

Waste Remediation Services Ltd  
Waikaikai Landfarm  
Monitoring Programme  
Annual Report  
2015-2016

Technical Report 2016-91

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## Executive summary

Waste Remediation Services Ltd (hereafter the Company) holds consent to manage and operate a drilling waste landfarm located off Lower Manutahi Road at Manutahi, Waikaikai Landfarm. In this monitoring period, the Company did not receive any new deliveries of land-farmable material.

This report for the period July 2015 to June 2016 describes the monitoring programme implemented by the Taranaki Regional Council (the Council) to assess the Company's environmental performance during the period under review. The report also details the results of the monitoring undertaken and assesses the environmental effects of the Company's activities.

The Company holds one resource consent, which includes a total of 31 conditions setting out the requirements that the Company must satisfy. The consent allows the discharges of drilling wastes from hydrocarbon exploration and production activities, oily wastes from wellsites and contaminated soil onto and into land via landfarming.

**During the monitoring period, Waste Remediation Services Ltd demonstrated an overall Good level of environmental performance.**

The Council's monitoring programme for the year under review included six inspections, 20 groundwater samples and six composite soil samples collected for physicochemical analysis.

The monitoring showed that salinity impacts in the groundwater in the direct locality of storage cells are still apparent, though reducing when compared to the previous monitoring year, whereby only one monitoring well remains above the conditional total dissolved salts limit of 2,500 mg/L. The Company, upon request of the Council, removed the unlined cell (termed 'contingency' cell) from the storage facility, which marked the removal of the last unlined storage cell in Taranaki. Total heavy metal analysis undertaken by the Council indicated concentrations close to or below Taranaki natural background concentrations for these target metals in the soil. Previously landfarmed areas were inspected and found to be re-vegetated to a high standard and growing well, with low concentrations of hydrocarbons analysed across each area.

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

During the year, the Company demonstrated a good level of environmental and administrative performance with the resource consents.

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

In terms of overall environmental and compliance performance by the consent holder over the last several years, this report shows that the consent holder's performance remains at a good level in the year under review.

This report includes recommendations for the 2016-2017 year.



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# **1. Introduction**

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

### **1.1.1 Introduction**

This annual report is for the period July 2015 to June 2016 by the Taranaki Regional Council (the Council). It describes the monitoring programme associated with resource consent 5956-1.7 held by Waste Remediation Services Ltd (hereafter the Company), whom operate the landfarm situated on Lower Manutahi Road at Manutahi (Waikaikai Landfarm).

The Company holds one resource consent. This was initially held by Swift Energy Ltd. The original consent was granted on 22 March 2002, permitting the disposal of solids and cuttings from drilling operations at the Kauri D wellsite. This consent was varied in 2003 to include the disposal of synthetic muds, and again in 2005 to include material from other wellsites. At this time, the consent had not been exercised. As such, it was varied again in 2007 to change the lapse date. The consent was transferred twice in 2008, first to Origin Energy Resources (SPV1) Ltd, then Origin Energy Resources (RIMU) Ltd.

The consent was then transferred from Origin Energy Ltd in 2011 to Waikaikai Farms Ltd, and was again varied in 2011 to include the disposal of oily waste. During the 2011-2012 monitoring year, Redback Contracting Ltd (Redback) began exercising the consent on behalf of Waikaikai Farms Ltd. In the 2012-2013 monitoring year the Council were required to intervene in site operations. Redback were no longer contracted to run the site.

After a period of cessation in activity, the site became operational again during the 2013-2014 monitoring period when Waste Remediation Services Ltd commenced management of the site, on behalf of the then consent holder Waikaikai Farms Ltd. In November 2014, the consent was transferred from Waikaikai Farms Ltd to Waste Remediation Services Ltd (the Company).

During the 2013-2014 monitoring period, there was a single disposal of approximately 1,200 m<sup>3</sup> of predominately water-based cuttings and fluids over an area of approximately 12,000 m<sup>2</sup>. No hydraulic fracturing wastes have been disposed of at this site during its life cycle.

During the 2014-2015 monitoring period the Company applied for a change of consent conditions to allow for the surface application of 4,300 m<sup>3</sup> of hydrocarbon impacted soils from the margins of former blow down pits, this was part of Shell Todd Oil Services' Kapuni remediation programme.

In this monitoring period the Company did not receive any new deliveries of material, the only site work which went ahead was the removal of the unlined contingency<sup>1</sup> cell.

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<sup>1</sup> Unused since 2014 though contained 50m<sup>3</sup>+/-of residual drilling material

This report covers the results and findings of the monitoring programme implemented by the Council in respect of the consent held by the Company that relate to the discharges of drilling wastes from hydrocarbon exploration and production activities, oily waste from wellsites, and contaminated soil onto and into land via landfarming in the Mangaroa catchment. This is the forth report to be prepared by the Council to cover the Company's discharges and their effects.

### **1.1.2 Structure of this report**

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

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

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

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

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

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

### **1.1.3 The Resource Management Act 1991 and monitoring**

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

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

In drafting and reviewing conditions on discharge permits, and in implementing monitoring programmes, the Council is recognising the comprehensive meaning of 'effects' inasmuch as is appropriate for each activity. Monitoring programmes are not only based on existing permit conditions, but also on the obligations of the RMA to assess the effects of the exercise of consents. In accordance with Section 35 of the RMA, the Council undertakes compliance monitoring for consents and rules in regional



plans, and maintains an overview of the performance of resource users and consent holders. Compliance monitoring, including both activity and impact monitoring, enables the Council to continually re-evaluate its approach and that of consent holders to resource management and, ultimately, through the refinement of methods and considered responsible resource utilisation, to move closer to achieving sustainable development of the region's resources.

#### 1.1.4 Evaluation of environmental and administrative performance

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

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

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

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

##### Environmental Performance

- **High:** No or inconsequential (short-term duration, less than minor in severity) breaches of consent or regional plan parameters resulting from the activity; no adverse effects of significance noted or likely in the receiving environment. The Council did not record any verified unauthorised incidents involving significant environmental impacts and was not obliged to issue any abatement notices or infringement notices in relation to such impacts.
- **Good:** Likely or actual adverse effects of activities on the receiving environment were negligible or minor at most. There were some such issues noted during monitoring, from self reports, or in response to unauthorised incident reports, but these items were not critical, and follow-up inspections showed they have been dealt with. These minor issues were resolved positively, co-operatively, and quickly. The Council was not obliged to issue any abatement notices or infringement notices in relation to the minor non-compliant effects; however abatement notices may have been issued to mitigate an identified potential for an environmental effect to occur.

For example:

- High suspended solid values recorded in discharge samples, however the discharge was to land or to receiving waters that were in high flow at the time;
- Strong odour beyond boundary but no residential properties or other recipient nearby.
- **Improvement required:** Likely or actual adverse effects of activities on the receiving environment were more than minor, but not substantial. There were some issues noted during monitoring, from self reports, or in response to unauthorised incident reports. Cumulative adverse effects of a persistent minor non-compliant activity could elevate a minor issue to this level. Abatement notices and infringement notices may have been issued in respect of effects.
- **Poor:** Likely or actual adverse effects of activities on the receiving environment were significant. There were some items noted during monitoring, from self reports, or in response to unauthorised incident reports. Cumulative adverse effects of a persistent moderate non-compliant activity could elevate an 'improvement required' issue to this level. Typically there were grounds for either a prosecution or an infringement notice in respect of effects.

#### **Administrative performance**

- **High:** The administrative requirements of the resource consents were met, or any failure to do this had trivial consequences and were addressed promptly and co-operatively.
- **Good:** Perhaps some administrative requirements of the resource consents were not met at a particular time, however this was addressed without repeated interventions from the Council staff. Alternatively adequate reason was provided for matters such as the no or late provision of information, interpretation of 'best practical option' for avoiding potential effects, etc.
- **Improvement required:** Repeated interventions to meet the administrative requirements of the resource consents were made by Council staff. These matters took some time to resolve, or remained unresolved at the end of the period under review. The Council may have issued an abatement notice to attain compliance.
- **Poor:** Material failings to meet the administrative requirements of the resource consents. Significant intervention by the Council was required. Typically there were grounds for an infringement notice.

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

## 1.2 Process description

### 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 (OBM) (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 has typically been used in the Taranaki region to assist the ultimate 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 \$3-4,000/ha to \$30-40,000/ha (2013).

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

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 leveling 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 leveled 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 Waikaikai Landfarm site was initially undertaken on a single application basis. This means dedicated spreading areas receive only single applications of waste. When disposal is complete, the area will be reinstated and monitored until consent surrender criteria have been met.

In this monitoring period the consent was varied to allow for the re-application of impacted soils to an area which was initially utilised for landfarming in 2012. The consent holder undertook analysis to quantify the concentrations of specific parameters in the soil which stipulated the area of land was within surrender criteria. Thus the decision was undertaken to allow for the second application of material.

### **1.3 Site location and description**

The Company operates a drilling waste landfarm off Manutahi Road, Manutahi. The site is owned by P. F. and K. M. Wards, trading under the name Waikaikai Farms Ltd. The predominant land use was previously dairy farming. The site location is detailed in Figure 1. The predominant soil type has been identified as black loamy sand and vegetation growth consists mostly of pasture. Test pitting and the logging of boreholes on site indicated a relatively shallow water table. Test bores were augured to 10 m both around the waste holding pit area and to the south-western site boundary, revealing alternating layers of sand and clays. Bore construction also revealed localised peat layers within some augured cores (approximately 4–8 m below surface). Average annual rainfall for the site is 1,043 mm (taken from the nearby Patea monitoring station).

Origin Energy Ltd's Kauri D wellsite is situated in the eastern corner of the site, and there is a small coastal lake inland and to the northeast (up gradient) of the storage pit area. Both of these features are presented in Figure 1.



**Figure 1** Site location of Waikaikai Landfarm with regional inset

A summary of site data is presented below:

Site data: Waikaikai Landfarm	
Location	
Word descriptor:	Lower Manutahi Road, Manutahi, Taranaki
Map reference:	E 1719720
(NZTM)	N 5605515
Mean annual rainfall:	1,043 m
Mean annual soil temperature:	15.1°C
Mean annual soil moisture:	32.9%
Elevation:	~45 m
Geomorphic position:	Dune backslope
Erosion / deposition:	Erosion
Vegetation:	Pasture, dune grasses
Parent material:	Aeolian/alluvial deposits
Drainage class:	Free/well draining

## 1.4 Resource consents

### 1.4.1 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.

The Company holds discharge permit 5956-1.7, to discharge drilling wastes from hydrocarbon exploration and production activities, and oily wastes from wellsites and contaminated soil onto and into land via landfarming. This permit was issued by the Council on 22 March 2002 under Section 87(e) of the RMA. This resource consent expired on 1 June 2016. The consent holder has recently applied for a renewal of the consent.

Condition 1 sets out definitions;

Condition 2 requires the consent holder to adopt the best practicable option to prevent or minimise any environmental effects;

Condition 3 requires the consent holder to install a minimum of three groundwater monitoring wells;

Condition 4 stipulates that all storage cells utilised for the storage of material shall be lined with a fit for purpose synthetic liner;

Conditions 5 to 11 set out the requirements for notifications, monitoring and reporting;

Condition 12 requires a buffer zone between areas of disposal and surface water bodies and property boundaries;

Condition 13 prohibits the discharge of fracturing fluids;

Condition 14 to 21 specifies discharge limits, locations and loading rate;

Conditions 22 to 27 specify receiving environment limits for both soil and water;

Condition 28 to 29 dictates surrender criteria;

Condition 30 concerns archaeological remains; and

Condition 31 is an amendment and review condition.

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

## **1.5 Monitoring programme**

### **1.5.1 Introduction**

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

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

The monitoring programme for the Waikaikai site consisted of four primary components.

### **1.5.2 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.

### **1.5.3 Site inspections**

The Waikaikai site was visited six times during the monitoring period. Additional inspections were also undertaken during chemical sampling runs. Inspections focused on the following aspects:

- observable and/or ongoing effects upon soil and groundwater quality associated with the land disposal process;
- effective incorporation of material, application rates and associated earthworks;
- integrity and management of storage facilities ;
- dust and odour effects in proximity of the site boundaries;
- housekeeping and site management and;
- the neighbourhood was surveyed for environmental effects.

### **1.5.4 Chemical sampling**

During the monitoring period the Council collected samples of soil and groundwater for chemical analysis. The facility has an active groundwater monitoring network which is comprised of five active groundwater monitoring wells.

These wells are sampled four times per annum to account for seasonal fluctuation and to assess for any adverse effects resulting from the exercise of the consent. The sampling is conducted through a peristaltic pump and field parameters are captured via a YSi multi parameter probe; the samples are collected once field parameters have been stable within 10% for three consecutive readings. The Council also collects soil samples to assess the quality of the landfarming operation.

The methodology utilised by the Council for collecting soil samples across the land farmed area is adapted from the Guidelines for the Safe Application of Biosolids to land in New Zealand (2003). To collect the sample, a soil corer is inserted to a depth of 400 mm +/- to encompass the zone of application. Ten soil cores are collected, spaced 10 meters apart. These ten soil cores are then composited to gain one representative soil sample of an application area. An example of a soil core is provided in Photo 1.



**Photo 1** An example of an extracted soil core

In this monitoring period six soil samples were collected, the analysis was slightly augmented from the normal analysis through the inclusion of total heavy metal testing after subsequent discussion with the consent holder.

These soil and groundwater samples were subjected to the following analysis.

#### **1.5.4.1 Soil analysis parameters**

- Total Heavy Metals (arsenic, cadmium, chromium, copper, mercury, nickel, lead and zinc);
- Calcium, chloride, conductivity, magnesium, potassium, sodium , total soluble salts and sodium adsorption ratio (SAR);
- Total petroleum hydrocarbons; and
- Moisture factor, ammoniacal nitrogen and nitrate/nitrite nitrogen.

#### **1.5.4.2 Groundwater analysis parameters**

- Barium (dissolved and acid soluble), chloride, conductivity (@ 20°C), sodium, total dissolved salts (TDS), pH; and
- Benzene, ethylbenzene, total petroleum hydrocarbons (speciated), toluene, meta-xylene, ortho-xylene.
- In-situ readings: pH, conductivity, dissolved oxygen (DO), oxidation and reduction potential (ORP) and temperature.

### **1.5.5 Review of consent holder supplied information**

The Council is provided with an annual report by the Company, this report contains a list of the deliveries which were made to the facility in this monitoring period. Inline with the delivery information would be the subsequent analysis which would accompany the deliveries. In this monitoring period the Company did not receive any additional land farmable material, thus the register is empty this period.



## **2. Results**

### **2.1 Inspections**

#### **31 July 2015**

At the time of inspection the following was found. The wind was from the north west, speed 3 m/s. No objectionable odours or visible emissions were found during the inspection. All pit liners appeared in good repair. Stormwater within the two lined pits were free of surface hydrocarbons, as was the unlined pit. The oily waste pit had some waxy type material in clumps on the surface. Oily wastes stored, that had been previously stored in bins have been removed from site. Two stock piles of gravel material remained at the load-in area of solids pit.

No recent deliveries appeared to have occurred and the level of the unlined pit appeared to be remaining stable. The area where impacted soils were recently spread, had been re-sown. The pasture strike looked good across the area and the rocks have been raked out and buried. All other pasture where muds had been spread appeared healthy and stable. Muds were identifiable within the soil profile, material was weathering well and broke apart easily, slight hydrocarbon/mud odours noted within the material.

The following action was required: Undertake works to land-farm all muds and other materials which have been on-site for twelve months or longer, in accordance with special condition 14 of resource consent 5956-1.

#### **02 December 2015**

At the time of inspection the wind was from the north, speed 3-4 m/s. Hydrocarbon odours were found around the oily waste pit, with some surface waxy oils also present from historic use. The pit was observed to be almost full of clear liquid. All other pits at the site were essentially empty, with a small volume of muds in the southern cell which were growing grasses. Minor surface hydrocarbons were present in the two lined pits.

No recent spreading activities had occurred. Spreading areas were inspected, pasture appeared healthy in all areas and had been recently cut and baled for silage. Some rocks were migrating to the surface through natural processes. Muds were well dispersed within the soil profile and were weathering well.

#### **31 March 2016**

At the time of inspection the following as found. The wind was from the north and variable, speed 3 m/s. No objectionable odours or visible emissions were found beyond the site boundary during the inspection. No recent storage or land-farming activities had occurred at the site. Pit liners in pits 1, 2 and the oily waste pit appeared in good repair, with plenty of storage space available for stormwater in all lined pits. The liquid within the pits was described as turbid brown, with minor surface hydrocarbons present in pit 2 and some waxy surface hydrocarbons present in the oily waste pit.

Gravel remained at the tip face of pit 1. The unlined pit was inspected, the turbid brown water had evaporated over the summer months leaving drilling muds exposed. Core depth investigated across the tip face area and found it to be approximately 1 m deep for 10 m of the tip face with the depth of mud trailing off into the liquid. The

exposed mud was approximately 5 m back into the pit indicating that there was around 50 m<sup>3</sup> +/- of drilling mud within the unlined pit.

Pasture where muds had been previously applied were inspected and appeared healthy. No muds were sighted at the surface.

### **28 April 2016**

At the time of inspection the following was found. The wind was from the west, speed 4-5 m/s. No objectionable odours or visible emissions were found during the inspection. No recent storage or spreading activities had occurred at the site.

All previously spread areas had very good pasture cover which appeared healthy, muds and rocks were identified within the soil profile around the spreading areas. All lined pits contained stormwater with surface hydrocarbons, and the liners appeared in good repair. It was noted that due to digger reach limitations, the unlined pit may have to have a track cut in order to empty the small volume of remaining muds.

### **14 June 2016**

During the inspection the following was found. The wind was from the west, speed 4 m/s. No objectionable odours or visible emissions were found during the inspection.

No recent deliveries of material had occurred and the storage pits remained unchanged. Stormwater had filled the pits to varying levels. The liquid in the unlined pit had a green tinge, likely caused by algal growth. Some visible muds were present above the water level in the tip area. No recent spreading activities had occurred at the site. All spreading areas had good pasture cover which appeared healthy and stable.

### **30 June 2016**

The inspection was conducted in conjunction with soil sampling, in overcast conditions with a strong SE wind.

The site was unoccupied at the time of inspection, although the spreading area had recently been permanently re-fenced. The storage site was tidy, with stormwater in all pits, and approx. 0.5 -3 m freeboard available.

A soil sample was collected in the northern end of the spreading area, it was comprised of 20 composited cores to approximately 300 mm depth. Flecks of mud encountered, with a layer of light brown clays from 0-100 mm depth. No odour was detected, with sample mainly composed of dark brown moist sands.

Spreading area A had re-grassed very well since application of the Kapuni soils. Good coverage was noted with no barren patches, and excellent rootlet development.

## 2.2 Results of abstraction and discharge monitoring

### 2.2.1 Provision of consent holder data

The consent holder provides data on the material which is delivered to the facility. This data will include the location, the amount, and the analysis, as required by specific consent conditions<sup>2</sup>. In this monitoring period there were no deliveries of material for the entire year.

### 2.2.2 Results of receiving environment monitoring

#### 2.2.2.1 Council soil results

The Council undertook the collection of six composite soil samples throughout the monitoring period. The rationale was to ascertain the quality of the landfarming operations in the first instance, to check the application rate requirements have been met.

Secondly, the parcels of land which have received applications of material are monitored to quantify the degradation rates of the material as it bioremediates in an in-situ state.

The Council collected six composite soil samples in the 2015-2016 monitoring period. The methodology utilised by the Council for the collection of soils is dictated in Section 1.5.4. The analysis of the Council collected soils is provided in Table 1. The locations where they were collected are annotated in Figure 2.

**Table 1** Council soil results Waikakai Landfarm 2015-2016 monitoring period

Council Soil	Date	24 Jul 2015	24 Jul 2015	06 May 2016	06 May 2016	06 May 2016	30 Jun 2016
Parameter	Unit/Time	11:00 F1(a)	12:00 F1(b)	10:20 A2N	10:50 A2S	11:40 F1	11:45 A1
Arsenic	mg/kg	-	-	<2	<2	<2	<2
Calcium	mg/kg	63.4	90.1	19.3	17.7	91	18.9
Cadmium	mg/kg	-	-	<0.10	<0.10	<0.10	<0.10
Chloride	mg/kg	41.6	22.7	26.4	27.3	21.8	23.4
Conductivity	mS/m@20 °C	59.8	56.1	29.5	37.6	98.7	35.6
Chromium	mg/kg	-	-	16	16	15	13
Copper	mg/kg	-	-	11	10	15	13
Mercury	mg/kg	-	-	<0.10	<0.10	<0.10	<0.10
Total petroleum hydrocarbon	mg/kg	430	755	14	39	24	17
Potassium	mg/kg	80.5	50.3	31.5	35.3	51.4	18.1
Moisture Factor	nil	1.182	1.169	1.09	1.075	1.069	1.116
Magnesium	mg/kg	7.6	10.9	6.6	11.3	24.7	4.7
Sodium	mg/kg	41.3	31.9	18	18.4	28.5	13
Ammonia	mgN/kg	2.03	1.45	2	1.16	3.83	2.37
Nickel	mg/kg	-	-	9	9	8	7
Nitrite/Nitrate	mgN/kg	2.38	3.18	7.98	8.56	1.49	1.43
Lead	mg/kg	-	-	1.5	1.5	2.7	2.5

<sup>2</sup> Conditions 5, 6, 7, 8 and 9 of consent 5956-1.7

Council Soil	Date	24 Jul 2015	24 Jul 2015	06 May 2016	06 May 2016	06 May 2016	30 Jun 2016
Parameter	Unit/Time	11:00 F1(a)	12:00 F1(b)	10:20 A2N	10:50 A2S	11:40 F1	11:45 A1
pH	pH	7.3	7.2	5.9	6.4	7	6.6
Sodium absorption ratio	None	1.30523	0.84505	0.90227	0.84064	0.68384	0.69349
Total soluble salts	mg/kg	468	439	230.9	294.3	772.4	278.6
Zinc	mg/kg	-	-	77	69	64	56

The six composite soil samples collected by the Council from Waikaikai Landfarm are provided in the above Table 1. This monitoring period contained a greater number of analytes than in the previous monitoring period. The rationale was to include total heavy metal analysis to the soil samples analysed to meet a specific consent condition, as prior to this monitoring period the consent holder did not undertake the required samples.

The additional analysis was added after discussions with the Council which occurred mid way through the year; as such the initial two soil samples did not contain heavy metal analysis, whereas the remaining four samples did contain the heavy metal analysis, post discussions with the Company.



**Figure 2** Council soil samples Waikaikai Landfarm

The results in this monitoring period indicated that analysis of total heavy metals in terms of arsenic, cadmium, chromium, copper, lead, nickel, mercury and zinc were all below the consented requirement and returned concentrations similar to natural background concentrations for these target metals in Taranaki soils.

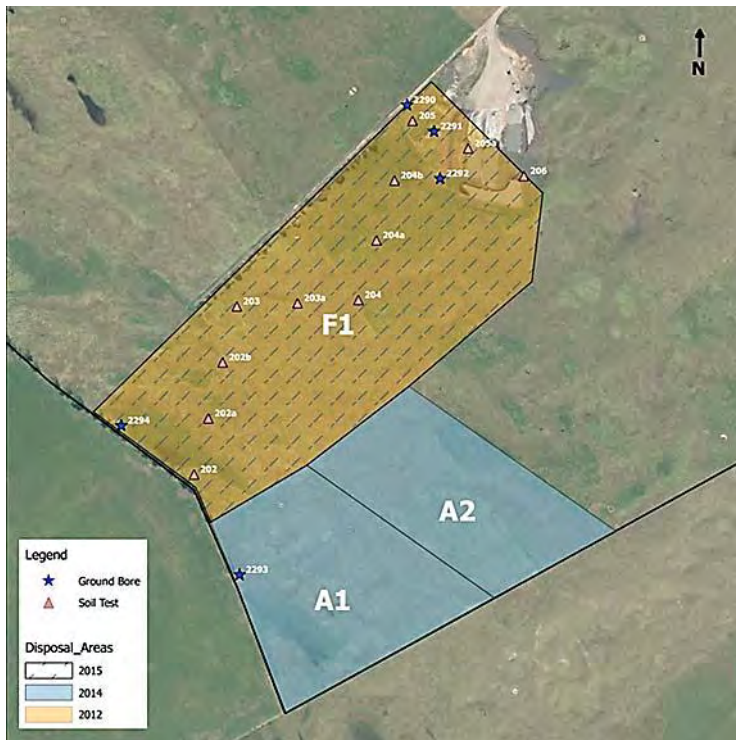
Similarly the concentration of sodium absorption ratio (SAR) returned low values, which were well below 2.0 SAR.

The concentrations of total soluble salts ranged from 230-772 mg/kg.

The conductivity of the soil samples were all well below their consented concentrations which is limited to 400 mS/m @20 °C.

Total petroleum hydrocarbon values were similarly low in all samples analysed, ranging from 17-755 mg/kg TPH. Note no speciation analysis, polycyclic aromatic hydrocarbon or mono aromatic hydrocarbon analysis was undertaken on request of the Company as they do not intend to undertake surrender sampling currently.

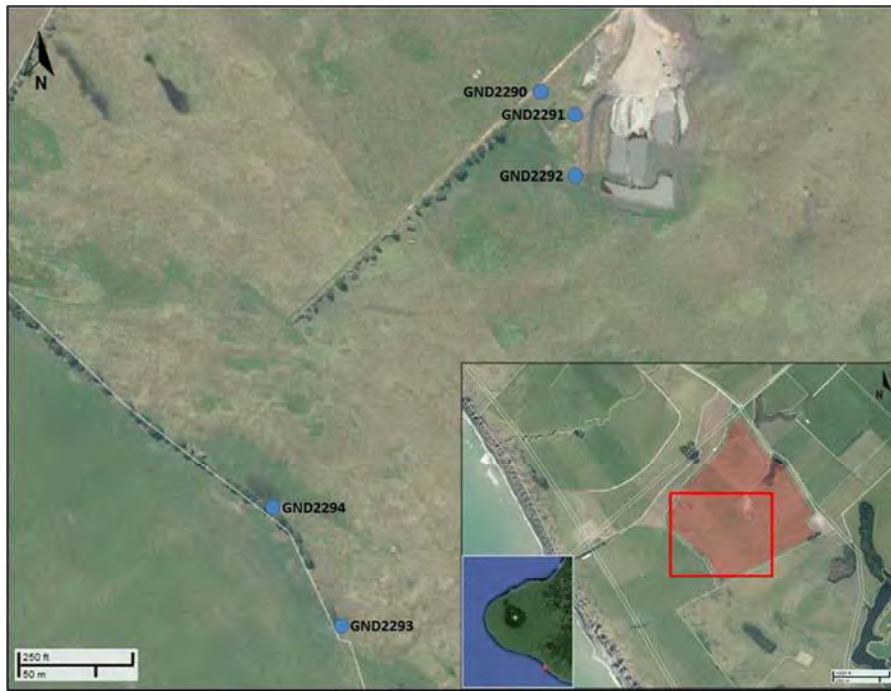
Specially, composite samples F1 (a), (b) and F1 were collected from the most recently spread area which is indicted as area F1 by the Company (Figure 3). This area was landfarmed in the previous monitoring period. Composite samples A2 (North) and A2 (South) were collected from spreading area A2, which was landfarmed in 2014.



**Figure 3** Company provided landfarming application map Waikaikai Landfarm

#### 2.2.2.2 Council groundwater results

The site contains an active groundwater monitoring network of five groundwater monitoring wells. Three of these wells are located in close proximity to the storage cells to monitor for any potential leaching effects from the storage of material in the lined storage cells, of which the site contains two cells. The other two monitoring wells are located to the south and south west of the storage cells, on the site boundary to monitor for the potential for offsite migration of contaminants (Figure 4). The results of the analysis are provided in the Tables 2-6.



**Figure 4** Groundwater monitoring well locations Waikakai Landfarm

**Table 2** GND2290 monitoring well results 2015-2016 monitoring period

	Well ID	GND2290	GND2290	GND2290	GND2290
Parameter	Date	20 Jul 2015	02 Dec 2015	04 Mar 2016	06 May 2016
Barium (Acid soluble)	g/m <sup>3</sup>	0.019	0.09	0.062	0.039
Barium (dissolved)	g/m <sup>3</sup>	0.019	0.07	0.047	0.039
Benzene	g/m <sup>3</sup>	<0.0010	<0.0010	<0.0010	<0.0010
Chloride	g/m <sup>3</sup>	22.8	49.1	21.1	19.9
Conductivity	mS/m@20 °C	25.8	61.1	41.5	38.1
Ethylbenzene	g/m <sup>3</sup>	<0.0010	<0.0010	<0.0010	<0.0010
HC C10-C14	g/m <sup>3</sup>	<0.2	<0.2	<0.2	<0.2
HC C15-C36	g/m <sup>3</sup>	<0.4	<0.4	<0.4	<0.4
HC C7-C9	g/m <sup>3</sup>	<0.10	<0.10	<0.10	<0.10
Total petroleum hydrocarbon	g/m <sup>3</sup>	<0.7	<0.7	<0.7	<0.7
Level	m	1.839	2.338	2.88	3.17
Sodium	g/m <sup>3</sup>	22.6	38.7	32.3	31
pH	pH	6.6	6.7	6.7	6.8
Total dissolved salts	g/m <sup>3</sup>	199.6	472.7	321.1	294.8
Temperature	°C	14.6	15.2	16.9	16.4
Toluene	g/m <sup>3</sup>	<0.0010	<0.0010	<0.0010	<0.0010
XYLENE-2	g/m <sup>3</sup>	<0.002	<0.002	<0.002	<0.002
XYLENE-1	g/m <sup>3</sup>	<0.0010	<0.0010	<0.0010	<0.0010

**Table 3** GND2291 monitoring results 2015-2016 monitoring period

	Well ID	GND2291	GND2291	GND2291	GND2291
Parameter	Unit/ Date	20 Jul 2015	02 Dec 2015	04 Mar 2016	06 May 2016
Barium (Acid soluble)	g/m <sup>3</sup>	0.02	0.1	0.044	0.08
Barium (dissolved)	g/m <sup>3</sup>	0.016	0.1	0.043	0.021
Benzene	g/m <sup>3</sup>	<0.0010	<0.0010	<0.0010	<0.0010
Chloride	g/m <sup>3</sup>	397	720	780	696
Conductivity	mS/m@20 °C	151	234	254	214
Ethylbenzene	g/m <sup>3</sup>	<0.0010	<0.0010	<0.0010	<0.0010
HC C10-C14	g/m <sup>3</sup>	<0.2	<0.2	<0.2	<0.2
HC C15-C36	g/m <sup>3</sup>	<0.4	<0.4	<0.4	<0.4
HC C7-C9	g/m <sup>3</sup>	<0.10	<0.10	<0.10	<0.10
Total petroleum hydrocarbon	g/m <sup>3</sup>	<0.7	<0.7	<0.7	<0.7
Level	m	3.517	3.852	4.75	5.17
Sodium	g/m <sup>3</sup>	65.6	82.1	97.3	79
pH	pH	6	6.1	5.9	6
Total dissolved salts	g/m <sup>3</sup>	1,168.3	1,810.5	1,965.2	1,655.7
Temperature	°C	15.4	16.1	16.9	15.8
Toluene	g/m <sup>3</sup>	<0.0010	<0.0010	<0.0010	<0.0010
XYLENE-2	g/m <sup>3</sup>	<0.002	<0.002	<0.002	<0.002
XYLENE-1	g/m <sup>3</sup>	<0.0010	<0.0010	<0.0010	<0.0010

**Table 4** GND2292 monitoring results 2015-2016 monitoring period

	Well ID	GND2292	GND2292	GND2292	GND2292
Parameter	Unit/ Date	20 Jul 2015	02 Dec 2015	04 Mar 2016	06 May 2016
Barium (Acid soluble)	g/m <sup>3</sup>	0.14	0.84	0.68	0.57
Barium (dissolved)	g/m <sup>3</sup>	0.14	0.84	0.68	0.52
Benzene	g/m <sup>3</sup>	<0.0010	<0.0010	<0.0010	<0.0010
Chloride	g/m <sup>3</sup>	842	2,240	2,380	2,120
Conductivity	mS/m@20 °C	277	612	678	608
Ethylbenzene	g/m <sup>3</sup>	<0.0010	<0.0010	<0.0010	<0.0010
HC C10-C14	g/m <sup>3</sup>	<0.2	<0.2	<0.2	<0.2
HC C15-C36	g/m <sup>3</sup>	<0.4	<0.4	<0.4	<0.4
HC C7-C9	g/m <sup>3</sup>	<0.10	<0.10	<0.10	<0.10
Total petroleum hydrocarbon	g/m <sup>3</sup>	<0.7	<0.7	<0.7	<0.7
Level	m	3.615	3.85	4.915	5.36
Sodium	g/m <sup>3</sup>	143	590	446	584
pH	pH	6	5.9	5.8	6.3
Total dissolved salts	g/m <sup>3</sup>	2,143.2	<b>4,735.1</b>	<b>5,245.8</b>	<b>4,704.2</b>
Temperature	°C	15.6	16.2	17.4	16.1
Toluene	g/m <sup>3</sup>	<0.0010	<0.0010	<0.0010	<0.0010
XYLENE-2	g/m <sup>3</sup>	<0.002	<0.002	<0.002	<0.002
XYLENE-1	g/m <sup>3</sup>	<0.0010	<0.0010	<0.0010	<0.0010

**Table 5** GND2293 monitoring results 2015-2016 monitoring period

	Well ID	GND2293	GND2293	GND2293	GND2293
Parameter	Unit/ Date	20 Jul 2015	02 Dec 2015	04 Mar 2016	06 May 2016
Barium (Acid soluble)	g/m <sup>3</sup>	0.22	0.28	0.21	0.22
Barium (dissolved)	g/m <sup>3</sup>	0.22	0.27	0.16	0.18
Benzene	g/m <sup>3</sup>	<0.0010	<0.0010	<0.0010	<0.0010
Chloride	g/m <sup>3</sup>	630	657	484	495
Conductivity	mS/m@20 °C	237	229	180	175
Ethylbenzene	g/m <sup>3</sup>	<0.0010	<0.0010	<0.0010	<0.0010
HC C10-C14	g/m <sup>3</sup>	<0.2	<0.2	<0.2	<0.2
HC C15-C36	g/m <sup>3</sup>	<0.4	<0.4	<0.4	<0.4
HC C7-C9	g/m <sup>3</sup>	<0.10	<0.10	<0.10	<0.10
Total Petroleum Hydrocarbon	g/m <sup>3</sup>	<0.7	<0.7	<0.7	<0.7
Level	m	0.946	1.458	2.02	2.57
Sodium	g/m <sup>3</sup>	148	131	103	94.4
pH	pH	6.7	7.2	6.9	6.8
Total dissolved salts	g/m <sup>3</sup>	1,833.7	1,771.8	1,392.7	1,354
Temperature	°C	15.5	15.1	16.5	16.1
Toluene	g/m <sup>3</sup>	<0.0010	<0.0010	<0.0010	<0.0010
XYLENE-2	g/m <sup>3</sup>	<0.002	<0.002	<0.002	<0.002
XYLENE-1	g/m <sup>3</sup>	<0.0010	<0.0010	<0.0010	<0.0010

**Table 6** GND2294 monitoring results 2015-2016 monitoring period

	Well ID	GND2294	GND2294	GND2294	GND2294
Parameter	Unit/ Date	20 Jul 2015	02 Dec 2015	04 Mar 2016	06 May 2016
Barium (Acid soluble)	g/m <sup>3</sup>	0.008	0.006	0.009	0.014
Barium (dissolved)	g/m <sup>3</sup>	0.005	0.006	0.008	0.011
Benzene	g/m <sup>3</sup>	<0.0010	<0.0010	<0.0010	<0.0010
Chloride	g/m <sup>3</sup>	40.6	45.4	44.7	46.8
Conductivity	mS/m@20 °C	28.8	28.6	29.5	36.1
Ethylbenzene	g/m <sup>3</sup>	<0.0010	<0.0010	<0.0010	<0.0010
HC C10-C14	g/m <sup>3</sup>	<0.2	<0.2	<0.2	<0.2
HC C15-C36	g/m <sup>3</sup>	<0.4	<0.4	<0.4	<0.4
HC C7-C9	g/m <sup>3</sup>	<0.10	<0.10	<0.10	<0.10
Total petroleum hydrocarbon	g/m <sup>3</sup>	<0.7	<0.7	<0.7	<0.7
Level	m	1.579	1.875	2.443	2.67
Sodium	g/m <sup>3</sup>	27.9	28.3	28.9	30.1
pH	pH	7	7.6	7	7.1
Total dissolved salts	g/m <sup>3</sup>	222.8	221.3	228.2	279.3
Temperature	°C	14.2	15.5	15.9	15.4
Toluene	g/m <sup>3</sup>	<0.0010	<0.0010	<0.0010	<0.0010
XYLENE-2	g/m <sup>3</sup>	<0.002	<0.002	<0.002	<0.002
XYLENE-1	g/m <sup>3</sup>	<0.0010	<0.0010	<0.0010	<0.0010



Groundwater analysis undertaken by the Council in the 2015-2016 monitoring period, in respect of the active groundwater monitoring network of the Waikaikai Landfarm is provided in the above Tables 2-6 respectively.

In similarity to the previous monitoring period, the concentrations of Total Dissolved Salts (TDS) were found to be close to or above its condition limit of 2,500 g/m<sup>3</sup> in two of five of the groundwater monitoring wells. In this period, only one well, GND2292, remained above this limit, with a maximum concentration of 5,245 g/m<sup>3</sup> TDS recorded in March 2016, before decreasing to a concentration of 4,704 g/m<sup>3</sup> in May 2016.

While this concentration of TDS is unsuitable for irrigation purposes (irrigation TDS quality 1,001- 3,500 mg/L) it is however suitable for stock watering purposes (3,501- 8,000 mg/L)<sup>3</sup>.

The location of this elevated TDS monitoring well GND2292, Figure 4, is in close proximity to the storage cell area. Up until very recently, the site contained an unlined storage cell which was utilised by the consent holder to store drilling material.

This unlined cell was inferred to be contributing to the elevated saline impacts observed in this monitoring well during and prior to this monitoring period. Discussions held between the Company and the Council has since mitigated this unlined cell (contingency cell) and it has now been removed. Correspondingly the concentrations of TDS have similarly decreased.

The concentrations of sodium and chloride followed similar trends to the TDS concentration in all wells, be it with a lower concentration.

The elevation of TDS in the remaining four wells was below this conditional limit, with the second highest GND2291, with a concentration of 1,965 g/m<sup>3</sup> also in March 2016.

No hydrocarbons were detected in the five monitoring wells throughout the four groundwater monitoring events undertaken by the Council in this period.

Groundwater levels were also the highest recorded (closest to the surface) in the four year data set, with the maximum groundwater level recorded in the July 2015 sample round.

## 2.3 Investigations, interventions, and incidents

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

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<sup>3</sup> Extracted from Table 5.1. Ministry for the Environment Guidelines for Assessing and Managing Hydrocarbon Contaminated Sites in New Zealand 1999.

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

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

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

### **3. Discussion**

#### **3.1 Discussion of site performance**

Waikaikai Landfarm in the 2015-2016 monitoring period did not receive any deliveries of material through out the period. Although it was non-operational in terms of deliveries to the site, it did still contain material from previous years which required management. In the previous monitoring period, the Company sequestered close to 4,000 m<sup>3</sup> of Shell Todd Oil Services Ltd (STOS) related, impacted soils for remediation.

The soil sample results collected throughout this period and in the previous monitoring period, indicated that the consented analytes are in low concentrations in the samples collected by the Council. This indicates that the quality of the landfarming operations was undertaken to good standard. The areas of land which were utilised for the application of material to land have been re-vegetated to a high standard.

The main undertaking by the Company in this period was the removal of the unlined contingency cell, upon request of Council. The removal of this unlined contingency cell marked the end of un-lined storage cells in Taranaki, as now all functional landfarms are fitted with fit for purpose synthetic liners. The main rationale for fitting the facilities with cell liners is to prevent the infiltration of hyper saline fluid and associated hydrocarbon component of the drilling waste to localised groundwater.

Sites which historically contained unlined storage cells had resulted in longer monitoring programmes as the localised saline impacts have prevented these facilities from being surrendered. Whereas facilities which are/were fitted with liners did not affect the groundwater to the same degree as the unlined versions. This also underlines the rationale for landfarms to contain an active groundwater monitoring network.

In terms of works required to be undertaken, the Company must undertake the landfarming of material which has been observed by Council to have been in storage for longer than one year. This has been pointed out during the inspections and the Council will continue to monitor the application of this material in the upcoming period.

#### **3.2 Environmental effects of exercise of consents**

The main environmental effect associated with the exercise of this consent is centered on elevated saline impacts in the groundwater in the direct locality of storage cells.

In similarity to the previous monitoring period, where the concentration of Total Dissolved Salts (TDS) were found to be close to or above its condition limit of 2,500 g/m<sup>3</sup> in two of five of the groundwater monitoring wells. In this period, only one well, GND2292, remained above this limit, with a maximum concentration of 5,245 g/m<sup>3</sup> TDS recorded in March 2016, before decreasing to a concentration of 4,704 g/m<sup>3</sup> in May 2016.

The location of this elevated TDS monitoring well GND2292, Figure 4, is in close proximity to the storage cell area. Note that the site up until very recently contained an unlined storage cell which was utilised by the consent holder to store drilling material.

This unlined cell was inferred to be contributing to the elevated saline impacts observed in this monitoring well during and prior to this monitoring period. Discussions held between the Company and the Council has since resulted in this unlined cell (contingency cell) being removed.

It is noteworthy to mention that while there are salinity impacts they are localised. This concentration of TDS is unsuitable for irrigation purposes (irrigation TDS quality 1,001-3,500 mg/L) it is however suitable for stock watering purposes (3,501-8,000 mg/L).

Total heavy metal analysis was also included in the soil sampling regime this monitoring period. The rationale for undertaking this analysis was to appease a specific consent condition<sup>4</sup>. The analysis returned values which were close to Taranaki background concentrations in the four samples collected this period. The additional areas which did not have heavy metal analysis undertaken this period will be sampled in the upcoming monitoring period.

The areas of land which had been utilised for the practice of landfarming had been re-vegetated to a high standard.

The Council will continue to monitor the salinity concentration observed in the groundwater in the locality of the storage cells in the upcoming monitoring period.

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<sup>4</sup> Condition 27, Consent 5956-1.7

### 3.3 Evaluation of performance

A tabular summary of the consent holder's compliance record for the year under review is set out in Table 7.

**Table 7** Summary of performance in respect of consent 5956-1.7

<b>Purpose: To discharge drilling wastes from hydrocarbon exploration and production activities, oily wastes from wellsites, and contaminated soil onto and into land via landfarming</b>		
<b>Condition requirement</b>	<b>Means of monitoring during period under review</b>	<b>Compliance achieved?</b>
1. Definitions of material, stockpiling and landfarming	N/A	N/A
2. Adoption of best practicable option	Inspection, sampling and liaison with consent holder	Yes
3. Groundwater monitoring well installation	Monitoring	Yes
4. Cell lined with fit for purpose liner	Inspection – Unlined contingency cell removed	Yes
5. Notify TRC 48 hours prior to transfer of waste to disposal site	No deliveries received	N/A
6. Notify TRC 48 hours prior to landfarming wastes	No landfarming undertaken	N/A
7. The consent holder shall sample for the following: a) Total petroleum hydrocarbons b) Benzene, toluene, ethylbenzene, xylenes c) Polycyclic aromatic hydrocarbons d) Chloride, nitrogen, pH, potassium, sodium	Sampling and report	N/A
8. Representative sample of every 10 <sup>th</sup> load of waste	No deliveries this monitoring period.	N/A
9. Keep records relating to wastes, areas, compositions, volumes, dates, treatments and monitoring	Company records	Yes
10. Report on records in condition 7 to Council by 31 August each year		Yes
11. No discharge within 25 m of surface water	Inspection	Yes
12. Discharge of hydraulic fracturing fluids is prohibited	Inspection, sampling, records	Yes
13. Contaminated soil application direction	Inspection	Yes
14. All waste landfarmed within 12 months	Inspection, some material in storage for longer than one year.	No

<b>Purpose: To discharge drilling wastes from hydrocarbon exploration and production activities, oily wastes from wellsites, and contaminated soil onto and into land via landfarming</b>		
<b>Condition requirement</b>	<b>Means of monitoring during period under review</b>	<b>Compliance achieved?</b>
15. Maximum application thickness for solid wastes: a) 100 mm TPH <5% b) 50 mm TPH >5%	Company records and sampling	Yes
16. Liquid wastes to be applied in a manner that prevents overland flow and ponding	Inspection	Yes
17. Incorporation into soil as soon as practicable to a depth of at least 250 mm	Inspection and sampling	Yes
18. Hydrocarbon concentration to not exceed 20,000 mg/kg following application and incorporation	Sampling	Yes
19. Farming of contaminated soil to occur in a specific area	Inspection	Yes
20. Specific application area for secondary application	Inspection	Yes
21. Re-vegetate landfarmed areas as soon as practicable	Company records and inspections	Yes
22. Total dissolved salts in any fresh water body shall not exceed 2,500 g/m <sup>3</sup>	Sampling	No -- high concentration of TDS in GND 2292
23. Consent shall not lead or be liable to lead to contaminants entering a surface water body	Inspections and sampling	Yes
24. Activities shall not result in any adverse impacts on groundwater or surface water	Inspections and sampling	No -- high concentration of TDS in GND 2292
25. Conductivity must be less than 400 mSm <sup>-1</sup> . If background soil has an conductivity greater than 400 mSm <sup>-1</sup> , then conductivity after disposal shall not exceed original conductivity by more than 100 mSm <sup>-1</sup>	Sampling	Yes
26. Sodium absorption ratio [SAR] must be less than 18.0, if background SAR exceeds 18.0 then increase shall not exceed 1.0	Sampling	Yes
27. Concentrations of heavy metals in the soil shall at all times comply with MfE guidelines	Sampling	Yes

<b>Purpose: To discharge drilling wastes from hydrocarbon exploration and production activities, oily wastes from wellsites, and contaminated soil onto and into land via landfarming</b>		
<b>Condition requirement</b>	<b>Means of monitoring during period under review</b>	<b>Compliance achieved?</b>
28. Prior to expiry/cancellation of consent these levels must not be exceeded: a) conductivity, 290 mSm <sup>-1</sup> b) chloride, 700 g/m <sup>3</sup> c) dissolved salts, 2,500 g/m <sup>3</sup> d) sodium, 460 g/m <sup>3</sup> e) MAH's/PAH MfE 1999 CS NZ Table 4.15 f) TPH CCME 2008 Table 5.3 Ecological direct contact	Not applicable – sampling prior to surrender of consent	N/A
29. Consent cannot be surrendered until standards in condition 25 have been met	Not applicable	N/A
30. Notification of discovery of archaeological remains	Not applicable – none found	N/A
31. Review condition	To be undertaken in 2016	To be renewed
Overall assessment of environmental performance in respect of this consent		<b>Good</b>
Overall assessment of administrative compliance in respect of this consent		<b>Good</b>

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

Ratings are as defined in Section 1.1.4.

### 3.4 Recommendations from the 2014-2015 Annual Report

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

1. THAT the monitoring programme for the Waste Remediation Services Ltd site of Waikaikai landfarm in the 2015-2016 year remains unchanged from that for 2014-2015 monitoring period.
2. Investigation into the contingency pit integrity.
3. THAT the consent holder provides analytical soil results for all the recently landfarmed areas within the monitoring period and these samples are representative of the true zone of application.
4. THAT the consent renewal be undertaken prior to expiry of the consent.

**During the 2015-16 monitoring period these recommendations were met as follows:**

1. The monitoring programme was implemented and remained unchanged apart from the inclusion of total heavy metals to the soil samples collected.
2. The unlined contingency pit was removed.
3. Soil samples were collected from the true zone of application.
4. The consent renewal has been undertaken.

### **3.5 Alterations to monitoring programmes for 2016-2017**

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

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

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

It is proposed that for 2016-2017, that the monitoring programme for the Waikaikai Landfarm be slightly augmented from the previous year. The number of soil samples collected by the Council will be lowered from six soil samples to two. The rationale being that areas landfarmed to date has been sufficiently sampled which included the addition of total heavy metal analysis to the soil analysis undertaken this year.

If the management wish to utilise paddocks for other means other than landfarming the management must submit a request for surrender sampling.

Once the site has undertaken additional landfarming the corresponding number of soil samples will increase to test those areas which are yet to be farmed.



## **4. Recommendations**

1. THAT monitoring of consented activities at Waikaikai Landfarm in the 2016-2017 year be slightly augmented in terms of the required number of soil samples to be collected. This number will be reduced from six soil samples to two. The remainder of the monitoring programme will continue unchanged in similarity to the previous monitoring period 2015-2016.

## Glossary of common terms and abbreviations

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

Al*	Aluminium.
As*	Arsenic.
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.
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.
Fresh	Elevated flow in a stream, such as after heavy rainfall.
g/m <sup>2</sup> /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.
Incident register	The incident register contains a list of events recorded by the Council on the basis that they may have the potential or actual environmental consequences that may represent a breach of a consent or provision in a Regional Plan.
L/s	Litres per second.
m <sup>2</sup>	Square Metres.
mS/m	Millisiemens per metre.
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.
pH	A numerical system for measuring acidity in solutions, with 7 as neutral. Numbers lower than 7 are increasingly acidic and higher than 7 are increasingly alkaline. The scale is logarithmic i.e. a change of 1 represents a ten-fold change in strength. For example, a pH of 4 is ten times more acidic than a pH of 5.
Physicochemical	Measurement of both physical properties (e.g. temperature, clarity, density) and chemical determinants (e.g. metals and nutrients) to characterise the state of an environment.
PM <sub>10</sub>	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	<i>Resource Management Act 1991</i> and including all subsequent amendments.
SS	Suspended solids.
Temp	Temperature, measured in °C (degrees Celsius).
Turb	Turbidity, expressed in NTU.
Zn*	Zinc.

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

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

## **Bibliography and references**

Department of Health 1992: Public health guidelines for the safe use of sewage effluent and sewage sludge on land. Department of Health.

Ministry for the Environment 1999: Guidelines for assessing and managing petroleum hydrocarbon contaminated sites in New Zealand, Ministry for the Environment.

Ministry for the Environment 2003: Guidelines for the safe application of biosolids to land in New Zealand, Ministry for the Environment.

Taranaki Regional Council (2014): Waikaikai Farms Ltd Drilling Waste Disposal Monitoring Programme Biennial Report 2011-2013. Technical Report 2013-68.

Taranaki Regional Council (2015): Waikaikai Farm Ltd Waikaikai Landfarm Monitoring Programme Annual Report 2013-14. Technical Report 2014-77.

Taranaki Regional Council (2015): Waikaikai Farm Ltd Waikaikai Landfarm Monitoring Programme Annual Report 2014-15. Technical Report 2015-95.

## **Appendix I**

**Resource consents held by  
Waste Remediation Services Ltd**  
(For a copy of the signed resource consent  
please contact the TRC Consents department)



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

Name of Consent Holder:	Waste Remediation Services Limited PO Box 7150 New Plymouth 4341
Decision Date (Change):	27 November 2014
Commencement Date (Change):	27 November 2014 (Granted Date: 22 March 2002)

**Conditions of Consent**

Consent Granted:	To discharge drilling wastes from hydrocarbon exploration and production activities, oily wastes from wellsites, and contaminated soil onto and into land via landfarming
Expiry Date:	01 June 2016
Review Date(s):	January 2015
Site Location:	Lower Manutahi Road, Manutahi
Legal Description:	Lots 2 & 4 DP 7139 Lots 2 & 12 DP 14551 & Sec 742 Patea Dist Blk I Carlyle SD Sec 3 SO 453117
Grid Reference (NZTM)	1720190E-5605380N
Catchment:	Mangaroa

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

### **General condition**

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

### **Special conditions**

1. For the purposes of this consent the following definitions shall apply:
  - a) Drilling wastes consist of; drilling fluids and cuttings from drilling operations with water based muds, and drilling cuttings from drilling operations with synthetic based muds;
  - b) Oily wastes from wellsites consist of; sludge removed from tanks and separators, slops oil removed from well cellars, tank wax which builds up in separators and tanks, oily formation sand, contaminated ground material from leaks and spills;
  - c) Contaminated soil refers specifically to the hydrocarbon contaminated soil from the Kapuni gas field, as detailed in the application for this consent;
  - d) Storage means a discharge of wastes from vehicles, tanks, or other containers onto land for the purpose of temporary storage prior to landfarming, but without subsequently spreading onto, or incorporating the discharged material into the soil within 48 hours;
  - e) Landfarming means the discharge of wastes onto land, subsequent spreading and incorporation into the soil, for the purpose of attenuation of hydrocarbon and/or other contaminants, 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.
3. Prior to the exercise of this consent, the consent holder shall after consultation with the Chief Executive, Taranaki Regional Council, install a minimum of three groundwater monitoring bores. The bores shall be at locations and to depths that enable monitoring to determine any change in groundwater quality resulting from the exercise of this consent. The bores shall be installed in accordance with NZS 4411:2001 and all associated costs shall be met by the consent holder. The bores shall be sampled prior to stockpiling or landfarming for baseline water quality parameters and concentrations of contaminants.
4. Any pits intended for the storage of solid or liquid wastes shall be lined with high-grade synthetic liners or equivalent and the consent holder shall demonstrate, that the lined pits are suitable for storing liquid without leakage through the base or side walls. The Consent holder will continue to monitor the integrity of the pit liners and repair or replace liners as required.



5. The consent holder shall notify the Chief Executive, Taranaki Regional Council, (by emailing [worknotification@trc.govt.nz](mailto:worknotification@trc.govt.nz)) at least 48 hours prior to permitting wastes onto the site for storage. Notification shall include the following information:
  - a) the consent number;
  - b) the name of the well and wellsite, or other source, from which the waste was generated;
  - c) the type of waste to be stored; and
  - d) the volume of waste to be stored.
6. The consent holder shall notify the Chief Executive, Taranaki Regional Council, (by emailing [worknotification@trc.govt.nz](mailto:worknotification@trc.govt.nz)) at least 48 hours prior to landfarming stockpiled material, or material brought onto the site for landfarming within 48 hours. 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(s) of waste to be landfarmed;
  - d) the volume and weight (or density) of the waste to be landfarmed;
  - e) the concentration of chlorides, nitrogen and hydrocarbons in the waste;
  - f) results of sampling undertaken in accordance with condition 10, including in a spreadsheet compatible format;
  - g) proposed loading rate and required area calculations showing compliance with condition 17 ; and
  - h) the specific location and area over which the waste will be landfarmed.
7. The consent holder shall take a representative sample of each type of waste, from each individual source, and have it analysed for the following:
  - a) total petroleum hydrocarbons (C<sub>6</sub>-C<sub>9</sub>, C<sub>10</sub>-C<sub>14</sub>, C<sub>15</sub>-C<sub>36</sub>);
  - b) benzene, toluene, ethylbenzene, and xylenes;
  - c) polycyclic aromatic hydrocarbons screening; and
  - d) chloride, nitrogen, pH, potassium, and sodium.

The consent holder shall record the data from these results onto a master spreadsheet to be supplied to the Taranaki Regional Council in accordance with conditions 9 and 10.

8. The consent holder shall take a representative sample of every 10<sup>th</sup> load of contaminated soil, and have it analysed for the following:
  - a) total petroleum hydrocarbons (C<sub>6</sub>-C<sub>9</sub>, C<sub>10</sub>-C<sub>14</sub>, C<sub>15</sub>-C<sub>36</sub>);
  - b) benzene, toluene, ethylbenzene, and xylenes;
  - c) polycyclic aromatic hydrocarbons screening

The consent holder shall record the data from these results onto a master spreadsheet to be supplied to the Taranaki Regional Council in accordance with conditions 9 and 10.

9. The consent holder shall keep records of the following:
- a) wastes from each individual well;
  - b) composition of wastes;
  - c) stockpiling area(s);
  - d) volumes of material stockpiled;
  - e) landfarming area(s), including a map showing individual disposal areas with GPS co-ordinates and up-to-date GIS shapefiles;
  - 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; and
  - 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.
10. The consent holder shall provide to the Chief Executive, Taranaki Regional Council:
- a) By 31 August of each year, a report on all records required to be kept in accordance with conditions 7, 8 and 9, for the period of the previous 12 months, 1 July to 30 June;
  - b) Monthly records of all movements of waste to the site in spreadsheet format, including source, material type, transporter, volumes and receiving storage pit.
11. No discharge shall take place within 25 metres of surface water or property boundaries.
12. The discharge of hydraulic fracturing fluids is prohibited.
13. Contaminated soil shall be either:
- a) Spread directly upon arrival to site if weather conditions allow; or
  - b) Stockpiled to a maximum height of 1 m and then spread within 1 month of arriving onsite.
14. All wastes must be landfarmed as soon as practicable, but no later than twelve months after being brought onto the site.
15. For the purposes of landfarming, solid 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.
16. For the purposes of landfarming, liquid wastes shall be applied to land:
- a) at a rate such that there is no overland flow of liquids; and
  - b) at a rate such that no ponded liquids remain after one hour, after application.

## Consent 05956-1.7

17. As soon as practicable following the application of solid wastes to land, the consent holder shall incorporate the wastes into the soil to a depth of at least 250 mm.
18. The hydrocarbon concentration in the soil over the landfarming area shall not exceed 20,000 mg/kg dry weight at any point where:
  - a) liquid waste has been discharged; or
  - b) solid waste has been discharged and incorporated into the soil.
19. The farming of contaminated soil is restricted to the area specified in the application for this consent.
20. The secondary application of wastes is only permitted in the areas specified in condition 19. Any other areas of land used for the landfarming of wastes in accordance with conditions 13-18 of this consent, shall not be used for any subsequent discharges of waste
21. 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.
22. 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>.
23. 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.
24. 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.
25. 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 landfarming of waste shall not increase the soil conductivity by more than 100 mSm<sup>-1</sup>.
26. The application of waste shall not increase the sodium adsorption ratio (SAR) of the soil by more than 2.0 and in no case shall the SAR of the soil/waste layer exceed 18.0 after application.

27. The concentration of heavy metals in the soil over the disposal area shall at all times comply with the Ministry for the Environment and New Zealand Water & Wastes Association's Guidelines for the safe application of biosolids to land in New Zealand (2003) and the *Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011*, as shown in the following table:

<b>Constituent</b>	<b>Standard (mg/kg dry weight)</b>
Arsenic	17
Cadmium	1
Chromium	600
Copper	100
Lead	160
Mercury	1
Nickel	60
Zinc	300

28. From 1 March 2016 (three months prior to the consent expiry date), constituents in the soil at any depth less than 500 mm shall not exceed the standards shown in the following table:

<b>Constituent</b>	<b>Standard</b>
conductivity	290 mS/m
chloride	700 mg/kg
sodium	460 mg/kg
total soluble salts	2500 mg/kg
MAHs PAHs  TPH	Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (Ministry for the Environment, 1999). Table 4.15, for soil type sand. Canada-wide Standard for Petroleum Hydrocarbons (PHC) in Soil: Scientific rationale, Supporting Technical Document (CCME, 2008), Table 5.3 'Agricultural - ecological direct soil contact'

MAHs - benzene, toluene, ethylbenzene, xylenes

PAHs - naphthalene, non-carc. (pyrene), benzo(a)pyrene eq.

TPH - total petroleum hydrocarbons (C<sub>7</sub>-C<sub>9</sub>, C<sub>10</sub>-C<sub>14</sub>, C<sub>15</sub>-C<sub>36</sub>)

The requirement to meet these standards shall not apply if, before 1 March 2016, the consent holder applies for a new consent to replace this consent when it expires, and that application is not subsequently withdrawn.

29. This consent may not be surrendered unless the standards in condition 28 have been met.
30. In the event that any archaeological remains are discovered as a result of works authorised by this consent, the works shall cease immediately at the affected site and tangata whenua and the Chief Executive, Taranaki Regional Council, shall be notified within one working day. Works may recommence at the affected area when advised to do so by the Chief Executive, Taranaki Regional Council. Such advice shall be given after the Chief Executive has considered: tangata whenua interest and values, the consent holder's interests, the interests of the public generally, and any archaeological or scientific evidence. The New Zealand Police, Coroner, and Historic Places Trust shall also be contacted as appropriate, and the work shall not recommence in the affected area until any necessary statutory authorisations or consents have been obtained.

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

Transferred at Stratford on 9 January 2015

For and on behalf of  
Taranaki Regional Council

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A D McLay  
**Director - Resource Management**

Advice Note

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

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

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



## **Appendix II**

### **WRS Annual report**







23 August 2016

Chief Executive  
Taranaki Regional Council  
Private Bag 713  
47 Cloten Road  
Stratford

Attention Nathan Crook

Dear Nathan

**RE: Resource Consent 5956-1/ 1.7 - Waikaikai (Wards) - Waikaikai Farms Ltd, 78 Lwr Manutahi Rd, RD 2, Patea 4598**

As required under special condition 10 of resource consent 5956-1/1.7, please find information that WRS, as the operator of the site, have recorded from the 1 July 2015 to the 30<sup>th</sup> June 2016.

This report and record of activities is presented on a change basis that is only changes from the previous annual report will be described. This approach has been undertaken for two reasons, the second a consequence of the first

1. The site has been inactive during the entire monitoring period from 1 July 2015-30 June 2016
2. To reduce unnecessary repetition and improve efficiency

As can be seen from the attached site Record of Delivery there has been no deliveries of any drilling mud or production station wastes, no discharge of storm water or spreading of stored waste and no new areas have been disturbed.

Similarly there has been no intention or activity directed at surrender or excise for surrender of any consented area.

As the consent does not require, or appear to require, any sampling by the consent holder of any programmed or routine nature by the consent holder during periods of inactivity, or by inference, once surrender criteria have been attained, the monitoring undertaken by WRS has been limited to one round of soil sampling of the most recently spread area in late June 2016.

WRS on site management activities have been limited to regular site visits ( approx.. monthly) by the Operations Manager and periodic liaison with the land owner. Minor maintenance and some photography were undertaken during these visits.

At the commencement of the monitoring year 1 July 2015 all three pits were approximately 50% full largely with storm water with minor drilling mud and cuttings that had been placed in storage over the previous year. The minor drilling wastes are those left in lined pits when pit emptying occurs to ensure the synthetic liner is not disturbed and to prevent wind shear across an empty pit causing the liner to flog and become damaged.

No further deliveries to site of neither drilling mud, production station waste nor impacted soils occurred during the year under review.

The Waikaikai (Wards) Record of Delivery for 2015 records zero activity.

Throughout the year pit water levels are determined by rainfall versus losses by ablation and evaporation – at no time during the year was the standing water level in Pit 1 and 2 observed to reduce the freeboard to less than approx.250mm. An equilibrium water balance appears to be maintained at around 250-300mm freeboard as the storage volume per mm rise increases rapidly with pit wall taper and similarly wind shear and evaporative loss increases as fetch across the water surface and area both increase.

No spreading of storm water has been necessary during the monitoring year.

With the sustained depression of world oil prices from the spring of 2014 showing no signs of recovering the cessation of exploration and sustaining production drilling has continued and thus there has been no drilling muds generated of any volume generated in the province requiring disposal.

The Waikaikai landfarm has been under Care and Maintenance for the entire 2015-2016 monitoring year with the effects as near to steady state as possible.

At the end of the monitoring year WRS were approached for input and assistance with scoping a remediation project for a disused wellsite that was under care and maintenance. Contaminated material from this remediation project could possibly have been disposed of at Waikaikai. The outcome of whether this project would proceed remained unknown at 30 June 2015.

Information pertaining to resource consent 5956-1/1.7 is provided under the following headings

### **1. Delivery Record - attached 'Mud Register'**

The Mud Register is an electronic record of the manual site Record of Delivery; it records deliveries received at site for storage or spreading of each well/delivery campaign notified by email to the TRC as required by Condition 5.

During July 2015 to June 2016 there were no deliveries, therefore no Record of Delivery entries – the Mud Register for Waikaikai was un-populated.

### **2. Spread Areas and Events during 2015/16**

Nil

### **3. Spreading Records**

Nil

### **4. Field Photographs - attached**

### **5. Composition of Wastes/Pre Disposal Analysis - attached**

Nil

## 6. TRC Inspection Notices

The consent holder has copies of inspections, however it is not known if this is a complete record of all the inspections undertaken. Entries in the Site Visitors log indicate that it is.

## 7. Operations Management Plan –attached

Operations at the Waikaikai land farm are all undertaken generally in accordance with the WRS Landfarm Management Plan. The document applies to both the Waikaikai and Manawapou land farms is a live document and is constantly reviewed and updated as necessary (most recently Aug 2016) to reflect current operational requirements and practices at both the sites operated by WRS

## TO SUMMARISE

### **A year with zero operational activity and the site under Care and Maintenance**

## **MONITORING**

1. **Consent Holder** - although there is no specific consent requirement for the consent holder to undertake routine programmed monitoring, there are numeric conditions that must be complied with in respect to conductivity Cond.25, SAR Cond.26 and heavy metals Cond.27. At the end of the 2015 monitoring year all spread areas had attained surrender criteria and regular further monitoring of the above parameters was deemed unnecessary and not undertaken.

However WRS did undertake on a voluntary basis one round of environmental soil sampling of the most recently spread (Jan – May 2015) area FI on 30 June 2016.

A 400 m transect running from roughly E-W through the centre and parallel to the areas long dimension was sampled at 10m intervals –a single 250-350 deep soil core was taken and aggregated into a single sample.

A second 100 m environmental sample was taken on the same heading, intervals and methodology from area A2.

See attached diagram Waikaikai 14037\_01 showing transect line locations;

The samples were sent to Hills Labs for analysis. The results are attached.

Only sodium exceeded the surrender criteria of Cond.28, namely 600 and 490 mg/kg compared to the surrender limit of 460 mg/kg, all other analytes were well below surrender criteria.

2. **Regulator** – a full programme of compliance monitoring was undertaken during the year by the TRC. WRS approached the TRC formally on 23 Nov 2015 to seek a reduction of the annual monitoring of the site due to site inactivity and therefore the likelihood of significant effects, and the site being under care and maintenance. Following discussions over the ensuing months the Council declined the request for monitoring relief of both activity and costs, but did signal a reduction in the programme for the subsequent year 2016-17 was under consideration.

Keith Brodie

**Waste Remediation Services Ltd**

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Post PO Box 7150, New Plymouth 4341, New Zealand

Email: keith@wrsLtd.co.nz



# ANALYSIS REPORT

Page 1 of 2

<b>Client:</b>	Waste Remediation Services Limited (WRS)	<b>Lab No:</b>	1610970	SPV2
<b>Contact:</b>	Keith Brodie PO Box 77 Oakura 4345 TARANAKI	<b>Date Received:</b>	05-Jul-2016	
		<b>Date Reported:</b>	21-Jul-2016	
		<b>Quote No:</b>	78402	
		<b>Order No:</b>	KB5672	
		<b>Client Reference:</b>	Symes Consent 7795-1/05956-1.7	
		<b>Submitted By:</b>	Keith Brodie	

Sample Type: Soil						
<b>Sample Name:</b>	WAI 1 05956-1-7 01-Jul-2016 3:30 pm	WAI 2 05956-1-7 01-Jul-2016 3:50 pm	MAN 1 07995-1 01-Jul-2016 4:30 pm			
<b>Lab Number:</b>	1610970.1	1610970.2	1610970.3			
Individual Tests						
Dry Matter	g/100g as rcvd	81	87	89	-	-
Soluble Salts*	g/100g dry wt	< 0.05	< 0.05	0.06	-	-
Electrical Conductivity (EC)*	mS/cm	< 0.2	< 0.2	< 0.2	-	-
Total Recoverable Sodium	mg/kg dry wt	600	490	240	-	-
Chloride*	mg/kg dry wt	4	< 3	5	-	-
pH*	pH Units	6.6	6.2	7.1	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 9	< 8	< 8	-	-
C10 - C14	mg/kg dry wt	< 20	< 20	< 20	-	-
C15 - C36	mg/kg dry wt	< 40	< 40	< 40	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	< 70	< 70	-	-

## SUMMARY OF METHODS

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

Sample Type: Soil			
Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-3
Soil Prep Dry & Sieve for Agriculture	Air dried at 35°C and sieved, <2mm fraction.	-	1-3
Total Petroleum Hydrocarbons in Soil	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	1-3
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. US EPA 3550. (Free water removed before analysis).	0.10 g/100g as rcvd	1-3
eslCextn*	(1:5) ratio of sample (g):0.02M potassium dihydrogen ortho-phosphate extractant (mL), analysis by Ion Chromatography. In House.	-	1-3
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1-3
Soluble Salts*	1:5 soil:water extraction followed by potentiometric determination of conductivity. SS=EC*0.35 Calculated from EC measurement.	0.05 g/100g dry wt	1-3
Conductivity from soluble salts*	1:5 soil:water extraction, potentiometric conductivity determination (Soluble salts/0.35).	0.2 mS/cm	1-3
Total Recoverable Sodium	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	40 mg/kg dry wt	1-3

Sample Type: Soil			
Test	Method Description	Default Detection Limit	Sample No
Chloride*	Ion Chromatography determination of es potassium phosphate extraction.	3 mg/kg dry wt	1-3
pH*	1:2 (v/v) soil : water slurry followed by potentiometric determination of pH.	0.1 pH Units	1-3

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

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

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



# ANALYSIS REPORT

Page 1 of 4

<b>Client:</b>	Waste Remediation Services Limited (WRS)	<b>Lab No:</b>	1610810 shpv1
<b>Address:</b>	PO Box 7150 New Plymouth 4341	<b>Date Registered:</b>	05-Jul-2016
		<b>Date Reported:</b>	07-Jul-2016
		<b>Quote No:</b>	78402
		<b>Order No:</b>	KB5672
<b>Phone:</b>	06 751 9221	<b>Client Reference:</b>	Symes Consent 7795-1/05956-1.7
		<b>Submitted By:</b>	Keith Brodie

**Sample Name:** WAI 1 05956-1-7 **Lab Number:** 1610810.1  
**Sample Type:** SOIL General, Outdoor (S10)

Analysis	Level Found	Medium Range	Low	Medium	High
Calcium (Sat Paste) mg/L	51				
Magnesium (Sat Paste) mg/L	8				
Sodium (Sat Paste) mg/L	27				
Sodium Absorption Ratio	0.9				

The above nutrient graph compares the levels found with reference interpretation levels. NOTE: It is important that the correct sample type be assigned, and that the recommended sampling procedure has been followed. R J Hill Laboratories Limited does not accept any responsibility for the resulting use of this information.

# ANALYSIS REPORT

Page 2 of 4

<b>Client:</b>	Waste Remediation Services Limited (WRS)	<b>Lab No:</b>	1610810	shpv1
<b>Address:</b>	PO Box 7150 New Plymouth 4341	<b>Date Registered:</b>	05-Jul-2016	
		<b>Date Reported:</b>	07-Jul-2016	
		<b>Quote No:</b>	78402	
		<b>Order No:</b>	KB5672	
		<b>Client Reference:</b>	Symes Consent 7795-1/05956-1.7	
<b>Phone:</b>	06 751 9221	<b>Submitted By:</b>	Keith Brodie	

**Sample Name:** WAI 2 05956-1-7 **Lab Number:** 1610810.2  
**Sample Type:** SOIL General, Outdoor (S10)

Analysis	Level Found	Medium Range	Low	Medium	High
Calcium (Sat Paste) mg/L	39				
Magnesium (Sat Paste) mg/L	7				
Sodium (Sat Paste) mg/L	24				
Sodium Absorption Ratio	0.9				

The above nutrient graph compares the levels found with reference interpretation levels. NOTE: It is important that the correct sample type be assigned, and that the recommended sampling procedure has been followed. R J Hill Laboratories Limited does not accept any responsibility for the resulting use of this information.

# ANALYSIS REPORT

Page 3 of 4

<b>Client:</b>	Waste Remediation Services Limited (WRS)	<b>Lab No:</b>	1610810	shpv1
<b>Address:</b>	PO Box 7150 New Plymouth 4341	<b>Date Registered:</b>	05-Jul-2016	
		<b>Date Reported:</b>	07-Jul-2016	
		<b>Quote No:</b>	78402	
		<b>Order No:</b>	KB5672	
<b>Phone:</b>	06 751 9221	<b>Client Reference:</b>	Symes Consent 7795-1/05956-1.7	
		<b>Submitted By:</b>	Keith Brodie	

<b>Sample Name:</b> MAN 1 07995-1			<b>Lab Number:</b> 1610810.3				
<b>Sample Type:</b> SOIL General, Outdoor (S10)							
Analysis		Level Found	Medium Range		Low	Medium	High
Calcium (Sat Paste)	mg/L	43					
Magnesium (Sat Paste)	mg/L	5					
Sodium (Sat Paste)	mg/L	17					
Sodium Absorption Ratio		0.7					

The above nutrient graph compares the levels found with reference interpretation levels. NOTE: It is important that the correct sample type be assigned, and that the recommended sampling procedure has been followed. R J Hill Laboratories Limited does not accept any responsibility for the resulting use of this information.

# ANALYSIS REPORT

Page 4 of 4

<b>Client:</b>	Waste Remediation Services Limited (WRS)	<b>Lab No:</b>	1610810	shpv1
<b>Address:</b>	PO Box 7150 New Plymouth 4341	<b>Date Registered:</b>	05-Jul-2016	
		<b>Date Reported:</b>	07-Jul-2016	
		<b>Quote No:</b>	78402	
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		<b>Client Reference:</b>	Symes Consent 7795-1/05956-1.7	
<b>Phone:</b>	06 751 9221	<b>Submitted By:</b>	Keith Brodie	

## SUMMARY OF METHODS

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

Sample Type: Soil			
Test	Method Description	Default Detection Limit	Sample No
Sample Registration	Samples were registered according to instructions received.	-	1-3
Calcium (Sat Paste)	Saturated Paste extraction followed by ICP-OES.	1 mg/L	1-3
Magnesium (Sat Paste)	Saturated Paste extraction followed by ICP-OES.	1 mg/L	1-3
Sodium (Sat Paste)	Saturated Paste extraction followed by ICP-OES.	1 mg/L	1-3
Sodium Absorption Ratio (SAR)	Calculation from the sodium, calcium and magnesium determined on a Saturated Paste extract.	0.2	1-3

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

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

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Shelley Edhouse  
Quality Assurance Coordinator - Agriculture









Waste Remediation Services Ltd (WRS)

Waikaikai (Wards)

&

Manawapou ( Symes )

Landfarm Management Plan

2015 - 16

Rev	Date	Reason for Issue	Prepared	Checked	Approved
A	May 2014	Issued for review	KMB		

B Aug 2015

KMB

C Aug 2016

KMB

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This landfarm Operations Management Plan describes the process and procedures/requirements for disposal by land farming of drilling muds and cuttings and production station wastes in accordance with the Taranaki Regional (TRC) and South Taranaki District Councils (STDC) resource and landuse consent conditions and relevant New Zealand guidelines.

## **1. Safety**

Waste Remediation Services Ltd will comply with all current Occupational Safety and Health legislation in operating the land farm sites at Waikaikai and Manawapou. The company has the services of an in-house dedicated Safety Supervisor who provide regular input and advice on all site and operational safety matters to identify risks and hazards, record and manage these through site visits and conduct safety meetings with site personnel, contractors and staff.

## **2. Scope**

This Landfarm Operations Management Plan sets out the location, parties involved, safety practices and methodologies adopted by the operator to meet all legal requirements, and to minimise the risks and effects of the disposal of oil and gas exploration, production and workover drilling and production station wastes to land.

Management of the landfarm sites involves liaison by Waste Remediation Services Ltd (the Operator) with the landowners (P and K Wards and A Symes), the Taranaki Regional Council and South Taranaki District Councils (as the consenting authorities), offsite service providers and agents (laboratories, surveyors, couriers..), the exploration/drilling/production station companies supplying the wastes, and contractors involved with delivery and landfarming of the wastes from time to time.

This liaison particularly with the TRC along with regular site and operations supervision and the keeping of comprehensive and timely records are key components of site management.

The land farm and each delivery of waste through to disposal needs to be managed to ensure compliance with resource consent conditions and guidelines viz the New Zealand guidelines for the safe application of bio solids to land (NZWWA, 2003), guidelines for assessing and managing petroleum hydrocarbon contaminated sites in New Zealand (MfE, 1999) and the TRC's guidelines for disposal of oilfield wastes by land farming.

## **3. Consents**

The site is authorised and operated under the following consents;

A) Waikaikai ( Wards)

1. TRC: Consent number 5956-1.7 - Issued 27 November 2014, Expiry1 June 2016, and currently under renewal as at 30 June 2016.
2. STDC: Landuse Consent RM 010155 Issued 9 January 2002.

## B) Manawapou (Symes)

1. TRC : Consent number 7796-1 - Issued 01 May 2012, Expiry 01 June 2028
3. STDC : STDC : Landuse Consent RM

## 4. Abbreviations

WBM	Water based drilling mud
SBM	Synthetic based drilling mud
TRC	Taranaki Regional Council
MfE	Ministry for the Environment
NZWWA	New Zealand Water and Wastes Association

STDC                      South Taranaki District Council

## 5. Overview of the Landfarming Process

Landfarming is the practice of disposing of drilling wastes to land. It comprises collection and delivery to site, storage to allow natural (solar and atmospheric degradation) to occur, and to enable a volume of wastes to accumulate to make ground preparation and spreading practical, viz > 500 m<sup>3</sup>. This is followed by stripping existing organic soil horizons, cut and fill earthworks to provide a rolling contour over the spread and adjoining areas. The waste is then spread onto land, incorporated into the soil by tilling (dilution), the stripped topsoil replaced, further tilled if required and then cultivating and re-sowing the area to pasture or crop to facilitate natural soil processes to effectively biodegrade, transform and assimilate the waste. This process results in improved soil properties particularly on light, free draining sandy soils resulting in dry matter pasture yields to be increase several fold.

The process involves the following broad steps:

1. Notification prior to removal from the wellsite of disposal consent number, well site name and well number, waste source, type and volumes , sampling ( for hydrocarbon characterization) and assessment of the wastes to be disposed of.
2. Collection of fluids and cuttings from the wellsite and transport to the disposal site in purpose built, sealed units. Fluids are pumped into tankers, and solids are transported by sealed well-side trucks using an excavator to load the material from wellsite in ground sumps/mud tanks.
3. Discharge of water based muds (WBM) cuttings and fluids, synthetic based mud (SBM) cuttings and fluids, and oily wastes, from transport vehicles into in ground lined storage pits to allow natural atmospheric degradation and dilution until volumes are sufficient to allow campaigned spreading.
4. Preparation of spreading areas by removal and stockpiling of topsoil (A soil horizon) usually into perimeter windrows, re-contouring and levelling the spreading area to improve uniformity and control of waste application rates. Establishment of spread area margin bunding if required.
5. Spreading of the cuttings and fluids materials over land at the consented rates

using tractor and trailers, digger and/or bulldozer, motor scraper or spray systems (depending on the fluid content of the mud). Fluids are usually distributed onto the disposal area using a tractor drawn spray irrigation system.

6. Allowing the cuttings and fluid to dry and degrade sufficiently to enable effective working into the sub-soils ( B horizon) and surface soils (A horizon) to required depths.
7. Levelling the soil surface with a levelling bar or similar to provide an easy grade workable field surface.
8. Replacement of the stockpiled A horizon clay/topsoil to aid stability and assist in grass establishment.
9. Fertilising and sowing either in crop or pasture in consultation with the landowner.

## **6. Wastes Consented for Landfarming**

There are only three types of waste able to be disposed of at the Waikaikai Landfarm from exploration and production activities

1. Water Based Mud (WBM) drill cuttings and fluids,
2. Synthetic Based Mud (SBM) drill cuttings and fluids
3. Oily Wastes from wellsites.

and two at the Manawapou Landfarm from exploration and production facilities

1. Water Based Mud (WBM) drill cuttings and fluids
2. Synthetic Based Mud (SBM) drill cuttings and fluids

## **7. Landfarm Management Process**

This management plan includes, as a minimum:

1. Notification to TRC of receipt of wastes for disposal ;
2. Procedures for the receipt and stockpiling of wastes onto the site;
3. Provision to the TRC of each waste types characteristics prior to spreading during each landfarming campaign
4. Methodology for the stripping and recontouring/levelling of area to be land farmed;
5. Methodology for landfarming drilling wastes (including methods of transfer from stockpiling area, methods of spreading, and incorporation into the soil);
6. Methodology for sowing land farmed areas;
7. Contingency procedures;
8. Sampling regime and methodology;
9. Post-landfarming management, monitoring and site reinstatement;
10. Record keeping; and
11. Control of site access and records.

## 8. Landfarm Management Responsibilities

The following table provides a step-by-step process of landfarm site management.

Table 1 Overview of site management process

Step	What	Who
	<ul style="list-style-type: none"> <li>Identify wastes types, characterisation and volumes for disposal, there are three possible types of waste:</li> <li>Water based muds;</li> <li>Synthetic based muds.</li> <li>Oily wastes</li> </ul>	Client production supervisors/, drilling supervisors/ well services supervisors
	<p>Contact WRS Operations Manager to discuss waste type/volume/sampling/timing of delivery to site</p> <p>Provide WRS Ops. Manager with written notification of source, delivery date, waste type, volume and transporting company.</p> <p>Receive OK for delivery/disposal of material from WRS</p>	Client production supervisors/, drilling supervisors/ well services supervisors
	<p>Receive notification in regard to waste for disposal;</p> <ul style="list-style-type: none"> <li>Receive notification of well exploration activities and programme for collection and delivery of waste to land farm site</li> <li>Ensure all information required by consent is provided by the client ;</li> <li>Confirm delivery and sample collected</li> <li>Record all collection details on WRS Waste Tracking Record. Assign each 'parcel' of waste a number ( sample # ) to ensure source, transport and storage location are recorded if required ;and</li> </ul> <ul style="list-style-type: none"> <li>Collect and submit pre-disposal sample for analysis.</li> </ul>	WRS Operations Manager
	<p>TRC Notification (delivery for storage):</p> <ul style="list-style-type: none"> <li>48 hours prior to delivery for stockpiling on site; including</li> <li>tracking number, consent number, name of well/site, type of waste, volume of waste.</li> </ul> <p>Planning for delivery/stockpiling:</p> <ul style="list-style-type: none"> <li>Arrange and assign storage pit into which the waste consignment is to be discharged taking into account mud type, characteristics and storage volumes available</li> <li>Ensure delivery driver completes delivery details into WRS Site Delivery Record (aka "Mud Register") located in the disposal site shack.</li> </ul>	<p>WRS Operations Manager</p> <p>WRS Operations Manager</p>
	<p>Delivery:</p> <ul style="list-style-type: none"> <li>Once location for stockpiling at landfarm has been arranged organize with a contractor for delivery; and</li> <li>Notify WRS of all deliveries to site, providing as much notice as practicable.</li> </ul>	Client production supervisors/drilling supervisors/well services supervisors

Step	What	Who
	<p>Managing Stockpiles:</p> <ul style="list-style-type: none"> <li>Maintain a record of volumes of wastes in storage pits and ensure freeboard and storage capacities are commensurate with drilling waste volumes as far as is practicable. If heavy rainfall reduces pit capacity and freeboard notify TRC of need to use contingency storage and removal of excess rainwater by irrigation to suitable land farming areas until land spreading of mud and solids is practicable</li> </ul>	WRS Operations Manager
	<p>Planning for spreading:</p> <ul style="list-style-type: none"> <li>Identify volumes delivered and sample results;</li> <li>Consider mixing similar waste to provide the appropriate and /or practical soil improvement properties sought by the landowner</li> </ul>	WRS Operations Manager
	<p>Resample for pre-disposal results</p> <ul style="list-style-type: none"> <li>Calculate loading, area required and spreading rate calculations according to the consent; and</li> <li>Identify location for disposal site based on area required and separation distances (at least 25 metres away from waterways and un-consented property boundaries, 6m from existing gas pipelines, and 2m from other disposal sites).</li> </ul>	WRS Operations Manager
	<p>TRC Notification (spreading):</p> <p>48 hours prior to spreading advise TRC of date; consent number; well/site; type of waste; volume; weight; concentrations of chloride, nitrogen and TPH; and location/area it will be spread upon</p>	WRS Operations Manager

## 9. Pre-Delivery and Storage Waste Characterisation

The consent requires that a representative samples are taken from each type of waste to be delivered to the landfarm for either storage or direct spreading. WRS requires that this is taken at source by the well owner or drilling contractor or other suitably qualified person and forwarded to WRS without delay for analysis.

The sample containers depend upon the waste type sampled – where practical WRs will make all reasonable endeavors to stipulate and provide the correct sample containers.

## 10. Pre-Disposal Testing of Wastes

There are no specific numeric limits specified in the consent for any waste type or consignment received for storage or disposal, but there are however limits for heavy metals after spreading viz

The concentration of heavy metals in the soil over the disposal area shall at all times comply with the MfE NZ Water and Wastes Association Guidelines for the application of bio solids to land NZ (2003) and the *Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011*, as shown in the following table.

These limits therefore in effect act only as a guide to attaining the required dilution and dispersal to meet heavy metal limits via the spreading rates

Table 1 - see Condition 27. Consent 05956-1.7

<b>Constituent</b>	<b>Standard (mg/kg dry weight)</b>
Arsenic	17
Cadmium	1
Chromium	600
Copper	100
Lead	160
Mercury	1
Nickel	60
Zinc	300

Similarly the surrender limits for constituents specified in Condition 28. Below provide guidance for pre spreading calculation/rates.

Table 2 Pre-surrender analytes and limits – see Condition 28. Consent 05956-1.7

<b>Parameter</b>	<b>Consent Limit (mg/kg unless otherwise stated)</b>	<b>Minimum pre-disposal analysis required</b>
Conductivity	290mS/m (guideline)	
Chloride	700 mg/kg (guideline)	
Sodium	460 (guideline)	
Total Soluble Salts	2500mg/kg	
BTEX Benzene Toluene Ethylbenzene Xylenes	Not Stated Submit results to TRC	i (for SBM only)
PAH ( Polycyclic Aromatic Hydrocarbons ) Naphthalene Pyrene Benzo(a)pyrene eq.	Not Stated Submit results to TRC(	(for SBM / OW only)

TPH (Total Petroleum Hydrocarbons)		
C6-C9		
C10-C14	Not Stated	
C15-C36	Submit results to TRC	

## 11. Mixing Waste

It is not practical or necessary to maintain separation of waste types by providing separate sealed pits. Actual discharge of wastes into the 3 available sealed pits at the site is generally solids into Pit 1 and liquids into Pit 2, oily wastes into Pit 4 ( Waikaikai only), but if capacities are limited disposal occurs on the basis of maintaining the maximum free board possible across all pits.

Predisposal assessment of waste will be carried out for each storage pit prior to any decision to spread. Both the combined product volumes and species concentrations of the resultant aggregated waste will be assessed to guide and provide a check on the actual composite, prior to spreading occurring.

## 12. Calculating spreading areas and depth requirements from pre-disposal sample results

The pre-disposal sample results are used for pre-planning of each waste disposal. The consents restrict the thickness that waste can be spread as follows:

- 100mm for wastes with hydrocarbon content less than 50,000mg/kg dry wgt;
- 50mm for wastes with hydrocarbon content greater than 50,000mg/kg dry wgt

Application must be at a rate such that there is no overland flow of liquids; and at a rate such that no ponded liquids remain one hour, after application

To ensure these limits can be met, the following calculations are required, using information from the pre-disposal sample.

To obtain the minimum area for spreading the calculation is:

a) for TPH < 50,000mg/kg)  
 $\text{volume (m}^3\text{)} / \text{depth allowed ( 0.10m)} = \text{area m}^2$

b) for TPH > 50,000 mg/kg  
 $\text{volume (m}^3\text{)} / \text{depth allowed ( 0.05m)} = \text{area m}^2$

e.g. Volume to be spread is 200 cu.m / m<sup>3</sup>

Spread Area=  $200/0.05 = 4,000 \text{ sq.} = 0.4\text{Ha}$

## 13. Monitoring

### 13.1. Site Inspections

Regular monitoring inspections of the landfarm sites will be undertaken (monthly on average as a minimum) to check for:

- Housekeeping of site (rubbish, access tracks, site layout, safety, security, hazards)
- Status of storage pits (volume, contamination, stability, wastes) and signage (wellsite and waste type)
- Land farming (progress, application, depth/area, slopes, separation, reinstatement), and
- Environmental (boundary distances, discharges/spills, water bodies).

### 13.2. Soil Sampling

TRC has developed a set of guidelines for the disposal of drilling wastes onto and into land that are reflected in the conditions of resource consents.

These guidelines, along with MFE and NZWWA guidelines, set the maximum concentrations of metals at all times, and the levels of hydrocarbons and other species and physical parameters at surrender.

Although there is no specific condition requiring consent holder soil sampling these levels form the basis for the monitoring that will be undertaken at the site.

It is these analytes that are monitored through periodic sampling of the landfarm spreading areas.

Soil sampling type, methodology and frequency undertaken by WRS also depends upon two other key drivers

- 1) Animal Health and Welfare/ Food Security
- 2) Decision/s to Surrender all or any part of the Consent Area

The sampling requirements and reasons are:

1. Pre-spreading - representative sample/s of the wastes to ascertain levels of hydrocarbons to calculate loadings and rates.
2. Heavy Metals - composite, representative soil samples of each disposal area following spreading at approx. one month after spreading, and then periodically, but not more than annually, until consent levels cited in conditions 27 and 28 are attained; and
3. Surrender -full testing undertaken on part or all disposal areas prior to lodging an application to surrender part of or close the site.

Analyses are normally conducted on a composite sample fraction. The composite is collected from a surveyed transect or representative "W" across the disposal area. Three to five soil cores are taken at each nominated sample points at depths determined by the objective for sampling from 75mm ( for annual health and welfare criteria) to 400mm ( for environmental sampling) From this bulk sample a representative fraction is submitted for



analysis. The sampling methodology provides material from the zone of exposure of livestock to the depth the material was applied, plus an additional margin to the depth tilling may have occurred to.

All analysis will be provided by R J Hill Laboratories in Hamilton and copies of these analysis results are provided to the TRC annually or as requested.

Not all parameters are tested at every sample due to cost and practicality – generally a surrogate analytical suite is established in consultation with R J Hills Labs and agreed with the TRC.

Before any consent can be surrendered all parameters will be analysed. The consent cannot be surrendered and the site closed until all species specified in the consent meet the surrender criteria as below

Table 3 Sampling requirements and consent limits

Parameter	Consent Limit (mg/kg unless otherwise stated)	Sampling requirements for WBM/SBM/Oily Wastes		
		1 month after*	6 months after*	Annual *
Chloride	700 mg/kg (expiry)	/	/	
Sodium (Na)	460 (expiry)			
Conductivity	290 mSm (expiry)			
Sodium Absorption Ratio	18 (post-app)			
Total soluble salts (g/100g)	2500 (expiry)			i
BTEX Benzene Toluene Ethylbenzene Xylenes PAH Naphthalene Pyrene Benzo(a)pyrene TPH C6-C9 C10-C14 C15-C36	Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in [New Zealand MfE 1999]. Tables 4.12 and 4.15, for soil type sand.	/	/	/

### 13.3. Pasture/Vegetation Monitoring

Pasture/vegetation monitoring will be carried out on a monthly basis in consultation with the landowner/farmer.

Any remedial action will be by agreement with the operator /landowner to enable return to the desired use as soon as practical.

#### **13.4. Photographic Records**

Representative photos of the site will be taken before spreading, immediately after spreading and then at 1- 2 months and 12 months post spreading. These will be held by the operator for 5 years and made available to the landowner and TRC upon request.

### **14. Contingency Procedures - Transport Spills**

The primary transport contractor maintains a spill plan that will be implemented should a spill occur during transport of wastes from the rig to the land farm site. A request for a copy of this plan should be made directly to the transporting company –Symons Transport Ltd.

### **15. Site Reinstatement and Closure**

When the area consented for landfarming at a particular site has been completed, stockpiling of material on the site will cease and the storage pits and discharge platform area will be reinstated to a standard and conformation compatible with the adjacent land farmed areas.

Monitoring of the site will continue until all spread areas within the site have met consent surrender conditions and guidelines. A final campaign of compliance sampling results are required before consents can be surrendered. The final round of sampling will be taken at 100m intervals along parallel transect lines (100m apart) crossing the entire site. This method will treat the site as a whole and provide an overview of waste remediation spatially across the landfarm. This method mirrors the process that the TRC uses to monitor the site on an annual basis.

### **16. Record Keeping**

Records are kept of the following, and provided to the Taranaki Regional Council as required by consent conditions:

- Notifications to TRC for disposal delivery and landfarming; trucking contractor and delivery volumes;
- Wastes from each individual well, including records of additives ( only if the client/drilling contractor is able or willing to provide these) used at the wellsite during the drilling process;
- Source descriptors (date collected, waste description, volume, any peculiarities in wastes for example: waxy, high percentage water, stony/sandy etc.);
- Stockpiling (area, volumes stockpiled, dates and times of commencement and completion);
- Disposal (area (including a map and GPS co-ordinates), volumes, dates and times of commencement and completion);
- Composition of material (including conductivity, concentrations of , chloride, sodium, total soluble salts and total hydrocarbons, and C6-C9, C10-C14 and C15-C36 fractions);
- Treatments applied (e.g. fertilisers);
- Site Inspections; and
- Sampling, analysis, and results of monitoring.

Records that are to be kept for 5 years from the date of closure include copies of the TRC monitoring programs, inspection notices, sample forms, sample results and notifications. These will be held on disc and/or in hard copy, all of which are managed by Waste Remediation Services Ltd's Operations Manager.

## 17. Accountabilities/Responsibilities

These personnel are responsible for the following activities:

Operations Manager	Implementation of this plan, maintaining records of all wastes approved for disposal via land farming, manage landfarm sites, provide notifications and reports to TRC as required by resource consent conditions.
Operations Manager	Liaison with landowners for all land farming matters
Client production supervisors, drilling supervisors, well services supervisors	Provide notification and information on source, nature and volume of wastes to WRS's Operations Manager. Collect sample at source and forward to WRS's Operations Manager
Civil/Earthworks/Spreading Contractor	Undertake spreading of wastes as instructed by WRS's Operations Manager, and in accordance with TRC consent conditions.

## 18. Reference Documents

Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand, Ministry for the Environment, 1999.

Disposal of Hydrocarbon Drilling Wastes near Geary Road, Taranaki Regional Council Report, June 2000.

Public Health Guidelines for the safe use of Sewage Effluent and Sewage Sludge on Land, Department of Health.

Guidelines for the control of disposal of drilling wastes onto and into land, Taranaki Regional Council, July 2003, 2005 and 2013.

Review of typical TRC consent conditions to discharge drilling wastes and oily wastes via landfarming

Alberta Energy Et Utilities Board Guide 50: Drilling Waste Management, October 1996  
Resource Consents

Consent Monitoring and Compliance Programmes

New Zealand Water and Wastes Association (2003): New Zealand guidelines such as Guidelines for the safe application of bio solids to land.

## RECORD OF DELIVERY - Waikakai (Wards)

YEAR:

2015 - 2016

[illegible]