Waste Remediation Services Limited (WRS) Symes Manawapou Landfarm Monitoring Programme Annual Report 2015-2016

Technical Report 2016-92

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Executive summary

Waste Remediation Services Ltd (the Company) operates a landfarm, Symes Manawapou, which is located on Manawapou Road near Manutahi, in the Manawapou catchment, South Taranaki. The consent for this landfarm was originally granted in May 2012 to Remediation Services NZ and was then transferred to the Company in June 2014. This report marks the second full year the Company has been in charge of the Symes Manawapou landfarm.

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 27 conditions setting out the requirements that the Company must satisfy.

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 eight inspections, 14 water samples collected for physicochemical analysis and six composited soil samples.

The monitoring showed that in similarity to the previous monitoring period, salinity impacts in the groundwater are still evident in the impacted well, GND2301. In addition, two wells have shown elevated impacts with one close to the consent concentration. Soil samples detailed no exceedance when compared to the consent conditions with application areas revegetated to a high standard. Housekeeping has recently been addressed. The site contains material which has been in storage for longer than one year and thus must be actioned in the upcoming monitoring period. The Company executed the successful remediation of a former landfarm storage area by excavating a considerable amount of material and replaced it with clean fill. This allowed a former landfarm site to be reinstated.

In comparison to previous monitoring year, the collection of samples this year was undertaken by the Council. This was an improvement to the previous monitoring period whereby the Company did not realise their obligations to collect samples and thus only a minimal level of samples were collected by the Council. Total heavy metal analysis was also added to the Council's soil sampling plan which satisfied a specific consent condition.

There were no unauthorised incidents 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 a Good level of administrative performance with the resource consent.

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 is improving and remains at a good level.

This report includes recommendations for the 2016-2017 year.

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1. Introduction

1.1 Compliance monitoring programme reports and the Resource Management Act 1991

1.1.1 Introduction

This report is for the monitoring period July 2015 to June 2016, it is prepared by the Taranaki Regional Council (the Council), and it describes the monitoring programme associated with resource consent held by Waste Remediation Services Ltd, hereafter referred to as the Company. The Company operates a landfarm situated on Manawapou Road, near Manutahi, South Taranaki. In this report it is referred to as Symes Manawapou landfarm.

Disposal activities undertaken by the Company commenced at this site during the 2013-2014 monitoring year. The original consent was granted 1 May 2012 to Remediation NZ Ltd, and the site became operational in September 2012. The present owners took control of the site in June 2014.

During the 2014-2015 monitoring period, there were disposals of approximately 1,170 m^3 of water-based and synthetic-based cuttings and fluids from the TAG OIL (NZ) Ltd Cheal E wellsite. These disposals commenced on 12 December 2014 through to 20 December 2014, across the consented area, spreading area A (Figure 2). Stormwater from the storage pits was also spread onto this area on two occasions prior to the disposal of solid wastes.

During the 2015-2016 monitoring period, the site was relatively inactive and only received three deliveries in this period; of these three deliveries, two originated from TAG Oil (NZ) and constituted a combined maximum of 448 m^3 from two sources, Supplejack and Cheal A, while the third was contaminated soil (1,147 m^3) from the former storage pit area of Origins' former Spence Road landfarm.

This report covers the results and findings of the monitoring programme implemented by the Council in respect of the consents held by the Company that relate to discharges of drilling wastes from hydrocarbon exploration and production activities, onto and into land, via landfarming. This is the forth annual report to be prepared by the Council to cover the discharges and their effects.

1.1.2 Structure of this report

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

- consent compliance monitoring under the RMA and the Council's obligations;
- the Council's approach to monitoring sites though annual programmes;
- the resource consents held by the Company/companies in the Manawapou 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 2015-2016 monitoring year.

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

1.1.3 The Resource Management Act 1991 and monitoring

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

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

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

In accordance with Section 35 of the RMA, the Council undertakes compliance monitoring for consents and rules in regional plans, and maintains an overview of the performance of resource users and consent holders. Compliance monitoring, including both activity and impact monitoring, enables the Council to continually re-evaluate its approach and that of consent holders to resource management and, ultimately, through the refinement of methods and considered responsible resource utilisation, to move closer to achieving sustainable development of the region's resources.

1.1.4 Evaluation of environmental and administrative performance

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

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

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

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

Environmental Performance

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

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

  For example:

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

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

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

Administrative performance

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

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

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

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

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

1.2 Process description

1.2.1 Drilling waste

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

Drilling fluids

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

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

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

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

1.2.2 Landfarming

The landfarming process has typically been used in the Taranaki region to assist the conversion of sandy coastal sites prone to erosion into productive pasture. Results of an independent research project conducted by AgKnowledge Ltd (2013) have indicated that the re-contoured sand dunes, after the inclusion of the drilling wastes (as per the consents), and with the addition of appropriate fertilisers and water (irrigation) are capable of producing high quality clover-based pastures and thus increasing the value of the land from about $3-4,000/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 site is on a single application basis. This means dedicated spreading areas each receive only a single application of waste. When

disposal is complete, the area will be reinstated and monitored until consent surrender criteria have been met.

Photo 1 Landfarm post application and reinstatement north west projection

Photo 2 Pasture cover establishment south east projection

1.3 Site location and description

The site is located on Manawapou Road at Manutahi, South Taranaki. This site is positioned on marginal coastal farm land situated on reworked dune fields. An extensive (100-250 m) foredune is located seaward of the consented site, and will remain undisturbed by site activities. The foredune provides a considerable natural buffer from prevailing onshore winds. A natural gas pipeline runs adjacent to the length of the site on the seaward side, marking the seaward extent of the disposal site. In addition, a QE II covenant is located in the north western end of the site, and Lake Taumaha (which is a QE II covenant and a Key Native Ecosystem) is located east of the site. The proximity of the site to these recognised ecosystems has been taken into account in the setting of buffer distances and location of the stockpiling facilities.

The predominant soil type has been identified as black loamy sand and vegetation growth is primarily a mixture of pasture and dune grasses. Test pitting and the logging of boreholes on site indicated a relatively shallow water table. Test bores were augured to 10 m in the pit area, revealing extensive compacted, low permeable clays underlying coastal dune sands. Pit construction revealed mostly tightly packed sand at the pit bases (approximately 4-5 m below surface). Average annual rainfall for the site is 1,023 mm (taken from the nearby 'Duffy' monitoring station). As with the other South Taranaki coastal sites, this site is subject to strong winds.

Figure 1 Aerial image of the Symes Manawapou Landfarm with regional location

Site data

Location	
Word descriptor:	Manawapou Road, Manutahi, Taranaki
Map reference:	E 1717244
(NZTM)	N 5608736
Mean annual rainfall:	1,023 mm
Mean annual soil temperature:	~15.1°C
Mean annual soil moisture:	~32.9%
Elevation:	~40 m
Geomorphic position:	Dune backslope
Erosion / deposition:	Erosion
Vegetation:	Pasture, dune grasses
Parent material:	Aeolian deposit
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 **7795-1** to discharge drilling wastes (consisting of drilling cuttings and drilling fluids from water based muds and synthetic based muds), from hydrocarbon exploration and production activities, onto and into land via landfarming. This permit was initially issued by the Council on 1 May 2012 to Remediation NZ, as a resource consent under Section 87(e) of the RMA. This resource consent is due to expire on 1 June 2028. It was transferred to the new consent holder Waste Remediation Services in June 2014.

Condition 1 sets out definitions, and condition 2 requires the consent holder to adopt the best practicable option to prevent or minimise any environmental effects.

Condition 3 sets out the requirements for a management plan, while condition 4 sets out the requirements for the installation of groundwater monitoring bores prior to the exercise of the consent.

Conditions 5 to 9 set out the requirements for a management plan, notifications, monitoring and reporting.

Conditions 10, 12, 13, 14 and 15 specify discharge limits, locations and loading rates.

Condition 11 requires a buffer zone between areas of disposal and surface water bodies, property boundaries, and QEII Key Native Ecosystems.

Conditions 16 and 17 regard operational requirements, while conditions 18 to 24 specify receiving environment limits for both soil and water.

Condition 25 concerns archaeological remains, while conditions 26 and 27 concern lapse provisions and consent reviews.

The permit is attached to this report in Appendix I.

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 site consisted of three 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

A total of six scheduled inspections were made of the site during the monitoring period, with regard to the consents for the discharge of drilling waste. An additional seven inspections were conducted at the site 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 will assess the mediums of soil and groundwater in relation to compliance at the facility. The facility has an active groundwater monitoring network which is comprised of four active groundwater monitoring wells.

These wells are sampled four times per annum to ascertain for seasonal fluctuation and to assess for any adverse effects permeating 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). Whereby 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 3.

Photo 3 An example of a soil core collected from Symes Manawapou landfarm

In this monitoring period six soil samples were collected, these samples were slightly augmented from the normal analysis through the inclusion of total heavy metal analysis after subsequent discussion with the consent holders. These soil 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, ortha-xylene.
- In-situ readings: pH, conductivity, dissolved oxygen (DO), oxidation and reduction potential (ORP) and temperature.

2. Results

2.1 Inspections

31 July 2015
During a planned inspection the following was observed. The wind was from the north west, speed 2 m/s, no objectionable odours or visible emissions were found during the inspection. A noticeable mud/hydrocarbon odour was detected down wind of cells. No recent deliveries or land-farming activities appeared to have occurred at the site. Two storage cells were full of storm water, which was observed to be up to the balance pipes. Some emulsified hydrocarbons were present on the first cell on the right; plenty of capacity was available in the receiving cell for further storm water inputs.
Liners appeared to be in good condition.

Historic application areas were inspected, where pasture had established in the original spreading areas. The land appeared stable and the pasture appeared healthy. The most recent application areas had large exposed areas from wind burn which had prevented the pasture establishment on the ridges, muds were identifiable in the soil profile, the material was weathering well and broke apart easily, a slight hydrocarbon/mud odour was noted in the material.

The following action was to be undertaken: Undertake works to spread all remaining muds at the site which have been stored for twelve months or more, in accordance with condition 16 of resource consent 7795-1.

23 September 2015
An inspection was conducted in overcast, showery conditions in conjunction with groundwater sampling. The three cells all contained turbid, milky light brown water with some sheen and a noticeable odour. Cell one was full and draining at a trickle into cell two via the overflow pipe.

All four groundwater bores were sampled with bailers. GND 2301 (between the cells) had a noticeable odour and foaming, while the other three bores had varying degrees of turbidity with no odour, sheen or foaming.

The re-vegetation of spreading area A was on-going; the flat area had re-grassed considerably, while the hillock area remained barren. The pasture detailed signs of wind damage. Permanent fencing was in place at the edge of spreading area A, separating the landfarmed area into two.

02 December 2016
At the time of the inspection the wind was from the North, speed 3-4 m/s. There were noticeable hydrocarbon/mud odours present down wind of the storage cells. Cells one and three had muds introduced; the material was quite solid/clumpy and was present around the loaded in areas, outside of the cells. Surface hydrocarbons were present on the liquid within each cell. The liner integrity looked good. Cell two had a small volume of liquid inside which also had minor hydrocarbon sheen. No recent spreading activities had occurred.

The spreading areas were inspected and the pasture cover appeared healthy across all spreading areas, only a small ridge close to the cells was exposed, likely caused by wind erosion.

Upon sampling the soil profile it was evident that the muds were well dispersed within the soil and are clearly weathering. Signage was apparent throughout. No incidents were reported, the land owner was happy with the way the site is being managed and the pasture improvements which have occurred.

07 December 2015
An inspection was conducted in conjunction with groundwater sampling in overcast, showery conditions with a gusty north west breeze. All four bores were sampled. A nitrate sample was collected from GND 2303 concurrent to the regular sample. A slight organic odour was encountered in bore GND 2302 at north west end of the site.

The sample collected from GND 2301 had abundant foaming, noticeable hydrocarbon odour, and black specks suspended in the sample. No sheen or foaming encountered in the other samples.

The recent mud which was delivered had been stored in cells one and three. Both had 1-2 m freeboard available. Cell two was very low-level. A hydrocarbon odour was apparent downwind in the vicinity of the cells.

23 March 2016
The Company contacted the Council in late November 2015 seeking a reduction in the 2015-2016 monitoring costs. After two meetings it became apparent that the WRS were not aware of their sampling requirements with respect to consent conditions, as such the route forward was for the sampling to be undertaken by the Council and the Company were in favor of this option.

This led to an amendment of the current 2015-2016 monitoring programme. The main change from the current programme was the inclusion of total heavy metal analysis to the soil analysis suite as this would satisfy a certain consent condition.

The Company would not be seeking to surrender any locations of the site, as such no speciation analysis of hydrocarbons or PAH analysis was added to the programme.

31 March 2016
At the time of the inspection, the following was found to have of occurred. Wind variable from the north, at 5 m/s, no objectionable odours or visible emissions were found during the inspection. No recent storage or land-farming activities had occurred at the site.

All cell liners appeared in good repair, very little liquid in any of the cells, cells one and three were found to contain a considerable volume of drilling muds whereby the mud level was higher than the cell. The muds were baked solid by the summer sun and so unlikely to escape the cell, they also contained plenty of capacity for storm water, if required. Cell two was essentially empty except for a minor volume of liquid and some residual mud stuck to the liner walls. Areas where muds had previously been spread were inspected. Pasture cover appeared healthy and stable, minor areas of wind erosion on the contours was recorded, but no muds were found to be migrating to the surface. No grazing of spreading areas was occurring during the inspection.

11 May 2016
An inspection of the preliminary earth works was undertaken. The hill on the north west side of the storage cells was being excavated to use as fill at the Origin Spence Road Landfarm site. Approximately 6,000 m^3 will be removed from the Symes storage area and approximately 1,000 m^3 of contaminated soil from the two Spence Road cells will be brought to site. The soil will be directly applied onto the spreading area to prevent double handling. Works will occur to landfarm the 'TAG' muds currently stored at the site, the two wastes will be spread in separate areas. A test cell had also been dug at the site, approximately 3.5 m of fine mud/clay is below approximately1 m of topsoil/sand, the base of the test cell was a loose sandstone. A metal track had been laid around the cell in order for trucks to load fill during poor weather. The excavator used at the site was being washed to prevent the transfer of bristle grass seed between sites.

14 May 2016
During an inspection the following was found to have occurred. The wind was westerly at 4 m/s. No objectionable odours or emissions were found during the inspection. Earth works were continuing to remove sand for the Kauri C wellsite cell reinstatement works (Spence Road Landfarm), two trucks were being loaded during the inspection.

Cells one and three at Kauri C had been excavated and brought to site, the material was stockpiled above ground on the northern side of the cell. The lined cells at the site were found to be in good repair. A small amount of material has been introduced into cells three and one. All three storage cells contained varying amounts of storm water which was essentially free of surface hydrocarbons. Plenty of capacity was available within the cells. No recent spreading had occurred at the site. All historic spreading areas had pasture cover and appeared stable.

2.2 Results of discharge monitoring

2.2.1 Provision of consent holder data

During this monitoring period (2015-16) the site at Symes Manawapou received material from two separate well locations and one former landfarm storage cell area. These two well locations were part of TAG Oil (NZ) operations, from their Supplejack and Cheal-A wellsite's. While the former storage cell area originated from Origin's former landfarm, Spence Road, which was located on the old Kauri C wellsite pad. A description and specific quantities are provided in Table 1.

Table 1 Drilling mud delivery record Symes Manawapou Landfarm 2015-16 monitoring year

Material Source	Description	Quantity m^3
Supplejack	-aged (>10years) drilling mud	368
Cheal A Water Well	Solids and liquids	75
Kauri C (Spence Road)	Impacted soils	1,147
Total m^3		1,590

The subsequent analysis of the material proposed to be landfarmed, as required by the consent[1] is provided in the Company's annual report which is attached in Appendix II.

The majority of 2015-2016 monitoring period had been a relatively slow period for the Company's operations at the Symes Manawapou Landfarm. Of the three deliveries which were received at the site, one was delivered in November 2015 (Supplejack aged mud), while the other two were delivered in June 2016 (Cheal A) and in to the following monitoring period in the case of Spence Road.

As such the following monitoring period (2016-2017) will deal specifically with reporting on the remediation exercise undertaken by the Company of the storage cell material from a former landfarm, as well as the landfarming of the existing material which is currently in-situ in the storage cells.

2.3 Results of receiving environment monitoring

2.3.1 Council soil sampling results

Throughout the monitoring year (2015-2016) the Council collected six composite soil samples (Table 2). The analysis undertaken in the Council's laboratory and Hill's laboratory in Hamilton is provided in Section 1.5.4 Chemical sampling. The locations of the soil samples are provided in Figure 2.

Table 2 Council soil samples Symes Manawapou Landfarm 2015-16 monitoring period

Symes Manawapou Landfarm 2015-2016 Soil Results		7795-1	Area A	Area A	Stage 3	Stage 2 (a)	Stage 2 (b)	Stage 1/2
Parameter	**Unit**	**Consent limit**	**22 Oct 2015**	**29 Jan 2016**	**21 Jun 2016**	**21 Jun 2016**	**21 Jun 2016**	**21 Jun 2016**
Arsenic Total	**mg/kg**	20	-	-	<2	<1	<2	<2
Cadmium Total	**mg/kg**	1	-	-	<0.10	<0.10	<0.10	<0.10
Chromium Total	**mg/kg**	600	-	-	21	23	19	18
Copper Total	**mg/kg**	100	-	-	10	10	11	10
Mercury Total	**mg/kg**	1	-	-	<0.10	<0.10	<0.10	<0.10
Nickel Total	**mg/kg**	60	-	-	12	10	10	10
Lead Total	**mg/kg**	300	-	-	2	1.4	1.6	1.5
Zinc Total	**mg/kg**	300	-	-	74	82	104	91
Calcium	**mg/kg**		154.8	24.4	85.6	49.3	118.9	181.4
Chloride	**mg/kg**	700*	411.4	65.1	7.6	10.1	9.1	22.2
Conductivity	**mS/m@20°C**	400/290*	239.8	39.7	28.4	19.1	46	67.5
Total Petroleum Hydrocarbon	**mg/kg**	50,000	40	6	292	14	13	15
Potassium	**mg/kg**		334.5	76.3	40	29.2	41.5	59.5

[1] Consent 7795-1 Condition 7 (attached in appendix I) the required analysis for each waste source.

Symes Manawapou Landfarm 2015-2016 Soil Results		7795-1	Area A	Area A	Stage 3	Stage 2 (a)	Stage 2 (b)	Stage 1/2
Parameter	**Unit**	**Consent limit**	**22 Oct 2015**	**29 Jan 2016**	**21 Jun 2016**	**21 Jun 2016**	**21 Jun 2016**	**21 Jun 2016**
Moisture Factor	**nil**		1.088	1.049	1.086	1.067	1.092	1.085
Magnesium	**mg/kg**		4.6	5.9	6.1	5	5.6	9.1
Sodium	**mg/kg**	460*	47.6	37.1	33.9	36.8	39.5	26.7
Ammonical nitrogen	**mgN/kg**		0.46	0.02	5.12	3.84	2.58	1.96
Nitrate/Nitrite Nitrogen	**mgN/kg**		0.1	2.75	0.46	0.91	1.06	0.91
pH	**pH**		8.2	6.2	7.5	6.7	8.2	7.5
Sodium Absorption Ratio	**None**	18	1.0287	1.74889	0.95453	1.33597	0.96099	0.52467
Total Soluble Salts	**mg/kg**	2,500*	1,876.7	310.7	222.3	149.5	360	528.3
*relates to surrender criteria sampling, which will also include MAH, PAH and TPH speciation analysis.								

The soil samples analysed in the 2015-16 monitoring period are tabulated in Table 2. In comparison to the previous years analysis, this year the parameters were slightly augmented to include total heavy metal analysis of specific heavy metals in the soil samples. The inclusion of heavy metals was at the request of the company as they were not aware of there sampling requirements in the previous years monitoring with respect to the consent conditions.

The consent (7795-1) requires that a certain number of samples be collected to firstly, ascertain the quality of the landfarming operation and secondly to assess for the potential for adverse effects arising from the exercise of the consent, by means of comparing the analytical values with what has been consented.

The consent conditions which are specific to the receiving environment soil are as follows:

Receiving environment limits – soil

Condition number:

20. *The conductivity of the soil/waste layer after landfarming shall be less than 400 mS/m, or alternatively, if the background soil conductivity exceeds 400 S/m, the landfarming of waste shall not increase the soil conductivity by more than 100 mS/m.*

21. *The sodium adsorption ratio (SAR) of the soil/waste layer after landfarming shall be less than 18.0, or alternatively if the background soil SAR exceeds 18.0, the landfarming of waste shall not increase the SAR by more than 1.0.*

22. *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 Assoication's*

Guidelines for the safe application of biosolids to land in New Zealand (2003), as shown in the following table:

Constituent	Standard (mg/kg dry weight)
Arsenic	20
Cadmium	1
Chromium	600
Copper	100
Lead	300
Mercury	1
Nickel	60
Zinc	300

Thus if the results from this monitoring period are compared to the consent conditions (Table 2), the total metal analysis undertaken across the landfarmed areas returned low concentrations of heavy metals which are close to background Taranaki concentrations.

There was no exceedance in any of the other consented parameters which were analysed. There however exists a good deal of variation across the site as can be seen by the varied pH and varying level of soluble salts analysed.

TPH analysis ranged from 6-292 mg/kg which is a minimal concentration across the samples collected.

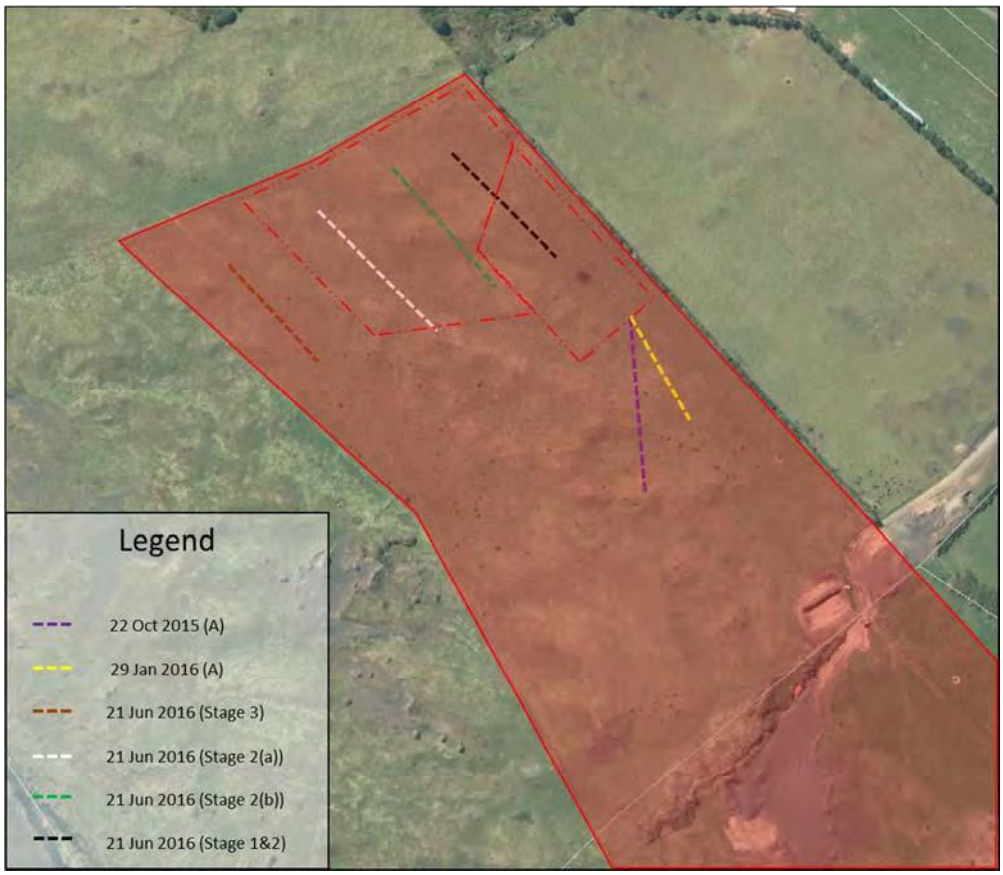

Figure 2 Council soil transects Symes Manawapou Landfarm 2015-2016

2.3.2 Council groundwater sampling results

The site contains an active groundwater monitoring network of four groundwater monitoring wells. Two 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 three cells. The other two monitoring wells are located to the north west and north of the storage cells, on the site boundary to monitor for the potential for offsite migration of contaminants (Figure 3). The results of the analysis are provided in the following Tables 3-6.

Figure 3 Locations of the active groundwater monitoring well network Symes Manawapou Landfarm

Table 3 GND 2300 Groundwater analysis 2015-2016

Parameter	Unit	GND2300	GND2300	GND2300	GND2300
		23 Sep 2015	07 Dec 2015	23 Mar 2016	21 Jun 2016
		12:00	11:00	09:30	12:10
Barium acid soluble	g/m³	1.17	0.29	0.53	0.112
Barium (dissolved)	g/m³	0.058	0.22	0.09	0.047
Benzene	g/m³	<0.0010	<0.0010	<0.0010	<0.0010
Chloride	g/m³	232	952	586	465
Conductivity	mS/m@20°C	87	294	187	155
Ethylbenzene	g/m³	<0.0010	<0.0010	<0.0010	<0.0010
Total Petroleum Hydrocarbons	g/m³	<0.7	<0.7	<0.7	<0.7
HC C_7-C_9	g/m³	<0.2	<0.2	<0.2	<0.10
HC C_{10}-C_{14}	g/m³	<0.4	<0.4	<0.4	<0.2
HC C_{15}-C_{36}	g/m³	<0.10	<0.10	<0.10	<0.4
Water level	m	6.128	7.204	-	-

Parameter	Unit	GND2300	GND2300	GND2300	GND2300
		23 Sep 2015	07 Dec 2015	23 Mar 2016	21 Jun 2016
		12:00	11:00	09:30	12:10
Sodium	g/m³	79.8	134	109	97.3
pH	pH	6.4	6	6.4	6
Total Dissolved Salts	g/m³	673.1	2,274.7	1,446.8	1,199.3
Temperature	°C	14.5	14.4	15.1	14.6
Toluene	g/m³	<0.0010	<0.0010	<0.0010	<0.0010
Meta-Xylene	g/m³	<0.002	<0.002	<0.002	<0.002
Ortha-Xylene	g/m³	<0.0010	<0.0010	<0.0010	<0.0010

Table 4 GND 2301 Groundwater analysis 2015-2016

Parameter	Unit	GND 2301	GND 2301
		23 Sep 2015	07 Dec 2015
		11:30	11:30
Barium acid soluble	g/m³	26.9	9.4
Barium (dissolved)	g/m³	26.9	9.4
Benzene	g/m³	<0.0010	<0.0010
Chloride	g/m³	**3,240**	**3,410**
Conductivity	mS/m@20°C	953	998
Ethylbenzene	g/m³	<0.0010	<0.0010
Total Petroleum Hydrocarbons	g/m³	**1.8**	**1.7**
HC C_7-C_9	g/m³	**1.8**	**1.2**
HC C_{10}-C_{14}	g/m³	<0.4	**0.6**
HC C_{15}-C_{36}	g/m³	<0.10	<0.10
Water level	m	6.198	7.237
Sodium	g/m³	534	520
pH	pH	6.5	6.3
Total Dissolved Salts	g/m³	**7,373.5**	**7,721.6**
Temperature	°C	16.8	15.8
Toluene	g/m³	<0.0010	<0.0010
Meta-Xylene	g/m³	<0.002	<0.002
Ortha-Xylene	g/m³	<0.0010	<0.0010
Note: No samples were collected in March or June 2016 as the well was dry.			

Table 5 GND 2302 Groundwater analysis 2015-2016

Parameter	Unit	GND 2302	GND 2302	GND 2302	GND 2302
		23 Sep 2015	07 Dec 2015	23 Mar 2016	21 Jun 2016
		10:00	09:20	09:15	10:35
Barium acid soluble	g/m³	0.14	0.071	0.018	0.023
Barium (dissolved)	g/m³	0.018	0.019	0.018	0.022
Benzene	g/m³	<0.0010	<0.0010	<0.0010	<0.0010
Chloride	g/m³	61.6	62.7	50.2	49.9
Conductivity	mS/m@20°C	38.8	36.5	36.2	41.1
Ethylbenzene	g/m³	<0.0010	<0.0010	<0.0010	0.001
Total Petroleum Hydrocarbons	g/m³	<0.7	**1.4**	<0.7	<0.7
HC C_7-C_9	g/m³	<0.2	<0.2	<0.2	<0.10
HC C_{10}-C_{14}	g/m³	<0.4	**1.4**	<0.4	<0.2
HC C_{15}-C_{36}	g/m³	<0.10	<0.10	<0.10	<0.4
Water level	m	6.715	7.043	-	-
Sodium	g/m³	45.2	44.9	43.6	42
pH	pH	6.8	6.6	6.6	6.5
Total Dissolved Salts	g/m³	300.2	282.4	280.1	318
Temperature	°C	14.7	14.9	15.8	14.3
Toluene	g/m³	<0.0010	<0.0010	<0.0010	<0.0010
Meta-Xylene	g/m³	<0.002	<0.002	<0.002	<0.002
Ortha-Xylene	g/m³	<0.0010	<0.0010	<0.0010	<0.0010

Table 6 GND 2303 Groundwater analysis 2015-2016

Parameter	Unit	GND2303	GND2303	GND2303	GND2303
		23 Sep 2015	07 Dec 2015	23 Mar 2016	21 Jun 2016
		10:50	10:20	08:50	11:15
Barium acid soluble	g/m³	0.28	0.44	0.38	0.225
Barium (dissolved)	g/m³	0.054	0.44	0.35	0.08
Benzene	g/m³	<0.0010	<0.0010	<0.0010	<0.0010
Chloride	g/m³	762	1,150	1,110	1,180
Conductivity	mS/m@20°C	232	350	340	358
Ethylbenzene	g/m³	<0.0010	<0.0010	<0.0010	<0.0010
Total Petroleum Hydrocarbons	g/m³	<0.7	<0.7	<0.7	<0.7
HC C_7-C_9	g/m³	<0.2	<0.2	<0.2	<0.10
HC C_{10}-C_{14}	g/m³	<0.4	<0.4	<0.4	<0.2
HC C_{15}-C_{36}	g/m³	<0.10	<0.10	<0.10	<0.4

Parameter	Unit	GND2303	GND2303	GND2303	GND2303
		23 Sep 2015	07 Dec 2015	23 Mar 2016	21 Jun 2016
		10:50	10:20	08:50	11:15
Water level	m	4.43	5.264	-	-
Sodium	g/m³	168	189	194	215
pH	pH	6.3	6	6	5.9
Total Dissolved Salts	g/m³	1,795	**2,708**	**2,630.6**	**2,769.9**
Temperature	°C	14.2	14.1	15.1	14.3
Toluene	g/m³	<0.0010	<0.0010	<0.0010	<0.0010
Meta-Xylene	g/m³	<0.002	<0.002	<0.002	<0.002
Ortha-Xylene	g/m³	<0.0010	<0.0010	<0.0010	<0.0010

As already detailed the site contains four active groundwater monitoring wells, the analysis of these wells is detailed in the above Tables 3-6 respectively. The analysis from the previous monitoring period (2014-2015) denoted that GND 2301 (Figure 2 and Table 4) contained a high concentration of Total Dissolved Salts (TDS) which had shown a decreasing trend throughout the previous monitoring year, decreasing from 9,207g/m³ to 5,370g/m³.

While this was a breech in consent conditions which states the following:

23. *The exercise of this consent shall not result in the concentration of total dissolved salts in any fresh water body exceeding 2500 g/m³.*

24. *Other than as provided for in condition 18, the exercise of this consent shall not result in any contaminant concentration, within surface water or groundwater, which after reasonable mixing, exceeds the background concentration for that particular contaminant.*

However, consideration was given, as one of the storage cells had been recently repaired (mid 2014) and it was surmounted that this may well have been the source for the elevated concentrations of salts within the groundwater, as a decreasing concentration was observed post the repair.

In this monitoring period though, the concentration of the TDS continued to rise in this specific well location, 5,370 g/m³ in May 2015 to 7,721 g/m³ in December 2015, this was prior to the well running dry, which incidentally is the first time this has occurred. Thus continued measurement was not possible due to insufficient water within the well. Initial analysis from the upcoming monitoring period 2016-2017 has detailed that this location has continued to decline in concentration 5,775 g/m³.

The elevation witnessed in well GND 2301 in terms of salt concentration was similarly echoed in two of the three existing wells on the site (Figure 3). GND 2303 which is located to the north of the site, close to the site boundary observed an increase in this period; 1,795g/m³ to 2,769g/m³, as did GND 2300, which is located up gradient of the storage cells, from 673g/m³ to 1,199 g/m³.

From reviewing the long term record of TDS analysis (Figure 4), GND 2301 has been affected by elevated TDS concentrations since November 2013. The other three

remaining wells have remained stable, below the concentration limit of the consent <2,500 g/m^3. There was a slight increase in December 2015, whether this was linked to a new delivery of material which was stored in the cells was unclear, the company did take delivery of material in November 2015.

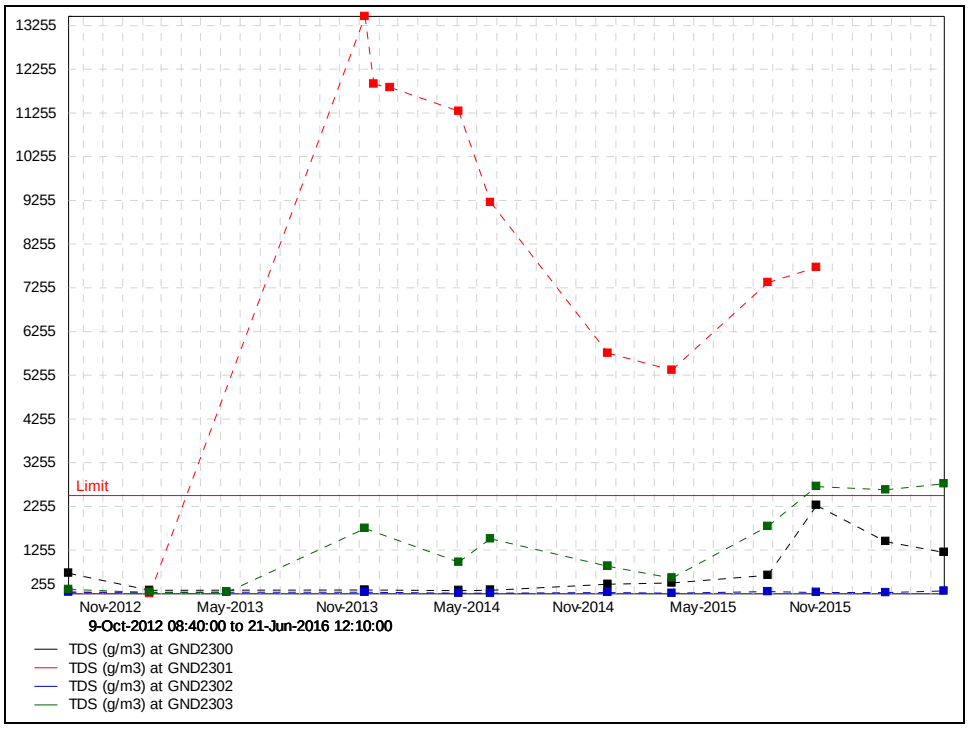

Figure 4 Total Dissolved Salt concentrations in groundwater Symes Manawapou long term record

To draw a conclusion as to the cause for this increase in TDS concentration in this period may be hard to accurately achieve. Reported in the previous monitoring period from the inspections, was that the liner of one of the cells had been repaired. Thus prior to this repair occurring, there existed a pathway for the fluid component of the storage cells to infiltrate into the local water table, in the locality of the storage cells.

Communication between the Council and the Company in this monitoring period centered on evidence of an increasing concentration of TDS within a specific well, GND 2301. This resulted in the draining of one of the cells to check its integrity. Whereby the result was that the liner was still intact. The times when the water level in the monitoring well had been at it lowest level (low volume of water in the well), corresponded with the highest elevated salt concentration (Figure 5).

Thus the likelihood is that a plume of elevated saline water exists in the vicinity of the storage cells, most likely caused by the historical intrusion of elevated saline water from the former tear within one of the storage cells. This coupled with the storage of recently delivered material on the side of the cells, rather than directly into the holding cell may serve as an explanation of the high TDS.

Linked to the high salt concentration in this well is also the detection of low chain hydrocarbons (1.8-1.2 g/m^3 C_7-C_9 and 0.6 g/m^3 C_{10}-C_{14}). Should the level of these hydrocarbons increase in the following monitoring period there will be a requirement to ascertain the source of these hydrocarbons. At the moments as they are at low

concentrations and there are no likely receptors to be adversely effected by this low level of low chain hydrocarbons within a 100 m radius.

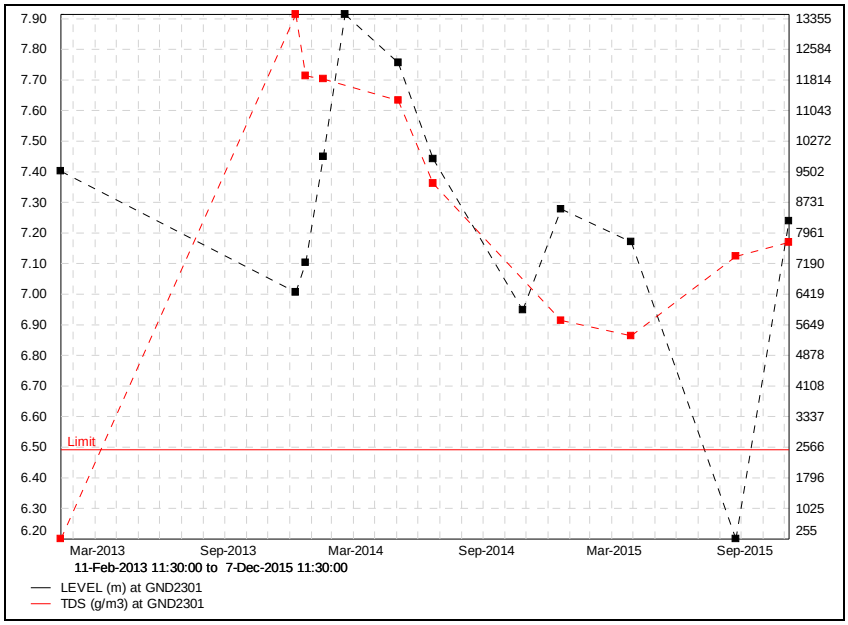

Figure 5 Long term record Total Dissolved Salts (in red) (TDS) and water level (from top of casing) (in black) GND 2301

The other well which is of concern to the Council is GND 2303, which as already stated is located on the boundary of the site. The increase in the TDS observed in this well will be closely monitored moving forward. The rationale for the concern is due to the fact the well is located within two hundred meters of a QE II Covenant, which is situated to the north of the well (Figure 6 hatched area). Initial sampling in the up coming monitoring period has reported the salinity in this specific well location has reduced to below the consented limit of 2,500 g/m^3.

Figure 6 Groundwater monitoring locations is relation to QE II covenant in hatched area

2.3.2.1 Groundwater conclusion

Elevated TDS groundwater impacts are evident at this site, in one of the four groundwater monitoring wells. Two additional wells detail an observable elevation in of TDS. The highest impact is seen in the locality of the storage cells.

Whether this is due to historical torn liner linked with a lower water table or due to a leak in the existing liner, it is too early to draw conclusions. The Council will continue to monitor the bores.

The Company had been pro-active when informed of the increase in GND 2301, whereby Cell three was pumped out and the liner inspected (comms late November 2015).

The rise in TDS in GND 2303 is a concern to the Council as it is within 200 m of a QE II covenant. *(initial results from GND2303 in the upcoming monitoring period have reported that this concentration is now below the consented concentration of 2,500 g/m^3 TDS)*

If a sample is not extractable from GND 2301 moving forward additional measures will be undertaken to mitigate the problem as groundwater sampling is a requisite for this facility.

2.4 Investigations, interventions, and incidents

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

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

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

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

3. Discussion

3.1 Discussion of site performance

In this monitoring period Symes Manawapou Landfarm was operational for a total of 41 days in total, as per the company supplied annual report which is attached in Appendix II. During this time, the Company undertook the rehabilitation of a previously spread area (Area A1), which was undertaken in April 2015 for the area that had been spread in October 2014.

During the year, the site held drilling material which had been in storage for longer than one year. This was outlined by the Council's Investigating Officer. To date this material is still in storage. This is in breech of condition 16 which details that all material is to be landfarmed as soon as practicable but no later than 12 months.

At times the level of drilling material contained within the storage cells was elevated above the height of the storage cells. A review of the recent photos will detail that at times there existed an overlap between the cell wall and the top loading area of cell and thus the potential existed for saline impacted fluids to infiltrate around the cell walls especially in times of high rainfall. Communication between the Council and the Company has led to these areas being addressed in terms of housekeeping and the overlap has been removed.

The Company undertook a large remediation operation at the end of the monitoring period, whereby impacted soils (1,147 m^3) from the former Spence Road Landfarm were excavated from the former storage pit areas and then brought to the Symes site. This operation carried through into the up coming monitoring year and was the result of planning by the Company and Origin Energy with the aid of Opus to quantify the scale of material to be removed from the former storage pit area. This operation was considered a duty of care undertaken to remediate the former Spence Road Landfarm (which ceased receiving material in January 2012). Spence Road Landfarm had a legacy in terms of the unlined storage pits, which had resulted in localised petroleum and saline impacts in the surrounding soil of these former storage pits. Thus with this material removed and clean fill brought in to fill the excavation, the former pit area at the Spence Road Landfarm was reinstated and revegetated.

Moving forward, the Council would encourage the consent holder to make sure the site is kept tidy, especially in the loading areas of the storage cells (Photo 4 & 5). Additionally the Company is encouraged to make sure that drilling material is landfarmed within the correct time period, and that storage cell integrity testing is undertaken periodically.

3.2 Environmental effects of exercise of consents

The main measurable environmental effect associated with the exercise of this consent in this monitoring period is centred on a legacy from the previous monitoring period in terms of elevated TDS concentrations. As in previous year, the concentration of TDS within GND 2301 has remained above the conditional value of 2,500 g/m^3. In the previous monitoring period the high concentration was considered a result of storage cell liner failure, which was mitigated in mid 2014. This monitoring period has seen an elevation in concentration for two additional wells, GND 2300 and GND 2303 Figure 7.

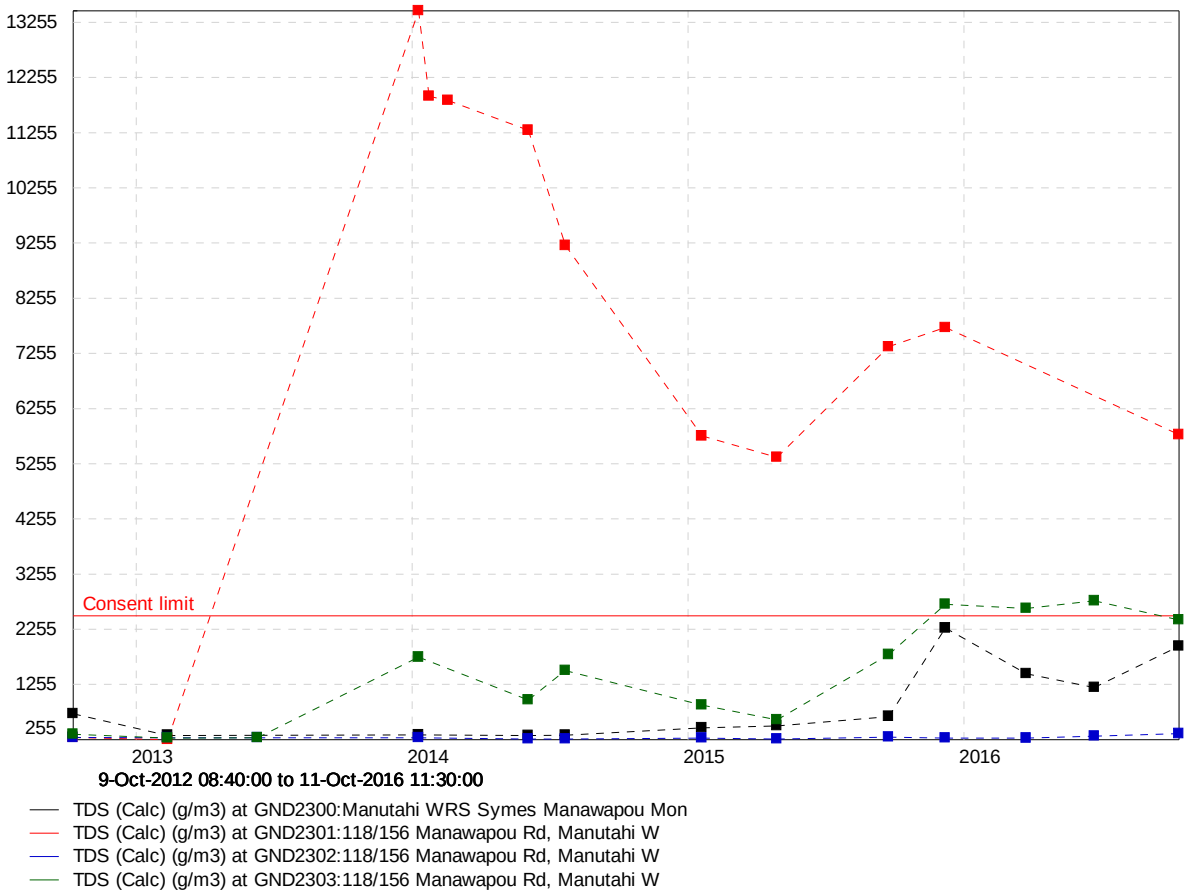

Figure 7 Long term TDS concentrations at Symes Manawapou Landfarm in the 2015-2016 monitoring period

When one compares the long term record (Figure 7), it may be discerned that the impact of elevated salts in wells GND2300 and GND2303 particularly, may well have been a function of this period. Prior to this monitoring period their concentrations had remained below the conditional value of 2,500 g/m^3.

In this period there were no applications of material to land, however, material was stockpiled in the cells, with the first delivery in this period occurring in November 2015 which constituted aged drilling mud. While aged drilling mud is quite benign owing to the fact the degree of hydrocarbons is minimal due to degradation within a mud pit, it does still contain a high concentrations of salts, in terms of sodium, potassium and chloride (reference the company data for supplejack analysis).

Linked to the delivery of material in November 2015 was the storage of drilling waste that was cited as a potential pathway (Photo 5) for elevated saline water to egress into the groundwater. This has now been addressed by the Company. At times the material which had been discharged was positioned on the lip of the cell rather than in it and at certain cells, mud was evident next to the cells, rather than in the cells (Photo 6), note that these picture were collected in December 2015.

Photo 4 Cell three Symes Manawapou December 2015

The sole purpose for lining of storage cells is to contain material which is discharged into the cell. If material is not fully discharged into the cells it has the potential to migrate/ leach into the soil strata as is possible at this location.

While the likelihood of a receptor being adversely affected by the high salinity in the direct locality of the storage cells is quite low, hence the rationale for positioning the majority of landfarms in close proximity to the coastal environment, it is good practice to make sure precautions are made to prevent this egress of salinity. This would include properly discharging material into the specific storage cell and the Company is now mindful of this potential pathway moving forward.

The other location which the Council will continue to monitor is the well located on the northern boundary of the site, GND 2303. As already discussed in Section 2.3.2, this well is located on the boundary of the facility and within 200 meters of a QE II covenant (Figure 6). Early indication from analysis collected at the beginning of the upcoming monitoring period has detailed that this well (which was above the consented concentration of 2,500 g/m^3) has now dropped to below that specific concentration.

Photo 5 Cell one Symes Manawapou December 2015

Petroleum hydrocarbons were detected at low concentrations in two locations this period, GND2301 and GND 2303 respectively. At GND2301, both times this well was sampled prior to running dry and GND 2303 once during the year, with the follow up sample detailing no detection.

The soils which were sampled in this period detailed no exceedance, no new landfarmed areas were undertaken since August 2014. Re-vegetation has been undertaken to a high standard as has the landfarming operation.

The site now contains two cells filled with mud. These muds have been in-situ for longer than one year as detailed by Section 2.1, as well as 1,000 m^3 +/- of contaminated soil which is stockpiled awaiting farming.

Overall, the environmental effects from the exercise of consent are minimal, the site has been managed in an acceptable way and the Company liaise with the Council regularly. At times some prompting from Council has been required; however, it has been kept to a minimum. The upcoming monitoring period marks the requirement to landfarm material on site within a year, thus the Council will continue to monitor the progress of the Company as they undertake this remediation operation in the 2016-2017 period.

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 Evaluation of consent 7795-1 in the 2015-2016 monitoring period

Purpose: ***To discharge drilling waste cuttings (consisting of drilling cuttings and drilling fluids from water based muds and synthetic based muds), from hydrocarbon exploration and production activities, onto and into land via landfarming***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Definitions which apply to the consent	N/A	N/A
2. Best practicable option to be adopted	Inspection and liaison with consent holder	
3. The consent holder shall provide a stockpiling and landfarming management plan prior to the exercise of the consent	Management plan received and approved	Yes
4. Install groundwater monitoring wells prior to exercise of consent	Inspections and site records	Yes
5. Notify TRC 48 hrs prior to stockpiling	Notifications received	Yes for the most part
6. Notify TRC 48 hrs prior to landfarming	Notifications received	N/A

Purpose: ***To discharge drilling waste cuttings (consisting of drilling cuttings and drilling fluids from water based muds and synthetic based muds), from hydrocarbon exploration and production activities, onto and into land via landfarming***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
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	Yes, agreement reached with the Council for the purpose of monitoring.
8. Keep records relating to wastes, areas, compositions, volumes, dates, treatments and monitoring	Company records	Yes
9. Report on records in condition 6 to Council by 31 August each year	Report received	Yes
10. Discharges made only within area as specified by submitted application	Inspection	Yes
11. No discharge within 25 m of a water body, 10 m from any property boundary and 50 m from the QEII covenant Key Native Ecosystems	Inspection	Yes
12. Maximum application thickness for wastes: a) 100 mm TPH <5% b) 50 mm TPH >5% c) No ponded liquids 1 hr after application	Company records and inspection	Yes
13. Incorporation into soil as soon as practicable to a depth of at least 250 mm	Inspection and sampling	Yes
14. Hydrocarbon concentrations in soil shall not exceed 50,000 mg/ kg dry weight	Sampling	Yes
15. Landfarming areas to be used in accordance with conditions 10 and 11 and shall not be used for any subsequent discharges of drilling wastes	Inspection	Yes
16. All material to be landfarmed as soon as practicable and no later than 12 months	Company records and inspections	No Some material still on site for longer than 1 year
17. Re-vegetate landfarmed areas as soon as practicable	Company records and inspections	Yes
18. Total dissolved salts in any fresh water body shall not exceed 2500 g/m^3	Sampling	1 well above this value, possibly associated with a legacy issue

Purpose: ***To discharge drilling waste cuttings (consisting of drilling cuttings and drilling fluids from water based muds and synthetic based muds), from hydrocarbon exploration and production activities, onto and into land via landfarming***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
19. Disposal of waste shall not lead to contaminants entering surface water or ground water exceeding background concentrations	Sampling, see above note	No
20. Conductivity must be less than 400 mS/m. If background conductivity exceeds 400 mS/m, then increase shall not exceed 100 mS/m	Sampling	Yes
21. Sodium absorption ratio [SAR] must be less than 18.02, if background SAR exceeds 18.0 then increase shall not exceed 1.0	Sampling	Yes
22. Concentrations of heavy metals in the soil shall at all times comply with MfE guidelines	Sampling	Yes
23. Prior to expiry/cancellation of consent these levels must not be exceeded: a. conductivity, 290 mSm^{-1} b. chloride, 700 g/m^3 c. dissolved salts, 2500 g/m^3 d. sodium, 460 g/m^3	Not applicable - sampling prior to surrender of consent	N/A
24. If condition 23 is not met, consent cannot be surrendered	Not applicable - sampling prior to surrender of consent	N/A
25. Notification of discovery of archaeological remains	Not applicable – none found	N/A
26. Consent shall lapse on 30 June 2017	Not applicable – consent exercised	N/A
27. Optional review provision re environmental effects	Next optional review June 2016	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent Overall assessment of administrative performance in respect of this consent		**Good** **Good**

During the year, the Company demonstrated a Good level of environmental and a Good level of administrative performance with the resource consent 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 monitoring of consented activities at Symes Manawapou Landfarm in the 2015-2016 year continues at the same level as in 2014-2015.
   This occurred with the inclusion of total heavy metal analysis of soil samples.

2. THAT the consent holder continues to provide timely administrative and environmental compliance with the Consent required conditions, including soil samples.

   The company contacted the Council in late November 2015 seeking a reduction in the monitoring costs associated with their consent, sighting a lack of drilling material to landfarm.

   At the time of assessment the company had not collected samples of soil or groundwater. Thus it was agreed a reduction would not occur and that in order to meet their obligations the Council would undertake sampling on behalf of the Company. It was also agreed that if the site was unlikely to receive material for an extended period then the monitoring would likely reduce as the monitoring undertaken would be sufficient to assess the environment effects of the activity.

   The site has since received material and contains two cells of material. There will be the requirement in the upcoming (2016-2017) monitoring period to assess the effects of these activities.

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 of the Symes Manawapou Landfarm continues at the same level as in 2015-2016.

4. Recommendations

1. THAT monitoring of consented activities at Symes landfarm in the 2016-2017 year continue at the same level as in 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.
cfu	Colony forming units. A measure of the concentration of bacteria usually expressed as per 100 millilitre sample.
COD	Chemical oxygen demand. A measure of the oxygen required to oxidise all matter in a sample by chemical reaction.
Conductivity	Conductivity, an indication of the level of dissolved salts in a sample, usually measured at 20°C and expressed in mS/m.
Cu*	Copper.
Cumec	A volumetric measure of flow- 1 cubic metre per second (1 m^3s^{-1}).
DO	Dissolved oxygen.
DRP	Dissolved reactive phosphorus.
$g/m^2/day$	Grams/metre^2/day.
g/m^3	Grams per cubic metre, and equivalent to milligrams per litre (mg/L). In water, this is also equivalent to parts per million (ppm), but the same does not apply to gaseous mixtures.
Incident	An event that is alleged or is found to have occurred that may have actual or potential environmental consequences or may involve non-compliance with a consent or rule in a regional plan. Registration of an incident by the Council does not automatically mean such an outcome had actually occurred.
Intervention	Action/s taken by Council to instruct or direct actions be taken to avoid or reduce the likelihood of an incident occurring.
Investigation	Action taken by Council to establish what were the circumstances/events surrounding an incident including any allegations of an incident.
Incident Register	The incident register contains a list of events recorded by the Council on the basis that they may have the potential or actual environmental consequences that may represent a breach of a consent or provision in a Regional Plan.
L/s	Litres per second.
m^2	Square Metres.
mS/m	Millisiemens per metre.
NH_4	Ammonium, normally expressed in terms of the mass of nitrogen (N).
NH_3	Unionised ammonia, normally expressed in terms of the mass of nitrogen (N).

NO_3	Nitrate, normally expressed in terms of the mass of nitrogen (N).
NTU	Nephelometric Turbidity Unit, a measure of the turbidity of water.
O&G	Oil and grease, defined as anything that will dissolve into a particular organic solvent (e.g. hexane). May include both animal material (fats) and mineral matter (hydrocarbons).
Pb*	Lead.
pH	A numerical system for measuring acidity in solutions, with 7 as neutral. Numbers lower than 7 are increasingly acidic and higher than 7 are increasingly alkaline. The scale is logarithmic i.e. a change of 1 represents a ten-fold change in strength. For example, a pH of 4 is ten times more acidic than a pH of 5.
Physicochemical	Measurement of both physical properties (e.g. temperature, clarity, density) and chemical determinants (e.g. metals and nutrients) to characterise the state of an environment.
Resource consent	Refer Section 87 of the RMA. Resource consents include land use consents (refer Sections 9 and 13 of the RMA), coastal permits (Sections 12, 14 and 15), water permits (Section 14) and discharge permits (Section 15).
RMA	*Resource Management Act 1991* and including all subsequent amendments.
SS	Suspended solids.
SQMCI	Semi quantitative macroinvertebrate community index.
TDS	Total Dissolved Salts.
Temp	Temperature, measured in °C (degrees Celsius).
Turb	Turbidity, expressed in NTU.
UI	Unauthorised Incident.
Zn*	Zinc.

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

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

Bibliography and references

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

Taranaki regional Council 2015: Waste remediation Services Ltd (WRS) Symes Manawapou Landfarm Monitoring Programme Annual Report 2014-2015. Technical Report 2015-77.

Taranaki Regional Council 2014: Waste Remediation Services (WRS) Limited Symes Manawapou Landfarm Monitoring Programme Annual Report 2013-2014. Technical Report 2014-118.

Taranaki Regional Council 2013: Remediation NZ Limited Drilling Waste Disposal Monitoring Programme Annual Report 2012-2013. Technical report 2013-67.

Waste Remediation Services Manawapou (Symes) Disposal Site Annual Report 2015.

Waste Remediation Services Manawapou (Symes) Disposal Site Annual Report 2016.

Appendix I

Resource consents held by (WRS) Symes Manawapou Landfarm

(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:	01 May 2012
Commencement Date:	01 May 2012

Conditions of Consent

Consent Granted:	To discharge drilling wastes (consisting of drilling cuttings and drilling fluids from water based muds and synthetic based muds), from hydrocarbon exploration and production activities, onto and into land via landfarming
Expiry Date:	01 June 2028
Review Date(s):	June 2016, June 2022
Site Location:	156 Manawapou Road, Manutahi
Legal Description:	Lot 1 DP 7324 (Discharge site)
Grid Reference (NZTM)	1717244E-5608736N
Catchment:	Manawapou

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) stockpiling means a discharge of drilling wastes from vehicles, tanks, or other containers onto land for the purpose of interim storage prior to landfarming, but without subsequently spreading onto, or incorporating the discharged material into the soil within 48 hours; and
   b) landfarming means the discharge of drilling 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 adopt the best practicable option (as defined section 2 of the Resource Management Act 1991) to prevent or minimise any actual or potential effects on the environment arising from the discharge.

Requirements prior to exercise of consent

3. Prior to the exercise of this consent, the consent holder shall provide a stockpiling and landfarming management plan that, to the reasonable satisfaction of the Chief Executive, Taranaki Regional Council, demonstrates the activity can and will be conducted to comply with all of the conditions of this consent. The management plan shall be reviewed annually (on or about the anniversary of the date of issue of this consent) and shall include as a minimum:

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

4. 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.

Notifications, monitoring and reporting

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

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

6. The consent holder shall notify the Chief Executive, Taranaki Regional Council, (by emailing worknotification@trc.govt.nz.) at least 48 hours prior to landfarming stockpiled material, 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 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; and
   f) 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_6-C_9, C_{10}-C_{14}, C_{15}-C_{36});
   b) benzene, toluene, ethylbenzene, and xylenes;
   c) polycyclic aromatic hydrocarbons screening; and
   d) chloride, nitrogen, pH, potassium, and sodium.

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

   a) wastes from each individual well;
   b) composition of wastes (in accordance with condition 5);
   c) stockpiling area(s);
   d) volumes of material stockpiled;
   e) landfarming area(s), including a map showing individual disposal areas with GPS co-ordinates;
   f) volumes and weights of wastes landfarmed;
   g) dates of commencement and completion of stockpiling and landfarming events;
   h) dates of sowing landfarmed areas;
   i) treatments applied; 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.

9. The consent holder shall provide to the Chief Executive, Taranaki Regional Council, by 31 August of each year, a report on all records required to be kept in accordance with condition 6, for the period of the previous 12 months, 1 July to 30 June.

Discharge limits

10. The discharge shall only occur on the disposal sites shown in the Drawing entitled 'Remediation NZ Ltd Proposed Disposal Site' submitted with the application and attached to this consent.

11. There shall be no discharge within buffer zone, being:

    - 25 metres of the Manawapou River;
    - 25 metres of the unnamed tributary;
    - 10 metres from any property boundary; and
    - 50 metres from the QE II covenant Key Native Ecosystem areas.

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

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

    prior to incorporation into the soil.

13. As soon as practicable following the application of solid drilling wastes to land, the consent holder shall incorporate the wastes into the soil to a depth of at least 250 mm.

14. The hydrocarbon concentration in the soil over the landfarming area shall not exceed 50,000 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.

15. An area of land used for the landfarming of drilling wastes in accordance with conditions 10 and 11 of this consent, shall not be used for any subsequent discharges of drilling waste.

Operational requirements

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

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

Receiving environment limits - water

18. The exercise of this consent shall not result in the concentration of total dissolved salts in any fresh water body exceeding 2500 g/m^3.

19. Other than as provided for in condition 18, the exercise of this consent shall not result in any contaminant concentration, within surface water or groundwater, which after reasonable mixing, exceeds the background concentration for that particular contaminant.

Receiving environment limits - soil

20. The conductivity of the soil/waste layer after landfarming shall be less than 400 mS/m, or alternatively, if the background soil conductivity exceeds 400 S/m, the landfarming of waste shall not increase the soil conductivity by more than 100 mS/m.

21. The sodium adsorption ratio (SAR) of the soil/waste layer after landfarming shall be less than 18.0, or alternatively if the background soil SAR exceeds 18.0, the landfarming of waste shall not increase the SAR by more than 1.0.

22. 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 Assoication's Guidelines for the safe application of biosolids to land in New Zealand (2003), as shown in the following table:

Constituent	Standard (mg/kg dry weight)
Arsenic	20
Cadmium	1
Chromium	600
Copper	100
Lead	300
Mercury	1
Nickel	60
Zinc	300

23. From 1 March 2028 (three months prior to the consent expiry date), constituents in the soil shall not exceed the standards shown in the following table:

Constituent	Standard
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). Tables 4.12 and 4.15, for soil type sand.

MAHs - benzene, toluene, ethylbenzene, xylenes
PAHs - napthalene, non-carc. (pyrene), benzo(a)pyrene eq.
TPH - total petroleum hydrocarbons (C_7-C_9, C_{10}-C_{14}, C_{15}-C_{36})

The requirement to meet these standards shall not apply if, before 1 March 2028, the consent holder applies for a new consent to replace this consent when it expires, and that application is not subsequently withdrawn.

24. This consent may not be surrendered at any time until the standards in condition 23 have been met.

Archaeological remains

25. 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.

Lapse and review

26. This consent shall lapse on 30 June 2017, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991.

27. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2016 and/or June 2022, 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 3 June 2014

For and on behalf of
Taranaki Regional Council

_____

A D McLay
Director - Resource Management

Appendix II

Company Supplied Annual Report

26 September 2016

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

Dear Nathan

RE: Resource Consent 7795-1 - Manawapou (Symes) - 156 Manawapou Road, RD 2, Patea

As required under special condition 9 of resource consent 7795-1, please find information that WRS, in its second year of operation of the site, have recorded from the 1 July 2015 to the 30th June 2016. WRS took over operation of the site from 30 May 2014.

At the beginning of the reporting period on 1 July 2015 all three pits had practically no drilling wastes as all drilling solids and liquids were spread in December 2015.

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 there has been no drilling muds generated of any volume in the province that required disposal.

<u>Wastes Received for Disposal</u>

A) Drilling Muds

No “fresh” hydrocarbon drilling wastes were received for storage during the reporting period from 1 July 2015 to 30 June 2016, however there was one consignment of vintage, well aged (>10yrs) drilling mud received from the TAG Supplejack site in Nov 2015 and a

second small (75m3) non-hydrocarbon consignment from development of a TAG water well at Cheal A site late June 2016.

B) Contaminated Soils

Kauri C Wellsite Remediation Project

In Late April 2016 WRS was awarded the contract to remediate Origin Energy NZ's (OENZ) Kauri C Wellsite. Kauri C site has not been drilled however some years ago three unlined pits were excavated within the surficial sands with the intention of storing drilling muds prior to land farming these on the adjacent sand dune country. It is understood no significant volumes of mud was ever received at the site, but a unknown quantity mud was discharged into pits 1 and 2 in error by a truck driver. This was later removed (pers comm.) Unfortunately the sandy material removed to form the pits was discarded and nothing remained on site with which to backfill the pits and return these to pasture. All backfill had to be imported from offsite.

WRS/Symons provided a cradle to grave approach with the backfill sand sourced from Symes property where the Manawapou land farm is located. Once sufficient volume was excavated and stockpiled, both at Symes and Kauri C, contaminated soil from the walls and floor of the three pits at Kauri C were transported and placed in temporary stockpile until all the required backfill sand had been won. From time to time back loading of contaminated soil occurred when feasible, but often this was not possible due to available working space, PID testing, sampling, waiting upon analytical results and particularly weather.

Initially the three pits were cleaned up a digger excavating both walls and floor based upon visual inspection, with up to one meter being removed from the walls and 0.5 m from the floor. Over the years disuse, the pit walls had collapsed and significant sand blow had buried both walls and pit. WRS engaged OPUS to undertake the photoionisation detection (PID) and sampling of the cleaned out pits. Samples were dispatched to Hills labs. Upon receipt of results OPUS produced a factual report for OENZ, this was then submitted to the TRC to seek approval that the pits were suitable for backfilling. Once approval was received backfilling commenced.

The project kicked off with ground preparation and forming of all- weather facilities at Symes on 19 May2016 and some minor movement of backfill sand from Symes to Kauri C followed. Earthmoving equipment was then transferred to Kauri C and ground preparation commenced there on 11 May 2016. Movement of contaminated soil to Manawapou started on the 11 May 2016 and continued on an intermittent basis as excavated and access and logistics allowed. Movement of contaminated soil was completed on 13 June 2106 with a total of 1,147 m3 of material stored in a short term temporary stockpile with the area it was later spread upon. This material remained in stockpile until the end of the monitoring year

until works were completed at Kauri C and the earthmoving machinery relocated to Manawapou to undertake reinstatement work. Spreading of the contaminated soil was subsequently undertaken in July, August 2016. Further detail as approved by the client will be reported in the 2016-17 monitoring year.

Movement of excavated contaminated soil is recorded in the site Mud Register on a daily basis is attached.

During the monitoring year site has remained inactive in respect of the import of significant hydrocarbon bearing drilling and production station wastes from 1 July - 17 November 2015, from 19 November 2015 - 14 June 2016, and again from 23 – 30 June 2016; under Care and Maintenance for over 9 months. The site received drilling muds for a total of 7 days in the monitoring period and received only mud with very low levels of or no hydrocarbons. The last fresh drilling or production station waste received for storage and disposal was in Dec 2014.
The site did however accept for disposal 1147 m3 of low level contaminated soil from the Kauri C remediation project between 11 May and 13 June 2016

In total the site has been in Care and Maintenance, apart from the 7days of activity in Nov 15 and late June 16 and 34 days from 11 May-13 June 16 for the more than 16 months. The only spread area activity during these 16 months has been some rehabilitation in April 2015 of the Dec 2014 spread area A1.

No spreading of drilling wastes was undertaken during the monitoring year.

Information pertaining to resource consent 7795-1 is provided under the following headings

1. Delivery Record - attached 'Mud Register'

The mud register contains the record of deliveries for storage, for each well/delivery campaign as notified by email to the TRC; as required by Condition 5.

2. Spread Areas and Events during 2015/16

NIL

3. Spreading Records

Nil

4. Field Photographs - attached

As attached.

5. Composition of Wastes/Pre Disposal Analysis - attached

The Supplejack aged drilling muds were not sampled as delivered as these were subjected to a comprehensive sampling and assessment project by BTW for client TAG as part of the approval process to clean up and remediate the site. A copy of this report is attached.

Cheal A Water Well. The samples have not yet been taken and thus no results were available at 30 June 2016.
The samples were finally available on 16 Aug 2016 and submitted to Hills for analysis on 29 Aug 2016. Results received on 08 Sep 2016, are attached.

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 as there are no identifiers that would show this.

7. Operations Management Plan –attached

Operations at the Manawapou land farm are all undertaken generally in accordance with the WRS's Landfarm Management Plan that covers both the Manawapou and Waikaikai sites. The document is a live document and is constantly reviewed and updated as necessary (most recently Aug2016) to reflect operational requirements and practices at both sites operated by WRS.

TO SUMMARISE

A year of effectively no wastes with significant hydrocarbon content from any source to the site, however over a total of 41 days the following was received at site and placed in storage.
This material remained in storage through to the end of the monitoring year.

Drilling Muds

Supplejack	- aged (> 10yrs) drilling mud	368 m3
17- 19 Nov 2015	3 days	
Cheal A Water Well – solids and liquids, no hydrocarbons		75 m3
14,16,18,22 June 2016	4 days	
	Total	448 m3

Contaminated Soils

Kauri C -	low level contaminated soils	1,147 m3
	Grand Total	1,595 m3

MONITORING

1. **Consent Holder - Soils** - 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.20, SAR Cond.21 and heavy metals Cond.22**.** As WRS had no plans to excise and surrender any part of the consent the requirement to undertake comprehensive soil sampling per Cond.23 did not exist. At the end of the 2015 monitoring year WRS undertook one round of soil sampling of the upper a soil horizon (< 75mm depth) specifically to assess the levels of contaminants that grazing dry stock may be exposed to and hence the possible effects upon the animals welfare and food security. A second round of sampling to test environmental levels of contaminants was also undertaken at the end of the monitoring year

   A 100 m transect running from roughly NE-SW through the centre of area A1 was sampled at 10m intervals where a single 250-350 deep soil core was taken and aggregated into a single sample.

   See attached diagram Manawapou 14037_02 showing the transect line locations;

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

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 the minimal site activity and therefore the likelihood of significant effects, whilst the site was effectively 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 is the programme for the subsequent year 2016-17 was under consideration.

METHODS

Soils

All sampling is undertaken as per standard Hill Laboratories sampling protocols. Representative samples are collected from a number of surveyed points and these are aggregated to produce the representative sample that is sent to the laboratory for analysis. Typically samples are retrieved from approximately 75mm depth with an industry standard plug sampler (exposure pathway sampling – animal welfare/food security) or 250-350 mm depth (environmental sampling to test the zone of application of hydrocarbon wastes) but sampling depths can vary depending on the location of the waste layer and the depth of waste disposal.

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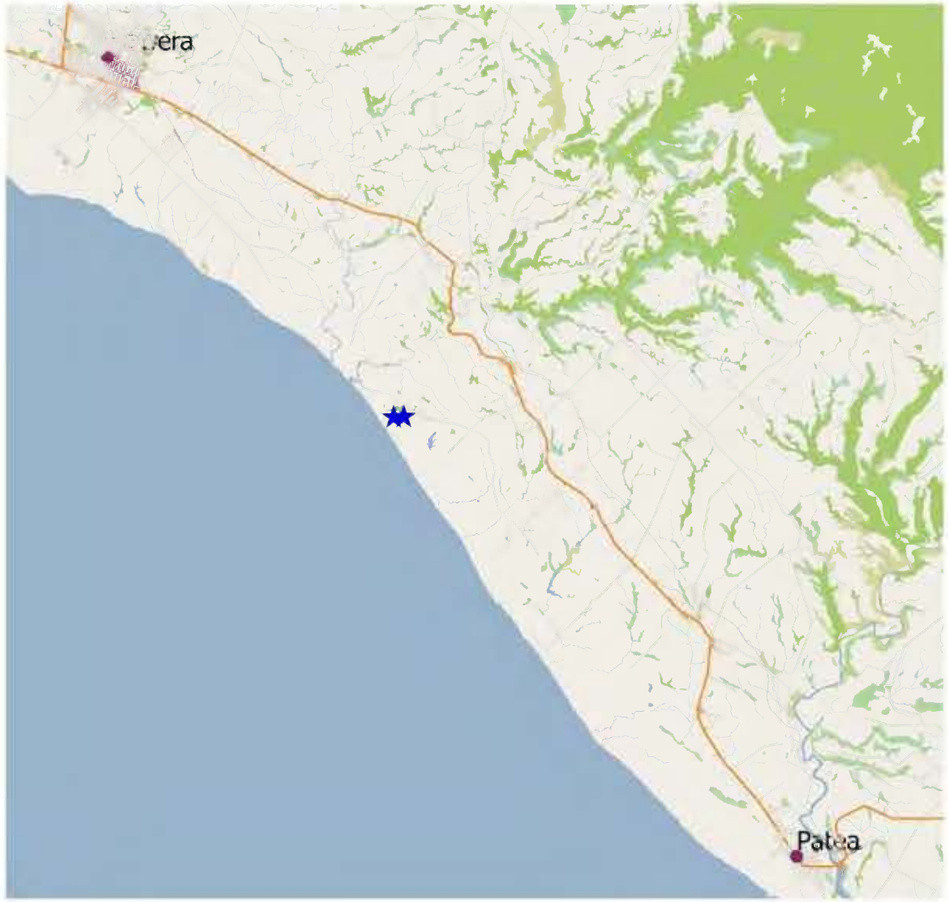

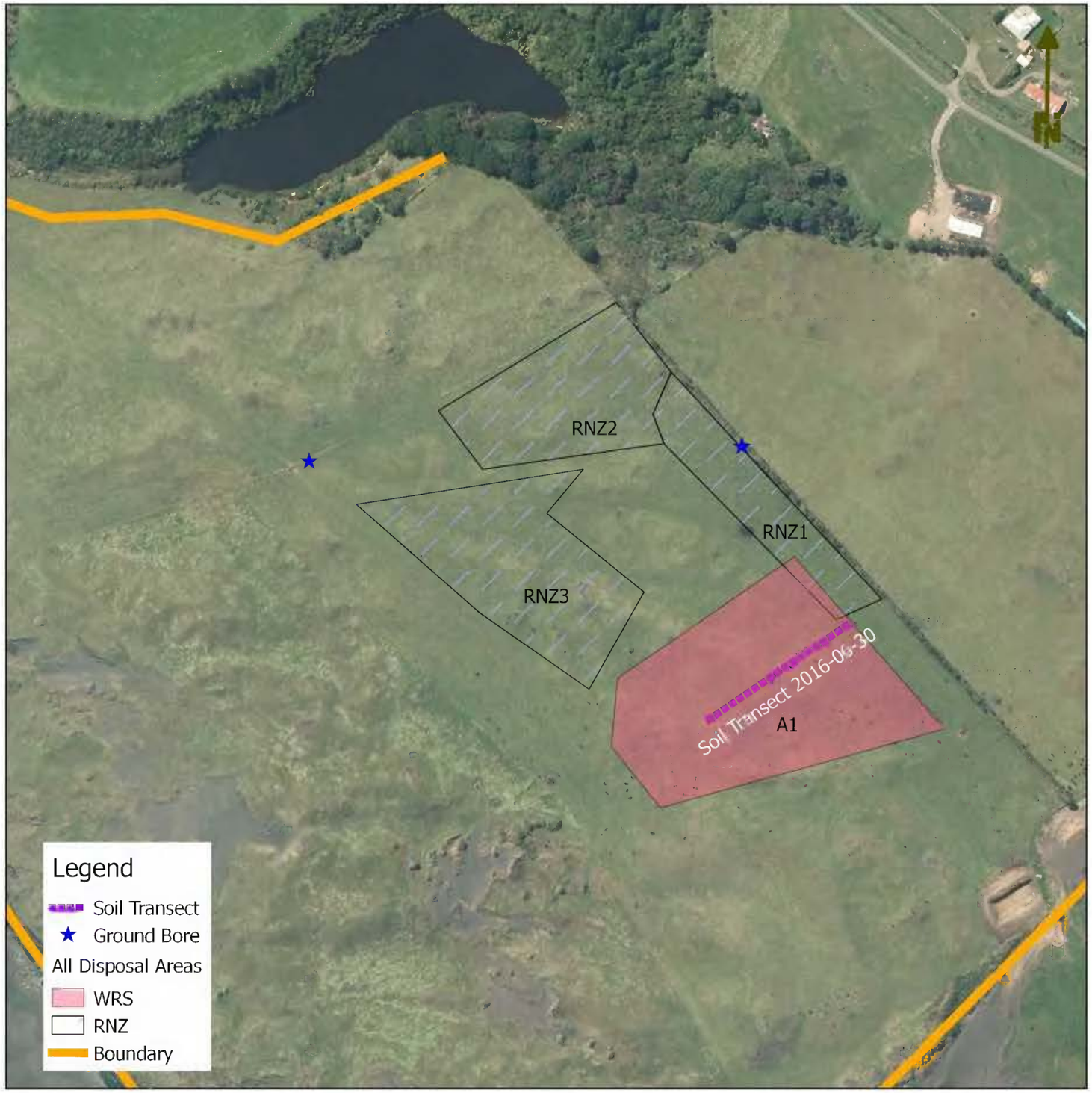

WASTE DISPOSAL

FARM	ADDRESS	ID	NUMBER	AREA (HA)	CONSENT NO	START DATE	END DATE	MUD TYPE
SYMES	Manawapou Rd	A	1	1.38	7795-1	12/12/2014	22/12/2014	DL/S
SYMES	Manawapou Rd	A	1	1.38	7795-1	29/10/2014	30/10/2014	SW
SYMES	Manawapou Rd	A	1	1.38	7795-1	01/07/2014	31/08/2014	SW
SYMES	Manawapou Rd	RNZ	3	0.86	7795-1	12/10/2013	27/01/2014	NA
SYMES	Manawapou Rd	RNZ	2	0.68	7795-1	19/09/2013	12/10/2013	NA
SYMES	Manawapou Rd	RNZ	1	0.43	7795-1	17/08/2013	19/09/2013	NA

Mud Type Codes
SW=Stormwater
DL/S= Drilling Liquids/Solids
NA=Not available

SOIL SAMPLING

FARM	ADDRESS	ID	TYPE	DATE
SYMES	Manawapou Rd	ENV	Soil Transect	2016-06-30

Rev	Date	Revision Details	By	Ver.	App.
C	09/2016	Mud Types inserted into table	BLW	KMB	KMB
B	07/2016	Soil Transect added	BLW	KMB	KMB
A	06/2015	RNZ data added	BLW	KMB	KMB

GeoSync
Land Surveying & Spatial Solutions
PO Box 8268 | New Plymouth 4342 | t 06 2811714
w geosync.co.nz | e info@geosync.co.nz

Datum:
NZGD2000/NZTM 2000 coordinates:ESPG 2193

Notes:
Aerial photography source TRC 2012
Stages 1-3 interpolated from RNZ

Project:
Manawapou

Owner:
Symes

WRS
Waste Services

Project No.
14037

Scale:
1:2500

Drawing No.
14037_02 Rev C

Tag Supple Jack												
Date	Symons Inv #	Contractor Inv #	Symons Doc #	Tag Doc #	Liquid Type - m³	Solid Type - m³	Transport Company	Total Hours	Company	Disposal Site	Source Site Location	Entered By
Nov-15				0654		**15**	Symons			Symes - Manawapou Rd	Supple Jack	
Nov-15				0655		**15**	Symons			Symes - Manawapou Rd	Supple Jack	
Nov-15				0656		**15**	Symons			Symes - Manawapou Rd	Supple Jack	
Nov-15				0657		**17**	Symons			Symes - Manawapou Rd	Supple Jack	
Nov-15				0658		**16**	Symons			Symes - Manawapou Rd	Supple Jack	
Nov-15				0659		**17**	Symons			Symes - Manawapou Rd	Supple Jack	
Nov-15				0660		**16**	Symons			Symes - Manawapou Rd	Supple Jack	
Nov-15				0661		**15**	Symons		TAG	Symes - Manawapou Rd	Supple Jack	
Nov-15				0662		**17.5**	Symons		TAG	Symes - Manawapou Rd	Supple Jack	
Nov-15				0663		**16.5**	Symons		TAG	Symes - Manawapou Rd	Supple Jack	
Nov-15				0664		**18**	Symons		TAG	Symes - Manawapou Rd	Supple Jack	
Nov-15				0665		**17**	Symons		TAG	Symes - Manawapou Rd	Supple Jack	
Nov-15				0666		**17**	Symons		TAG	Symes - Manawapou Rd	Supple Jack	
Nov-15				0667		**16**	Symons		TAG	Symes - Manawapou Rd	Supple Jack	
Nov-15				0668		**17**	Symons		TAG	Symes - Manawapou Rd	Supple Jack	
Nov-15				0669		**16.5**	Symons		TAG	Symes - Manawapou Rd	Supple Jack	
Nov-15				0670		**16**	Symons		TAG	Symes - Manawapou Rd	Supple Jack	
Nov-15				0671		**17**	Symons		TAG	Symes - Manawapou Rd	Supple Jack	
Nov-15				0672		**16**	Symons		TAG	Symes - Manawapou Rd	Supple Jack	
Nov-15				0673		**16**	Symons		TAG	Symes - Manawapou Rd	Supple Jack	
Nov-15				0674		**16**	Symons		TAG	Symes - Manawapou Rd	Supple Jack	
Nov-15				0675		**16**	Symons		TAG	Symes - Manawapou Rd	Supple Jack	
							Symons		TAG	Symes - Manawapou Rd	Supple Jack	
			Grand	**Totals**	**0**	**358.5**		**0**				

End of Monitoring Year 2015-16

Tag Cheal A Water Well

Date	Symons Inv #	Contractor Inv #	Symons Doc #	Tag Doc #	Liquid Type - m³	Solid Type - m³	Transport Company	Company	Estimated Cost	Disposal Site	Source Site Location	Entered By
14-06-16						24	Fale Transport	TAG		Manawapou	Cheal A Water Well	KMB
16-06-16					9.7		Fale Transport	TAG		Manawapou	Cheal A Water Well	KMB
18-06-16					17.7		Fale Transport	TAG		Manawapou	Cheal A Water Well	KMB
22-06-16						24	Fale Transport	TAG		Manawapou	Cheal A Water Well	KMB
			Totals		27.4	48						
					END of 2015-16 Monitoring Year							
11-08-16					?	19	Symons	TAG		Manawapou	Cheal A Water Well	KMB
11-08-16					?	19	Symons	TAG		Manawapou	Cheal A Water Well	KMB
Grand Totals					54.8	134		0				

OENZ Kauri C

Date	Symons Inv #	Contractor Inv #	Symons Doc #	Tag Doc #	Liquid Type - m³	Solid Type - m³	Transport Company	Total Hours	Company	Disposal Site	Source Site Location	Entered By
11-05-16						**20**	Symons		OENZ	Manawapou/ Symes	Kauri C	KMB
13-05-16						**42**	Symons		OENZ	Manawapou/ Symes	Kauri C	KMB
16-05-16						**84**	Symons		OENZ	Manawapou/ Symes	Kauri C	KMB
17-05-16						**94**	Symons		OENZ	Manawapou/ Symes	Kauri C	KMB
18-05-16						**71**	Symons		OENZ	Manawapou/ Symes	Kauri C	KMB
19-05-16						**91**	Symons		OENZ	Manawapou/ Symes	Kauri C	KMB
20-05-16						**40**	Symons		OENZ	Manawapou/ Symes	Kauri C	KMB
24-05-16						**20**	Symons		OENZ	Manawapou/ Symes	Kauri C	KMB
30-05-16						**160**	Symons		OENZ	Manawapou/ Symes	Kauri C	KMB
31-05-16						**20**	Symons		OENZ	Manawapou/ Symes	Kauri C	KMB
					Total May	**642**						
01-06-16						**58**	Symons		OENZ	Manawapou/ Symes	Kauri C	KMB
02-06-16						**78**	Symons		OENZ	Manawapou/ Symes	Kauri C	KMB
07-06-16						**36**	Symons		OENZ	Manawapou/ Symes	Kauri C	KMB
08-06-16						**78**	Symons		OENZ	Manawapou/ Symes	Kauri C	KMB
09-06-16						**150**	Symons		OENZ	Manawapou/ Symes	Kauri C	KMB
10-06-16						**60**	Symons		OENZ	Manawapou/ Symes	Kauri C	KMB
13-06-16						**45**	Symons		OENZ	Manawapou/ Symes	Kauri C	KMB
					Total June	**505**						
			Grand	**Totals**	**0**	**1147**		**0**				

End of Monitoring Year 2015-16

TAG NGAPAERURU

Date	Symons Inv #	Contractor Inv #	Symons Doc #	Tag Doc #	Liquid Type - m³	Solid Type - m³	Transport Company	Total Hours	Company	Disposal Site	Source Site Location	Entered By
			Grand	Totals	0	0		0				