

# Waste Remediation Services Ltd

## Waikaikai Landfarm

Monitoring Programme

Annual Report

2022-2023

Technical Report 23-04



Working with people | caring for Taranaki



Taranaki Regional Council  
Private Bag 713  
Stratford

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## Executive summary

Waste Remediation Services Ltd (the Company) operates a drilling waste landfarm (Waikaikai Landfarm) located off Lower Manutahi Road at Manutahi, South Taranaki, in the Mangaroa catchment.

This report for the period July 2022 to June 2023 describes the monitoring programme implemented by the Taranaki Regional Council (the Council) to assess the Company's environmental and consent compliance 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.

**During the monitoring period, the Company demonstrated an overall high level of environmental performance and an overall high level of administrative performance.**

The Company holds one resource consent, which includes 32 conditions setting out the requirements that the Company must satisfy. The consent allows the Company to discharge drilling waste from hydrocarbon exploration and production activities from well sites and contaminated soil onto and into land via landfarming.

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

Inspections found the site to be compliant on all occasions. Previously landfarmed areas held good pasture cover.

Groundwater sample results indicated compliance with consent conditions. Most of the samples demonstrated stability for the analytes tested. However, there is some evidence that recent landfarming has increased the analyte concentrations in one of the groundwater samples.

Soil sample analysis found that further bioremediation would be required prior to surrender of the two areas sampled.

For reference, in the 2022-2023 year, consent holders were found to achieve a high level of environment performance and compliance for 878 (87%) of a total of 1007 consents monitored through the Taranaki tailored monitoring programmes, while for another 96 (10%) of the consents a good level of environmental performance and compliance was achieved. A further 27 (3%) of consents monitored required improvement in their performance, while the remaining one (<1%) achieved a rating of poor.

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

This report includes recommendations for the 2023-2024 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 period July 2022 to June 2023 by the Taranaki Regional Council (the Council) on the monitoring programme associated with resource consents held by Waste Remediation Services Ltd hereafter referred to as the Company. The Company operates a landfarm situated on Lower Manutahi Road at Manutahi, South Taranaki, in the Mangaroa catchment.

The report includes the results and findings of the monitoring programme implemented by the Council in respect of the consent held by the Company, that relates to the discharges of drilling waste within the Mangaroa catchment, under the practice known as landfarming.

One of the intents of the *Resource Management Act 1991* (RMA) is that environmental management should be integrated across all media, so that a consent holder's use of water, air, and land should be considered from a single comprehensive environmental perspective. Accordingly, the Council generally implements integrated environmental monitoring programmes and reports the results of the programmes jointly. This report discusses the environmental effects of the Company's use of land and is the ninth annual report by the Council for the Waikakai Landfarm, and the seventh with WRS as the consent holder.

### 1.1.2 Structure of this report

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

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

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

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

**Section 4** presents recommendations to be implemented in the 2023-2024 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' in as much as is appropriate for each activity. Monitoring programmes are not only based on existing permit conditions, but also on the obligations of the RMA to assess the effects of the exercise of consents. In accordance with Section 35 of the RMA, the Council undertakes compliance monitoring for consents and rules in regional plans, and maintains an overview of the performance of resource users and consent holders. Compliance monitoring, including both activity and impact monitoring, enables the Council to continually re-evaluate its approach and that of consent holders to resource management and, ultimately, through the refinement of methods and considered responsible resource utilisation, to move closer to achieving sustainable development of the region's resources.

#### 1.1.4 Evaluation of environmental and administrative performance

Besides discussing the various details of the performance and extent of compliance by the consent holders, this report also assigns a rating as to each Company's environmental and administrative performance during the period under review. The rating categories are high, good, improvement required, and poor for both environmental and administrative performance. The interpretations for these ratings are found in Appendix III.

For reference, in the 2022-2023 year, consent holders were found to achieve a high level of environment performance and compliance for 878 (87%) of a total of 1007 consents monitored through the Taranaki tailored monitoring programmes, while for another 96 (10%) of the consents a good level of environmental performance and compliance was achieved. A further 27 (3%) of consents monitored required improvement in their performance, while the remaining one (<1%) achieved a rating of poor.<sup>1</sup>

## 1.2 Process description

### 1.2.1 Drilling waste

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

#### Drilling fluids

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

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<sup>1</sup> The Council has used these compliance grading criteria for more than 19 years. They align closely with the 4 compliance grades in the MfE Best Practice Guidelines for Compliance, Monitoring and Enforcement, 2018

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 ultimate conversion of sandy coastal sites prone to erosion into productive pasture. Results of an independent research project conducted by AgKnowledge Ltd (2013) have indicated that the re-contoured sand dunes, after the inclusion of the drilling wastes (as per the consents), and with the addition of appropriate fertilisers and water (irrigation) are capable of producing high quality clover-based pastures and thus increasing the value of the land from about \$3-4,000/ha to \$30-40,000/ha (2013).

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

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

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

In a previous monitoring period the consent was varied to allow for the re-application of impacted soils to an area which was initially utilised for landfarming in 2012. The consent holder undertook analysis to

quantify the concentrations of specific parameters in the soil which stipulated the area of land was within surrender criteria. Thus the decision was undertaken to allow for the second application of material.

More recently the consent holder requested the surrender of the areas of site which had been re-utilised for the landfarming and as a result of the request, additional soil sampling was undertaken by the Council.

### 1.3 Site location and description

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

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



Figure 1 WRS Waikaikai Landfarm and regional insert

A summary of the site data is provided below:

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

## 1.4 Resource consents

The Company holds one resource consent, the details of which are summarised in the table below. Summaries of the conditions attached to the permit are set out in Section 3 of this report.

A copy of the consent issued by the Council is included in Appendix I.

Table 1 Consent held by the Company

Consent number	Purpose	Granted	Review	Expires
<i>Discharges of waste to land</i>				
<b>5956-2.0</b>	To discharge drilling wastes from hydrocarbon exploration and production activities, oily wastes from wellsites, and contaminated soil onto and into land via landfarming	2017	2026	2034

## 1.5 Monitoring programme

### 1.5.1 Introduction

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

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

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

### 1.5.2 Programme liaison and management

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

- ongoing liaison with resource consent holders over consent conditions and their interpretation and application;
- discussion over monitoring requirements;



- preparation for any consent reviews, renewals or new consent applications;
- advice on the Council's environmental management strategies and content of regional plans; and
- consultation on associated matters.

### 1.5.3 Site inspections

The Waikaikai Landfarm was visited three times during the monitoring period. Sources of data being collected by the Company were identified and assessed, so that performance in respect of operation, internal monitoring, and supervision could be reviewed by the Council. The neighbourhood was surveyed for environmental effects.

### 1.5.4 Chemical sampling

#### Soil sampling

Soil sampling is undertaken to monitor the quality of the landfarming in the first instance. It also serves as a marker for the degree of remediation achieved in the landfarming process at the time of sample collection.

The methodology utilised by the Council for collecting soil samples across the landfarmed area is adapted from the Guidelines for the Safe Application of Biosolids to land in New Zealand (2003).

To collect the sample, a soil corer is inserted to a depth of 400 mm +/- to encompass the zone of application. Ten soil cores are collected, spaced 10 m apart. These ten soil cores are then composited to gain one representative soil sample of an application area. An example of an extracted soil core is provided in Photo 1.



Photo 1 An example of an extracted soil core

#### Soil analysis parameters

- Total heavy metals (arsenic, cadmium, chromium, copper, mercury, nickel, lead and zinc) and barium;
- Calcium, chloride, conductivity, magnesium, potassium, sodium, total soluble salts and sodium adsorption ratio (SAR);
- Total petroleum hydrocarbons (C<sub>7</sub>-C<sub>9</sub>, C<sub>10</sub>-C<sub>14</sub>, C<sub>15</sub>-C<sub>36</sub> and C<sub>7</sub>-C<sub>36</sub>), poly-cyclic aromatic hydrocarbons and mono-cyclic aromatic hydrocarbons;
- BTEX (benzene, toluene, ethylbenzene, m&p-Xylene and o-Xylene); and



- Moisture factor.

### Groundwater monitoring

Groundwater monitoring is also undertaken at this landfarm. The facility, as required by consent, contains an active groundwater monitoring network which is comprised of five groundwater monitoring wells.

All five wells were sampled four times this monitoring year to account for seasonal fluctuation and to assess for any adverse effects resulting from the exercise of the consent. The results are presented in Section 2.2.

The sampling was conducted through a peristaltic pump and field parameters are captured via a YSI flow through cell and a multi parameter probe. The samples are collected once field parameters have been stable within 8% for three consecutive readings.

### Groundwater analysis parameters

- Barium (dissolved and acid soluble), chloride, conductivity (@ 25°C), sodium, total dissolved salts (TDS), pH;
- Benzene, ethylbenzene, total petroleum hydrocarbons (speciated), toluene, meta-xylene, ortho-xylene; and
- In-situ readings: pH, conductivity, dissolved oxygen (DO), oxidation and reduction potential (ORP) and temperature.

### 1.5.5 Provision of consent holder provided data

In accordance with conditions 11 and 12 of the consent (5956-2.0), the Company must provide the Council with an annual report on the consent holder's operations in the 2022-2023 monitoring period. This report contains information relating to the receipt, handling, storage and disposal of wastes.

A copy of the Company annual report can be found in Appendix II of this compliance monitoring report.

## 2 Results

### 2.1 Inspections

#### 25 October 2022

Compliance monitoring inspection was undertaken to assess compliance with resource consent conditions. The inspection found that Pit 2 was empty (no liner), Pit 1 was full with solids, and Pit 3 contained liquids. Good pasture growth on the recently seeded area. The seaward land spreading area was inspected. No barren patches were noted.

Overall, there was no issue to note at the time of inspection and the Company was found compliant.

#### 6 March 2023

Inspection undertaken to assess compliance with resource consent conditions. The inspection found that Pit 2 with no liner was empty. Pit 1 and 3 contained product but had ample free board. Landfarming activities have occurred in the area in front of the storage facility in recent months. The seaward landfarmed areas were inspected. Good pasture growth. Request the Company to submit pit integrity report.

Overall, there was no issues to note and the Company was found compliant on the assessed conditions.

#### 26 June 2023

Inspection undertaken to assess compliance with resource consent conditions. The inspection found that Pit 2 with no liner was completely empty. Pit 1 contained solids and Pit 3 contained liquids. Landfarming activities have recently been undertaken in the area south east of the storage pits. Good application rate. The landfarmed area directly in front of the pits had good pasture strike. The seaward landfarmed area was inspected. Good pasture growth and no barren patches.

Overall, there was no issues to note and the Company was found compliant under the conditions assessed.

### 2.2 Results of receiving environment monitoring

#### 2.2.1 Groundwater monitoring

The Waikaikai Landfarm contains five groundwater monitoring wells. These wells, which were a consent requirement, are situated in two locations (Figure 2). Three wells are located down gradient from the lined storage cells (GND2290, 2291 and 2292). The intention of these wells is to assess the groundwater in the immediate vicinity of the storage cells. The remaining two wells (GND2293 and 2294) are situated on the south western boundary of the landfarm to assess for any potential offsite contaminant migration. The results of the sample analysis for the four monitoring rounds, is provided in Tables 2-6.

Where the analyses of total petroleum hydrocarbons (C<sub>7</sub>-C<sub>9</sub>, C<sub>10</sub>-C<sub>14</sub>, C<sub>15</sub>-C<sub>36</sub>) and benzene, toluene, ethylbenzene and xylenes (m, o & p) (collectively termed BTEX), were recorded below the laboratory defined limit of detection (LOD), they have not been tabulated.



Figure 2 WRS Waikaikai Landfarm groundwater monitoring well locations

Table 2 GND 2290 2022-2023 monitoring period

GND2290	Collected	05 Aug 2022	30 Nov 2022	29 Mar 2023	18 May 2023
Parameter	Time	11:10	10:55	10:35	12:35
Temperature	°C	15.8	16.3	15.7	16.2
Electrical Conductivity (EC)	mS/m	40.2	39.3	32.2	34.2
pH	pH Units	6.8	6.6	7.1	6.8
Chloride	g/m <sup>3</sup>	47	23	13.5	24
Total Sodium	g/m <sup>3</sup>	18.7	19.3	17.3	17
Acid Soluble Barium	g/m <sup>3</sup>	< 0.11	< 0.11	< 0.11	< 0.11
Dissolved Barium	g/m <sup>3</sup>	0.040	0.037	0.029	0.030
Total Dissolved Solids (TDS)	g/m <sup>3</sup>	270	270	260	290
Toluene	g/m <sup>3</sup>	<0.0010	<0.0010	<0.0010	0.0069

All analytes remained stable throughout the monitoring period in bore GND2290. Figures 3, 4 and 5 show the long term monitoring records for chloride, TDS and EC respectively at this site, although variable, levels remain fairly stable.

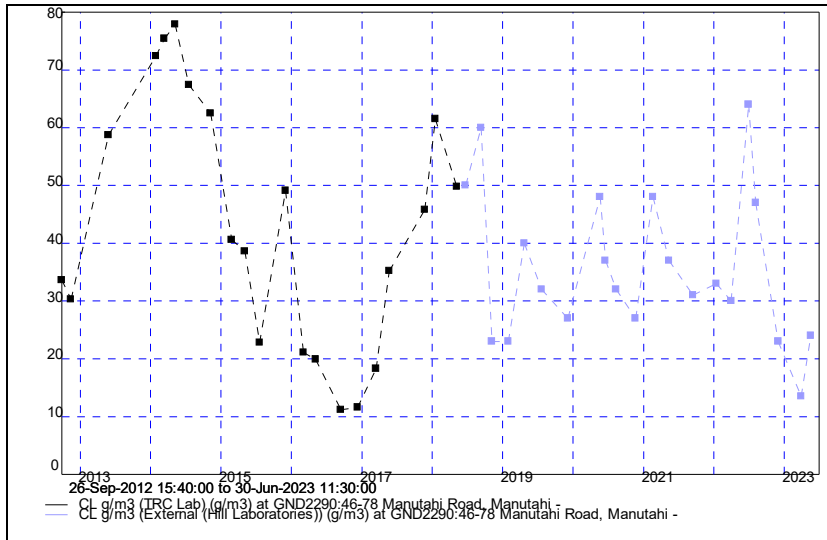


Figure 3 Long term chloride monitoring GND2290 2012-2023

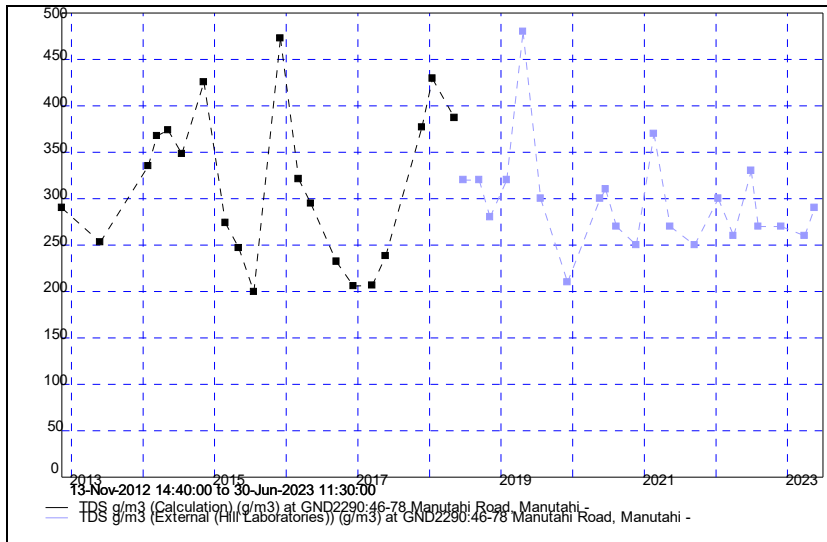


Figure 4 Long term TDS monitoring GND2290 2012-2023

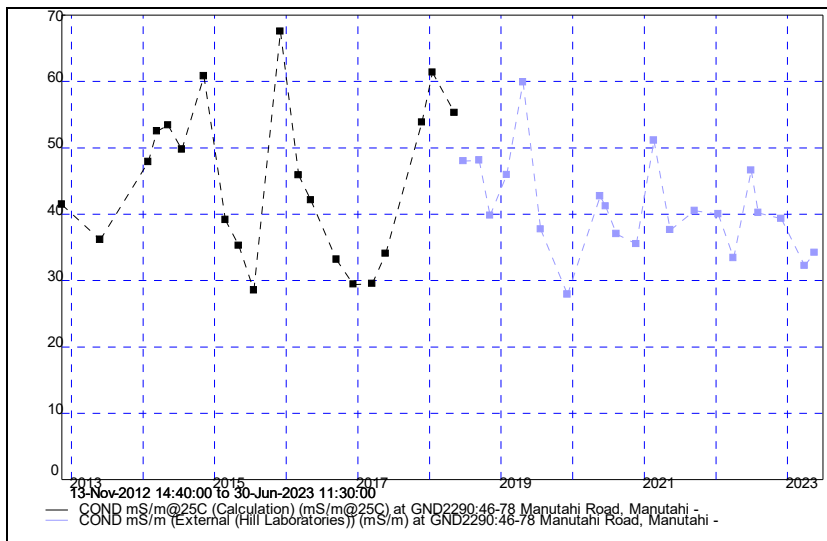


Figure 5 Long term EC monitoring GND2290 2012-2023

Table 3 GND2291 2022-2023 monitoring period

GND2291	Collected	05 Aug 2022	30 Nov 2022	29 Mar 2023	18 May 2023
Parameter	Time	10:35	10:17	10:00	11:55
Temperature	°C	15.7	15.7	14.8	15.3
Electrical Conductivity (EC)	mS/m	129.9	103.3	99.1	94.8
pH	pH Units	6.3	6.4	6.6	6.5
Chloride	g/m <sup>3</sup>	210	129	134	111
Total Sodium	g/m <sup>3</sup>	78	77	74	74
Acid Soluble Barium	g/m <sup>3</sup>	< 0.11	< 0.11	< 0.11	< 0.11
Dissolved Barium	g/m <sup>3</sup>	0.021	0.018	0.021	0.019
Total Dissolved Solids (TDS)	g/m <sup>3</sup>	890	700	700	670

All analytes displayed a relatively stable trend for the monitoring period for bore GND2291. The first monitoring round in August 2022 recorded slightly elevated chloride, TDS, and EC, compared to those for November 2022, March and May 2023. Figures 6, 7 and 8 show the long term monitoring record for these parameters at this site.

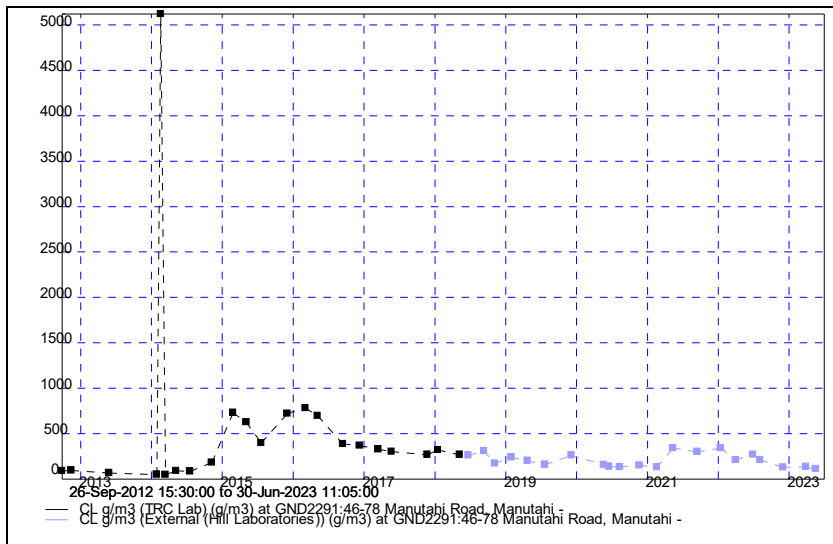


Figure 6 Long term chloride monitoring GND2291 2012-2023

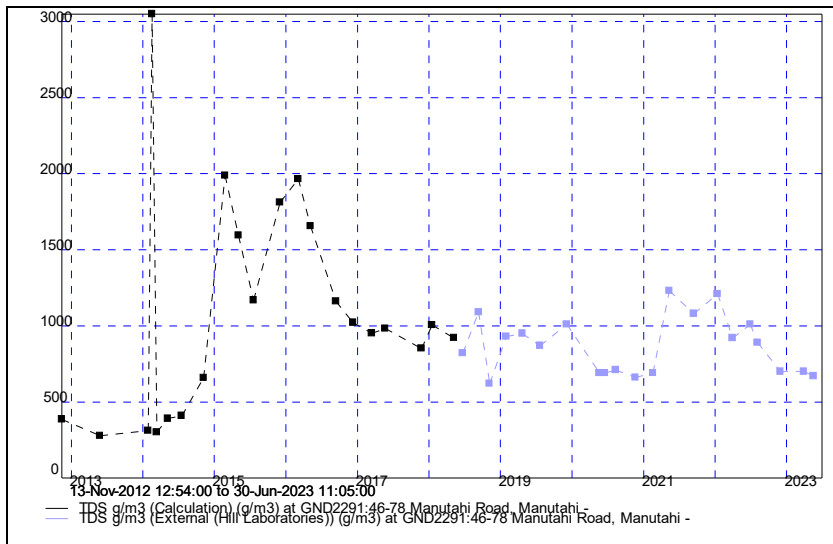


Figure 7 Long term TDS monitoring GND2291 2012-2023

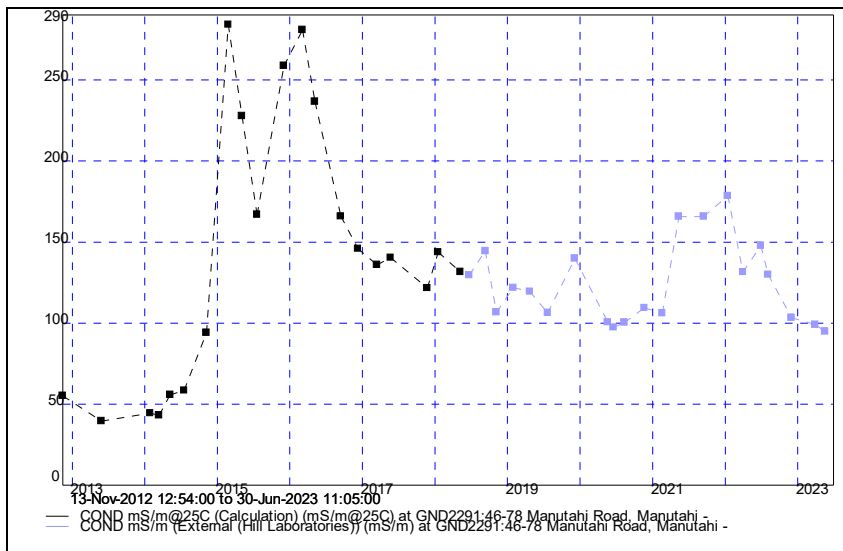


Figure 8 Long term EC monitoring GND2291 2012-2023

Table 4 GND2292 2022-2023 monitoring period

GND2292	Collected	05 Aug 2022	30 Nov 2022	29 Mar 2023	18 May 2023
Parameter	Time	11:45	11:03	11:05	11:05
TEMP	°C	15.7	16.1	15.5	15.7
Electrical Conductivity (EC)	mS/m	87.1	69.9	63.1	54.1
pH	pH Units	6.5	6.4	6.7	6.6
Chloride	g/m <sup>3</sup>	140	97	97	67
Total Sodium	g/m <sup>3</sup>	86	73	65	57
Acid Soluble Barium	g/m <sup>3</sup>	< 0.11	< 0.11	<0.11	< 0.11
Dissolved Barium	g/m <sup>3</sup>	0.097	0.065	0.050	0.039
Total Dissolved Solids (TDS)	g/m <sup>3</sup>	490	430	400	350
Toluene	g/m <sup>3</sup>	<0.0010	<0.0010	<0.0010	0.0049

All analytes demonstrated general stability, with slightly elevated concentrations of EC, chloride and TDS recorded in the August 2022 sample at bore GND2292 during the monitoring period. When compared to the long term trends, as demonstrated by Figures 9 to 11, the levels are continuing to show an overall decreasing trend.

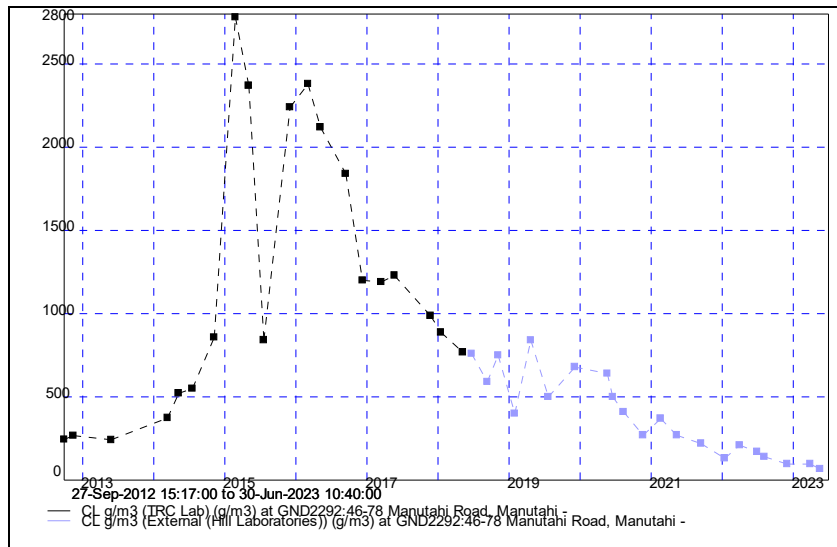


Figure 9 Long term chloride monitoring GND2292 2012-2023

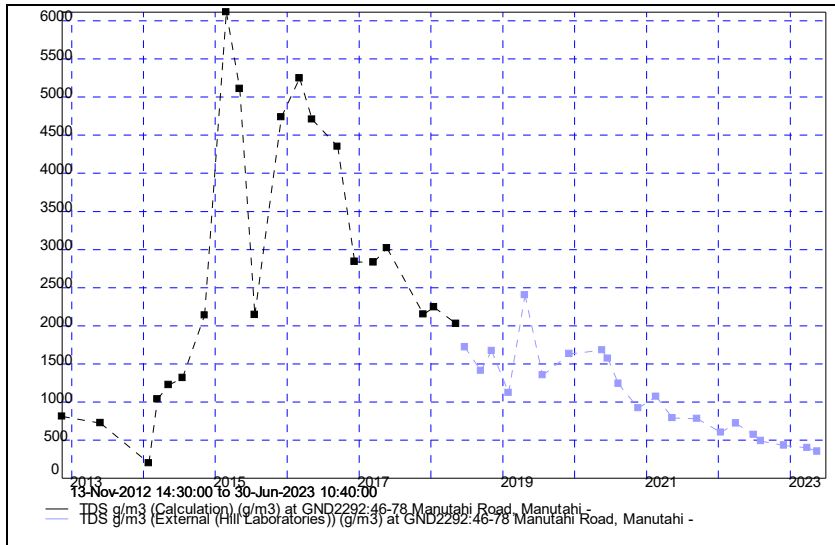


Figure 10 Long term TDS monitoring GND2292 2012-2023

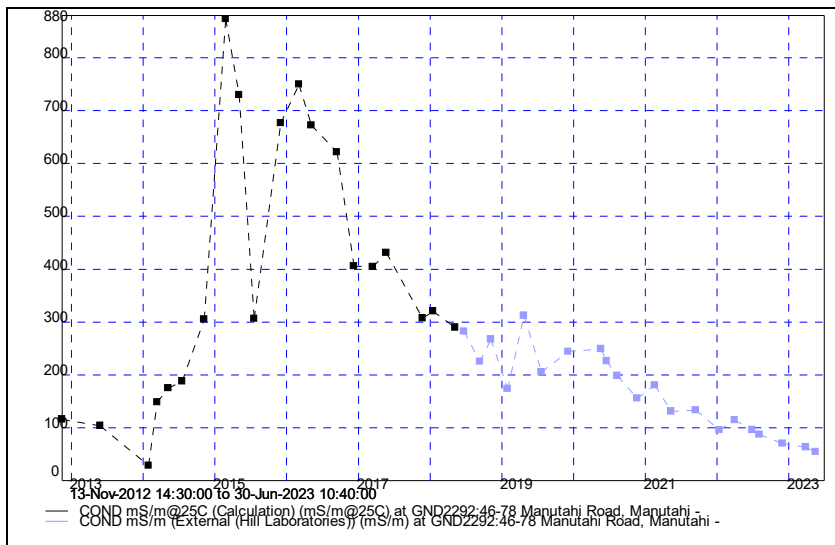


Figure 11 Long term EC monitoring GND2292 2012-2023



Table 5 GND2293 2022-2023 monitoring period

GND2293	Collected	05 Aug 2022	30 Nov 2022	29 Mar 2023	18 May 2023
Parameter	Time	13:15	12:25	11:40	13:20
TEMP	°C	16.3	16.2	15.3	15.9
Electrical Conductivity (EC)	mS/m	109.3	67.7	94.9	94.7
pH	pH Units	7.0	7.1	7.2	7.0
Chloride	g/m <sup>3</sup>	230	113	185	187
Total Sodium	g/m <sup>3</sup>	52	31	53	64
Acid Soluble Barium	g/m <sup>3</sup>	<0.11	<0.11	<0.11	<0.11
Dissolved Barium	g/m <sup>3</sup>	0.105	0.070	0.086	0.104
Total Dissolved Solids (TDS)	g/m <sup>3</sup>	670	410	660	630

All analytes remained relatively stable throughout the monitoring period for bore GND2293. Slight reductions in TDS, chloride and EC were recorded in November 2022. Results were similar to the previous monitoring period, and concentrations for chloride, TDS and EC are generally stabilising as shown in Figures 12, 13 and 14.

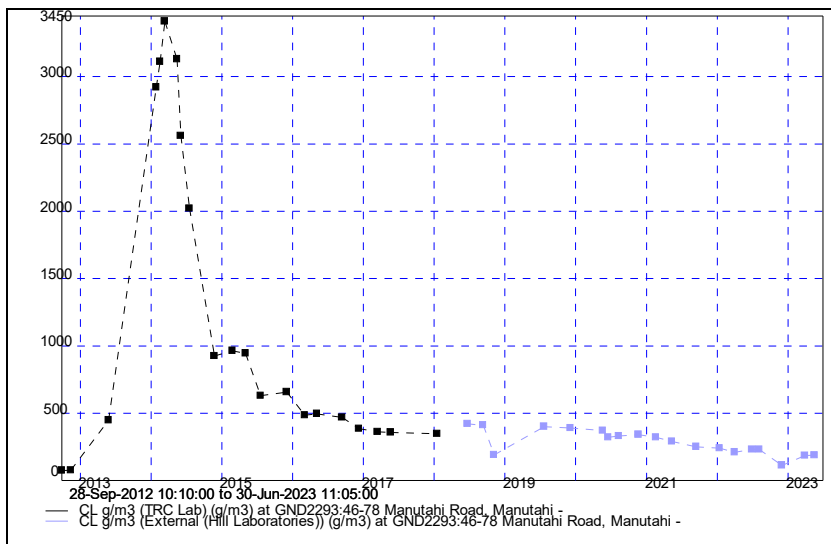


Figure 12 Long term chloride monitoring GND2293 2012-2023

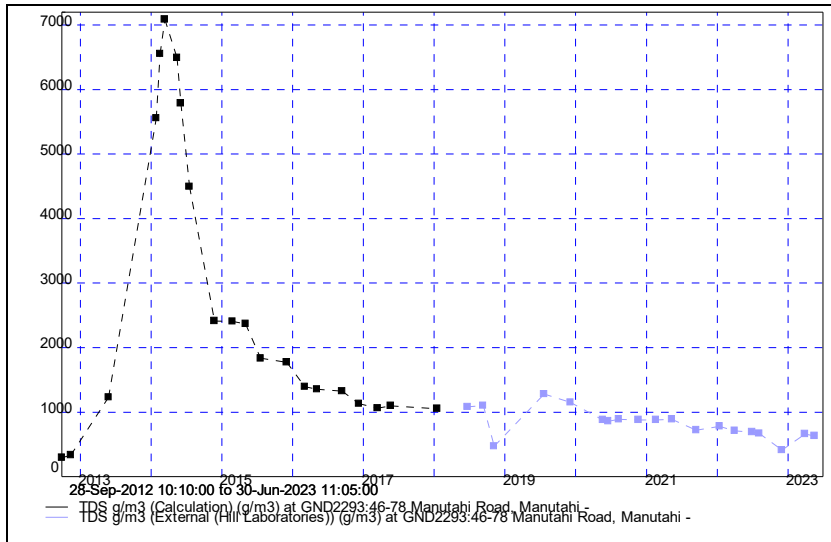


Figure 13 Long term TDS monitoring GND2293 2012-2023

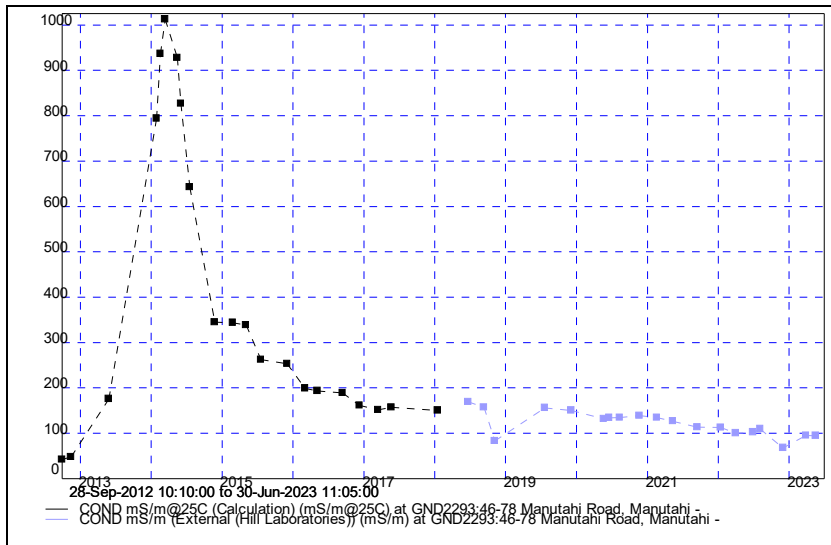


Figure 14 Long term EC monitoring GND2293 2012-2023

Table 6 GND2294 2022-2023 monitoring period

GND2294	Collected	5 Aug 2022	1 Dec 2022	29 Mar 2023	18 May 2023
Parameter	Time	13:55	11:45	12:15	14:10
TEMP	°C	15.0	15.5	15.3	15.2
Electrical Conductivity (EC)	mS/m	182.2	122.5	101.5	144.0
pH	pH Units	6.8	7.3	7.0	6.8
Chloride	g/m <sup>3</sup>	540	300	210	340
Total Sodium	g/m <sup>3</sup>	71	63	58	67
Acid Soluble Barium	g/m <sup>3</sup>	< 0.11	< 0.11	< 0.11	< 0.11
Dissolved Barium	g/m <sup>3</sup>	0.053	0.034	0.027	0.037
Total Dissolved Solids (TDS)	g/m <sup>3</sup>	1200	900	750	1390

The monitoring of GND2294 indicated a stabilising trend of all analytes throughout the monitoring period except for TDS, which increased in concentration during May 2023. However, these levels remain elevated compared to the baseline as shown in Figures 15, 16 and 17 for chloride, TDS and EC respectively. It is likely that the increase in analyte concentrations continues to be associated with the landfarming activity from area W2205 and W2305, the shallow groundwater table and sandy soils.

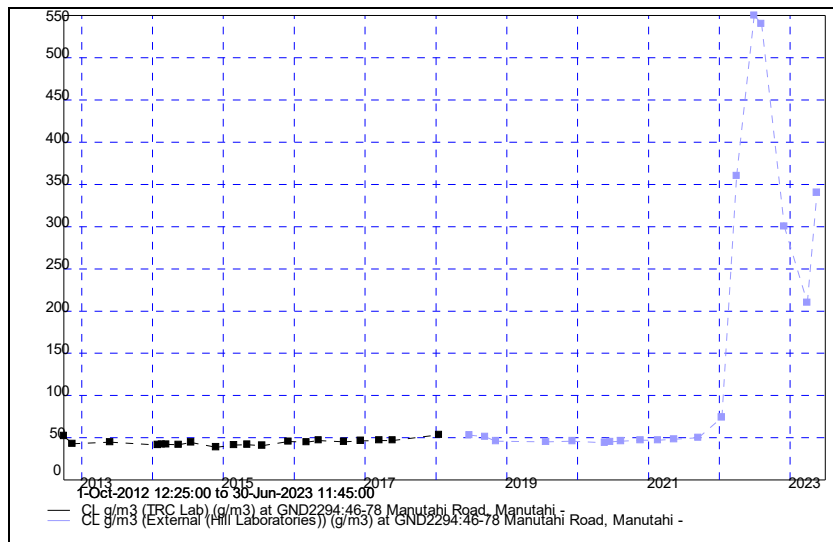


Figure 15 Long term chloride monitoring GND2294 2012-2023

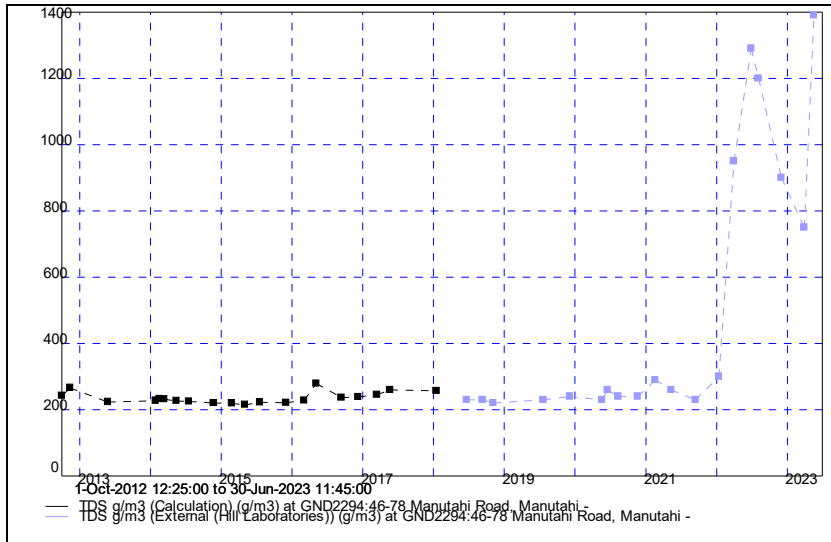


Figure 16 Long term TDS monitoring GND2294 2012-2022

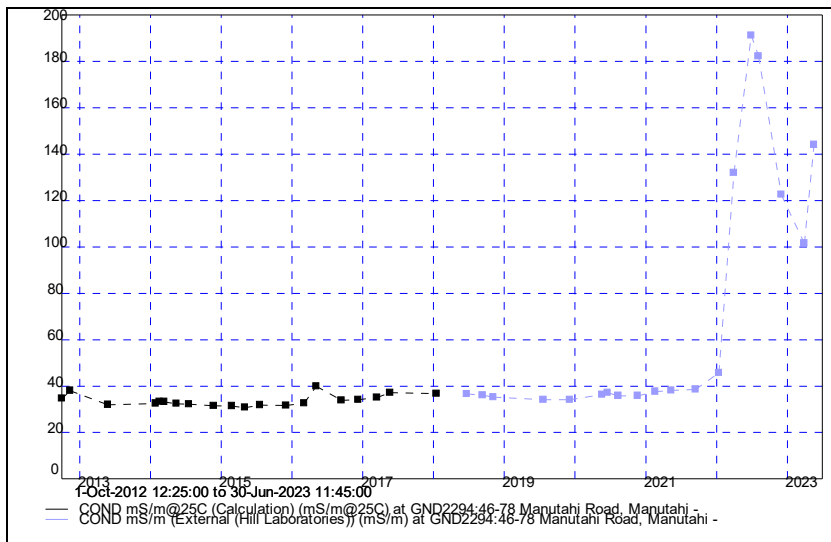


Figure 17 Long term EC monitoring GND2294 2012-2022

The analysis of the groundwater monitoring network at Waikaikai landfarm indicated results were within consent condition limits for the 2022-2023 monitoring period. For most of the bores, the analytes remain stable or slightly decreasing during the monitoring period.

Analyte levels in GND2294 have mostly stabilised during this monitoring period, however they remain at higher concentrations than the baseline during previous monitoring periods. Given the location of this bore (on the boundary of the site) it is likely that the increase is due to the activity in area W2205 and recent activity in area W2305, together with the sandy soils and shallow groundwater. It is therefore important to continue monitoring the trend of analytes in this bore during the 2023-2024 period.

## 2.2.2 Soil monitoring

During this monitoring period spreading and incorporation of waste material into the iron sands continued in a contingency spreading area within area W2205. The areas farmed, including previously landfarmed areas are depicted in the consent holder provided map (Figure 18). Once this area had been fully utilised a new adjoining area to the south-east and east of W2205 was prepared, namely area W2305. Area W2205 was rehabilitated in May 2022 and good pasture has since been established. The new area W2305 remains active at the end of June 2023 with additional adjoining areas in preparation.

Six samples were collected from the site. Two transects were taken from the previously landfarmed area W1911. Area W1911 was farmed during the 2019-2020 monitoring period. Four transects were taken from area W2205 which was farmed during 2021-2023. Figure 19 shows the location of the soil transects for the 2022-2023 monitoring period.

The analysis is provided in Table 7. Please note that analytes which did not record results above the LOD were not tabulated except for those with specific consent limits.

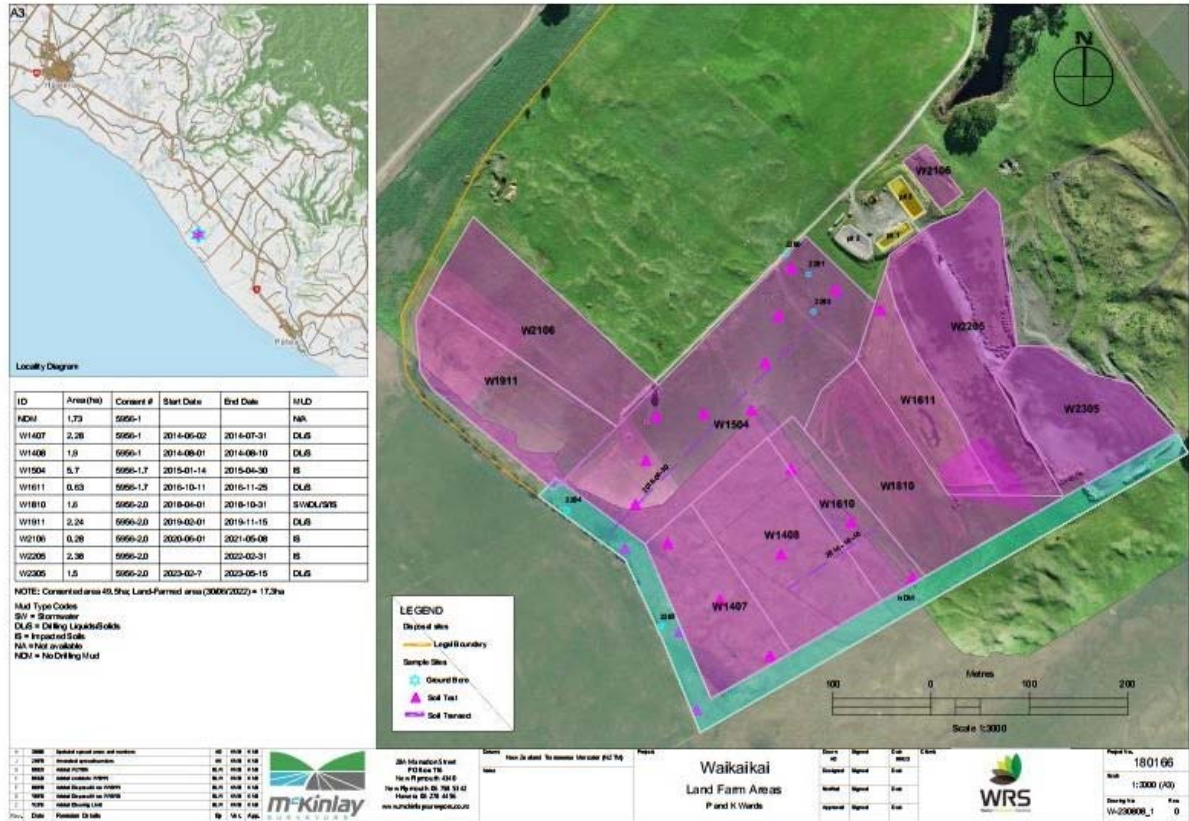


Figure 18 WRS Waikakai Landfarm landfarmed areas (image provided by WRS)\*

\*(Note that the soil transects and soil samples are not from monitoring period 2022-2023, but from a previous period – current transects are shown in Figure 19).

Table 7 WRS Waikaikai Landfarm soil monitoring 2022-2023 monitoring period

WRS Waikaikai soil	Site	Consent surrender limit 5956-2.0	Transect 1 W1911	Transect 2 W1911	Transect 3 W2205	Transect 4 W2205	Transect 5 W2205	Transect 6 W2205
2022-2023	Collected		7 June 2023	7 June 2023	7 June 2023	7 June 2023	7 June 2023	7 June 2023
Parameter	Unit/Time		10:43	11:15	12:10	12:35	13:05	13:35
Dry Matter (Env)	g/100 g as rcvd		86	86	89	86	88	84
1- Methylanthalene	mg/kg dry wt		< 0.012	< 0.012	< 0.012	0.063	0.014	0.056
2-Methylanthalene	mg/kg dry wt		< 0.012	< 0.012	< 0.012	0.08	0.024	0.075
Anthracene	mg/kg dry wt		< 0.012	< 0.012	< 0.012	0.014	< 0.012	< 0.012
Naphthalene	mg/kg dry wt	7.2	<0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Perylene	mg/kg dry wt		< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	0.021
Phenanthrene	mg/kg dry wt		< 0.012	< 0.012	< 0.012	0.062	< 0.012	0.029
Pyrene	mg/kg dry wt		< 0.012	< 0.012	< 0.012	0.016	< 0.012	< 0.012
Fluoranthene	mg/kg dry wt		< 0.012	< 0.012	< 0.012	0.013	< 0.012	< 0.012
Fluorene	mg/kg dry wt		< 0.012	< 0.012	< 0.012	0.047	< 0.012	< 0.012
Chrysene	mg/kg dry wt		<0.012	<0.012	<0.012	0.021	<0.012	<0.012
Total of Reported PAHs in soil	mg/kg dry wt		<0.3	<0.3	<0.3	0.4	<0.3	<0.3
pH	pH Units		7.2	7.9	7.3	8.4	7.9	7.4
Calcium (Sat Paste)	mg/L		123	145	152	290	881	2200
Magnesium (Sat Paste)	mg/L		20	21	18	29	62	64
Sodium (Sat Paste)	mg/L		32	43	27	53	126	361
Conductivity from soluble salts	mS/cm	2.9	< 0.2	0.2	< 0.2	1.0	< 0.2	< 0.2
Sodium Absorption Ratio (SAR)		18	0.7	0.9	0.6	0.8	1.1	2.1
Soluble Salts	g/100 g dry wt	0.25	< 0.05	< 0.05	< 0.05	0.07	0.16	0.30

WRS Waikaikai soil	Site	Consent surrender limit 5956-2.0	Transect 1 W1911	Transect 2 W1911	Transect 3 W2205	Transect 4 W2205	Transect 5 W2205	Transect 6 W2205
2022-2023	Collected		7 June 2023	7 June 2023	7 June 2023	7 June 2023	7 June 2023	7 June 2023
Parameter	Unit/Time		10:43	11:15	12:10	12:35	13:05	13:35
C10 - C14	mg/kg dry wt	150	210 <sup>2</sup> [VM1]	430	570	1420	1480	5000
C15 - C36	mg/kg dry wt	1,300	980	1950	2300	5400	3900	11900
Total hydrocarbons (C7 - C36)	mg/kg dry wt		1180	2400	2900	6900	5400	16900
Chloride	mg/kg dry wt	700	26	29	31	149	470	1340
Total Recoverable Barium	mg/kg dry wt	10,000	2400	2600	760	3300	1560	3200
Total Recoverable Calcium	mg/kg dry wt		5800	7200	4300	7500	7000	12000
Total Recoverable Chromium	mg/kg dry wt	600	16	17	16	19	15	19
Total Recoverable Copper	mg/kg dry wt	100	12	14	10	15	11	19
Total Recoverable Lead	mg/kg dry wt	160	2.3	3.4	2.4	6.0	3.1	6.7
Total Recoverable Magnesium	mg/kg dry wt		2200	2200	2100	2300	2300	3000
Total Recoverable Nickel	mg/kg dry wt	60	8	9	8	10	8	11
Total Recoverable Potassium	mg/kg dry wt		450	520	340	620	510	1020
Total Recoverable Sodium	mg/kg dry wt	460	520	490	300	350	390	550
Total Recoverable Zinc	mg/kg dry wt	300	75	78	66	70	52	76
Total Recoverable Arsenic	mg/kg dry wt		< 2	< 2	< 2	< 2	< 2	3

<sup>2</sup> Figures in red are above the consent surrender limit.

The analysis of the soil samples indicated the following:

- Sodium absorption ratio (SAR) was below 2.1 for area W2205 and less than 0.9 for area W1911, the limit is set at <18.
- In terms of petroleum hydrocarbons:
  - C<sub>7</sub>-C<sub>9</sub> was not recorded above the LOD and was not tabulated.
  - C<sub>10</sub>-C<sub>14</sub> ranged from 210-430 mg/kg for area W1911 and 570-5000 mg/kg for area W2205. The limit for surrender is set at <150 mg/kg. All six transects are currently above the limit for surrender for this analyte.
  - C<sub>15</sub>-C<sub>36</sub> ranged 980-1950 mg/kg for area W1911 and 2300-11900 mg/kg for area W2205, the limit for surrender is <1,300 mg/kg. The only transect below the limit is Transect 1 in area W1911.
- Soil chloride ranged 26-1340 mg/kg. The surrender concentration must be below 700 mg/kg. This analyte was only above the surrender limit on one location (Transect 6 area W2205) and remained below in the other transects.
- Total recoverable sodium ranged from 490-520 mg/kg in area W1911 and 300-550 mg/kg in area W2205, the surrender limit is 460 mg/kg. Both transects in area W1911 were above the limit, with only one transect (Transect 6) above the limit in area W2205.

The resampling of area W1911 occurred in 2022-2023 due to concentrations of TPH C<sub>10</sub>-C<sub>14</sub> & C<sub>15</sub>-C<sub>36</sub>, being above the consent criteria of surrender. The current results from 2022-2023 indicate that area W1911 still cannot be surrendered mainly due to concentrations of TPH C<sub>10</sub>-C<sub>14</sub> & C<sub>15</sub>-C<sub>36</sub> remaining above the consent criteria for surrender. Sodium concentrations have marginally increased in 2022-2023 since the previous monitoring period and now no longer meet the limit of surrender. Disposal at this site occurred from February – November 2019. Results have shown a decline in TPH levels in comparison to the previous year's concentrations, and it is anticipated that TPH levels will continue to decline with time.

Resampling of area W2205, landfarmed in 2021-2022, occurred due to concentrations of TPH C<sub>10</sub>-C<sub>14</sub> & C<sub>15</sub>-C<sub>36</sub>, chloride and soluble salts being above the consent criteria. The current results from 2022-2023 indicate that area W2205 still cannot be surrendered due to concentrations of TPH C<sub>10</sub>-C<sub>14</sub> & C<sub>15</sub>-C<sub>36</sub>, chloride, soluble salts and total recoverable sodium (in one transect) remaining above the consent criteria for surrender. Rehabilitation of the site was completed in 2022 and it is anticipated with adequate aerobic soil conditions, with time these levels will continue to decline.

Soil monitoring in the upcoming monitoring period will assess the degree of bioremediation over time for both areas.





Figure 19 Location of soil transects 1 to 6

## 2.3 Consent holder provided information

As required by their consent, the Company provided the Council with an annual report of operations undertaken at the Waikaikai Landfarm during this monitoring period. This is attached in Appendix II.

In addition, the Company have been proactive in communications with the Council, including providing associated analysis of material accepted at the landfarm. They also undertake the necessary notification of deliveries and landfarming operations.

The log of material delivered is provided below (adapted from the Company annual report).

**Table 8 Summary of inwards drilling waste register WRS Waikaikai Landfarm 2022-2023**

Date	Source	Customer	Remediation Site m <sup>3</sup>		
			Solid	Liquid	Total
Sep 22	GPL Moturoa	GPL	18	16	34
	<b>GPL Moturoa Total</b>		<b>18</b>	<b>16</b>	<b>34</b>
Oct 22	Tūrangi B 18	GPL	676	216	892
Nov 22	Tūrangi B 18	GPL	120	170	290
	<b>Tūrangi B 18 Total</b>		<b>796</b>	<b>386</b>	<b>1182</b>
Feb 23	Tūrangi B 19	GPL	180	132	312
	Tūrangi B 19	GPL	588	306	894
	Tūrangi B 19	GPL	80	62	142
	<b>Tūrangi B 19 Total</b>		<b>848</b>	<b>500</b>	<b>1348</b>
Dec 22	Tūrangi A T2	GPL	-	16	16
Jan 23	Tūrangi A T2	GPL	18	126	144
Feb 23	Tūrangi A T2	GPL	-	118	118
	<b>Tūrangi A T2 Total</b>		<b>18</b>	<b>260</b>	<b>278</b>
Jan 22	Tūrangi A 18	GPL	-	18	18
	<b>Tūrangi A 18 Total</b>		<b>-</b>	<b>18</b>	<b>18</b>
Apr 23	Tūrangi C-2	GPL	126	118	244
May 23	Tūrangi C-2	GPL	240	16	256
	<b>Tūrangi C-2 Total</b>		<b>366</b>	<b>134</b>	<b>500</b>
May 23	Tūrangi C-1	GPL	216	291	507
Jun 23	Tūrangi C-1	GPL	66	268	334
	<b>Tūrangi C-1 Total</b>		<b>282</b>	<b>559</b>	<b>841</b>
Dec 22	Kapuni A 8/18	Todd Energy	35	-	35
	<b>Kapuni A 8/18 Total</b>		<b>35</b>	<b>-</b>	<b>35</b>
Jan 23	70 Leach Street	Chris Bell	3	-	3
	<b>70 Leach Street Total</b>		<b>3</b>		<b>3</b>

Date	Source	Customer	Remediation Site m <sup>3</sup>		
			Solid	Liquid	Total
Mar 23	Manutahi C	Westside	12	-	12
	<b>Manutahi C Total</b>		<b>12</b>	<b>-</b>	<b>12</b>
Apr 23	MHW D Flare Pit	Todd Energy	-	320	320
	<b>MHW D Flare Pit Total</b>		<b>-</b>	<b>320</b>	<b>320</b>
Apr 23	Cheal B (in MT)	Tamarind	305	329	634
	<b>Cheal B Total</b>		<b>305</b>	<b>329</b>	<b>634</b>
<b>Annual Total to 30 June 2023 (m3)</b>			<b>2683</b>	<b>2522</b>	<b>5205</b>

GPL – Greymouth Petroleum

## 2.4 Incidents, investigations, and interventions

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

For all significant compliance issues, as well as complaints from the public, the Council maintains a database record. The record includes events where the individual/organisation concerned has itself notified the Council. Details of any investigation and corrective action taken are recorded for non-compliant events.

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 individual/organisation is indeed the source of the incident (or that the allegation cannot be proven).

In the 2022-2023 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

During the 2022-23 period until the allowable spreading rate had been attained, periodic spreading and incorporation of materials received into the iron sands was undertaken in a contingency spreading area within W2205 (Figure 18). Once this area had been fully utilised a new adjoining area to the south-east and east of W2205 was prepared, identified as area W2305. Liquid/solid wastes were received from Greymouth Petroleum's Tūrangi B 18, Tūrangi B 19, Tūrangi A T2, Tūrangi A 18, Tūrangi C-2, Tūrangi C-1, Todd Energy's Kapuni A 8/18, MHW D Flare Pit, Chris Bell's 70 Leach Street, Westside's Manutahi C, and Tamarind's Cheal B.

Area W2205 was rehabilitated in May 2022, and the new area W2305 remained active at the end of June 2023 with additional adjoining areas in preparation.

At the end of the monitoring period all the storage pits were full, awaiting updates to be provided by Greymouth Petroleum Ltd's drilling programme for the next months. Drilling during the monitoring period halted in June 2023 due to the depressed gas market prices and demand.

Pit 2 was decommissioned in 2021, the liner removed and a layer of clay placed to reduce the mobilisation of sand on the pit walls and floor. This pit has been unused for the entire monitoring period, and will be modified in the following year if mud volumes received increase in the future and the need arises. Both operational Pits 1 and 3 were utilised for this monitoring period and were visually inspected during April 2023 by Red Jacket Engineering. Minor liner repair at the north-eastern end of Pit 1 was required and undertaken.

During inspections there was no issues to note, and the Company was found compliant under the conditions assessed. Notifications, associated waste analysis, the Company's annual report and the Pit Integrity report were provided to the Council.



Photo 2 Pasture strike Area W2205 28/6/23

(Provided by WRS)





Photo 3 Pit 3 stirring and pumping

(Provided by WRS)

### 3.2 Environmental effects of exercise of consents

The previously landfarmed area within W1911 was sampled again this monitoring period. The corresponding results indicated that the parcel of land is still above surrender criteria for mid to high range petroleum hydrocarbons and total recoverable sodium. The total recoverable sodium concentrations have marginally increased in 2022-2023 since the previous monitoring period, and now no longer meet the limit of surrender. Area W2205 was also sampled again this monitoring period, and the results indicate that this land area remains above surrender criteria for mid to high range petroleum hydrocarbons, chloride, soluble salts and total recoverable sodium.

Groundwater monitoring for wells GND2290, GND2291, GND2292 and GND2293 recorded relatively stable chloride, electrical conductivity (EC) and TDS concentrations. For wells GND2291 and GND2292 there is a general decreasing trend for analytes chloride, EC and TDS concentrations. GND2294 has shown an increasing trend in concentrations of chloride, EC and TDS, but with a marginal decrease this monitoring period except for TDS. During May 2023 TDS levels were slightly elevated having dropped earlier in the monitoring period. There were traces of toluene recorded in GN2290 and GND2294 during May 2023, no other petroleum related compounds were recorded above the LOD in the remainder of the site monitoring wells this period.

Landfarmed areas, W1504, W1810, W1611, W1408 and W1407 have met their limit for surrender. If the consent holder intends to return these areas back to their former land use (agriculture) they will need to apply for a variation of consent 5956-2.0. Once this has been undertaken, the consent holder must then supply the District Council with the associated surrender analysis and the updated varied consent, for a removal of the temporary industrial zoning.

### 3.3 Evaluation of performance

A tabular summary of the consent holder's compliance record for the year under review and previous years is set out in Tables 9 and 10.

Table 9 Summary of performance for consent 5956-2.0

<b>Purpose: 5956-2.0 To discharge drilling wastes from hydrocarbon exploration and production activities, oily wastes from wellsite's and contaminated soil onto and into land via landfarming</b>		
<b>Condition requirement</b>	<b>Means of monitoring during period under review</b>	<b>Compliance achieved?</b>
1. Definitions of material	N/A	Yes
2. Application area detailed on attached map	Landfarming occurred in specific area	Yes
3. Adoption of Best Practicable Option (BPO)	Inspections	Yes
4. Groundwater monitoring well installation	Inspections and sampling	Yes
5. Cell lined with fit for purpose liner	All pits are compliant. Pit 2 remains decommissioned and empty.	Yes
6. Storage cell integrity check every 24 months	Pit integrity report received June 2023. One cell liner remains decommissioned.	Yes
7. Operation in accordance with management plan	Inspections, annually reviewed management plan received September 2019	Yes
8. Notify TRC 48 hours prior to transfer of waste to disposal site	Notifications received	Yes
9. Notify TRC 48 hours prior to landfarming wastes	Notifications received	Yes
10. Representative waste sample from each source and each type of waste and have it analysed for the following: a) total petroleum hydrocarbons (C <sub>6</sub> -C <sub>9</sub> , C <sub>10</sub> -C <sub>14</sub> , C <sub>15</sub> -C <sub>36</sub> ); b) benzene, toluene, ethylbenzene, and xylenes; c) polycyclic aromatic hydrocarbons screening; d) barium, calcium, chloride, magnesium, sodium, potassium, sodium adsorption ratio, nitrogen and pH, and e) heavy metals; arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc.	Submitted	Yes
11. Record keeping	Annual report provided and mud delivery log provided. All consent notifications provided by consent holder this period	Yes

<b>Purpose: 5956-2.0 To discharge drilling wastes from hydrocarbon exploration and production activities, oily wastes from wellsite's and contaminated soil onto and into land via landfarming</b>		
<b>Condition requirement</b>	<b>Means of monitoring during period under review</b>	<b>Compliance achieved?</b>
12. Annual Report due by 31 August	Report received	Yes
13. No discharge within 25 m of surface water or property boundaries	Inspections	Yes
14. No hydraulic fracturing fluids	Record check	Yes
15. Contaminated soil may only be brought to site after it has been assessed by condition 10 of this consent and by the Chief Executive	Yes, contaminated soil assessed and agreed prior to being brought to site	Yes
16. All waste brought to site must be landfarmed as soon as practicable but no later than 24 months after delivery date	Inspections and liaison with Company	Yes
17. Application of drilling material thickness	Inspections and review of consent holder data	Yes
18. No ponding or overland flow after one hour of application	No ponding noted	Yes
19. As soon as practicable after landfarming the consent holder shall mix the wastes with native topsoil with a minimum of 250 mm	Inspections	Yes
20. Maximum application rate of 20,000 mg/kg (TPH) at any point after incorporation	Inspections and sampling	Yes
21. Secondary application of material is permitted if the standards of condition 29 have been met and the Chief Executive has considered this analysis appropriate	Not required this period	N/A
22. Revegetation as soon as practicable	Achieved	Yes
23. Shall not exceed a value of 2,500 g/m <sup>3</sup> TDS within any groundwater or surface water	Monitoring	Yes
24. Consent shall not lead or be liable to lead to contaminants entering a surface water body	Monitoring	Yes
25. Shall not result in any adverse impacts on groundwater and or surface water	Minor short term impacts in terms of salinity, and TDS although below consent conditions for TDS	Yes

Purpose: 5956-2.0 To discharge drilling wastes from hydrocarbon exploration and production activities, oily wastes from wellsite's and contaminated soil onto and into land via landfarming		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
26. Conductivity must be less than 400 mSm <sup>-1</sup> . If background soil has an conductivity greater than 400 mSm <sup>-1</sup> , then conductivity after disposal shall not exceed original conductivity by more than 100 mSm <sup>-1</sup>	Inspections and sampling	Yes
27. Sodium absorption ratio [SAR] must be less than 18.0, if background SAR exceeds 18.0 then increase shall not exceed 1.0	Inspections and sampling	Yes
28. The concentration of metals and salts in the soil layer containing the discharge shall comply with certain criteria	Sampling	Yes
29. Prior to expiry/cancellation of consent these levels must not be exceeded: a) Conductivity, 290 mSm <sup>-1</sup> b) Chloride, 700 g/m <sup>3</sup> c) Total dissolved salts, 2,500 g/m <sup>3</sup> d) Sodium, 460 g/m <sup>3</sup> e) MAH's/PAH MfE 1999 CS NZ Table 4.12 f) TPH CCME 2008 Table 5.2 Ecological direct contact	Current soil samples indicate area W1911 remains above the surrender limit for C <sub>10</sub> -C <sub>14</sub> , C <sub>15</sub> -C <sub>36</sub> and sodium. Current soil samples indicate area W2205 is above the surrender limit for C <sub>10</sub> -C <sub>14</sub> , C <sub>15</sub> -C <sub>36</sub> , chloride, soluble salts and sodium.	N/A
30. Consent cannot be surrendered until standards in condition 29 have been met	No consent surrender	N/A
31. Notification of discovery of archaeological remains	None this monitoring period	N/A
32. Review, amend, delete	Not required	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		<b>High</b>
Overall assessment of administrative performance in respect of this consent		<b>High</b>

N/A = not applicable

Table 10 Evaluation of environmental performance over time

Year	Consent no	High	Good	Improvement req	Poor
2011-2012	5956-1	-	-	-	1
2012-2013	5956-1	-	-	-	1
2013-2014	5956-1	-	-	1	-



Year	Consent no	High	Good	Improvement req	Poor
Waste Remediation Services consent holder from 2014-2015 onwards					
2014-2015	5956-1.7	-	1	-	-
2016-2017	5956-2.0	-	1	-	-
2017-2018	5956-2.0	1	-	-	-
2018-2019	5956-2.0	1	-	-	-
2019-2020	5656-2.0	-	1	-	-
2020-2021	5656-2.0	1	-	-	-
2021-2022	5656-2.0	1	-	-	-
2022-2023	5696-2.0	1	-	-	-
Totals		5	3	1	2

During the year, the Company demonstrated a high level of environmental and high level of administrative performance with the resource consents as defined in Appendix III.

### 3.4 Recommendations from the 2021-2022 Annual Report

In the 2021-2022 Annual Report, it was recommended:

1. THAT in the first instance, monitoring of consented activities at Waikaikai Landfarm in the 2022-2023 year continue at the same level as in 2021-2022.
2. THAT should there be issues with environmental or administrative performance in 2022-2023, monitoring may be adjusted to reflect any additional investigation or intervention as found necessary.
3. THAT the option for a review of resource consent(s) in June 2023, as set out in condition 32 of the consent, not be exercised, on the grounds that the current consent conditions are sufficient.

The recommendations were implemented as appropriate.

### 3.5 Alterations to monitoring programmes for 2023-2024

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

- the extent of information already made available through monitoring or other means to date;
- its relevance under the RMA;
- the Council's obligations to monitor consented activities and their effects under the RMA;
- the record of administrative and environmental performances of the consent holder; and
- reporting 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 exercising resource consents.

It should be noted that the proposed programme represents a reasonable and risk-based level of monitoring for the site in question. The Council reserves the right to subsequently adjust the programme from that initially prepared, should the need arise if potential or actual non-compliance is determined at any time during 2023-2024.

## 4 Recommendations

1. THAT in the first instance, monitoring of consented activities at Waikakai Landfarm in the 2023-2024 year continue at the same level as in 2022-2023.
2. THAT should there be issues with environmental or administrative performance in 2023-2024, monitoring may be adjusted to reflect any additional investigation or intervention as found necessary.

## Glossary of common terms and abbreviations

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

Al*	Aluminium.
As*	Arsenic.
Bund	A wall around a tank to contain its contents in the case of a leak.
CBOD	Carbonaceous biochemical oxygen demand. A measure of the presence of degradable organic matter, excluding the biological conversion of ammonia to nitrate.
COD	Chemical oxygen demand. A measure of the oxygen required to oxidise all matter in a sample by chemical reaction.
Conductivity	Conductivity, an indication of the level of dissolved salts in a sample, usually measured at 25°C and expressed in $\mu\text{S}/\text{cm}$ .
Cu*	Copper.
Cumec	A volumetric measure of flow- 1 cubic metre per second ( $1 \text{ m}^3\text{s}^{-1}$ ).
DO	Dissolved oxygen.
DRP	Dissolved reactive phosphorus.
F	Fluoride.
Fresh	Elevated flow in a stream, such as after heavy rainfall.
$\text{g}/\text{m}^2/\text{day}$	grams/metre <sup>2</sup> /day.
$\text{g}/\text{m}^3$	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.
LOD	Limit of detection: the lowest measurement that analysis can differentiate from a non-detectable result.
L/s	Litres per second.
$\text{m}^2$	Square Metres.
Mixing zone	The zone below a discharge point where the discharge is not fully mixed with the receiving environment. For a stream, conventionally taken as a length equivalent to 7 times the width of the stream at the discharge point.
$\mu\text{S}/\text{cm}$	Microsiemens per centimetre.
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	<i>Resource Management Act 1991</i> and including all subsequent amendments.
SS	Suspended solids.
Temp	Temperature, measured in °C (degrees Celsius).
Turb	Turbidity, expressed in NTU.
Zn*	Zinc.

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

For further information on analytical methods, contact an Environment Quality Manager.

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- Taranaki Regional Council (2018): Waste Remediation Services Ltd Waikaikai Landfarm Monitoring Programme Annual Report 2017-2018 Technical Report 2018-63.
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- Taranaki Regional Council (2021): Waste Remediation Services Ltd Waikaikai Landfarm Monitoring Programme Annual Report 2020-2021 Technical Report 2021-50.
- Taranaki Regional Council (2021): Waste Remediation Services Ltd Waikaikai Landfarm Monitoring Programme Annual Report 2021-2022 Technical Report 2022-27.



# Appendix I

## Resource consent held by Waste Remediation Services

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

### Water abstraction permits

Section 14 of the RMA stipulates that no person may take, use, dam or divert any water, unless the activity is expressly allowed for by a resource consent or a rule in a regional plan, or it falls within some particular categories set out in Section 14. Permits authorising the abstraction of water are issued by the Council under Section 87(d) of the RMA.

### Water discharge permits

Section 15(1)(a) of the RMA stipulates that no person may discharge any contaminant into water, unless the activity is expressly allowed for by a resource consent or a rule in a regional plan, or by national regulations. Permits authorising discharges to water are issued by the Council under Section 87(e) of the RMA.

### Air discharge permits

Section 15(1)(c) of the RMA stipulates that no person may discharge any contaminant from any industrial or trade premises into air, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations. Permits authorising discharges to air are issued by the Council under Section 87(e) of the RMA.

### 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. Permits authorising the discharge of wastes to land are issued by the Council under Section 87(e) of the RMA.

### Land use permits

Section 13(1)(a) of the RMA stipulates that no person may in relation to the bed of any lake or river use, erect, reconstruct, place, alter, extend, remove, or demolish any structure or part of any structure in, on, under, or over the bed, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations. Land use permits are issued by the Council under Section 87(a) of the RMA.

### Coastal permits

Section 12(1)(b) of the RMA stipulates that no person may erect, reconstruct, place, alter, extend, remove, or demolish any structure that is fixed in, on, under, or over any foreshore or seabed, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations. Coastal permits are issued by the Council under Section 87(c) of the RMA.



**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: 19 April 2017

Commencement Date: 19 April 2017

**Conditions of Consent**

Consent Granted: To discharge drilling wastes from hydrocarbon exploration and production activities, oily wastes from wellsites, and contaminated soil onto and into land via landfarming

Expiry Date: 1 June 2034

Review Date(s): Annually until June 2020 and then every three years thereafter

Site Location: Lower Manutahi Road, Manutahi  
(Property owner: Waikaikai Farms Limited)

Grid Reference (NZTM) 1720190E-5605380N

Catchment: Mangaroa

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

### **General condition**

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

### **Special conditions**

1. For the purposes of this consent the following definitions shall apply:
  - a) drilling wastes consist of; drilling fluids and cuttings from drilling operations with water based muds, and drilling fluids and cuttings from drilling operations with synthetic based muds;
  - b) oily wastes from wellsites consist of; sludge removed from tanks and separators, slops oil removed from well cellars, tank wax which builds up in separators and tanks, oily formation sand, contaminated ground material from leaks and spills;
  - c) contaminated soil refers specifically to the hydrocarbon contaminated soil;
  - d) storage means a discharge of wastes from vehicles, tanks, or other containers onto land for the purpose of temporary storage prior to landfarming, but without subsequently spreading onto, or incorporating the discharged material into the soil within 48 hours;
  - e) landfarming means the discharge of wastes onto land, subsequent spreading and incorporation into the soil, for the purpose of attenuation of hydrocarbon and/or other contaminants, and includes any stripping and relaying of topsoil.
2. This consent authorises the application of material to land only within the area indicated on the attached map.
3. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects on the environment from the exercise of this consent.
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. The bores shall be sampled prior to stockpiling or landfarming for baseline water quality parameters and concentrations of contaminants.
5. Any pits intended for the storage of solid or liquid wastes shall be lined with high-grade (fit for purpose) synthetic liners or equivalent so that they retain liquid without leakage through the base or side walls.
6. At intervals not exceeding 24 months the consent holder shall check the integrity of the pit liners, repair or replace liners as required and demonstrate to the Chief Executive, Taranaki Regional Council they retain liquid as required by condition 5.

7. The site shall be operated in accordance with a 'Management Plan' prepared by the consent holder and approved by the Chief Executive, Taranaki Regional Council, acting in a certification capacity. The plan shall detail how the site will be managed to achieve compliance with the consent conditions of this consent and shall include as a minimum:
- a) control of site access;
  - b) procedures for notification to Council of disposal activities;
  - c) procedures for the receipt and stockpiling of drilling wastes onto the site;
  - d) procedures for the management of stormwater recovered from, or discharging from, the drilling waste stockpiling area;
  - e) procedures for demonstrating storage cell integrity;
  - f) methods used for the mixing and testing of different waste types;
  - g) procedures for landfarming drilling wastes and or contaminated soil (including means of transfer from stockpiling area, means of spreading, and incorporation into the soil);
  - h) contingency procedures;
  - i) sampling regime and methodology; and
  - j) post-landfarming management, monitoring and site reinstatement.

#### **Notification and sampling requirements**

8. The consent holder shall notify the Chief Executive, Taranaki Regional Council, (by emailing [worknotification@trc.govt.nz](mailto:worknotification@trc.govt.nz)) at least 48 hours prior to permitting wastes onto the site for storage. Notification shall include the following information:
- a) the consent number;
  - b) the name of the well and wellsite, or other source, from which the waste was generated;
  - c) the type of waste to be stored; and
  - d) the volume of waste to be stored.
9. The consent holder shall notify the Chief Executive, Taranaki Regional Council, (by emailing [worknotification@trc.govt.nz](mailto:worknotification@trc.govt.nz)) at least 48 hours prior to landfarming stored 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)/or location from which the waste was generated;
  - c) the type(s) of waste to be landfarmed;
  - d) the volume and weight of the waste to be landfarmed;
  - e) the specific concentrations of Metals (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn), Salts (Barium, Calcium, Chloride, Magnesium, Sodium, Potassium) and Sodium Adsorption Ratio. Hydrocarbons (Total Petroleum Hydrocarbons, Mono Cyclic Aromatic Hydrocarbons and Poly Cyclic Aromatic Hydrocarbons) and Nitrogen in the waste prior application to land;
  - f) results of sampling undertaken in accordance with condition 8, including in a spreadsheet compatible format;
  - g) proposed loading rate and required area calculations showing compliance with condition 18; and
  - h) the specific location and area over which the waste will be landfarmed.

## Consent 5956-2.0

10. The consent holder shall take a representative sample of each type of waste, from each individual source, and have it analysed for the following:
  - a) total petroleum hydrocarbons (C<sub>6</sub>-C<sub>9</sub>, C<sub>10</sub>-C<sub>14</sub>, C<sub>15</sub>-C<sub>36</sub>);
  - b) benzene, toluene, ethylbenzene, and xylenes;
  - c) polycyclic aromatic hydrocarbons screening;
  - d) barium, calcium, chloride, magnesium, sodium, potassium, sodium adsorption ratio, nitrogen and pH, and
  - e) heavy metals; arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc.

The consent holder shall record the data from these results onto a master spreadsheet to be supplied to the Taranaki Regional Council in accordance with conditions 8 and 9.

### Monitoring and reporting

11. The consent holder shall keep records of the following:
  - a) wastes from each individual well/source;
  - b) analytical composition of wastes;
  - c) stockpiling area(s);
  - d) volumes of material stockpiled;
  - e) landfarming area(s), including a map showing individual disposal areas with GPS co-ordinates and up-to-date GIS shapefiles;
  - f) volumes and weights of wastes landfarmed;
  - g) dates of commencement and completion of stockpiling and landfarming events;
  - h) dates of sowing landfarmed areas;
  - i) treatments applied; and
  - j) details of monitoring, including sampling locations, sampling methods and the results of analysis;and shall make the records available to the Chief Executive, Taranaki Regional Council.
12. The consent holder shall provide to the Chief Executive, Taranaki Regional Council:
  - a) by 31 August of each year, a report on all records required to be kept in accordance with conditions 8, 9, 10 and 11 for the period of the previous 12 months, 1 July to 30 June;
  - b) monthly records of all movements of waste to the site in spreadsheet format, including source, material type, transporter, volumes and receiving storage pit.

### Discharge Limits

13. No discharge shall take place within 25 metres of surface water or property boundaries.
14. Waste brought to the site shall not contain any hydraulic fracturing fluids.
15. Contaminated soil may be brought to the site only after the Chief Executive, Taranaki Regional Council has assessed the analysis required by condition 10 and advised that the material is suitable for bioremediation.
16. All wastes must be landfarmed as soon as practicable, but no later than 24 months after being brought onto the site.
17. For the purposes of landfarming, solid wastes shall be applied to land in a layer not exceeding:
  - a) 100 mm thick for wastes with a hydrocarbon concentration less than 50,000 mg/kg dry weight; or
  - b) 50 mm thick for wastes with a hydrocarbon concentration equal to or greater than 50,000 mg/kg dry weight.
18. For the purposes of landfarming, liquid wastes shall be applied to land:
  - a) at a rate such that there is no overland flow of liquids; and
  - b) at a rate such that no ponded liquids remain after one hour, after application.
19. When landfarming, as soon as practicable following the application of solid wastes to land, the consent holder shall mix the wastes with, as a minimum, the top 250 mm of native soil.
20. The hydrocarbon concentration in the soil over the landfarming area shall not exceed 20,000 mg/kg dry weight at any point where:
  - a) liquid waste has been discharged; or
  - b) solid waste has been discharged and incorporated into the soil.
21. The secondary application of material to land may only occur if:
  - a) the areas of application meet the standards of surrender as shown in conditions 28 and 29 of this consent;
  - b) the Chief Executive, Taranaki Regional Council, having considered the appropriate soil analysis, has confirmed that the standards specific in a) above have been met.
22. 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 environmental limits for water**

- 23. The exercise of this consent shall not result in a level of total dissolved salts within any surface or groundwater of more than 2,500 gm<sup>3</sup>.
- 24. The exercise of this consent, including the design, management and implementation of the discharge, shall not lead or be liable to lead to contaminants entering a surface water body.
- 25. The exercise of this consent shall not result in any adverse impacts on groundwater as a result of leaching, or on surface water including aquatic ecosystems, and/or result in a change to the suitability of use of the receiving water as determined by the Chief Executive, Taranaki Regional Council

**Receiving environmental limits for soil**

- 26. The conductivity of the soil/waste layer after application shall be less than 400 mSm, or alternatively, if the background soil conductivity exceeds 400 mSm, the landfarming of waste shall not increase the soil conductivity by more than 100 mSm.
- 27. The application of waste shall not increase the sodium adsorption ratio (SAR) of the soil by more than 2.0 and in no case shall the SAR of the soil/waste layer exceed 18.0 after application.
- 28. The concentration of metals and salts in the soil layer containing the discharge shall comply with the following criteria:

Metal/ Salt	Maximum value (mg/kg)
Arsenic <sup>1</sup>	17
Barium – Barite <sup>2</sup>	10,000
Extractable Barium <sup>2</sup>	250
Cadmium <sup>1</sup>	0.8
Chromium <sup>3</sup>	600
Copper <sup>3</sup>	100
Lead <sup>1</sup>	160
Nickel <sup>3</sup>	60
Mercury	1
Zinc <sup>3</sup>	300
<sup>1</sup> SCS – Rural Residential MfE 2011b; <sup>2</sup> Alberta Environment 2009; <sup>3</sup> NZWWA 2003, lowest of protection of human health and ecological receptors. (Biosolids to land)	

29. From 1 March 2034 (three months prior to the consent expiry date), constituents in the soil at any depth less than 500 mm (below ground level) shall not exceed the standards shown in the following table:

Constituent	Standard
Conductivity	Not greater than 290 mS/m
Chloride	Not greater than 700 mg/kg
Sodium	Not greater than 460 mg/kg
Total Soluble Salts	Not greater than 2500 mg/kg
TPH Fraction	Guideline Value Agricultural Ecological Direct Soil Contact (Fine Sand) From table 5.2
F1 (C6-C10)	210
F2 (>C10-C16)	150
F3 (>C16-C34)	1300
F4 (>C34)	5600
Canadian Council of Ministers of the Environment (CCME), in the document Canada Wide Standard for Petroleum Hydrocarbons (PHC) in Soil: Scientific Rationale, 2008. Table 5.2	
Soil Type/ Contaminant	Depth of contamination
	Surface (<1m) (mg/kg)
SANDY Silt	
MAHs	
Benzene	1.1
Toluene	82
Ethylbenzene	59
Xylene	59
PAHs	
Naphthalene	7.2
Non-carc (Pyrene)	160
Benzo(a)pyrene	0.027
Table 4.12 SANDY SILT Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (MfE 1999)	

MAHs - benzene, toluene, ethylbenzene, xylenes  
 PAHs - naphthalene, non-carc. (pyrene), benzo(a)pyrene eq.  
 TPH - total petroleum hydrocarbons (C<sub>7</sub>-C<sub>9</sub>, C<sub>10</sub>-C<sub>14</sub>, C<sub>15</sub>-C<sub>36</sub>)

The requirement to meet these standards shall not apply if, before 1 March 2034, the consent holder applies for a new consent to replace this consent when it expires, and that application is not subsequently withdrawn.

30. This consent may not be surrendered unless the standards in condition 29 have been met.
31. 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.

32. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June annually until 2020 and every three years thereafter, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 19 April 2017

For and on behalf of  
Taranaki Regional Council

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A D McLay  
**Director - Resource Management**

*The consent holder's attention is drawn to MPI's "Food safety and animal welfare guidance if spreading rocks and minerals from drilling oil and gas wells on land" (July 2015) which provides guidance to producers and processors of food, including farmers, on how ensure food safety and animal welfare if spreading rocks and minerals from drilling oil and gas wells on land. Should you require further information, please contact Mary Western (MPI, Wellington) or visit <https://www.mpi.govt.nz/document-vault/8698> for the report.*

Advice Note (included at the request of DITAG)

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

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

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





Total consented area for Waikaikai Landfarm (in yellow) as authorised by consent 5956-2.0



## Appendix II

Company provided annual report





30 August 2023

Chief Executive  
Taranaki Regional Council  
Private Bag 713  
47 Cloten Road Stratford  
Attention: Chania Hattle

Dear Chania

**RE: Resource Consent 5956 -2.0 - Waikaikai (Wards) – Waikaikai Farms Ltd, 78 Lower Manutahi Road, RD 2, Patea**

As required under special condition 12 of resource consent 5956-2.0, please find all relevant information recorded from the operational period 1 July 2022 to 30 June 2023 relating to receipt and landspreading activities undertaken at Waste Remediation Services (WRS) Waikaikai remediation site. This is the ninth annual report completed by WRS for this site covering the previous periods:

- 2014-15
- 2015-16
- 2016-17
- 2017-18
- 2018-19
- 2019-20
- 2020-21
- 2021-22
- 2022-23

This report follows on from the previously submitted 2021-22 consent monitoring report and as such is focused on activities, records, and results from the 2022-23 period. This report is structured into six sections, as per the following:

1. Overview and Background
2. Wastes Received for Remediation
3. Remediation - comprising preparatory earthworks, landspreading and incorporation and Rehabilitation Operations - comprising topsoil application, sowing and additional works
4. Monitoring
5. Additional Consent Requirements
6. Summary

## 1. OVERVIEW AND BACKGROUND

WRS took over operating the Waikakai remediation site in 2014, after the original remediation consent 5956-1 was transferred to them by the landowner of the site, following an unsuccessful attempt at operating the site by a third party operator. Between 2014 and the currently reported on year (2022-23), operations at the site have improved, as reflected in the TRC consent compliance ratings for these years. Somewhat dissimilar to WRS's other site (Manawapou, consent 7795-1.1 ) there has been a reasonably consistent period of activity at the site, reflecting consistent levels of activity within the local drilling industry. During the 2016-17 period, consent 5956-1.1 was superseded by the current consent, 5956-2.0 on 19 April 2017

During 2022-23, material from Greymouth Petroleum's wells Moturoa-5, Turangi A-18 and B-18, Turangi A T2, Turangi B-19, Turangi C-2 and Turangi C-1.

Monitoring of the site undertaken in the 2022-23 year by both the Taranaki Regional Council (TRC) and WRS management has shown the operations undertaken at Waikakai to be compliant with consent conditions.

## 2. WASTES RECEIVED FOR REMEDIATION

### Waste Types and Volumes

WRS' Waikakai site is consented to dispose of a wider range of petrochemical industry material for remediation than the Manawapou site, including oily fractions, provided TPH levels are < 250,000 ppm or volumes are very small. During the 2022-23 year, a total of 5,205m<sup>3</sup> of both solid and liquid wastes were received onsite from Greymouth Petroleum's Moturoa-5, Turangi A-18 and B-18, Turangi A T2, Turangi B-19, Turangi C-2 and Turangi C-1.

An updated mud register is attached as [Appendix A](#) for reference.

### Waste Characterisation

Consent 5956-2.0 requires the site operator to sample and keep records of the waste's chemical composition. Samples are taken (generally by well site staff prior to transport or by WRS staff at the landfarm). WRS, following discussion with the TRC, no longer takes composite pre-spreading samples from the pits prior to landspreading for further waste characterization as 1) the waste is only stored for short periods of time and 2) there is minimal mixing of waste in the pits before incorporation into the sand horizons of the spread area.

With the significantly increased volume material for remediation now being directed to WRS's operations (Waikakai and Manawapou are the only two remaining sites able to accept oilfield waste in the region) storage pits that originally enabled the accumulation of both liquid wastes for campaign spreading, now operate as transit facilities enabling the transfer of waste from road haulage to agricultural machinery; material for remediation is

being continually delivered and then removed for spreading and remediation, with very little storage involved.

All samples are sent to RJ Hill Laboratories (now "Hills Labs") for analyses. Results are all sent directly and simultaneously by Hills Laboratories to the TRC for their records and for cross-referencing purposes. Results are used by WRS to calculate the required spreading areas as per condition 17 of consent 5956-2.0 ensuring the hydrocarbon limits in condition 20 are adhered to. Additionally, consent 5956-2.0 condition 15 requires WRS to present pre-remediation results to the TRC for any contaminated soil, to assess on a case-by-case, its suitability for spreading. This is typically undertaken and provided by the owner/source of the waste and supplied to the TRC directly when the delivery notification to the TRC is negotiated and undertaken. WRS will only accept delivery of impacted soils if analysis provided to TRC are OK'ed by the TRC for remediation

As TRC have been provided directly with all analyses of incoming material for remediation sampling ; in the interest of avoiding duplication and confusion, PDF copies of analyses will not be attached to this report.

### 3. REMEDIATION AND REHABILITATION OPERATIONS

In the 2022-23 until the allowable spreading rate had been attained, periodic spreading and incorporation of materials received into the iron sands of was undertaken in a contingency spreading area within W2205, as indicated on the site map (Appendix B). Once this area had been fully utilized a new adjoining area to the south-east and east of W2205 was prepared. Area W2205 was rehabilitated in May 2022 and has vigorous established pasture This included the liquid/solid wastes received from Greymouth Petroleum's Turangi B-14, B-16 and A-15 wells, First Gas's Ahuroa B, Tamarind's Cheal A Pipeline A-B, and NPDC's Matai Street soils. The new W23?? area remains active at the end of June 23 with additional adjoining areas in preparation. At the end of the monitoring period all the storage pits were full, awaiting updates to be provided by Greymouth Petroleum Ltd's updated drilling programme for the next months. Drilling during the monitoring period stopped in June 2023 due to the depressed gas market prices and demand.

#### Appendix B: Site Map

The landspreading processes employed at this site are detailed further in the site management plan. WRS closely monitors spreading operations to ensure contractors practices are consistent with the procedures outlined in the management plan and to ensure application thickness and ponding consent conditions are adhered to. The inspection notices received from the TRC imply these processes were implemented satisfactorily during 2022-23. Photographs of spreading and rehabilitation operations at the Waikakai site are attached as Appendix C as further reference.

#### Appendix C: Photographs

### 4. MONITORING

#### **Site Inspections - WRS**

WRS closely supervises site operations to ensure all contractors are following best practice as per the site operation management plan and conditions specified in consent 5956-2.0. WRS has two nominated On-Site Persons (OSP's) who are contracted to attend every visit to the land farms by vehicles delivering materials for remediation. It is their responsibility to open the sites locked gate and ensure unloading is into the specified pits,

activities are undertaken in a safe and efficient manner and all documentation is provided by the delivery driver. If any aspect of the delivering company does not comply with WRS procedures then discharge of materials is on hold until compliance with WRS's processes is attained.

Regular site inspections are also undertaken by either the OSP's or Operations Manager during periods of inactivity at the site.

### Site Inspections – TRC

WRS has received three inspection notices from the TRC for the 2022-23 year. No issues with the state of the site or practices were noted or required any further action by the TRC or WRS.

Appendix D: TRC site inspection notices.

### Receiving Environment Sampling

Composite soil sampling and groundwater sampling is now managed and undertaken exclusively by TRC scientific and field staff, with all samples being sent to RJ Hill Laboratories for the full suite of analyses required under consent 5956-2.0. At the time of reporting, WRS has received both soil sample and groundwater results from the TRC, but has not undertaken any in depth analysis of the soil results that have, in previous years, been undertaken by the TRC

Soil sample results are presented below Appendix E.

Groundwater results are presented below Appendix F.

The groundwater results show compliance with the groundwater conditions 23-25 of consent 5956-2.0. *No hydrocarbons have been detected in any of the samples, salinity is slightly elevated in bores GND2291 and 2294 but remains well within the consented TDS limit (2500 g/m<sup>3</sup>) given in condition 23.*

## 5. ADDITIONAL CONSENT REQUIREMENTS

As per condition 3 of consent 5956-2.0, the site management plan is a live document which is reviewed constantly. Operations at the Waikakai landfarm are all undertaken generally in accordance with the WRS' Landfarm Management Plan (LMP) that covers both the Manawapou and Waikakai sites. It is a live document and is constantly reviewed and updated as necessary to reflect operational requirements and practices at both sites operated by WRS. In 2020-21 no significant changes were made to the LMP. The current 2022-23 plan will be reviewed in Q4/23

Consent 5956-2.0 condition 6 requires WRS to assess pit liner integrity at regular intervals. Pit 2 was decommissioned in 2021, the liner removed and a layer of clay placed to reduce the mobilization of sand on pit walls and floor. This pit has been unused for the entire monitoring period, and will be modified in the following year if mud volumes received increase and the need arises. As previously mentioned both operational pits 1 and 3 were being utilized at the end of the monitoring period and visually inspected by RedJacket Engineering. Their report, provided to the TRC in May 2023. Minor liner stabilisation of the southern pit top selvage of Pit 1 was required and undertaken. The nearest down gradient groundwater monitoring bore results did not show any signature of the contained remediation materials whatsoever.



Pasture establishment and ongoing vegetation coverage are monitored by TRC and by WRS in partnership with the landowner at the Waikaikai site. If either the landowner or the TRC are not satisfied with vegetation coverage at the site, WRS and their contractors will work with the landowner to address any issues. In 2022- 23, neither written nor verbally has there been any concerns noted during or following field inspections by the TRC. Similarly, no rehabilitation issues were raised.

Two areas were rehabilitated in the 2023 monitoring year, viz W2205 and W2305, by owner Peter Wards using local contractors. As this was the land owners wish and decision WRS has made it very clear that WRS will not accept any responsibility for the quality and pasture development of any areas undertaken by the land owner; the land owner accepts this responsibility without reservation.

## 6. SUMMARY AND COMMENT

As in the previous year, there was a reasonable level of activity at the Waikaikai site in 2022-23. Earlier in the operational period, moderate quantities of material were received from Greymouth Petroleum's wells Moturoa-5, Turangi A-18 and B-18, Turangi A T2, Turangi B-19, Turangi C-2 and Turangi C-1.

All of the waste received for remediation during the 2022-23 monitoring year has been spread and successfully rehabilitated.

No incidents or significant issues have been identified at the site during 2022-2023. Any queries raised by the TRC re operations at the site appear to have been answered satisfactorily by email or verbally and accepted

It should be noted that WRS continues to be asked by the major oil and gas operators in the region what is the expected life of both WRS's landfarms. This is a conundrum dependent upon national and local political decisions, the price of wholesale gas, the volume and rate of drilling required to meet the gas demand and the volumes of material produced for remediation. In addition the ongoing implications of the Waste Minimisation Act (WMA) 2008 registration and reporting requirements have presented considerable uncertainty for all, especially the land owners who were not contacted at all by MfE regarding the risks associated with registration, the stigma attached to having private land registered as a land fill and the enduring legacy that this places upon agricultural land and the methodology to have the land returned to unrestricted private agricultural use.

In effect the countdown of remaining acreage for land farming in the region (ie Manawapou and Waikaikai ) is underway; once this is exhausted, the operational areas - turnarounds and pits- will be returned to functional farmable paddocks by removing the pits recontouring the ground and spreading the last of the material accepted. At this point the efforts undertaken by the consent holder to construct and maintain the impermeability of the storage pits, now transfer points, will have immediately become a futile exercise in respect of avoiding discharge to ground, costs to maintain this, and efforts by all during the entire operational life of the land farm.

It should also be noted WRS's Waikaikai remediation operation alone has prevented 5,205 m<sup>3</sup> (approx. 7,300 tonne) of incompressible liquids and solids going to land fill at facilities several hundred km outside of the rohe from where they were generated.

As in 2021-22 WRS would again welcome constructive comment on this aspect of the consent holders' views and the sector's future options for disposal of oilfield wastes by well managed remediation activities that are undertaken in full compliance with consents and with positive outcomes for the oil and gas operators, and landowner, all of which contribute to the continuing support of livelihoods in the region and beyond.

**Waste Remediation Services Ltd**

w +64 6 751 9221 m + 64 275 996 105 f +64 751 9225

Address 141 – 143 Connett Road East, Bell Block 4312, New Zealand Post

PO Box 7150, New Plymouth 4341, New Zealand

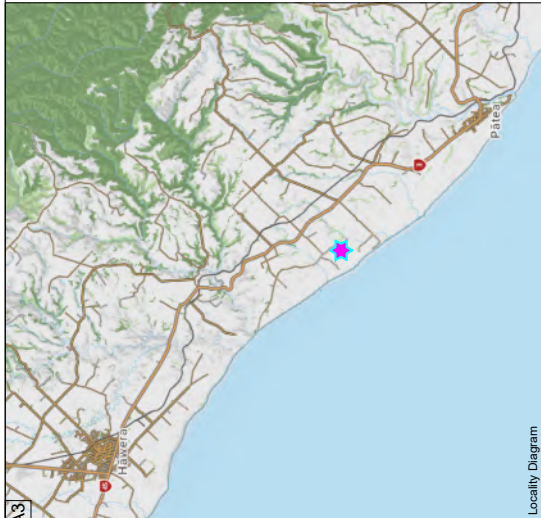
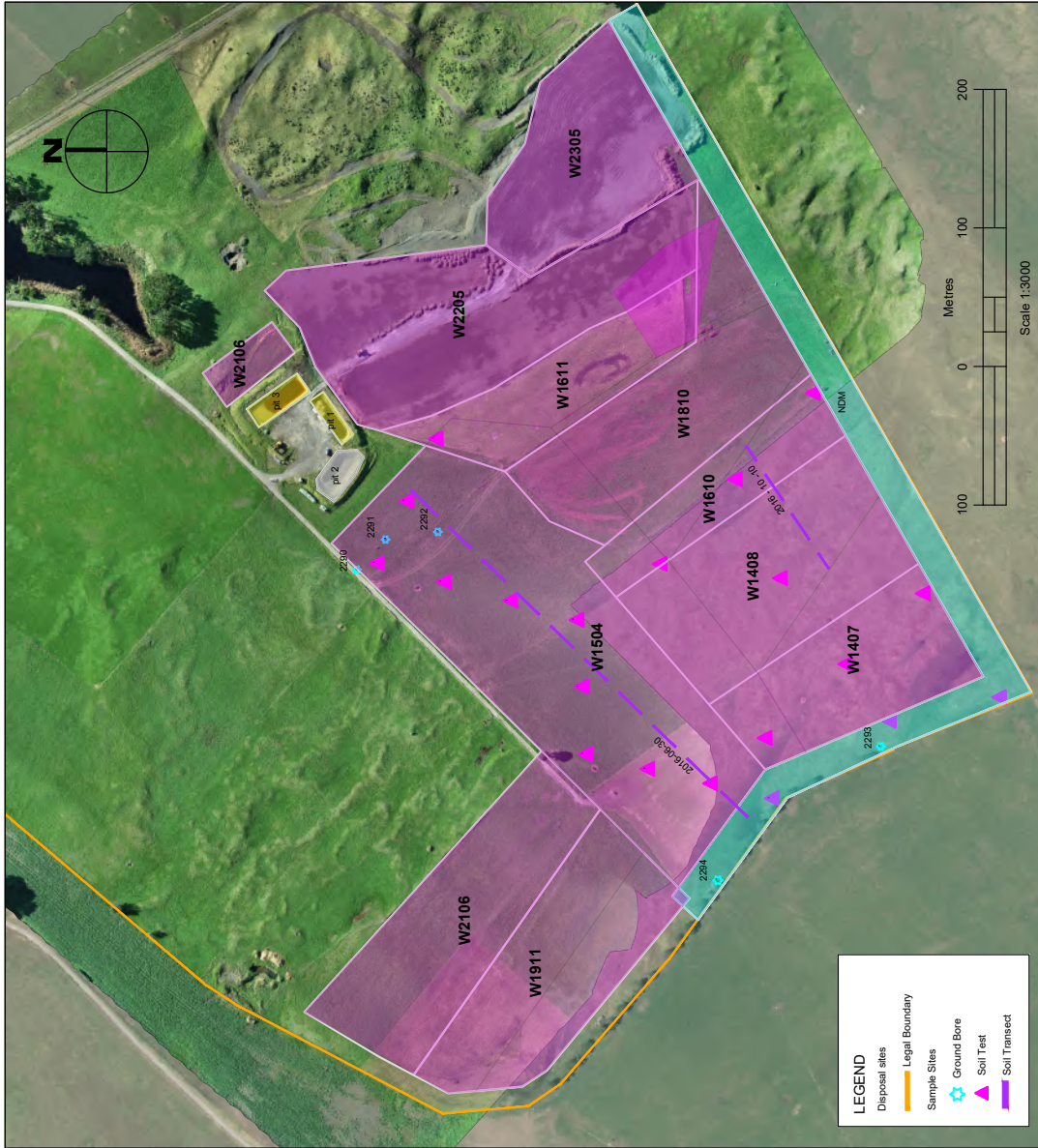
Email: [keith@wrsLtd.co.nz](mailto:keith@wrsLtd.co.nz)

## Appendix A - Mud Register

Date	Source	Customer	Remediation Site m3			
			Solid	Liquid	Direct Spread	Total
Sep-22	GPL Moturoa	Greymouth Petroleum	18	16	-	34
		<b>GPL Moturoa Total</b>	<b>18</b>	<b>16</b>	<b>-</b>	<b>34</b>
Oct-22	Turangi B 18	Greymouth Petroleum	676	216	-	892
Nov-22	Turangi B 18	Greymouth Petroleum	120	170	-	290
		<b>Turangi B 18 Total</b>	<b>796</b>	<b>386</b>	<b>-</b>	<b>1,182</b>
Feb-23	Turangi B 19	Greymouth Petroleum	180	132	-	312
Mar-23	Turangi B 19	Greymouth Petroleum	588	306	-	894
Apr-23	Turangi B 19	Greymouth Petroleum	80	62	-	142
		<b>Turangi B 19 Total</b>	<b>848</b>	<b>500</b>	<b>-</b>	<b>1,348</b>
Dec-22	Turangi A T2	Greymouth Petroleum	-	16	-	16
Jan-23	Turangi A T2	Greymouth Petroleum	18	126	-	144
Feb-23	Turangi A T2	Greymouth Petroleum	-	118	-	118
		<b>Turangi A T2 Total</b>	<b>18</b>	<b>260</b>	<b>-</b>	<b>278</b>
Jan-22	Turangi A 18	Greymouth Petroleum	-	18	-	18
		<b>Turangi A 18 Total</b>	<b>-</b>	<b>18</b>	<b>-</b>	<b>18</b>
Apr-23	Turangi C-2	Greymouth Petroleum	126	118	-	244
May-23	Turangi C-2	Greymouth Petroleum	240	16	-	256
		<b>Turangi C-2 Total</b>	<b>366</b>	<b>134</b>	<b>-</b>	<b>500</b>
May-23	Turangi C-1	Greymouth Petroleum	216	291	-	507
Jun-23	Turangi C-1	Greymouth Petroleum	66	268	-	334
		<b>Turangi C-1 Total</b>	<b>282</b>	<b>559</b>	<b>-</b>	<b>841</b>
Dec-22	Kapuni A 8/18	Todd Energy	35	0	0	35
		<b>Kapuni A 8/18 Total</b>	<b>35</b>	<b>0</b>	<b>0</b>	<b>35</b>
Jan-23	70 Leach Street	Chris Bell	3	-	-	3
		<b>70 Leach Street Total</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>3</b>
Mar-23	Manutahi C	Westside	12	-	-	12
		<b>Manutahi C Total</b>	<b>12</b>	<b>-</b>	<b>-</b>	<b>12</b>
Apr-23	MHW D Flare Pit	Todd Energy	-	320	-	320
		<b>MHW D Flare Pit Total</b>	<b>-</b>	<b>320</b>	<b>-</b>	<b>320</b>
Apr-23	Cheal B (in MT)	Tamarind	305	329	-	634
		<b>Cheal B Total</b>	<b>305</b>	<b>329</b>	<b>-</b>	<b>634</b>
<b>ANNUAL TOTAL TO 30 June 2023 (m3)</b>			<b>2,683</b>	<b>2,522</b>	<b>-</b>	<b>5,205</b>

NB: This is a summary table; a full mud register with records of individual deliveries is available upon request.

Appendix B – Waikakai Site Map



ID	Area (ha)	Consent #	Start Date	End Date	MUD
NDM	1.73	5956-1			N/A
W1407	2.28	5956-1	2014-06-02	2014-07-31	D/L/S
W1408	1.9	5956-1	2014-08-01	2014-08-10	D/L/S
W1504	5.7	5956-1.7	2015-01-14	2015-04-30	IS
W1611	0.63	5956-1.7	2016-10-11	2016-11-25	D/L/S
W1810	1.6	5956-2.0	2018-04-01	2018-10-31	SW/DL/S/IS
W1911	2.24	5956-2.0	2019-02-01	2019-11-15	D/L/S
W2106	0.26	5956-2.0	2020-06-01	2021-05-08	IS
W2205	2.38	5956-2.0	2022-02-31		IS
W2305	1.5	5956-2.0	2023-02-?	2023-05-15	D/L/S

NOTE: Consented area 49.5ha, Land-Farmed area (30/06/2022) = 17.3ha

Mud Types Codes  
 S/W = Stormwater  
 D/L/S = Drilling Liquids/Solids  
 IS = Impacted Soils  
 NA = Not available  
 NDM = No Drilling Mud

		Project: Waikakai Land Farm Areas P and K Wards		Project No: 180166	
26A Mandaro Street New Plymouth 4340 New Plymouth 06 758 5342 Hawera 06 278 4456 www.mckinlayremediation.co.nz		Date: 2023-05-15 Note:		Scale: 1:3000 (A3) Drawing No: W-230808_1 Rev: 0	
Drawn: [Name] Checked: [Name]		Date: 2023-05-15 Date: 2023-05-15		Project: 180166	
Design: [Name] Verified: [Name]		Date: 2023-05-15 Date: 2023-05-15		Scale: 1:3000 (A3)	
Approved: [Name]		Date: 2023-05-15		Drawing No: W-230808_1 Rev: 0	





## Appendix C - Field Photographs



Photograph 1: 28/6/23 Pasture strike area W2205



Photograph 2: 28/6/23 Pasture strike area W2205



Photograph 3: 28/6/23 Pasture strike area W2205



Photograph 4: 10/3/23 Pit 1 dewatered mud



Photograph 5: 10/3/23 Pit 1 dewatered mud



Photograph 6: 1/3/23 Waikakai Solids Spread





Photograph 7: 27/2/23 Waikakai Spreading liquid



Photograph 8: 27/2/23 Waikakai Spreading liquid



Photograph 9: 6/1/23 Pit 1 wall armouring



Photograph 10: 1/11/22 Waikakai cut and carry W1611 area



Photograph 11: 1/11/22 Waikakai cut and carry W1611 area



Photograph 12: 16/8/22 Pit 3 stirring, pumping, spreading



Photograph 13: 16/8/22 Pit 3 stirring, pumping, spreading



Photograph 14: Why it's important to get it right

## Appendix D - TRC Inspection Notices

Private Bag 713 | 47 Cloten Road | Stratford 4352 | New Zealand | T: 06 765 7127 | F: 06 765 5097 | www.trc.govt.nz



### Inspection Notice

Under section 332 of the Resource Management Act 1991

**Consent Number:** R2/5956-2.0  
**Consent Name:** Waste - discharge landfarming  
**Contact Name:** Waste Remediation Services Limited  
**Postal Address:** PO Box 7150, New Plymouth 4341  
**Site Location Address:** Lower Manutahi Road, Manutahi (Property owner: Waikakai Farms Limited)  
**Inspection Number:** OBS-2022-106493  
**Inspection Type:** Compliance Monitoring Insp.  
**Inspection Date:** 25 Oct 2022  
**Inspection Time:** 11:28  
**Weather Details:** Rainfall:  
Wind Direction:  
Wind Strength:  
**Samples Taken:** No  
**Consent Purpose:** To discharge drilling wastes from hydrocarbon exploration and production activities, oily wastes from wellsites, and contaminated soil onto and into land via landfarming  
**Conditions Assessed:** 0  
**Overall Compliance Status:** Compliance  
**Inspection Comments:** Inspection 1/3. Inspection undertaken to assess compliance with resource consent conditions. The inspection found that Pit 2 was empty (no liner), Pit 1 was full with solids, and pit 3 contained liquids. Good pasture growth the recently seeded area. The seaward land spreading area was inspected. No barren patches were noted. No issues to note today. Compliant at the time of inspection. Thanks, Celeste.  
**Further Actions Advice:** Nil  
**Signed:**  
**Council Officer:** Celeste Bevins  
**Officer Warrant Number:** 299

Disclaimer: The compliance rating reflects the warranted Officer/s observations at the time of inspection and does not provide a comprehensive assessment of compliance with the consent. Therefore the compliance rating is limited to the exact period during which the inspection was undertaken as well as the specific aspects that were inspected.





Private Bag 713 | 47 Cloten Road | Stratford 4352 | New Zealand | T: 06 765 7127 | F: 06 765 5097 | www.trc.govt.nz

## Inspection Notice

Under section 332 of the Resource Management Act 1991

<b>Consent Number:</b>	R2/5956-2.0
<b>Consent Name:</b>	Waste - discharge landfarming
<b>Contact Name:</b>	Waste Remediation Services Limited
<b>Postal Address:</b>	PO Box 7150, New Plymouth 4341
<b>Site Location Address:</b>	Lower Manutahi Road, Manutahi (Property owner: Waikaikai Farms Limited)
<b>Inspection Number:</b>	OBS-2023-111707
<b>Inspection Type:</b>	Compliance Monitoring Insp.
<b>Inspection Date:</b>	06 Mar 2023
<b>Inspection Time:</b>	12:36
<b>Weather Details:</b>	Rainfall: None Wind Direction: Wind Strength: Nil
<b>Samples Taken:</b>	No
<b>Consent Purpose:</b>	To discharge drilling wastes from hydrocarbon exploration and production activities, oily wastes from wellsites, and contaminated soil onto and into land via landfarming
<b>Conditions Assessed:</b>	0
<b>Overall Compliance Status:</b>	Compliance
<b>Inspection Comments:</b>	Inspection 2/3. Inspection undertaken to assess compliance with resource consent conditions. The inspection found that Pit 2 with no liner was empty. Pit 1 and 3 contained product but had ample free board. Land farming activities have occurred in the area in front of the storage facility in recent months. The seaward landfarmed area was inspected. Good pasture growth. No issues to note. Please submit integrity report of the pit liners. Compliant at the time of inspection. Thanks. Celeste.
<b>Further Actions Advice:</b>	Nil
<b>Signed:</b>	
<b>Council Officer:</b>	Celeste Bevins
<b>Officer Warrant Number:</b>	299

Disclaimer: The compliance rating reflects the warranted Officer/s observations at the time of inspection and does not provide a comprehensive assessment of compliance with the consent. Therefore the compliance rating is limited to the exact period during which the inspection was undertaken as well as the specific aspects that were inspected.

## Inspection Notice

Under section 332 of the Resource Management Act 1991

<b>Consent Number:</b>	R2/5956-2.0
<b>Consent Name:</b>	Waste - discharge landfarming
<b>Contact Name:</b>	Waste Remediation Services Limited
<b>Postal Address:</b>	PO Box 7150, New Plymouth 4341
<b>Site Location Address:</b>	Lower Manutahi Road, Manutahi (Property owner: Waikaikai Farms Limited)
<b>Inspection Number:</b>	OBS-2023-114498
<b>Inspection Type:</b>	Compliance Monitoring Insp.
<b>Inspection Date:</b>	26 Jun 2023
<b>Inspection Time:</b>	10:53
<b>Weather Details:</b>	Rainfall: None Wind Direction: Wind Strength: Nil
<b>Samples Taken:</b>	No
<b>Consent Purpose:</b>	To discharge drilling wastes from hydrocarbon exploration and production activities, oily wastes from wellsites, and contaminated soil onto and into land via landfarming
<b>Conditions Assessed:</b>	0
<b>Overall Compliance Status:</b>	Compliance
<b>Inspection Comments:</b>	3/3 Inspection. Inspection undertaken to assess compliance with resource consent conditions. The inspection found that Pit 2 with no liner was completely empty. Pit 1 contained solids and pit 3 contained liquids. Land farming activities have recently been undertaken in the area south east of the storage pits. Good application rate. The land farmed area directly in front of the pits had good pasture strike. The seaward land farmed area was inspected. Good pasture growth and no barren patches. No issues to note. Compliant at the time of inspection. Thanks. Celeste.
<b>Further Actions Advice:</b>	Nil
<b>Signed:</b>	
<b>Council Officer:</b>	Celeste Bevins
<b>Officer Warrant Number:</b>	299

Disclaimer: The compliance rating reflects the warranted Officer/s observations at the time of inspection and does not provide a comprehensive assessment of compliance with the consent. Therefore the compliance rating is limited to the exact period during which the inspection was undertaken as well as the specific aspects that were inspected.

## Appendix E – Soil Sample Results

TRC supplied soil sample results, Waikakai site 2022-23 – all samples taken 7 June 2023

Parameter	Consent Limit	Sample	TRC2312844	TRC2312847	TRC2312848	TRC2312849	TRC2312850	TRC2312851
		Area	W1911	W1911	W2205	W2205	W2205	W2205
1-Methylnaphthalene	NS	mg/kg dry wt	< 0.012	< 0.012	< 0.012	0.063	0.014	0.056
2-Methylnaphthalene	NS	mg/kg dry wt	< 0.012	< 0.012	< 0.012	0.08	0.024	0.075
Acenaphthene	NS	mg/kg dry wt	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012
Acenaphthylene	NS	mg/kg dry wt	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012
Anthracene	NS	mg/kg dry wt	< 0.012	< 0.012	< 0.012	0.014	< 0.012	< 0.012
Benzene	1.1	mg/kg dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo[a]anthracene	NS	mg/kg dry wt	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012
Benzo[a]pyrene (BAP)	NS	mg/kg dry wt	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	NS	mg/kg dry wt	< 0.028	< 0.028	< 0.027	< 0.028	< 0.027	< 0.029
Benzo[a]pyrene Toxic Equivalence (TEF)	NS	mg/kg dry wt	< 0.028	< 0.028	< 0.027	< 0.028	< 0.027	< 0.028
Benzo[b]fluoranthene + Benzo[j]fluoranthene	NS	mg/kg dry wt	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012
Benzo[e]pyrene	0.027	mg/kg dry wt	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012
Benzo[g,h,i]perylene	NS	mg/kg dry wt	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012
Benzo[k]fluoranthene	NS	mg/kg dry wt	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012
C10 - C14	NS	mg/kg dry wt	210	430	570	1420	1480	5000
C15 - C36	NS	mg/kg dry wt	980	1950	2300	5400	3900	11900
C7 - C9	NS	mg/kg dry wt	< 20	< 20	< 20	< 20	< 20	< 20
Calcium (Sat Paste)	NS	mg/L	123	145	152	291	881	2200
Chloride	700	mg/kg dry wt	26	29	31	149	470	1340
Chrysene	NS	mg/kg dry wt	< 0.012	< 0.012	< 0.012	0.021	< 0.012	< 0.012
Conductivity from soluble salts	290	mS/cm	< 0.2	< 0.2	< 0.2	0.2	0.4	0.9
Dibenzo[a,h]anthracene	NS	mg/kg dry wt	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012
Dry Matter (Env)	NS	g/100g as rcvd	86	86	89	86	88	84
Ethylbenzene	59	mg/kg dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	NS	mg/kg dry wt	< 0.012	< 0.012	< 0.012	0.013	< 0.012	< 0.012
Fluorene	NS	mg/kg dry wt	< 0.012	< 0.012	< 0.012	0.047	< 0.012	< 0.012
Indeno(1,2,3-c,d)pyrene	NS	mg/kg dry wt	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012
m&p-Xylene	NS	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Magnesium (Sat Paste)	NS	mg/L	20	21	18	29	62	64
Naphthalene	7.2	mg/kg dry wt	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
o-Xylene	59	mg/kg dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05

Parameter	Consent Limit	Sample	TRC2312844	TRC2312847	TRC2312848	TRC2312849	TRC2312850	TRC2312851
		Area	W1911	W1911	W2205	W2205	W2205	W2205
Perylene	NS	mg/kg dry wt	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	0.021
pH	NS	pH Units	7.2	7.9	7.3	8.4	7.9	7.4
Phenanthrene	NS	mg/kg dry wt	< 0.012	< 0.012	< 0.012	0.062	< 0.012	0.029
Pyrene	160	mg/kg dry wt	< 0.012	< 0.012	< 0.012	0.016	< 0.012	< 0.012
Sodium (Sat Paste)	NS	mg/L	32	43	27	53	126	361
Sodium Absorption Ratio (SAR)	NS		0.7	0.9	0.6	0.8	1.1	2.1
Soluble Salts	2.5	g/100g dry wt	< 0.05	< 0.05	< 0.05	0.07	0.16	0.30
Toluene	82	mg/kg dry wt	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Total hydrocarbons (C7 - C36)	NS	mg/kg dry wt	1180	2400	2900	6900	5400	16900
Total of Reported PAHs in Soil	NS	mg/kg dry wt	< 0.3	< 0.3	< 0.3	0.4	< 0.3	< 0.3
Total Recoverable Arsenic	17	mg/kg dry wt	< 2	< 2	< 2	< 2	< 2	3
Total Recoverable Barium	10,000	mg/kg dry wt	2400	2600	760	3300	1560	3200
Total Recoverable Cadmium	0.8	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Calcium	NS	mg/kg dry wt	5800	7200	4300	7500	7000	12000
Total Recoverable Chromium	600	mg/kg dry wt	16	17	16	19	15	19
Total Recoverable Copper	100	mg/kg dry wt	12	14	10	15	11	19
Total Recoverable Lead	160	mg/kg dry wt	2.3	3.4	2.4	6.0	3.1	6.7
Total Recoverable Magnesium	NS	mg/kg dry wt	2200	2200	2100	2300	2300	3000
Total Recoverable Mercury	1	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	60	mg/kg dry wt	8	9	8	10	8	11
Total Recoverable Potassium	NS	mg/kg dry wt	450	520	340	620	510	1020
Total Recoverable Sodium	460	mg/kg dry wt	520	490	300	350	390	550
Total Recoverable Zinc	300	mg/kg dry wt	75	78	66	70	52	76

## Appendix F – Groundwater Sample Results

TRC supplied groundwater results, Waikakai site, all bores 2022-23

Parameter	Consent Limit	Bore	GND2290				GND2291				GND2292			
		Date	5/8/22	30/11/22	29/3/23	18/5/23	5/8/22	30/11/22	29/3/23	18/5/23	5/8/22	30/11/22	29/3/23	18/5/23
		Survey	7703	8085	8440	8585	7703	8085	8440	8585	7703	8085	8440	8585
		Sample Number	227183	229237	2311666	2312615	227184	229238	2311667	2312616	227185	229239	2311668	2312617
CONDF	NS	µS/cm	327.6	325.6	271.4	288.4	982	868		769	709	588	530	447.6
CONDF	NS	mS/m							823					
CONDSPF	NS	µS/cm	398.2	390.9	329.3	346.8	1194	1055	1021	943	862	709	649	544.2
DO	NS	g/m3	3.65		2.81	1.35	4.52		3.98	3.96	0.52		2.24	2.13
DOF	NS	g/m3		2.42				4.24				0.88		
LEVEL	NS	m	1.9	1.92	2.60	2.67	3.1	3.098	4.07	3.86	3.24	3.24	4.27	3.93
PERSAT	NS	%	36.7	25.1	28.6	13.7	45.1	43.6	39.6	40.1	5.3	9.1	23.2	21.6
PHF	NS	pH	6.55	6.54	6.52	6.54	6.05	6.16	6.12	6.15	6.24	6.29	6.20	6.25
TEMP	NS	Deg.C	15.8	16.3	15.7	16.2	15.7	15.7	14.8	15.3	15.7	16.1	15.5	15.7
Acid Soluble Barium	NS	g/m3	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11
Benzene	NS	g/m3	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
C10 - C14	NS	g/m3	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
C15 - C36	NS	g/m3	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
C7 - C9	NS	g/m3	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chloride	NS	g/m3	47	23	13.5	24	210	129	134	111	140	97	97	67
Dissolved Barium	NS	g/m3	0.040	0.037	0.029	0.030	0.021	0.018	0.021	0.019	0.097	0.065	0.050	0.039
Electrical Conductivity (EC)	NS	µS/cm	402	393	322	342	1299	1033	991	948	871	699	631	541
Electrical Conductivity (EC)	NS	mS/m	40.2	39.3	32.2	34.2	129.9	103.3	99.1	94.8	87.1	69.9	63.1	54.1
Ethylbenzene	NS	g/m3	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
m&p-Xylene	NS	g/m3	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	NS	g/m3	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
pH	NS	pH Units	6.8	6.6	7.1	6.8	6.3	6.4	6.6	6.5	6.5	6.4	6.7	6.6
Toluene	NS	g/m3	< 0.0010	< 0.0010	< 0.0010	0.0069	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	0.0049
Total Dissolved Solids (TDS)	2,500	g/m3	270	270	260	290	890	700	700	670	490	430	400	350
Total hydrocarbons (C7 - C36)	NS	g/m3	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7
Total Sodium	NS	g/m3	18.7	19.3	17.3	17.0	78	77	74	74	86	73	65	57

NS Not Specified

Parameter	Consent Limit	Bore	GND2290				GND2291			
		Date	5/8/22	30/11/22	29/3/23	18/5/23	5/8/22	30/11/22	29/3/23	18/5/23
		Survey	7703	8085	8440	8585	7703	8085	8440	8585
		Sample Number	227186	229240	2311669	2312618	227187	229241	2311670	2312619
CONDF	NS	µS/cm	318.2	431.3	494.4	787	1493	1027	869	1191
CONDF	NS	mS/m								
CONDSPF	NS	µS/cm	380.6	518.3	585.2	951	1846	1255	1068	1463
DO	NS	g/m3	4.19		2.40	0.13	4.30		0.19	2.96
DOF	NS	g/m3		4.49				0.74		
LEVEL	NS	m	1.05	0.94	1.95	1.56	1.66	1.36	2.16	2.15
PERSAT	NS	%	42.7	46.7	2.40	1.3	42.8	7.6	1.8	29.0
PHF	NS	pH	7.15	7.23	7.15	6.74	6.58	6.54	6.67	6.64
TEMP	NS	Deg.C	16.3	16.2	15.3	15.9	15.0	15.5	15.3	15.2
Acid Soluble Barium	NS	g/m3	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11
Benzene	NS	g/m3	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
C10 - C14	NS	g/m3	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
C15 - C36	NS	g/m3	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
C7 - C9	NS	g/m3	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chloride	NS	g/m3	230	113	185	187	540	300	210	340
Dissolved Barium	NS	g/m3	0.105	0.070	0.086	0.104	0.053	0.034	0.027	0.037
Electrical Conductivity (EC)	NS	µS/cm	1093	677	949	947	1822	1225	1015	1440
Electrical Conductivity (EC)	NS	mS/m	109.3	67.7	94.9	94.7	182.2	122.5	101.5	144.0
Ethylbenzene	NS	g/m3	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
m&p-Xylene	NS	g/m3	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	NS	g/m3	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
pH	NS	pH Units	7.0	7.1	7.2	7.0	6.8	7.3	7.0	6.8
Toluene	NS	g/m3	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Total Dissolved Solids (TDS)	2,500	g/m3	670	410	660	630	1200	900	750	1390
Total hydrocarbons (C7 - C36)	NS	g/m3	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7
Total Sodium	NS	g/m3	52	31	53	64	71	63	58	67

NS Not Specified

.....END

## Appendix III

Categories used to evaluate environmental and administrative performance

## Categories used to evaluate environmental and administrative performance

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 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 during investigations of incidents reported to the Council by a third party 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 during investigations of incidents reported to the Council by a third party. 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 during investigations of incidents reported to the Council by a third party. 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.

