauri C Wellsite			
8						1	Sto	S14	- YX-	02,120	1000				
089							SII	1.	XAN	\$22					
						C	\$12			S21					
Legend							513	58	Sig						
- Pipelin	nes							59							
Contro	ol Site							46.		S20					
OBM															
OWV															
SBM															
WBM															
WBM	fluids														
g n/a															
		1721200		1721	400		1	1721600	172	800	1722000	1722	200 1725	2400	1722600
Index :			0	lists Ote	GENER 1. Con	RAL NOTES:	ms of NZGD 20	00 Transverse Mercato	7 16/01/12 JH DR	Add disposal site S31		DRAWN THOMPSON 04/11/08	SPENCE ROAD	T	
DTM	COM	Danv	P.O Box 551, NEW	PLYMOUTH	4340				6 28/07/11 JH GJ	Add disposal sites S26, S27/28, S29 Mema disposal areas S24/S255 h		CHECKED JOINES 04/11/08 PROJECTINO: 08327	DISPOSAL SITE PLAN	N	Origin
		1 Jan Iy	Ph : (06) 759 5040		DISCL	AIMER:			4 06/10/10 PT GJ	Adjust disposal area S24/S25a		LOCATION MANUTAH	EXTENTS AS AT JANUARY	( 2011	Denergy
, surveyors , planners			Fax : (06) 759 5049	9	Bound Areas	ary information and dimensions	nas been importer may be subject to	d from external source: o scale error.	3 16/08/10 PT GJ	Add disposal area S24/S25a & S24/S2 Add disposal area S23	56	ORIGINAL SIZE A3			energy
, engineers			E-mail : survey@btv	wcompany.c	o.nz Use of Print fr	this drawing for om PDF: scale	other purposes is not accurate.	at the user's risk.	1 10/07/09 PT AJ	Add disposal area		BUALE 1:4,000	200 300	$\rightarrow$	DRAWING NO. REVISION
, lend a g-is s	BRVIDES		VVBD , WWW.DOWCOM	ipany.co.nz	Pipelin	es are indicativ	only.		No DATE BY CH AP	OP DESCRIPTION REVISIONS			Meters		08327-02-GIS 7

## Attachment C: Sample Analysis Results

						_					Heavy	Metals					TF	ы				BTEX	PAH						
Site	Туре	Date Farmed	Date of last sample	Conductivity mSm-1	Recov Ba mg/kg dry wt	Recov CI 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	Cadium mg/kg dry wt	Chromium mg/kg dry wt	Copper mg/kg dry w	Lead mg/kg dry wt	Mercury mg/kg dry w	Nickel mg/kg dry wt	Zinc mg/kg dry wt	C7-C9 mg/kg dry wt	C10-C14 mg kg dry wi	C15-C36 mg/kg dry wi	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	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	<50	<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	<50	<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	<50	<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	<50	<0.02	<0.02	<0.02	<0.02	<0.02	<0.03	0.13	0.03
S7	SBM	Sep 2005	18/06/2010	<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	71.5	<0.1	7	46	<8	<20	93	96	<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	248	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	0.06	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
\$22	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	30/06/2012	<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	30/06/2012	<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

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)



### Attachment A: Landfarm Site Map

L			[		1	1	[	171	600 171000	1719000	1719200 171	9400 1719600	1719800 172000
Ref.	Mud Type	Date Farmed	Well Name	Easting	Northing	Area m <sup>2</sup>	Volume m <sup>a</sup>					1	N
H1	WBM	Jun 2004	Manutahi B	1718877	5605117	2890							(Th)
H2	WBM	Jun 2004	Manutahi A	1718878	5605077	2488							WEE
H3	WBM	Jul 2004	Manutahi D	1718949	5605075	2996							XIX
Hd	WBM	Jun 2004	Kauri E5	1718931	5605019	2984							Ś
	NAME AND ADDRESS OF AD	140004	Handahir	4740000	5005000	0047						H63	
no	WDM	Jul 2004	Manutanic	1710993	0000039	2017	-						
HG	ORW	Jul 2004	Manutani D	1/19035	5605098	6943	-	000				×	
H7	OBM	Jun 2004	Manutahi A	1718924	5605143	7965		010				a la	
HB	OBM	Aug 2004	Kauri C	1718904	5605182	3031						F	
H9	OBM	Jun 2004	ManutahiB	1718979	5605192	6570						8	
H11	OBM	Jul 2004	ManutahiG	1719060	5605212	7922						8 H64	
	0014	1.1.000.4	ManutahiQ	1710000	5005100	40.00							
H12	OBM	Jul 2004	Manutanic	1719030	5605192	4830						H62	
H20	WBM	Jan 2006	Pohutukawa A	1/19526	5604985	408/							
H21	WBM	Mar 2006	Goss A	1719531	5605115	5357							
H22	WBM	Mar 2006	Kauri E12	1719510	5605098	5518		00					
H23	WBM	Feb 2006	Trapper A	1719479	5605093	5059		101					
H24	SBM	Feb 2006	Trapper A	1719444	5605035	13480						/	
H25	SBM	Mar 2008	Kauri E12	1719385	5604947	5323							
1120	OW	Fab 2000	Ob Wests	1710000	5004041	4000							
H20	UW	F 80 2000	Gry maste	17 19 3 2 2	30049/11	4209							
H26A	OW	Mar 2006	Oly Waste	1719387	5605063	1338						HRI	
H27	SBM	Apr 2006	Kauri E12	1719410	5605207	8636						1100	
H28	SBM	Mar 2006	Goss A	1719296	5605056	17012						HOU	
H29	OW	Jun 2006	Oiy Waste	1719293	5604960	4402		8			H5	9	
H30	WBM	Aug 2006	Waihapa C MBC sump	1719350	5605194	925		0100			H58		
H31	WBM	Sept 2006	Waihapa C	1719358	5605273	1645		6					
H32	WPM	Sent 2006	Waihapa H	1710330	5605249	936					H57		
H22	OW	042006	Ob Warts	1710104	5605000	662					H56		
Had	OW	0012000	Oly Waste	1710104	0000030	002					H54		
H34	OW	Oct 2006	Wainapa C Oly waste	1/19160	5605197	1416					100		
H36	OW	Feb 2007	Rimu PS Glycol OW	1719171	5605202	892							
H36	OW	Dec 2006	Oiy Waste	1719203	5605110	308			Kouri E Woll Site		H45		
H37	WBM	Feb 2007	Trapper A sump	1719295	5605149	8138		00	Kaun E wen Site		H44		
H38	OW	Feb 2007	Oily Waste	1719332	5605201	960		400	A	/			
H39	SBM	Feb 2007	Kauri E12 tank waste	1719215	5605217	7310					H66		
H39A	SBM	Feb 2007	Kauri E12 tank waste	1719235	5605114	2491				. //			
140	CDM	Eab 2007	Transará	4740247	5005202	4700			r t	-18	H41 H65		
1110	3DM	F-00 2007	110020110	1710017	50050202	1700							
1941	WBM	Feb 2007	Goss A sump	1/19163	0000323	10487					H43 H41		
H42	WBM	May 2007	Wainapa C Sump	1719287	5605231	1029			1 and 1		192		
H43	WBM	May 2007	Waihapa H Sump	1719251	5605280	3666	L		13		H42		
H44	SBM	Aug 2007	Goss A SBM	1719242	5605410	2061		200		H11	H39	H27	
H45	OW	Aug 2007	RPS Olly Waste	1719271	5605443	2037		2005	HB	H9 H12	5 H30H30		
H46	WBM	Aug 2007	Piakau A	1719109	5604813	9840			no				
H47	WBM	Aug 2007	Ahuroa B	1719070	5604874	6339			H7		Н37		
H48	OW	Sept 2007	WPS Olly Waste	1718982	5604945	1919			HI		HIDCH394	H21	
H40	OW	Oct 2007	Oily Warts	1710027	5604929	21.97				H6	HJDITICON	H23H22	
HEO	OW	May 2009	RPS Oly Waste	1740029	5604000	1055			H2 H3				
100	OW	May 2000	no ong masie	17 18028	5004882	1200					H28 H26		
H51	OW	3UV 2008	RPS GIVOI Waste	1/18982	0604978	237	l			HD		H24	
H52	OW	July 2008	Oly Waste	1718961	5604965	452		bao	H4			Lin	
H53	OW	Sept 2008	Tariki A contaminated metal	1719294	5605495	437		200		H50		H20	
H54	OW	Sept 2008	Kauri F contaminated metal	1719291	5605507	45			H52		H29		
H55	OW	Sept 2008	Manutahi D contaminated metal	1719287	5605518	24				H48	H25		
H56	OW	Sept 2008	Waihapa Production Station Cleanings	1719311	5605530	648				1140	H26		
H57	OW	Sept 2008	Rimu Production Station	1719336	5605544	1565							
H58	OW	June 2009	Rimu A Contaminated Soil	1719365	5605599	1179	40			H47			
H59	OW	June 2009	Rimu & Oily Waste	1719388	5605624	933	20						Legend
HED	OW	June 2009	Pirmu & Oily Waste	1710448	5005021	1675	100			140			Oil Record Murd
100	OW	June 2009	Nind A Oily Waste	17 (9415	000000	10/0	100	ate		H46			Oil based Mud
H61	OW	June 2009	Oily waste from cleaning (various	1/19445	0605677	808	30	2					Oily Waste
H62	OW	June 2010	sources)	1719274	5605322	250	3.5						Contaminated Soil
H63	WBM	June 2010	Ahuroa B3	1719600	5606060	9496	768			V			Contaminated Soll
HRA	WBM	June 2010	Kauri F	1710575	5605000	16574	1406						Synthetic Based Mud
LICE	CUM	Aug 2000	Objugate from cleaning old worth alter	4740074	500520	250	10						Water Based Mud
HOD	OW	Aug 2009	Viry waste nom cleaning on waste pts	1/192/4	5005322	200	10						rider based mud
H66	OW	Malich 2011	Naurie	1719293	0600372	3707		171	600 1713800	1719000	1719200 171	9400 1719600	1719800 172000
					GENERAL NOT	ES: re in terms of h	17GD 2000 Transve	rse Mercato	7 23/08/11 BO GA Add H66.		DRAWN THOMPSON 04/11/03		
$(\mathbf{O})$	W C	omn	PO Boy 551 NEW PLYMO	5. UTH 4340					6 11/08/10 PT DF Add a volume to H65 in the table.		CHECKED JOINES 04/11/08	SCHRIDER DISPOSAL SITE	()rioin
	Ph: (06) 759 5040								5 25/06/10 PT PS Adjust H64 & H62.		PROJECT No. 05342	South Der Dier Gone Grie	
. SUIVE	yons		DISCLAIMER:				a 2010010 P1 PS Add H52 & H55 and amend areas 3 23/06/10 PT PS Add disposal areas Line 4 Line 4		COLICIAN MANUTARI		energy		
. plann	planners Fax: (06) 759 5049					ation has been	imported from exte	mal sources	2 10/07/09 PT GA Add disposal areas H62		SCALE 16 000		
. engin	engineers E-mail : survey@btwcompany.co. Web : www.btwcompany.co.nz					Areas and dimensions may be subject to scale error.			1 10/07/09 PT GA Add disposal areas H58. H59. H6	0. H61	0 50 1	00 200 300 400	DRAWING No. PROJECTOR
. land a	s g∔s services		Web : www.btwcompany.co	5.02	Print from PDF:	scale not accur	ate.		No DATE BY CH DE	SCRIPTION		05342-06-GIS 7	
-									REVISIONS		1	meters	00012-00-010 /



## Attachment B: Sample Analysis Results

										Heavy Metals									Т	PH		BTEX							
Site	Туре	Date Farmed	Date of last sample	Conductivity mSm-1	Recov Ba mg/kg dry wt	Recov CI mg/kg dry v/t	Recov Na mg/kg dry wt	oluble Salts g/100g dry w	odium Absorption Ratio S.	Arsenic mg/kg dry wt	Cadium mg/kg dry wt	Chromium mg/kg dry vit	Copper mg/kg dry wt	Lead mg/kg dry wt	Mercury mg/kg dry wt	Nickel mg/kg dry wr	Zinc mg/kg dry wt	C7-C9 mg/kg dry wt	C10-C14 mg.kg diy wt	C15-C36 mg/kg dry wt	Total HC's mg/kg dry wt	Benzene mg/kg dry wt	Toluene mg/kg dry wt	thylbenzene mg/kg dry wt	n & p-xylene mg/kg dry wt	o-Xylene mg/kg dry vit	Benzo(a)pyrene (BAP)	Naphthalene	Pyrene
-								ۍ ۲	S.															ω.	E				-
Consent Li	mits		0.005.0001.1	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
H1	VVBM	Jun 2004	6/05/2014	<0.02	11	12	29	<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	</td <td>&lt;10</td> <td>290</td> <td>290</td> <td>&lt;0.05</td> <td>&lt;0.05</td> <td>&lt;0.05</td> <td>&lt;0.10</td> <td>&lt;0.05</td> <td>&lt;0.03</td> <td>&lt;0.12</td> <td>&lt;0.03</td>	<10	290	290	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.12	<0.03
H3	VVBM	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
14	VVDW	Juli 2004	6/05/2014	<0.02	319	49	24	-0.05	0.9	~2	-0.1	17	13	2.0	50.1	9	01	~4	-0	~20	~30	-0.05	~0.05	-0.05	-0.1	-0.05	10.03	-0.13	<0.03
HD	ORM	Jul 2004	6/05/2014	<0.02	70	30	67	<0.05	0.8	< <u>2</u>	<0.1	14	11	1.3	<0.1		60	<8	<20	-20	450	<0.05	<0.05	<0.05	<0.02	<0.03	<0.03	<0.12	<0.03
H0	OBM	Jun 2004	19/06/2014	<0.02	150	20	260	<0.05	2.1	~2	<0.1	20	14	3.7	<0.1	0	02	-7	<10	<30	<60	<0.03	<0.00	<0.03	<0.03	<0.03	<0.023	<0.07	<0.022
HB	OBM	Aug 2004	8/05/2014	<0.02	470	8	00	<0.05	0.80	<2	<0.1	20	14	1.8	<0.1	10	100	<7	15	1220	1230	>0.05	<0.00	<0.05	<0.03	<0.05	<0.023	<0.12	<0.022
HQ	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	<0.027	<0.14	<0.027
H10/12	OBM	Jul 2004	1/02/2013	<0.02	340	18	199	<0.00	1.0	<2	<0.1	10	12	1.3	<0.1	12	54	<7	26	2190	2220	<0.00	<0.07	<0.00	<0.00	<0.00	<0.023	<0.12	<0.023
H11	OBM	Jul 2004	18/06/2010	<0.02	395	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	<0.08	<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	<0.08	<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	<0.08	<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	<0.09	<0.04	< 0.03	<0.12	< 0.03
H24	SBM	Feb 2006	18/03/2014	0.2	1660	141	300	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/Mar 2006	18/06/2013	< 0.02	506	212	209	<0.05	0.7	<2	<0.1	18	9	2.4	<0.1	9	80	<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	<0.09	<0.05	< 0.02	< 0.1	0.04
H28	SBM	Mar 2006	18/03/2014	0.26	2500	350	310	0.09	0.7	<2	<0.1	10	10	4.3	<0.1	6	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	0.6	<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	135	<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	0.9	<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	1.3	<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	<50	<0.03	<0.03	<0.03	<0.07	<0.03	<0.02	<0.1	<0.02
H38	OW	Feb 2007	12/08/2011	<0.20	270	160	360	<0.05	1.80	<2	<0.1	20	15	4.0	<0.1	9	90	<8	<20	<30	<60	<0.1	<0.1	<0.1	<0.1	<0.1	<0.022	<0.11	0.33
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	47	15	1.8	<0.1	9	9/	<8	<20	<30	<60	<0.05	<0.05	<0.05	<0.1	<0.05	<0.02	<0.1	<0.02
141	MON	Peb 2007	6/05/2014	~0.0Z	511	78	01	~0.05	1.30	~2	<0.1	22	47	42.2	<0.1	10	73	~0	~20	<30	<60	<0.05	<0.05	<0.05	<0.09	<0.05	<0.03	<0.13	<0.03
1142	MOM	May 2007	6/05/2014	6.90	241	10	75	2.24	0.0	4	<0.1	20	4/	42.2	<0.1	0	77	-1	<10	<30	~00	<0.04	~0.04	<0.04	~0.00	<0.04	<0.03	<0.13	<0.03
H44	SBM	Aug 2007	3/09/2010	<0.03	1630	462	340	<0.05	1.00	<2	<0.1	15	12	2 20	<0.1	7	71	<8	<20	150	150	<0.04	<0.04	<0.04	<0.00	<0.04	<0.023	<0.12	<0.023
H45	OW	Aug 2007	6/05/2014	<0.02	51	18	75	<0.00	1.00	<2	<0.1	16	13	13	<0.1	8	78	<7	<10	<30	<60	<0.05	<0.05	<0.05	<0.09	<0.05	<0.023	<0.12	0.054
H46	WBM	Aug 2007	1/06/2014	0.29	230	213	202	0.10	2.00	<2	<0.1	17	18	4.3	<0.1	9	95	<9	40	480	520	<0.1	0.20	<0.1	<0.2	0.10	<0.03	<0.12	<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	16	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	28/05/2009	< 0.02	52	12	20	<0.05	1.7	<2	<0.1	19	16	1.6	<0.1	8.9	91	<8	<20	510	510	<0.05	<0.05	<0.05	<0.1	<0.05	<0.025	<0.13	<0.025
H52	OW	Jul 2008	18/06/2010	<0.02	69	18	410	<0.05	1.6	<2	<0.1	19	16	1.4	<0.1	9.9	100	<8	<20	<40	<60	<0.05	<0.05	<0.05	<0.10	<0.05	<0.025	>0.13	<0.025
H53	OW	Sept 2008	18/06/2010	<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	18/06/2010	<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	360	<0.05	0.9	<2	<0.1	23	16	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	19	15	1.4	<0.1	9	92	<8	25	490	510	<0.05	<0.05	<0.05	<0.10	<0.05	<0.024	<0.12	<0.024
H58	OW	Jun 2009	3/09/2010	<0.2	74	18	410	<0.05	0.9	<2	<0.10	20	34	3.5	<0.1	9	100	<8	<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	0.26	21	35	5.0	0.16	9	108	<8.7	<20	43	<60	<0.06	<0.06	<0.06	<0.13	<0.06	<0.029	<0.15	<0.02
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	2/0	<0.05	0.094	0.097	3	0.88	<0.03	<0.13	<0.03
H61	OW	Jun 2009	3/09/2010	<0.2	48	15	380	<0.05	0.7	3.1	<0.10	3.9	69	6.7	<0.10	2	44	<8.6	<20	<30	<60	<0.05	<0.05	<0.05	<0.10	<0.05	<0.029	<0.15	<0.029
H62	LOW MALE AND A	Jun 2010	17/03/2012	<0.2	50	9	360	<0.05	1.2	<2	<0.10	14	13	1.4	<0.10	5	57	<8	<20	<40	0</td <td>&lt;0.05</td> <td>&lt;0.05</td> <td>&lt;0.05</td> <td>&lt;0.10</td> <td>&lt;0.05</td> <td>&lt;0.03</td> <td>&lt;0.12</td> <td>&lt;0.03</td>	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.12	<0.03
H03	W/BM	Jun 2010	24/08/2011	1.3	26	<j 14</j 	400	0.46	0.0	4.1	0.26	10	21	16.0	<0.10	19	5/	<8	<20	100	100	<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	<0.08	1.2	<2	<0.10	18	10	1.1	<0.10	8	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	<0.00	12	<2	<0.10	14	10	1 1	<0.10	6.0	59	<8	<20	<40	<70	<0.05	<0.05	<0.05	<0.10	<0.05	<0.03	<0.12 <0.12	<0.03
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### Compilation of soil sample analysis for Schrider 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)



### Attachment A: Landfarm Site Map





# Attachment B: Sample Analysis Results

										Heavy Metals									TI	ч				BTEX	PAH				
Site	Туре	Date Farmed	Date of last sample	Conductivity mSm-1	Recov Ba mg/kg dry w	Recov Cl mg/kg dry w	Recov Na mg/kg dry w	Soluble Salts g/100g dry w	Sodium Absorption Ratio SAR	Arsenic mg/kg dry w	Cadium mg/kg dry w	Chromium mg/kg dry w	Copper mg/kg dry w	read mg/kg dry w	Mercury mg/kg dry w	Nickel mg/kg dry w	Zinc mg/kg dry w	C7-C9 mg/kg dry w	C10-C14 mg.kg dry w	C15-C36 mg/kg dry w	Total HC's mg/kg dry w	Benzene mg/kg dry w	Toluene mg/kg dry w	Ethylbenzene mg/kg dry w	m & p-xylene mgikg dry w	o-Xylene mgikg dry w	Benzo(a)pyrene (BAP)	Naphthalene	Pyrene
Consent Li	nits			290	10000	700	460	2500	18	20	1	600	100	300	1	60	300	120	58	4000		1.1	68	53	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	0.06	<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	< 0.03	<0.14	< 0.03
Site C	WBM	Jul 2001	11/11/2012	0.11	848	26	0.37	<0.05	1.00	<2	<0.1	16	12.00	4.60	<0.1	8.00	67.00	<5	<5	<5	<5	< 0.05	<0.05	< 0.05	<0.10	< 0.05	< 0.03	<0.12	<0.03
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	< 0.03	<0.13	< 0.03
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	1.60	<2	<0.1	14	13	1.5	<0.1	7	69	<7	<10	<30	<50	<0.02	<0.02	<0.02	<0.02	<0.02	<0.023	<0.12	<0.023
G3	WO	Oct 2002	11/11/2012	0.07	652	64	0.25	<0.05	2.60	<2	<0.1	15	81.00	7.30	<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	590	8	89	<0.05	1.50	<2	<0.1	16	18	1.50	<0.1	8	73	<8	<20	<30	<60	< 0.05	<0.05	<0.05	<0.10	< 0.05	<0.03	<0.13	< 0.03
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	69	<7	<10	100	100	< 0.05	<0.05	< 0.05	<0.10	< 0.05	< 0.03	<0.13	<0.03
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	68	<7	<10	<30	<50	<0.05	<0.05	< 0.05	<010	<0.05	< 0.03	<0.12	<0.03
G10	SBM	Aug 2003	1/06/2013	< 0.02	2930	6	190	<0.05	0.5	<2	<0.1	12	24	2.5	<0.1	6	60	<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	488	12	1	<0.05	1.8	<2	<0.1	14	11	1.3	<0.1	7	69	<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	80	<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	67	<7	<10	170	170	<0.05	<0.05	<0.05	<0.1	<0.05	<0.02	<0.12	<0.02
G15	WBM	Nov 2003	1/09/2014	<0.02	445	15	204	<0.05	0.9	<2	<0.1	14	14	1.6	<0.1	7	66	<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	68	<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	88	<0.05	0.60	<2	<0.1	18	14	1.2	0.10	8	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	461	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	190	< 0.03	<0.06	< 0.03	<0.03	< 0.03	<0.02	<0.1	<0.02
G22	OBM	Aug 2005	29/08/2012	< 0.02	610	20	440	<0.05	0.90	<2	<0.1	13	10	1.0	<0.1	6	61	<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	52	440	<0.05	1.7	<2	<0.1	13	12	3	<0.1	6	58	<7	<10	<30	<60	<0.04	<0.04	<0.04	<0.08	< 0.04	<0.03	<0.13	< 0.03
G24	SBM	Apr 2005	29/08/2011	< 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	149	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	29/08/2011	<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	29/11/2014	<0.02	110	5	214	<0.05	1.6	<2	<0.1	10	9	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	< 0.05	<0.1	< 0.05	< 0.03	<0.13	< 0.03
G11	OW	Jul 2005	14/09/2007	<0.02	488	12	1	<0.05	1.8	<2	<0.1	14	11	1.3	<0.1	7	69	<7	<10	<30	<50	<0.2	<0.2	<0.2	<0.2	<0.2	<0.02	<0.1	<0.02
G32	SBM	Jul 2005	3/07/2007	<0.02	381	8	446	<0.05	1.6	<2	<0.1	17	21	8.8	<0.1	9	68	<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	<8	<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	230	<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	<0.03	<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	18/03/2014	<0.02	2200	27	320	<0.05	1.1	<2	<0.1	18	15	14.2	<0.1	8	67	<8	<20	78	78	<0.04	<0.04	< 0.04	<0.08	0.13	< 0.03	<0.1	< 0.03
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	66	<8	<20	<30	<60	< 0.04	< 0.04	< 0.04	<0.08	< 0.04	< 0.03	< 0.13	< 0.03

### 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)