Boyd Drilling Waste and Stockpiling Landfarm and Landspreading

Monitoring Programme

Annual Report

2020-2021

Technical Report 2021-87

Working with people | caring for Taranaki

Taranaki Regional Council

Taranaki Regional Council
Private Bag 713
Stratford

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Executive summary

Colin Boyd (the consent holder), in conjunction with MI SWACO (the Company), operate a drilling waste stockpiling facility (Surrey Road stockpiling facility) and a landspreading/landfarming operation on his property, near Inglewood. This site is located within the Waitara catchment. Stockpiled drilling mud from the Surrey Road stockpiling facility is landfarmed or landspread on the consent holder's property. The consent holder also dewaters water treatment sludge in lagoons at two locations on his property. This material is then applied to land via landfarming.

During the monitoring period, the consent holder and the Company demonstrated an overall poor level of environmental performance.

This report for the period July 2020 to June 2021 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.

The consent holder holds three resource consents, which include a total of 51 conditions setting out the requirements that the consent holder must satisfy. The consent holder holds three consents to allow it to discharge material to land.

The Council's monitoring programme for the year under review included 12 inspections, 28 water samples, eight composite soil samples collected for physicochemical analysis and two biomonitoring surveys of receiving waters.

Inspections identified numerous occasions when the Company had not been able to accomplish the site processes within consent conditions. These occasions have been described in detail in the inspections section of this report.

In some cases these were repeat non-compliances by the Company, where the causes of the non-compliance were known and were directly related to the actions and inactions of the Company. It was necessary for the Council to repeatedly impose enforcement on the Company and consent holder throughout the monitoring year to negate their operational issues.

The monitoring showed that the biology within the unnamed tributary of the Mangatengehu Stream was significantly adversely impacted due to the site operations this monitoring period. This was due to poor housekeeping and fluid management by the Company.

In comparison with previous years, the monitoring indicated a significant decline in species diversity and population within the unnamed tributary.

The Surrey Road stockpiling site is now closed and has been decommissioned and re-contoured. 60+ paddocks are still actively remediating under consent 7591-1.2. Paddock assessment will be undertaken in the 2021-2022 monitoring year.

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

There were six unauthorised incidents recording non-compliance in respect of this consent holder during the period under review. Five infringement notices and one abatement notice were issued.

For reference, in the 2020-2021 year, consent holders were found to achieve a high level of environmental performance and compliance for 86% of the consents monitored through the Taranaki tailored monitoring programmes, while for another 11% of the consents, a good level of environmental performance and compliance was achieved.

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

This report includes recommendations for the 2021-2022 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 2020 to June by the Taranaki Regional Council (the Council) on the monitoring programme associated with resource consents held by CD Boyd (the consent holder) and his subsidiary Company, Surrey Road Landfarms Limited. The consent holder in conjunction with MI SWACO (the Company) controlled and operated a drilling waste stockpile facility (Surrey Road stockpiling facility) as well as a landfarming and landspreading operation, situated on Surrey Road at Tariki, in the Waitara catchment.

The report includes the results and findings of the monitoring programme implemented by the Council in respect of the consents held by the consent holder that relate to the discharges of drilling mud to land within the Waitara catchment.

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 consent holder's use of water, land and air, and is the 12th combined annual report by the Council for the consent holder.

Structure of this report

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

- consent compliance monitoring under the RMA and the Council's obligations;
- the Council's approach to monitoring sites though annual programmes;
- the resource consents held by the Company in the Waitara 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 2021-2022 monitoring year.

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

1.1.2 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.

1.1.3 Evaluation of environmental and administrative performance

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

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

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

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

Environmental Performance

High: No or inconsequential (short-term duration, less than minor in severity) breaches of consent or regional plan parameters resulting from the activity; no adverse effects of significance noted or likely in the receiving environment. The Council did not record any verified unauthorised incidents involving 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.

For reference, in the 2020-2021 year, consent holders were found to achieve a high level of environmental performance and compliance for 86% of the consents monitored through the Taranaki tailored monitoring programmes, while for another 11% of the consents, a good level of environmental performance and compliance was achieved. [1]

1.2 Process description

1.2.1 Hydrocarbon exploration and production wastes

For the purposes of disposal to land, waste from the petroleum industry can be divided into two broad categories; exploration (drilling) wastes, and production wastes. The wastes disposed of through the consent holder's operations are primarily drilling waste. Fracture return fluids are not disposed of at these sites.

1.2.2 Drilling wastes

Waste drilling material is produced during well drilling for hydrocarbon exploration. The primary components of this waste are drilling fluids (muds) and rock cuttings.

[1] The Council has used these compliance grading criteria for more than 17 years. They align closely with the 4 compliance grades in the MfE Best Practice Guidelines for Compliance, Monitoring and Enforcement, 2018

1.2.3 Drilling fluids

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. Oil and gas wells may be drilled with either synthetic based mud (SBM) or water based mud (WBM). As the names suggest, these are fluids with either water (fresh or saline) or synthetic oil as a base material, to which further compounds are added to modify the physical characteristics of the mud (for example mud weight or viscosity).

More than one type of fluid may be used to drill an individual well. In the past, oil based muds (diesel/crude oil based) have also been used. Their use has declined since the 1980s due to their ecotoxicity; they have been replaced by SBM. SBM use olefins, paraffins or esters as a base material. While this is technically still a form of oil based fluid, these fluids have been engineered to remove polynuclear 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.

1.2.4 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.

1.2.5 Landfarming process description

Basic steps in the landfarming process include:

1. Drilling waste is transported from a specific wellsite by truck (cuttings) or tanker (liquids). It is placed in a dedicated, fit for purpose, lined storage pit. At the consent holder's facilities cuttings arrive from site in metal 'D' bins directly collected from the wellsite. Material is subjected to an analytical screen undertaken in a registered laboratory. The analysis is dictated by specific consent conditions.
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.

Consent 7559-1.4 allows for the discharge of drilling waste from hydrocarbon exploration activities with WBM and SBM to land for the purpose of temporary storage at the Surrey Road stockpiling facility.

Consent 7591-1.2 allows for the discharge of drilling cuttings and drilling fluids from hydrocarbon exploration activities with WBM and SBM muds onto and into the land via landfarming, landspreading, injection spreading and irrigation. The irrigation is the primary route to discharge contaminated storagee

The preferred method for the treatment and disposal of drilling material at the consent holder's property is via landspreading (under consent 7591-1.2). A large muck spreader (Photo 1), is used for this purpose.

Photo 1 A muck spreader as utilised by the consent holder for landspreading

An auger in the base of the spreader conveys material back and through an opening (where the size is controlled by a sliding plate) where it contacts two rapidly rotating augers and is applied up to 10 m on either side. The deposition rate is controlled by the size of the opening at the rear of the unit and the speed of forward travel by the tractor. The waste is deposited onto existing pasture in small fragments, which are allowed some time to dry out before chain harrows and roman discs are used to till and break-up the waste which is dispersed back into the soil, as shown in Photo 2.

Photo 2 Tilling the soil post landspreading

1.3 Resource consents

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

A summary of the various consent types issued by the Council is included in Appendix I, as are copies of all permits held by the Company during the period under review.

Table 1 Resource consents held by the consent holder

Consent number	Purpose	Granted	Review	Expires
Discharges of waste to land				
7559-1.4	To discharge drilling waste (consisting of drilling cuttings and drilling fluid) from hydrocarbon exploration activities with water based muds and synthetic based muds onto and into land for the purpose of storage prior to disposal.	20 Nov 2009 Change 20 November 2018	June 2019	1 June 2027
7591-1.2	To discharge drilling waste cuttings (consisting of drilling cuttings and drilling fluids) from hydrocarbon exploration activities with water based muds and from synthetic based muds onto and into the land via landfarming, landspreading, injection spreading and irrigation.	21 Jan 2010 Change 20 November 2018	June 2019	1 June 2027
5821-2.2	To discharge sludge and other residuals from water treatment plants in the New Plymouth and South Taranaki Districts onto and into land	14 Dec 2005	June 2021	1 June 2026

1.4 Monitoring programme

1.4.1 Introduction

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

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

The monitoring programme for the consent holder's operations consisted of five primary components.

1.4.2 Programme liaison and management

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

- ongoing liaison with resource consent holders over consent conditions and their interpretation and application;
- 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.

1.4.3 Site inspections

The site was visited 12 times during the monitoring period. With regard to consents for the discharge to water, the main points of interest were plant processes with potential or actual discharges to receiving watercourses. This included contaminated stormwater and process wastewaters. Air inspections focused on plant processes with associated actual and potential emission sources and characteristics, including potential odour, dust, noxious or offensive emissions. Sources of data being collected by the Company were identified and accessed, so that performance in respect of operation, internal monitoring, and supervision could be reviewed by the Council. The neighbourhood was surveyed for environmental effects.

1.4.4 Chemical sampling

The Council collected samples of soil and water (groundwater and surface water) throughout the monitoring period. This is to assess the compliance of the consent holder with the consented conditions and to assess for any adverse effects arising from the facilities or activities of the consent holder.

1.4.4.1 Soil

In total, 8 composite soil samples from specific disposal areas were collected by Council staff. The sampling methodology utilised is adapted from the Guidelines for the Safe Application of Biosolids to Land in New Zealand (2003). This is undertaken through the compositing of 10 soil cores (Photo 3) (400 mm+/- depth to encompass the zone of application of the drilling mud) taken at 10 m intervals along a transect, through an landfarmed area.

Photo 3 An example of an extracted soil core

The analysis undertaken by the Council is described in Table 2. Each transect is GPS referenced to allow for areas to be characterised and repeat analysis when required.

1.4.4.2 Water

Compliance water analysis was undertaken across the following sources in this monitoring period:

- surface water;
- stormwater discharge; and
- groundwater.

Surface water samples were also obtained on five separate occasions along the unnamed tributary of the Mangatengehu Stream (Figure 1) in relation to stormwater discharges from the Surrey Road stockpiling facilities.

Groundwater analysis results were obtained through the groundwater monitoring bore network. The Surrey Road facility has three groundwater monitoring bores. These bores were installed to quantify the quality of the groundwater and, specifically to understand if any adverse effects were permeating from the facility through the storage of material in lined storage pits in the case of Surrey Road. A nova-flow drain discharge is also sampled.

The Council utilises a peristaltic low flow pump to collect the water samples. The samples are only collected post stabilisation of groundwater quality during pumping, and are obtained through a Yellow Springs Instrument (YSI) multi parameter probe and a flow through cell.

Surface water, groundwater, discharge and soil analytes are provided in Table 2 below.

Table 2 Chemical analytes by medium

Surface / Discharge water analytes	
Barium (acid soluble)	Calcium
Benzene	Chloride
Toluene	Conductivity
Ethylene	Total petroleum hydrocarbons
Xylene M/O	Suspended solids
Biological oxygen demand (BOD)	Total dissolved salts (TDS)

Biochemical oxygen demand (BCOD)	Temperature pH
Groundwater analytes	
Barium (acid soluble) Barium (dissolved) Benzene Toluene Ethylene Xylene M/O Chloride Conductivity	Sodium Level Nitrite-nitrate nitrogen Total dissolved salts (TDS) Temperature Level Total petroleum hydrocarbon Biochemical oxygen demand (BCOD)
Soil analytes	
Calcium Chloride Magnesium Sodium Conductivity Potassium Moisture factor Sodium absorption ratio (SAR)	Ammoniacal nitrogen Nitrite-nitrate nitrogen pH Total soluble salts Total recoverable heavy metals Total petroleum hydrocarbons Polycyclic aromatic hydrocarbons Monocyclic aromatic hydrocarbons

1.4.5 Biomonitoring surveys

Two biological surveys were performed during the monitoring period under review. The Surrey Road stockpiling facility is located in close proximity to the unnamed tributary of the Mangatengehu Stream. A Council Officer undertook a spring and a late summer survey of four specific monitoring sites on this tributary.

Please note that the specific biomonitoring reports are now reported separately from this report, however a summary of each survey is provided in Section 2.1.3.

1.4.6 Review of consent holder data

In accordance with the consent conditions the consent holder or subsidiary must supply the Council with an annual report. The annual report is to contain information pertaining to the records kept by the consent holder and shall include but not be limited to:

- the location from which the drilling waste originated;
- the composition of the waste, including analytical analysis of a specified range of analytes;
- the stockpiling locations if utilised;
- volume of material;
- the areas landfarmed, including a map;
- volumes of wastes landfarmed; and
- details of monitoring undertaken.

It is noted that no annual report was supplied by the consent holder or Company this monitoring period.

2 Results

2.1 Surrey Road stockpiling facility

The Surrey Road stockpiling facility (Figure 1) is located on the Taranaki ring plain bordering the Egmont National Park near Inglewood. An unnamed tributary of the Mangatengehu Stream flows adjacent to the facility. The proximity of the site to this recognised ecosystem had been taken into account in the setting of buffer distances and location of the stockpiling facilities.

The predominant soil type has been identified as gravelly sand and vegetation growth consists of native bush which transitions into pasture. Average annual rainfall for the site is 1,942 mm (taken from the nearby 'Stratford' monitoring station).

The stockpiling facility located at Surrey Road is operated under one consent (7559-1.4). This consent allows the consent holder to discharge specific quantities of drilling related material (consisting of drilling cuttings, drilling fluids and muds, both WBM and SBM) onto land for stockpiling purposes.

The landfarming or landspreading of material is actioned under a separate consent (7591-1.2) which is discussed later in this report. No consents are held to discharge stormwater from this stockpiling site; it is expected to comply with the permitted activity criteria of Rule 23 in the Regional Freshwater Plan for Taranaki (RFWP). However contaminated stormwater is required to be pumped from the irrigation pit to the adjacent paddock.

Figure 1 Surrey Road stockpiling facility and monitoring locations

Site data	
Location	
Word descriptor:	Surrey Road, Inglewood, Taranaki
Map reference:	E 1701847
(NZTM)	N 5651476
Mean annual rainfall:	1,942 mm
Mean annual soil temperature:	-
Mean annual soil moisture:	-
Elevation:	~500 MASL
Geomorphic position:	Ring plain
Erosion / deposition:	Negligible
Vegetation:	Transitional-native bush to pasture
Parent material:	Tephra / volcanoclastic
Drainage class:	Free / well draining

2.1.1 Inspections

07 July 2020

During the inspection the following was noted. A follow-up inspection was undertaken due to a non-compliance on consent 7559-1.4 (abatement Notice EAC-23349 and 23344). This related to the compromised liner in pit 3.

At the time of inspection, rainfall was light to medium and there was no wind. The inspection found that material had been removed from pit 3 and placed into the concrete lined pit 1. Pit 3 on observation still contained overflow liquid from pit 1 and 2.

A stockpile of material next to pit 3 looked to contain the old pit lining, and material from the pit walls and base. An inspection of the wider area was also carried out. It was found the irrigation pond was discharging into the adjacent drain which leads to the stormwater treatment system.

A sample was taken of the discharge point. The irrigation pump was not operating. The discharge had a hydrocarbon odour. The drain had noticeable foaming just down of the discharge point. Just up from the discharge point, a sheen was visible near the irrigation hose, which suggests that it may be leaking.

The drain cleared towards the stormwater ponds. An inspection of the stormwater ponds found that there were no sheens. The receiving waters were sampled and inspected. The discharge was slightly turbid. No effect was noted in the receiving waters.

The finding of the irrigation pond discharging into the adjacent drain was considered a non-compliance of resource consent R2/7591-1.2[2]. An infringement notice may be issued. This breached abatement notice EAC-22343 issued 28 November 2018.

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[2] Condition 1 b) of consent 7591-1.2 states- landspreading means the discharge to land of the liquid fraction of drilling wastes/ this includes the stormwater component of the storage cells through the use of a landspreader and/ or irrigator and/ or injection spreader. Throughout the application of the liquid fraction the consent holder shall maintain pasture cover at all times.

29 July 2020

A follow up inspection was undertaken due to a recent non-compliance (on consent 7591-1.2). This related to the discharge of irrigation fluid to the adjacent drain. The inspection found that the irrigation pit was well below the discharge pipe. The irrigated area was inspected. The irrigated area appeared in reasonable condition. A small amount of sand was noted immediately adjacent to the irrigator. This looked to have resulted from a blockage. There was a pile of material stored next to pit 1 and 2. This pile appeared to contain some drilling mud or contaminated soil.

29 September 2020

A routine compliance monitoring inspection was undertaken of the landfarm storage facility and irrigation area. The inspection found that the site was largely clean and tidy. The pile of material noted near pit 1 and 2 had been removed. The uncontaminated stormwater pits looked to contain clean stormwater only. The stormwater pits were free of sheens.

An inspection of the irrigation pond found it was low in level and had ample freeboard remaining for any likely inflow of water. The generator was running and drilling fluid wastewater was discharging to land. The end nozzle of the irrigator had been removed, and irrigation fluid was pouring from the end of the irrigator.

This fluid was ponding and pooling around the general irrigation area, and travelling across the land where it entered the tributary in multiple locations. A sludge similar to what was present in the ponds was observed on the ponding and pooling. This was on first assessment a non-compliance. Samples, videos and photographs were taken, for further review (see Table 23).

06 November 2020

A routine compliance monitoring inspection was undertaken. The inspection found that the site was clean and tidy. The irrigator was running at the time of inspection. The irrigation pond was almost empty. The irrigation area was inspected. No ponding or pooling was noted in the irrigation area.

Stock were grazing within the pit and stormwater pond area. An inspection of the stormwater ponds found that the far stormwater pond (near the IBCs) and back up towards the drain was discoloured. A greasy substance was floating on the surface. The vegetation around the pond had been grazed and stock foot prints were evident in the area indicating that the stock had been in the stormwater pond.

Samples of the discolored water in the drain were taken, along with a sample from the discharge into the farm drain and upstream and downstream of the discharge into the farm drain. The activities were apparently compliant at the time of inspection, pending sample review (but see Table 23).

04 December 2020

During the inspection it was noted that the two discoloured stormwater ponds had cleared up since the last visit, however, the ponds were still turbid, and a greasy substance was still evident in the pond. An infringement notice may be issued for the incident as described on the visit of 6 November.

03 March 2021

A routine compliance monitoring inspection was undertaken of the landfarm storage facility and irrigation area. The inspection found that the site was largely clean and tidy. The uncontaminated stormwater pits looked to contain clean stormwater and have cleared up considerably since the last incident. The stormwater pits were free of sheens.

An inspection of the irrigation pond found it was low in level. No discharge to land was occurring at the time of inspection. The irrigation area was inspected. New irrigator pods had been purchased and had been in use.

Evidence of over application was found around two of the pods, as indicated by pasture burn in large circles within the vicinity of the pod. The pods did not looked to have been moved recently as the grass beneath the pipe was dead. Potential flow paths of irrigation fluid into surface water were identified by burn marks towards the Mangatengehu Stream and one the farm drains. This was a non-compliance with the consent, as pasture cover must be maintained at all times as per special condition 1 b. and 11 of consent 7591-1.2.

07 April 2021

A follow up inspection was undertaken after the recent non-compliance with consent 7591-1.2, which was due to lack of pasture cover in the irrigation area. The inspection found that the site was largely clean and tidy. The stormwater pits on the far side (close to the stream) were again heavily discolored and an oily substance was noted.

A sample of the discharge point from the far stormwater pond into the drain was taken, along with an upstream and downstream sample to test for any residual contamination. The other stormwater pits were free of sheens. An inspection of the irrigation pond found it was beginning to get high in level again after recent rain.

No irrigation had occurred recently, and all liquid from the irrigation pit had been removed off site and taken to a landfarm in Manutahi. The irrigation pods will need to be moved prior to any irrigation as cover must be maintained at all times as per special condition 1 b. and 11 of consent 7591-1.2.

Paddock 51 had been prepared to land farm. It was communicated to the consent holder to ensure all setbacks for discharges to land are adhered to as per special condition 14 and 15 of Resource Consent 7591-1.2. The activities were deemed compliant pending sample results.

21 May 2021

A routine compliance monitoring inspection was undertaken. The inspection found that works had been undertaken to decommission the storage pits. The pits adjacent to Surrey Road had been filled in. The other storage pits had been largely emptied of their contents. These two pits had been joined into the irrigation pit. The stormwater ponds on the northern side had been drained.

The irrigator was running at the time of inspection. The other two ponds adjacent to the stream remained intact. An inspection was undertaken of the irrigation area. This found ponding of semi solid drilling waste around two of the irrigation pods.

Around one of the irrigation pods there was significant ponding which was tracking towards the stream. A sample was taken of this discharge, along with samples taken from upstream, and two samples downstream from the discharge point. A further sample was taken from within the drain that runs adjacent to the discharge point of the stormwater ponds. Further enforcement action was being considered (see Table 23).

The recently land farmed area was inspected. No issues with over application were found, and no discharge of waste was occurring into the stream.

28 May 2021

Follow up inspection was undertaken after it was noted during the last inspection that drilling waste irrigation fluid was discharging into the stream. The inspection found that the irrigator has not been used since the last inspection. The area of ponded drilling waste around the irrigators was still present. Decommissioning of the pits had continued to take place, with the storage pits almost completely filled in. Some liquid remained in the irrigation pit.

02 June 2021

A compliance monitoring inspection was undertaken to assess compliance during the decommissioning of the storage pits. The storage pits had almost been completely flattened. There was sludge in the area where

the irrigation pit was. The irrigation pit was broken out to allow the liquid to drain into a new confined area to allow for land soakage. This is not best practice.

A sample was taken of the discharge from the stormwater pits closer to the Surrey Road side to check for compliance. The area of ponded drilling waste around the irrigators was still present. The irrigator was no longer utilised and had been removed from the site.

09 June 2021

A compliance monitoring inspection undertaken to assess compliance during the decommissioning of the storage pits. The storage pits have almost been completely flattened. The irrigation pit was bunded to prevent liquid draining into the newly created land soakage area. The area of ponded drilling waste around the irrigators was still present.

22 June 2021

A compliance monitoring inspection was undertaken to assess compliance during the decommissioning of the storage pits. The old irrigation pit was trickle discharging into the newly created land soakage area which was had been bunded and was almost full. It was communicated to the consent holder to please ensure that the liquid does not escape this area and enter the stormwater pits. It was recommended to pump this ponded area down, as more rain was forecast.

The WTP sludge ponds on the stockpiling site had been completely flattened. Some sedimentation was noted in the nearby drain, however, downstream was clear. The area of ponded drilling waste around the irrigators was no longer present. Pasture strike is good in the recently landfarmed area. No issues were noted.

2.1.2 Results of abstraction and discharge monitoring

2.1.2.1 Groundwater monitoring

The Surrey Road stockpiling facility contains a groundwater monitoring network comprised of three monitoring wells. In addition, a nova flow drain which flows from under the storage pits is also sampled (GND2517). These four monitoring locations are sampled quarterly. Their locations are shown in Figure 1.

Analysis for total petroleum hydrocarbons (TPH) (C_7-C_9, C_{10}-C_{14}, C_{15}-C_{36} and C_7-C_{36}) as well as benzene, toluene ethylbenzene and xylenes (BTEX) analysis was undertaken on samples from three of four monitoring locations, (GND2166, 2167 and 2517). The quarterly results are provided in the following Tables 3-6.

Table 3 GND2165 2020-2021

GND2165	Collected	03 Aug 2020	06 Nov 2020	11 Feb 2021	05 May 2021
Parameter	Time	11:15	10:30	Dry well	Dry well
Level	m	3.175	2.36		
Sample Temperature	°C	11.6	12.4		
Electrical Conductivity (EC)	µS/cm	57	98		
	mS/m	5.7	9.8		
pH	pH Units	6	6.4		
Acid Soluble Barium	g/m^3	< 0.11	< 0.11		
Dissolved Barium	g/m^3	0.019	0.02		

GND2165	Collected	03 Aug 2020	06 Nov 2020	11 Feb 2021	05 May 2021
Parameter	Time	11:15	10:30	Dry well	Dry well
Chloride	g/m³	6.1	9.8		
Nitrate-N + Nitrite-N	g/m³	0.154	0.89		
Total Dissolved Solids (TDS)	g/m³	49	70		
Total Sodium	g/m³	3.7	4.7		

Table 4 GND2166 2020-2021

GND2166	Collected	03 Aug 2020	06 Nov 2020	11 Feb 2021	05 May 2021
Parameter	Time	12:20	11:40	10:40	11:50
Level	m	1.625	1	1.83	1.73
Sample Temperature	°C	10.9	13.7	15	14.4
Electrical Conductivity (EC)	µS/cm	44	71	65	45
	mS/m	4.4	7.1	6.5	4.5
pH	pH Units	6.1	5.6	6	5.9
Acid Soluble Barium	g/m³	< 0.11	< 0.11	< 0.11	< 0.11
Dissolved Barium	g/m³	0.008	0.015	0.017	0.01
Chloride	g/m³	5.5	7.8	7.2	4.7
Nitrate-N + Nitrite-N	g/m³	0.52	1.94	0.92	0.46
Total Dissolved Solids (TDS)	g/m³	33	58	54	36
Total Sodium	g/m³	4	4.5	5.7	3.8

Table 5 GND2167 2020-2021

GND2167	Collected	03 Aug 2020	06 Nov 2020	11 Feb 2021	05 May 2021
Parameter	Time	13:05	12:20	11:10	12:30
Level	m	2.27	1.73	2.29	2.305
Sample Temperature	°C	12.1	13.3	14.5	14.7
Electrical Conductivity (EC)	µS/cm	122	82	120	84
	mS/m	12.2	8.2	12	8.4
pH	pH Units	5.9	5.7	6.1	5.8
Acid Soluble Barium	g/m³	< 0.11	< 0.11	< 0.11	< 0.11
Dissolved Barium	g/m³	0.046	0.045	0.053	0.031

GND2167	Collected	03 Aug 2020	06 Nov 2020	11 Feb 2021	05 May 2021
Parameter	Time	13:05	12:20	11:10	12:30
Chloride	g/m³	14.1	5.5	14.4	6.5
Nitrate-N + Nitrite-N	g/m³	2.5	0.157	0.065	0.27
Total Dissolved Solids (TDS)	g/m³	92	57	92	59
Total Sodium	g/m³	10.1	5.5	8.4	6.1

Table 6 GND2517 2020-2021

GND2517	Collected	03 Aug 2020	06 Nov 2020	11 Feb 2021	05 May 2021
Parameter	Time	11:45	10:55	10:00	11:20
Sample Temperature	°C	11.7	13.1	16.1	14.2
Electrical Conductivity (EC)	µS/cm	562	508	676	512
	mS/m	56.2	50.8	67.6	51.2
pH	pH Units	6.4	6.5	6.5	6.6
Acid Soluble Barium	g/m³	0.22	0.2	0.4	0.25
Dissolved Barium	g/m³	0.23	0.194	0.41	0.25
Chloride	g/m³	97	84	144	92
Nitrate-N + Nitrite-N	g/m³	< 0.002	0.023	< 0.002	0.007
Total Dissolved Solids (TDS)	g/m³	320	270	390	290
Total Sodium	g/m³	22	22	39	32
Benzene	g/m³	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Toluene	g/m³	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Ethylbenzene	g/m³	< 0.0010	< 0.0010	< 0.0010	< 0.0010
o-Xylene	g/m³	< 0.0010	< 0.0010	< 0.0010	< 0.0010
m&p-Xylene	g/m³	< 0.002	< 0.002	< 0.002	< 0.002
C7 - C9	g/m³	< 0.10	< 0.10	< 0.10	< 0.10
C10 - C14	g/m³	0.5	< 0.2	< 0.2	< 0.2
C15 - C36	g/m³	2.3	< 0.4	1.2	0.7
Total hydrocarbons (C7 - C36)	g/m³	2.7	< 0.7	1.4	0.8

Minimal impacts to groundwater were recorded in monitoring wells GND2165, 2166 and 2167.

GND2517 is a nova coil discharge, it is located beneath the storage cell area. The discharge contained marginally elevated chloride (ranging 84-144 g/m^3) and total dissolved salts (TDS) (ranging 70-390 g/m^3) throughout the monitoring period. The cause of these marginal elevations is because the Company stored

material in a compromised storage cell. This is documented in the inspections (section 2.1.1) and incidents (section 2.3) sections of this report.

Trace detections of total petroleum hydrocarbons (TPH) C10-C14 (0.5 g/m^3, August 2020) and C15-C36 (2.3 g/m^3. August 2020, 1.2 g/m^3, February 2021 and 0.7 g/m^3, May 2021), were also recorded.

2.1.2.2 Surface water monitoring of the unnamed tributary of the Mangatengehu Stream

Surface water monitoring of the unnamed tributary of the Mangatengehu Stream and the Surrey Road stormwater discharge location (IND001067) was performed on five occasions this monitoring period (Tables 7-12). The monitoring locations are shown in Figure 1. The facility does not hold a specific stormwater discharge consent. It is required to comply with the Regional Freshwater Plan (RFWP) rule 23.

Table 7 Surface water monitoring 03 August 2020

	Site	MTH000060	IND001067	MTH000064
	Collected	03 Aug 2020	03 Aug 2020	03 Aug 2020
Parameter	**Time**	**11:35**	**13:35**	**13:20**
Sample Temperature	°C	9.3	8.6	9.5
Acid Soluble Barium	g/m^3	-	0.18	-
Dissolved Barium	g/m^3	-	0.13	-
Electrical Conductivity (EC)	µS/cm	95	246	111
	mS/m	9.5	24.6	11.1
Chloride	g/m^3	5.5	43	9.8
Dissolved C-Biochemical Oxygen Demand ($CBOD_5$)	g O_2/m^3	< 1.0	< 1.0	< 1.0
pH	pH Units	7.6	7	7.6
Total Dissolved Solids (TDS)	g/m^3	87	158	91
Total Sodium	g/m^3	6.2	13.5	7.1
Total Suspended Solids	g/m^3	< 5	10	< 4
Benzene	g/m^3	-	< 0.0010	-
Toluene	g/m^3	-	< 0.0010	-
Ethylbenzene	g/m^3	-	< 0.0010	-
m&p-Xylene	g/m^3	-	< 0.002	-
o-Xylene	g/m^3	-	< 0.0010	-
C7 - C9	g/m^3	-	< 0.10	-
C10 - C14	g/m^3	-	< 0.2	-
C15 - C36	g/m^3	-	< 0.4	-
Total hydrocarbons (C7 - C36)	g/m^3	-	< 0.7	-

Minimal impacts from the stormwater discharge (IND001067) were noted during the 3 August 2020 monitoring round. The discharge was slightly more mineralised than the receiving waters, as referenced by the EC, chloride, sodium and TDS. However, the impact on the surface waters of the unnamed tributary of the Mangatengehu Stream for these parameters was minimal.

Table 8 Surface water monitoring 29 September 2020

	Site	MTH000060	MTH000062
	Collected	29 Sep 2020	29 Sep 2020
Parameter	Time	13:24	13:40
Sample Temperature	°C	-	-
Acid Soluble Barium	g/m^3	< 0.11	< 0.11
Dissolved Barium	g/m^3	0.016	0.102
Electrical Conductivity (EC)	µS/cm	66	113
	mS/m	6.6	11.3
Chloride	g/m^3	5.3	18.2
Dissolved C-Biochemical Oxygen Demand ($CBOD_5$)	g O_2/m^3	-	-
pH	pH Units	7	6.6
Total Dissolved Solids (TDS)	g/m^3	60	101
Total Sodium	g/m^3	-	-
Total Suspended Solids	g/m^3	-	-
Benzene	g/m^3	< 0.0010	< 0.0010
Toluene	g/m^3	< 0.0010	< 0.0010
Ethylbenzene	g/m^3	< 0.0010	< 0.0010
m&p-Xylene	g/m^3	< 0.002	< 0.002
o-Xylene	g/m^3	< 0.0010	< 0.0010
C7 - C9	g/m^3	< 0.10	< 0.10
C10 - C14	g/m^3	< 0.2	< 0.2
C15 - C36	g/m^3	< 0.4	< 0.4
Total hydrocarbons (C7 - C36)	g/m^3	< 0.7	< 0.7

Surface water monitoring on the 29 September 2020 was undertaken, due to the inspector identifying a non-compliance with the consent holder's irrigator[3]. Overland flow of drilling fluid was observed, due to over application of the irrigator. This was tracked to the unnamed tributary of the Mangatengehu Stream. The analysis indicated an elevation in dissolved barium, EC, chloride and TDS in the surface waters. Both the Company and the consent holder were issued an abatement notice to cease the discharge and an infringement notice as penalty.

[3] Section 2.1.1 29 September 2020 inspection.

Table 9 Surface water monitoring 06 November 2020

	Site	MTH000060	IND001067	MTH000064	On site next to IBC
	Collected	06 Nov 2020	06 Nov 2020	06 Nov 2020	06 Nov 2020
Parameter	**Time**	**10:45**	**12:40**	**12:30**	**10:39**
Sample Temperature	°C	12.5	14.4	13.2	-
Acid Soluble Barium	g/m^3	-	0.18	-	0.30
Dissolved Barium	g/m^3	-	0.173	-	0.118
Electrical Conductivity (EC)	µS/cm	355	140	342	113
	mS/m	35.5	14	34.2	11.3
Chloride	g/m^3	85	21	76	15.0
Dissolved C-Biochemical Oxygen Demand ($CBOD_5$)	$g\ O_2/m^3$	1.8	< 1.0	2.1	-
pH	pH Units	6.8	6.6	6.8	6.7
Total Dissolved Solids (TDS)	g/m^3	250	97	250	77
Total Sodium	g/m^3	29	8.5	28	-
Total Suspended Solids	g/m^3	< 5	20	< 5	-
Oil and grease	g/m^3	-	-	-	197
Benzene	g/m^3	-	< 0.0010	-	< 0.0010
Toluene	g/m^3	-	< 0.0010	-	< 0.0010
Ethylbenzene	g/m^3	-	< 0.0010	-	< 0.0010
m&p-Xylene	g/m^3	-	< 0.002	-	< 0.002
o-Xylene	g/m^3	-	< 0.0010	-	< 0.0010
C7 - C9	g/m^3	-	< 0.10	-	<0.10
C10 - C14	g/m^3	-	< 0.2	-	23
C15 - C36	g/m^3	-	< 0.4	-	240
Total hydrocarbons (C7 - C36)	g/m^3	-	< 0.7	-	270

Surface water and discharge sampling undertaken on the 6 November 2020 was due to a grease type substance being identified in the stormwater system during the corresponding inspection on the same day[4].

The sample of the substance on site indicated elevated oil and grease (197 g/m^3) as well as measurable TPH C7-C36 (270 g/m^3). The Company and consent holder were issued an abatement notice for this result as they were in breach of the Regional Freshwater Plan rule 23, which allows up to 15 g/m^3 of oil and grease in discharges.

The resultant analysis (Table 9) did not indicate the discharge from the stormwater system was adversely affecting the unnamed tributary of the Mangatengehu Stream, at the time of sampling. It was noted though, at the time, that both stream samples recorded somewhat elevated oxygen demand, chloride and TDS.

[4] Refer to Section 2.1.1 inspection 6 November 2020.

Table 10 Surface water monitoring 04 December 2021

	Site	MTH000062	IND001067	MTH000064
	Collected	04 Dec 2020	04 Dec 2020	04 Dec 2020
Parameter	Time	12:10	12:35	11:55
Sample Temperature	°C	12.3	15.8	12.3
Acid Soluble Barium	g/m³	< 0.11	0.21	< 0.11
Dissolved Barium	g/m³	0.021	0.21	0.038
Electrical Conductivity (EC)	µS/cm	86	269	101
	mS/m	8.6	26.9	10.1
Chloride	g/m³	7.5	56	11.5
Dissolved C-Biochemical Oxygen Demand ($CBOD_5$)	g O_2/m³	< 1.0	< 1.0	< 1.0
pH	pH Units	7.2	6.7	7
Total Dissolved Solids (TDS)	g/m³	75	157	80
Total Sodium	g/m³	5.9	17.7	6.9
Total Suspended Solids	g/m³	< 4	10	< 5
Benzene	g/m³	< 0.0010	< 0.0010	< 0.0010
Toluene	g/m³	< 0.0010	< 0.0010	< 0.0010
Ethylbenzene	g/m³	< 0.0010	< 0.0010	< 0.0010
m&p-Xylene	g/m³	< 0.002	< 0.002	< 0.002
o-Xylene	g/m³	< 0.0010	< 0.0010	< 0.0010
C7 - C9	g/m³	< 0.4	< 0.10	< 0.4
C10 - C14	g/m³	< 1.0	< 0.2	< 1.0
C15 - C36	g/m³	< 2	< 0.4	< 2
Total hydrocarbons (C7 - C36)	g/m³	< 4	< 0.7	< 4

Surface and discharge sampling undertaken on the 4 December 2020 (Table 10) was conducted as a follow up to the previous non-compliance identified during the November 2020 sample round. The results indicated no non compliances, with minimal adverse effects noted to the surface waters.

Table 11 Surface water monitoring 11 February 2021

	Site	MTH000060	IND001067	MTH000064
	Collected	11 Feb 2021	11 Feb 2021	11 Feb 2021
Parameter	Time	09:55	11:45	11:25
Sample Temperature	°C	12	18	12.4
Acid Soluble Barium	g/m³	-	0.11	-
Dissolved Barium	g/m³	-	0.104	-
Electrical Conductivity (EC)	µS/cm	83	238	93
	mS/m	8.3	23.8	9.3
Chloride	g/m³	10	45	11.6

	Site	MTH000060	IND001067	MTH000064
	Collected	11 Feb 2021	11 Feb 2021	11 Feb 2021
Dissolved C-Biochemical Oxygen Demand ($CBOD_5$)	g O_2/m^3	1	1.7	< 1.0
pH	pH Units	7	7.3	6.9
Total Dissolved Solids (TDS)	g/m^3	79	115	80
Total Sodium	g/m^3	6.8	17.6	7.2
Total Suspended Solids	g/m^3	< 5	8	< 5
Benzene	g/m^3	-	< 0.0010	-
Toluene	g/m^3	-	< 0.0010	-
Ethylbenzene	g/m^3	-	< 0.0010	-
m&p-Xylene	g/m^3	-	< 0.002	-
o-Xylene	g/m^3	-	< 0.0010	-
C7 - C9	g/m^3	-	< 0.10	-
C10 - C14	g/m^3	-	< 0.2	-
C15 - C36	g/m^3	-	< 0.4	-
Total hydrocarbons (C7 - C36)	g/m^3	-	< 0.7	-

Minimal impacts to the unnamed tributary of the Mangatengehu Stream were noted during the February 2021 (Table 11) surface water and discharge monitoring round.

Table 12 Surface water monitoring 05 May 2021

	Site	MTH000060	IND001067	MTH000064
	Collected	05 May 2021	05 May 2021	05 May 2021
Parameter	Time	11:05	13:00	12:45
Sample Temperature	°C	9.5	10.4	10
Acid Soluble Barium	g/m^3	-	0.17	-
Dissolved Barium	g/m^3	-	0.171	-
Electrical Conductivity (EC)	µS/cm	417	300	308
	mS/m	41.7	30	30.8
Chloride	g/m^3	96	57	66
Dissolved C-Biochemical Oxygen Demand ($CBOD_5$)	g O_2/m^3	11.4	1.9	6.4
pH	pH Units	7	7	7
Total Dissolved Solids (TDS)	g/m^3	210	191	270
Total Sodium	g/m^3	36	21	26
Total Suspended Solids	g/m^3	< 8	12	10
Benzene	g/m^3	-	< 0.0010	-
Toluene	g/m^3	-	< 0.0010	-
Ethylbenzene	g/m^3	-	< 0.0010	-
m&p-Xylene	g/m^3	-	< 0.002	-
o-Xylene	g/m^3	-	< 0.0010	-

	Site	MTH000060	IND001067	MTH000064
	Collected	05 May 2021	05 May 2021	05 May 2021
C7 - C9	g/m^3	-	< 0.10	-
C10 - C14	g/m^3	-	< 0.2	-
C15 - C36	g/m^3	-	< 0.4	-
Total hydrocarbons (C7 - C36)	g/m^3	-	< 0.7	-

The surface water and discharge monitoring round undertaken on the 5 May 2021 identified elevated concentrations of EC, chloride, BOD and TDS within both surface water monitoring locations (MTH00060 and 64). The corresponding discharge was compliant with RFWP rule 23 conditions.

However, the elevations identified within the surface water were again attributed to the Company and the consent holder over irrigating the irrigation area. This in turn had overland flowed in to the unnamed tributary of the Mangatengehu Stream. Further infringement notices were issued to both parties.

2.1.3 Biological monitoring of the unnamed tributary of the Mangatengehu Stream

Two macroinvertebrate surveys of the unnamed tributary of the Mangatengehu Stream were undertaken during this monitoring period. These were conducted 22 December 2020 and 1 March 2021. Full reports are available on request.

Biological monitoring 22 December 2020

A macroinvertebrate survey was performed on 22 December 2020 in order to monitor the health of the macroinvertebrate communities of an unnamed tributary of the Mangatengehu Stream. This was in relation to the disposal of drilling waste to land within the vicinity of this tributary at the Surrey Road landfarm. The site located off Surrey Road, receives drilling wastes, which are stored on site, and then eventually spread over land. Drainage of water from the storage pits flows through at least two skimmer pits. From here, it is either pumped out for removal, or discharged to land, in the vicinity of the unnamed tributary. No consent is held to discharge to the tributary from the skimmer pits, as this discharge was to be undertaken in accordance with permitted activity rule 23 of the Regional Fresh Water Plan for Taranaki. A condition of this permitted activity rule is that the discharge shall not give rise to (amongst other effects), any significant adverse effects on aquatic life.

Numerous surveys between December 2013 and October 2018 have indicated that activities at the drilling waste stockpiling site and stockpiling area may have resulted in impacts to the macroinvertebrate communities in the lower section of the tributary of the Mangatengehu Stream. However, the extent to which this may have occurred, could not be determined due to variables such as periphyton coverage and iron oxide deposits. It was recommended that an investigation into whether stockpiling activities were responsible for the high level of iron oxide deposits observed at the two 'impacted' sites would be useful in determining whether stockpiling activities were responsible for low macroinvertebrate indices recorded at the downstream sites in the unnamed tributary of the Mangatengehu Stream. The previous summer survey (February 2019) gave no indication that stockpiling activities had a significant detrimental impact on the stream macroinvertebrate communities, and it was concluded that macroinvertebrate communities had predominantly been affected by habitat differences between sites. However, in the two most recent surveys (January 2020 and March 2020) significant adverse effects were evident. Results suggested that a harmful discharge associated with stockpiling activities had likely entered the unnamed tributary of the Mangatengehu Stream between sites 1 and 2 and had significantly adversely affected the macroinvertebrate community. It was recommended that further investigation into stockpiling activities and associated discharges be carried out to determine the source of any toxic discharges, and to manage these immediately to ensure water quality and the health of the macroinvertebrate communities of the unnamed tributary of the Mangatengehu Stream.

Methods

This biomonitoring survey was undertaken at four sites on 22 December 2020 (Table 13 and Figure 2). At the time of the initial survey undertaken in April 2010, site 1 was established as a 'control site', upstream of the drilling stockpile area and sites 2 and 3 were established downstream of the skimmer pit discharge. During an inspection of the site in mid-2010, an unauthorised discharge of hydrocarbons was observed entering the stream. As a consequence of this inspection, changes were made to the onsite drainage. These changes were made between the April 2010 and November 2010 surveys. The result was that site 2 was located upstream of any discharge from the sites, and site 3 became the primary impact site. The stormwater discharge from the site now enters the unnamed tributary immediately upstream of the race crossing, approximately 35 m upstream of site 3. A new, secondary impact site (site 4) was established 100 m downstream of the stormwater discharge during the May 2012 survey.

The Council's standard 400 ml 'kick-sampling' technique was used to collect macroinvertebrates from the unnamed tributary of the Mangatengehu Stream. The 'kick-sampling' technique is very similar to Protocol C1 (hard-bottomed, semi-quantitative) of the New Zealand Macroinvertebrate Working Group (NZMWG) protocols for macroinvertebrate samples in wadeable streams (Stark *et al*, 2001).

Table 13 Biomonitoring sites in an unnamed tributary of the Mangatengehu Stream

Site number	Site code	Grid reference (NZTM)	Location	Altitude (masl)
1	MTH000060	E1701830 N5651430	Upstream of drilling waste stockpiling site	495
2	MTH000062	E1701954 N5651468	Approximately 85 m upstream of the spring and skimmer pit discharge	495
3	MTH000064	E1702050 N5651525	Approximately 35 m downstream of the skimmer pit discharge	490
4	MTH000066	E1702102 N5651582	Approximately 100 m downstream, of the skimmer pit discharge	485

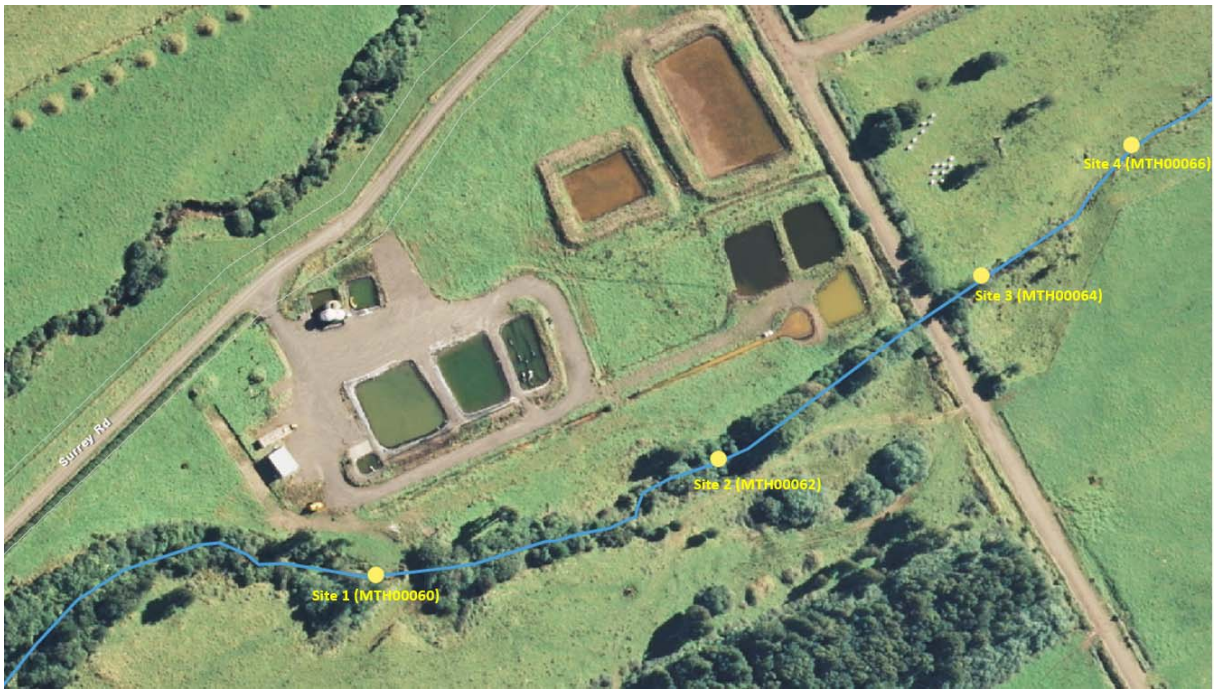

Figure 2 Biomonitoring sites in an unnamed tributary of the Mangatengehu Stream

Samples were preserved with ethanol for later sorting and identification under a stereomicroscope according to Taranaki Regional Council methodology using protocol P1 of NZMWG protocols for sampling macroinvertebrates in wadeable streams (Stark *et al.* 2001). Macroinvertebrate taxa found in each sample were recorded based on the abundance categories in Table 14.

Table 14 Macroinvertebrate abundance categories

Abundance category	Number of individuals
R (rare)	1-4
C (common)	5-19
A (abundant)	20-99
VA (very abundant)	100-499
XA (extremely abundant)	>499

Stark (1985) developed a scoring system for macroinvertebrate taxa according to their sensitivity to organic pollution in stony New Zealand streams. Highly `sensitive' taxa were assigned the highest scores of 9 or 10, while the most `tolerant' forms scored 1. Sensitivity scores for certain taxa have been modified in accordance with Taranaki experience. By averaging the scores obtained from a list of taxa collected from one site and multiplying by a scaling factor of 20, a Macroinvertebrate Community Index (MCI) value was obtained. The MCI is a measure of the overall sensitivity of macroinvertebrate communities to the effects of organic pollution (Table 3). More 'sensitive' communities inhabit less polluted waterways. A difference of 10.83 units or more in MCI values is considered significantly different between individual kick samples (Stark 1998) and from past TRC experience is also significantly different between individual kick-samples and other values (medians, means, limits, expected values etc).

Table 15 Macroinvertebrate community health based on MCI and SQMCI ranges which has been adapted for Taranaki streams and rivers from Stark's classification (Stark, 1985 and Stark, 1998)

TRC Grading	MCI	SQMCI
Excellent	≥140	≥7.00
Very Good	120-139	6.00-6.99
Good	100-119	5.00-5.99
Fair	80-99	4.00-4.99
Poor	60-79	3.00-3.99
Very Poor	<60	<3.00

A semi-quantitative MCI value, SQMCI (Stark 1999) has also been calculated for the taxa present at each site by multiplying each taxon score by a loading factor (related to its abundance), totalling these scores, and dividing by the sum of the loading factors (Table 15). The loading factors were 1 for rare (R), 5 for common (C), 20 for abundant (A), 100 for very abundant (VA), and 500 for extremely abundant (XA). A difference of 0.83 units or more in SQMCI values is considered significantly different between individual kick samples (Stark 1998) and from past TRC experience is also significantly different between individual kick-samples and other values (medians, means, limits, expected values etc.).

Results of December 2020 biological monitoring survey

Site habitat characteristics and hydrology

This December 2020 survey followed a period of 11 days since a fresh in excess of three times median flow and 12 days since a fresh in excess of seven times median flow, based on the nearest flow gauging site on the Manganui river at SH3 Midhurst. Environmental data is presented in Table 16.

Table 16 Summary of the environmental data recorded at four sites in relation to monitoring carried out for the Surrey Road drilling waste stockpiling site, 22 December 2020

Site number		Site 1	Site 2	Site 3	Site 4
Site Code		MTH000060	MTH000062	MTH000064	MTH000066
Sample Number		FWB20356	FWB20357	FWB20358	FWB20359
Time		08:55	08:35	08:20	08:05
Temperature		13.1	13.3	13.7	13.7
Water colour		Uncoloured	Uncoloured	Uncoloured	Uncoloured
Water clarity		Cloudy	Cloudy	Cloudy	Cloudy
Flow conditions		Moderate	Moderate	Moderate	Moderate
Water speed		Steady	Steady	Steady	Steady
Sampling habitat		Run	Run	Riffle	Riffle
Periphyton mats		Patchy	Slippery	Widespread	Widespread
Periphyton filaments		None	None	None	Patchy
Moss		Patchy	Patchy	Patchy	None
Leaves		Patchy	Widespread	Patchy	None
Wood		Patchy	Patchy	Patchy	None
Macrophytes		Edges Only	None	Edges Only	None
Bank stability		Mostly Stable	Mostly Stable	Stable	Stable
Stock damage		None	None	None	None
Iron oxide or silt coating		Yes	Yes	Yes	Yes
Substrate embedded		No	No	No	No
Substrate disturbed		Moderate Kicking	Moderate Kicking	Moderate Kicking	Moderate Kicking
Bed shaded		Partial	Complete	Partial	Partial
Undercut banks		No	No	No	No
Overhanging vegetation		Yes	Yes	Yes	Yes
Substrate composition	Silt	5	5	5	5
	Sand	5	5	0	5
	Fine gravel	5	10	5	5
	Coarse gravel	45	50	45	5
	Cobble	25	25	40	60
	Boulder	10	5	5	20
	Bedrock	0	0	0	0
	Hard clay	0	0	0	0
	Wood/root	5	0	0	0
	Concrete/gabion	0	0	0	0

Macroinvertebrate communities

Table 17 provides a summary of the results from previous surveys sampled in relation to the Surrey Road drilling waste stockpiling site, along with current survey results. Macroinvertebrate fauna of an unnamed tributary of the Mangatengehu Stream are recorded in the following Table 18.

Table 17 Number of taxa, MCI and SQMCI values for an unnamed tributary of the Mangatengehu Stream, sampled in relation to the Surrey Rd landfarm drilling waste stockpiling site on 22 December 2020 and a summary of historical data for these sites

Site	N	Number of taxa				MCI values				SQMCI values			
		Median	Range	Previous Survey	Current Survey	Median	Range	Previous Survey	Current Survey	Median	Range	Previous Survey	Current Survey
1	22	20	13-36	22	14	109	89-127	97	106	5.1	2.0-7.1	4.5	5.1
2	22	19	5-30	8	3	116	76-128	95	53	5.4	1.6-6.9	4.1	1.7
3	22	10	4-19	11	4	97	60-121	80	45	2.9	1.4-4.3	3.5	1.6
4	18	14	7-26	10	5	99	77-114	114	52	3.1	1.4-4.7	4.3	2.4

Table 18 Macroinvertebrate fauna of an unnamed tributary of the Mangatengehu Stream, sampled on 22 December 2020

Taxa List	Site Number	Taranaki MCI score	Site 1	Site 2	Site 3	Site 4
	Site Code		MTH000060	MTH000062	MTH000064	MTH000066
	Sample Number		FWB20356	FWB20357	FWB20358	FWB20359
ANNELIDA (WORMS)	Oligochaeta	1	R	C	C	C
MOLLUSCA	*Potamopyrgus*	4	R	-	R	C
CRUSTACEA	Ostracoda	1	-	-	R	-
EPHEMEROPTERA (MAYFLIES)	*Austroclima*	7	C	-	-	-
	Deleatidium	8	C	-	-	-
	Zephlebia group	7	R	-	-	-
PLECOPTERA (STONEFLIES)	*Austroperla*	9	R	-	-	-
	Zelandobius	5	R	-	-	-
TRICHOPTERA (CADDISFLIES)	*Hydrobiosis*	5	R	-	-	-
	Hydrochorema	9	R	-	-	-
DIPTERA (TRUE FLIES)	Eriopterini	5	R	-	-	-
	Hexatomini	5	-	R	-	-
	Zelandotipula	6	R	-	-	-
	Orthocladiinae	2	C	R	-	C
	Polypedilum	3	C	-	R	R
	Muscidae	3	-	-	-	R
	Austrosimulium	3	R	-	-	-
		No of taxa	14	3	4	5
		Taranaki MCI	106	53	45	52
		Taranaki SQMCI	5.1	1.7	1.6	2.4
		EPT (taxa)	7	0	0	0
		%EPT (taxa)	50	0	0	0
'Tolerant' taxa	'Moderately sensitive' taxa	'Highly sensitive' taxa				

R = Rare[3] C = Common[3] A = Abundant[3] VA = Very Abundant[3] XA = Extremely Abundant

This biological survey of four sites in an unnamed tributary of the Mangatengehu Stream was performed on 22 December 2020, to monitor the 'health' of the macroinvertebrate community of the tributary, in relation to the storage of drilling waste within its vicinity and the discharge of stormwater to land or to the stream. Samples were processed to provide number of taxa (richness), MCI, and SQMCI scores for each site.

Taxa richness and abundance is the most robust index when ascertaining whether a macroinvertebrate community has been exposed to harmful discharges. Macroinvertebrates when exposed to harmful chemicals may die or deliberately drift downstream as an avoidance mechanism (catastrophic drift). In the

current survey, taxa richness was very low and ranged between three and 14 taxa. The impacted sites 2, 3 and 4 recorded considerably lower taxa richness (three, four and five taxa respectively) than that recorded upstream at 'control' site 1 (14 taxa). These results are concerning, and indicate that a toxic discharge has likely entered the unnamed tributary of the Mangatengehu Stream below site 1. In comparison to the previous survey, all four sites recorded lower numbers of taxa, with the three impacted sites all recording their lowest taxa richness to date. Furthermore, and similarly to the previous survey results, taxa abundances were very low, with only 'rare' (1-4 individuals) and 'common' (5-19 individuals) recorded at sites 2, 3 and 4. Of the taxa recorded, three 'highly sensitive' and seven 'moderately sensitive' taxa were recorded at site 1, however only one, rare 'moderately sensitive' taxon was recorded at site 2, and no 'sensitive' taxa were recorded at sites 3 and 4. These results indicate that 'sensitive' macroinvertebrates may have perished or exhibited 'catastrophic drift,' downstream of a harmful discharge.

The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of organic pollution in stony streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to environmental conditions. The SQMCI takes into account taxa abundances as well as sensitivity to pollution. Significant differences in either the taxa richness, MCI or the SQMCI between sites may indicate the degree of adverse effects (if any) of the discharge being monitored.

The MCI score recorded at site 1 was reflective of 'good' macroinvertebrate community health, while the three impacted downstream sites recorded 'very poor' macroinvertebrate community health. Site 1 recorded an MCI score of 106 units, which was similar to the median for the site and higher than the previous survey score (although not significantly). The 'good' MCI score recorded at 'control' site 1 was significantly higher than that recorded downstream at sites 2, 3 and 4 (by 53, 61 and 52 units respectively). These results are extremely concerning and indicate that a harmful and toxic discharge has likely entered the unnamed tributary below site 1 and above site 2. All three 'impacted' sites (2, 3 and 4), recorded MCI scores that were significantly lower than site medians and significantly lower than the previous survey results. These scores were also significantly lower than the lowest scores previously recorded at all sites.

SQMCI scores were reflective of 'good' macroinvertebrate health at site 1 and 'very poor' health at sites 2, 3 and 4. The SQMCI score of 5.1 units recorded at site 1 was equal to the median for the site and was higher than the previously recorded score (although not significantly). The SQMCI scores recorded at site 2 (1.7 units), site 3 (1.6 units) and site 4 (2.4 units), were all significantly lower than that recorded at site 1 (by 3.4, 3.5 and 2.7 units respectively). Again, these results are extremely concerning and indicate that a toxic discharge has likely entered the unnamed tributary below site 1 and upstream of site 2 and has significantly adversely effected the macroinvertebrate communities of the unnamed tributary of the Mangatengehu Stream. The SQMCI scores recorded at sites 2, 3 and 4 were all significantly lower than those recorded in the previous survey and were lower than respective site medians (sites 2 and 3 both significantly).

Overall, these results suggest that a harmful discharge associated with stockpiling activities has likely entered the unnamed tributary of the Mangatengehu Stream between sites 1 and 2 and has significantly adversely affected the macroinvertebrate communities of this stream. It is recommended that further investigation into stockpiling activities and associated discharges are undertaken to determine the source of any toxic discharges, and that these are managed immediately to ensure water quality and the health of the macroinvertebrate communities of the unnamed tributary of the Mangatengehu Stream.

Biological monitoring March 2021

A macroinvertebrate survey was performed on 01 March 2021 in order to monitor the health of the macroinvertebrate communities of an unnamed tributary of the Mangatengehu Stream. This was in relation to the disposal of drilling waste to land within the vicinity of this tributary at the Surrey Road landfarm. The site located off Surrey Road, receives drilling wastes, which are stored on site, and then eventually spread over land. Drainage of water from the storage pits flows through at least two skimmer pits. From here, it is either pumped out for removal, or discharged to land, in the vicinity of the unnamed tributary. No consent

is held to discharge to the tributary from the skimmer pits, as this discharge was considered to comply with permitted activity rule 23 of the Regional Fresh Water Plan for Taranaki. A condition of this permitted activity rule is that the discharge shall not give rise to (amongst other effects), any significant adverse effects on aquatic life.

Results of the March 2021 biological survey

Site habitat characteristics and hydrology

Table 19 provides a summary of the results from previous surveys sampled in relation to the Surrey Road drilling waste stockpiling site, along with current survey results. Macroinvertebrate fauna of an unnamed tributary of the Mangatengehu Stream is provide in the following Table 20.

Table 19 Number of taxa, MCI and SQMCI values for an unnamed tributary of the Mangatengehu Stream, sampled in relation to the Surrey Rd landfarm drilling waste stockpiling site on 01 March 2021 and a summary of historical data for these sites

Site	N	Number of taxa				MCI values				SQMCI values			
		Median	Range	Previous Survey	Current Survey	Median	Range	Previous Survey	Current Survey	Median	Range	Previous Survey	Current Survey
1	23	20	13-36	14	18	109	89-127	106	86	5.1	2.0-7.1	5.1	3.3
2	23	18	3-30	3	9	115	53-128	53	71	5.2	1.6-6.9	1.7	2.5
3	23	10	4-19	4	13	96	45-121	45	77	2.8	1.4-4.3	1.6	2.8
4	19	13	5-26	5	6	99	52-114	52	60	2.8	1.4-4.7	2.4	2.3

Table 20 Macroinvertebrate fauna of an unnamed tributary of the Mangatengehu Stream, sampled on 01 March 2021

Taxa List	Site Number	Taranaki MCI score	Site 1	Site 2	Site 3	Site 4
	Site Code		MTH000060	MTH000062	MTH000064	MTH000066
	Sample Number		FWB21196	FWB21197	FWB21198	FWB21199
NEMATODA	Nematoda	3	-	-	R	-
ANNELIDA (WORMS)	Oligochaeta	1	C	A	A	A
	Lumbricidae	5	C	R	R	R
MOLLUSCA	*Potamopyrgus*	4	C	C	R	C
	Sphaeriidae	3	R	-	-	-
CRUSTACEA	Ostracoda	1	R	R	R	-
	Talitridae	5	R	-	-	-
EPHEMEROPTERA (MAYFLIES)	*Austroclima*	7	R	-	-	-
	Zephlebia group	7	R	-	-	-
COLEOPTERA (BEETLES)	Hydraenidae	8	R	-	-	-
	Ptilodactylidae	8	-	R	-	-
	Staphylinidae	5	-	-	R	-
TRICHOPTERA (CADDISFLIES)	*Hydrobiosis*	5	R	-	-	-
	Psilochorema	6	R	-	R	-
DIPTERA (TRUE FLIES)	*Limonia*	6	-	-	R	-
	Zelandotipula	6	R	-	-	-
	Orthocladiinae	2	C	R	-	R
	Polypedilum	3	A	A	VA	A
	Tanypodinae	5	-	-	R	-
	Empididae	3	R	-	-	-
	Muscidae	3	R	-	R	R
	Austrosimulium	3	A	C	R	-
ACARINA (MITES)	Acarina	5	R	R	R	-
		No of taxa	18	9	13	6
		Taranaki MCI	86	71	77	60
		Taranaki SQMCI	3.3	2.5	2.8	2.3
		EPT (taxa)	4	0	1	0

Taxa List	Site Number	Taranaki MCI score	Site 1	Site 2	Site 3	Site 4
	Site Code		MTH000060	MTH000062	MTH000064	MTH000066
	Sample Number		FWB21196	FWB21197	FWB21198	FWB21199
		%EPT (taxa)	22	0	8	0
'Tolerant' taxa	'Moderately sensitive' taxa	'Highly sensitive' taxa				

R = Rare[3] C = Common[3] A = Abundant[3] VA = Very Abundant[3] XA = Extremely Abundant

This biological survey of four sites in an unnamed tributary of the Mangatengehu Stream was performed on 01 March 2021, to monitor the 'health' of the macroinvertebrate community of the tributary, in relation to the storage of drilling waste within its vicinity and the discharge of stormwater to land or to the stream. Samples were processed to provide number of taxa (richness), MCI, and SQMCI scores for each site.

Taxa richness and abundance is the most robust index when ascertaining whether a macroinvertebrate community has been exposed to harmful discharges. Macroinvertebrates when exposed to harmful chemicals may die or deliberately drift downstream as an avoidance mechanism (catastrophic drift). In the current survey, taxa richness was low and ranged between six and 18 taxa. The impacted sites 2, 3 and 4 recorded lower taxa richness (nine, thirteen and six taxa respectively) than that recorded upstream at 'control' site 1 (18 taxa). In comparison to the previous survey, all four sites recorded higher numbers of taxa; however, with the exception of site 3 were all lower than site medians. Taxa abundances had improved from the previous survey, with abundant 'tolerant' taxa recorded at all four sites. In the previous survey taxa abundances were very low, with only 'rare' (1-4 individuals) and 'common' (5-19 individuals) taxa recorded at sites 2, 3 and 4. These results reflect an improvement from the previous survey results, however the low taxa richness recorded at sites 2 and 4 are still of concern and may indicate negative adverse effects from a toxic discharge entering below site 1.

The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of organic pollution in stony streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to environmental conditions. The SQMCI takes into account taxa abundances as well as sensitivity to pollution. Significant differences in either the taxa richness, MCI or the SQMCI between sites may indicate the degree of adverse effects (if any) of the discharge being monitored.

The MCI score recorded at site 1 was reflective of 'fair' macroinvertebrate community health, while the three impacted downstream sites recorded 'poor' macroinvertebrate community health. Site 1 recorded an MCI score of 86 units, which was significantly lower than both the previous survey score and the median for the site and was the lowest score recorded for this site to date. The 'fair' MCI score recorded at 'control' site 1 was significantly higher than that recorded downstream at sites 2, and 4 (by 15 and 26 units respectively) and was substantially higher than that recorded at site 3 (by 9 MCI units). These results reflect a decline in macroinvertebrate community health below site 1, however were an improvement from that recorded in the previous survey where a 53, 61 and 52 MCI unit decline was recorded at sites 2, 3 and 4 respectively. The current survey results are still concerning, particularly at site 4, which recorded a significantly lower MCI score than the three upstream sites. All three 'impacted' sites (2, 3 and 4), recorded MCI scores that were significantly lower than site medians, however were higher than that recorded by the previous survey (sites 2 and 3 both significantly).

SQMCI scores were reflective of 'poor' macroinvertebrate health at site 1 and 'very poor' health at sites 2, 3 and 4. The SQMCI score of 3.3 units recorded at site 1 was significantly lower than the median for the site and the previously recorded score. The SQMCI scores recorded at site 2 (2.5 units), site 3 (2.8 units) and site 4 (2.3 units), were all lower than that recorded at site 1 (by 0.8, 0.5 and 1.0 units respectively). In comparison to the previous survey results, sites 2 and 3 both recorded higher SQMCI scores (by 0.8 and 1.2 units respectively), while site 3 recorded a slightly lower score (by 0.1 unit). The SQMCI score recorded at site 3 was equal to the site median, while at site 4 was slightly lower than the median. The SQMCI score recorded at site 2 was significantly lower than the site median (by 2.7 units). These results reflect a decline in

macroinvertebrate 'health' at site 1 from the previous survey but a slight recovery at impacted sites 2 and 3. Site 4 remained in a similar state to that recorded in the previous survey.

Overall, these results suggest improvement from the previous survey results, however, still reflect a decline in macroinvertebrate community health at the three 'impacted' sites, downstream of 'control' site 1. It is recommended that further investigation into stockpiling activities and associated discharges are undertaken to determine the source of any toxic discharges, and that these are managed immediately to ensure water quality and the health of the macroinvertebrate communities of the unnamed tributary of the Mangatengehu Stream.

2.2 Landspreading and landfarming

The Company undertakes landspreading or landfarming of drilling waste material across a large consented area on the consent holder's farm (Figure 3). To date 60+ paddocks have been landfarmed. In this monitoring period two paddocks (51 and a portion of 47) were utilised by the consent holder for landfarming.

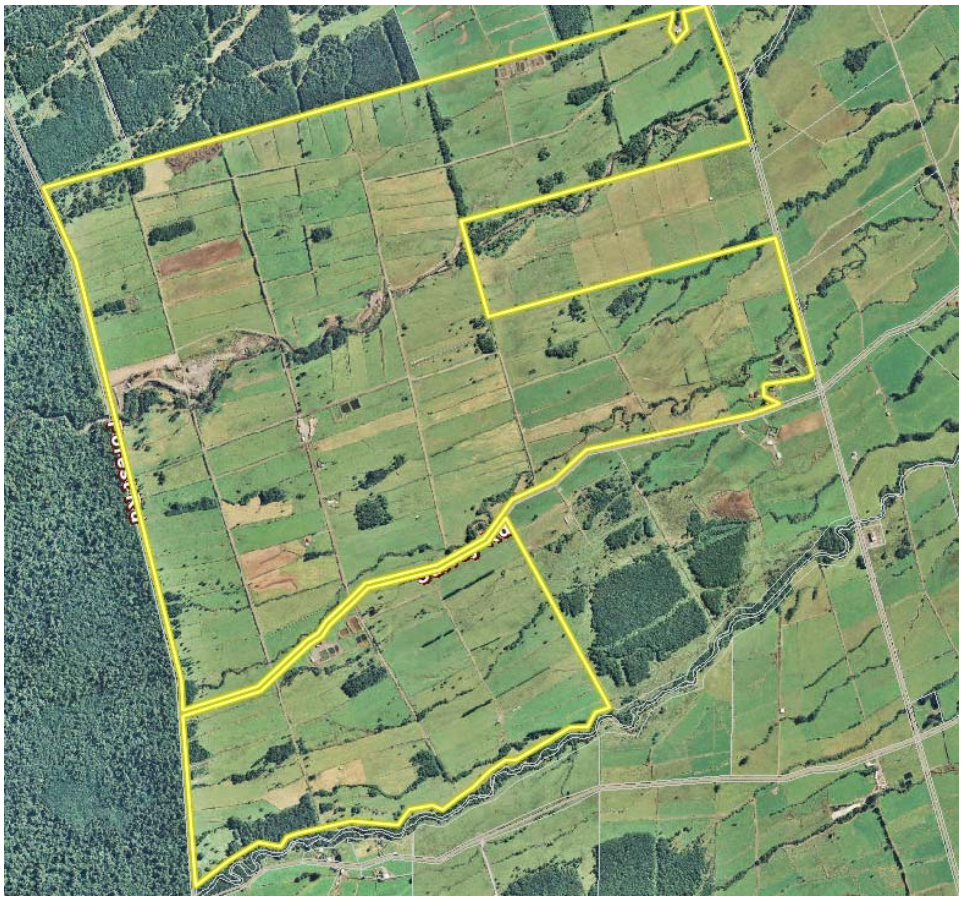

Figure 3 Aerial view of the consent holder's consented landfarming area

2.2.1 Landfarming operations

Material received and discharged by the Company and consent holder in this monitoring year is provided in the following Table 21.

Table 21 Summary of landfarming activities to paddock 51 and 47 2020-2021 monitoring period

Company and well site	Quantity
Tamarind resources Tui H3	542 m^3
Todd Energy MHW23	25 m^3
Todd Energy McKee 9	19 m^3
Waste from Surrey Road cell 3 altercations	500 m^3
OMV MA-07A	141 m^3
OMV MA-03A	10 m^3
OMV MA-11A	28 m^3
Total	1,265 m^3

2.2.2 Soil sampling

Eight composite soil samples were collected from landfarmed paddocks in the 2020-2021 monitoring period. The paddocks sampled were 51, 86, 87 B, 87 C and the former Derby Road stockpiling facility.

Polycyclic aromatic hydrocarbons which were not recorded above the LOD, or required as a surrender criteria analyte, have not been tabulated in the following Table 22.

Table 22 Landfarming soil samples 2020-2021

15-Sep-21	Location	7591-1.2	51	51	86	86	87 B	87 C	Derby	Derby
Parameter	**Time**	**Surrender Limit**	**10:00**	**10:30**	**11:20**	**11:45**	**12:30**	**12:46**	**13:20**	**13:45**
Dry Matter (Env)	g/100 g as rcvd		66	68	58	68	69	64	71	66
Electrical Conductivity (EC)	mS/cm	<2,.900	0.03	0.52	0.07	0.06	0.29	0.15	0.17	0.14
1-Methylnaphthalene	mg/kg dry wt		< 0.016	0.2	< 0.017	< 0.015	< 0.014	< 0.016	0.026	< 0.016
2-Methylnaphthalene	mg/kg dry wt		< 0.016	0.37	< 0.017	< 0.015	< 0.014	< 0.016	0.042	< 0.016
Benzo[a]pyrene (BAP)	mg/kg dry wt	<0.027	< 0.016	< 0.015	< 0.017	< 0.015	< 0.014	< 0.016	< 0.014	< 0.016
Benzo[e]pyrene	mg/kg dry wt		< 0.016	0.02	< 0.017	< 0.015	< 0.014	< 0.016	< 0.014	< 0.016
Benzo[g,h,i]perylene	mg/kg dry wt		< 0.016	0.021	< 0.017	< 0.015	< 0.014	< 0.016	< 0.014	< 0.016
Chrysene	mg/kg dry wt		< 0.016	0.024	< 0.017	< 0.015	< 0.014	< 0.016	< 0.014	< 0.016
Fluoranthene	mg/kg dry wt		< 0.016	0.032	< 0.017	< 0.015	< 0.014	< 0.016	< 0.014	< 0.016
Fluorene	mg/kg dry wt		< 0.016	0.025	< 0.017	< 0.015	< 0.014	< 0.016	< 0.014	< 0.016
Naphthalene	mg/kg dry wt	<7.2	< 0.08	0.21	< 0.09	< 0.08	< 0.07	< 0.08	< 0.07	< 0.08
Perylene	mg/kg dry wt		< 0.016	< 0.015	0.026	0.018	0.042	< 0.016	< 0.014	< 0.016
Phenanthrene	mg/kg dry wt		< 0.016	0.132	< 0.017	< 0.015	< 0.014	< 0.016	0.021	< 0.016
Pyrene	mg/kg dry wt	<160	< 0.016	0.083	< 0.017	< 0.015	< 0.014	< 0.016	< 0.014	< 0.016

15-Sep-21	Location	7591-1.2	51	51	86	86	87 B	87 C	Derby	Derby
Parameter	**Time**	**Surrender Limit**	**10:00**	**10:30**	**11:20**	**11:45**	**12:30**	**12:46**	**13:20**	**13:45**
Total of Reported PAHs in Soil	mg/kg dry wt		< 0.4	1.2	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Sodium (Sat Paste)	mg/L		13	97	14	20	51	33	26	15
Calcium (Sat Paste)	mg/L		9	531	28	29	220	100	123	102
Magnesium (Sat Paste)	mg/L		< 3	20	< 3	< 3	10	4	5	4
Sodium Absorption Ratio (SAR)		8	1	1.1	0.7	1	0.9	0.9	0.6	0.4
Soluble Salts (Field)	%	<0.25	< 0.05	0.18	< 0.05	< 0.05	0.1	0.05	0.06	< 0.05
Total Recoverable Barium	mg/kg dry wt	10,000	680	4,800	1,800	3,100	4,700	5,300	2,200	1,990
Chloride	mg/kg	<700	21	616	15	52	279	90	77	50
Total Recoverable Sodium	mg/kg dry wt	<460	500	590	540	540	580	560	700	670
Benzene	mg/kg dry wt	<1.1	< 0.07	< 0.07	< 0.09	< 0.07	< 0.07	< 0.08	< 0.07	< 0.07
Toluene	mg/kg dry wt	<82	0.07	0.32	< 0.09	< 0.07	< 0.07	< 0.08	< 0.07	< 0.07
Ethylbenzene	mg/kg dry wt	<59	< 0.07	0.08	< 0.09	< 0.07	< 0.07	< 0.08	< 0.07	< 0.07
o-Xylene	mg/kg dry wt	<59	< 0.07	0.18	< 0.09	< 0.07	< 0.07	< 0.08	< 0.07	< 0.07
m&p-Xylene	mg/kg dry wt	<59	< 0.14	0.52	< 0.17	< 0.14	< 0.13	< 0.15	< 0.13	< 0.14
C7 - C9	mg/kg dry wt	<210	< 10	12	< 10	< 9	< 9	< 10	< 9	< 10
C10 - C14	mg/kg dry wt	<150	53	2,800	27	46	1,460	1,180	410	39
C15 - C36	mg/kg dry wt	<1,300	370	6,100	340	700	5,300	3,900	6,300	670
Total hydrocarbons (C7 - C36)	mg/kg dry wt	<20,000	430	8,900	370	750	6,700	5,100	6,700	710
Total Recoverable Arsenic	mg/kg dry wt	<17	< 2	< 2	< 2	< 2	< 2	2	2	2
Total Recoverable Cadmium	mg/kg dry wt	<0.8	0.12	0.15	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	<600	5	8	7	7	8	7	12	10
Total Recoverable Copper	mg/kg dry wt	<100	31	35	41	42	38	40	37	39
Total Recoverable Lead	mg/kg dry wt	<160	4	11.1	5.3	6.1	9.6	14.7	4.6	4.6
Total Recoverable Mercury	mg/kg dry wt	<1	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	<60	2	5	3	4	5	4	7	6
Total Recoverable Zinc	mg/kg dry wt	<300	29	29	30	31	36	31	35	35

Eight soil samples were collected from landfarmed areas this monitoring period. The analysis indicated the following, when compared to the consent defined landfarm surrender criteria.

- Electrical conductivity (EC) ranged 0.03-0.52 mS/cm. The limit for surrender is set at <29,000 mS/cm.
- Benzo (a) pyrene (BaP) results were all below the limit for surrender (<0.027 mg/kg).
- Naphthalene and pyrene results were all below the limit for surrender (<7.2 mg/kg and <160 mg/kg respectively).
- Sodium absorption ratio (SAR) results were below the set consent limit (8 SAR).

- Soluble field salt results were also all below the consent surrender limit (<0.25 %) in all samples analysed.
- Total recoverable barium results were all below the surrender limit (<10,000 mg/kg).
- Soil chloride results were also below the consent limit in all samples (<700 mg/kg).
- Soil sodium results were all above the limit for surrender (460 mg/kg), ranging 500-700 mg/kg.
- Benzene, toluene, ethylbenzene and xylenes m & p and O (collectively termed BTEX) results were all below the limit for surrender for these analytes.
- In terms of total petroleum hydrocarbons (TPH), TPH C7-C9 results were below the limit for surrender (<210 mg/kg).
- TPH C10-C14 results indicated four areas which were above the consent surrender limit (<150 mg/kg), paddock 51, 12:30, 2,800 mg/kg, paddock 87 B 1,460 mg/kg, paddock 87C 1,180 mg/kg and Derby Road, 13:20, 410 mg/kg.
- TPH C15-C36 results were above surrender criteria in the same paddocks as the mid chain hydrocarbons, Paddock 51 (12:30), Paddock 87 B, 87 C and Derby Rad (13:20).
- TPH C7-C36 results were all below the set consent limit, which stipulates post landfarming, at no point should 20,000 mg/kg be exceeded.
- In terms of the heavy metals, arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc were below the consent criteria.

2.3 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 consent holder and 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).

Table 23 below sets out details of any incidents recorded, additional investigations, or interventions required by the Council in relation to the Company and consent holder's activities during the 2020-2021 period. This table presents details of all events that required further investigation or intervention regardless of whether these were found to be compliant or not.

Table 23 Incidents, investigations, and interventions summary table

Date	Details	Compliant (Y/N)	Enforcement Action Taken?	Outcome
29 July 2020	Irrigator associated with irrigation pond discharging to adjacent drain, as opposed to the irrigation area	N	Y	Infringement notice issued to both consent holder and Company

Date	Details	Compliant (Y/N)	Enforcement Action Taken?	Outcome
29 September 2020	The irrigation pond was low in level and had ample freeboard remaining for any likely inflow of water. The generator was running and drilling fluid wastewater was discharging to land. The irrigator was located approximately 80 metres from the nearby tributary. The end nozzle of the irrigator had been removed, and irrigation fluid was pouring from the end of the irrigator. This fluid was ponding and pooling around the general irrigation area, and travelling across the land where it entered the tributary in multiple locations. A sludge similar to what was present in the ponds was observed on the ponding and pooling	N	Y	Abatement notice (EAC-23578 and 23579) and infringement notice issued to both consent holder and Company
06 November 2020	Unauthorised discharge of contaminated stormwater into an unnamed tributary of Mangatengehu Stream - non-compliance of condition 8. Breach of Abatement Notice EAC-23349 (C Boyd) and EAC-23344 (Schlumberger)	N	Y	Infringement notice issued to both consent holder and Company
03 March 2021	Ponding of irrigation fluid in the irrigation area, in contravention of abatement notice EAC-23579	N	Y	Infringement notice issued to both consent holder and Company
21 May 2021	The irrigator was running at the time of inspection. An inspection was undertaken of the irrigation area which found that ponding of semi solid drilling waste was noted around two of the irrigation pods. Around one of the irrigation pods there was significant ponding which was tracking towards the stream. Contravention of EAC-23578	N	Y	Infringement notice issued to both the consent holder and the Company

3 Discussion

3.1 Discussion of site performance

The 2020-2021 monitoring period, in similarity to the 2019-2020 monitoring period, observed a significant amount of non-compliance. This was primarily related to poor housekeeping and specifically fluid material management.

The consent (7591-1.2) allows for the discharge of contaminated stormwater to land, via irrigator from the irrigation pond. This must be undertaken when conditions allow, and must be carried out in such a manner which does not lead to surface ponding/ overland flow. Throughout the application of the liquid phase, pasture cover must be maintained at all times.

Inspections identified numerous occasions when the Company had not been able to accomplish the irrigation to land within consent conditions. These occasions have been described in detail in the inspections section. In some cases these were repeat non-compliances by the Company, where the causes of the non-compliance were known and were directly related to the action and in action of the Company. Repeat enforcement was required by the Council to address the operational issues caused by the Company and consent holder throughout the monitoring year.

The 2020-2021 monitoring period marked the final year of drilling waste acceptance and landfarming at the Surrey Road stockpiling facility. Drilling waste (1,265 m^3) from seven different sources was landfarmed in two locations (Paddock 51 and 47) this monitoring period.

To date, all drilling waste has now been removed from the stockpiling site, this included residual material which was removed and landfarmed in Manutahi. The facility is now closed to the acceptance of drilling waste. The pits have since been decommissioned and the site area has been re-contoured. The consent holder is planning to utilise the flat standing for the storage of heavy machinery and quarrying materials.

Consent required notifications of material delivered and farming operations were provided by the Company this monitoring period. The associated records which are to be provided annually via annual report were not supplied by the Company, though they had been requested by the Council on numerous occasions.

Former landfarm areas, which now number over 60 paddocks, are required to be assessed against the consent surrender conditions. The Company are currently considering options, to have these previously landfarmed areas assessed against the consent defined surrender criteria. This will be reported in future monitoring reports.

Water treatment sludge is held in two areas on the consent holder's property: on the corner of Derby and Surrey Roads, and within the Surrey Road stockpiling facility. The later has now been put to land within the site boundary of Surrey Road stockpiling facility, as part of the re-contouring exercise undertaken by the consent holder.

3.2 Environmental effects of exercise of consents

Environmental effects are directly associated with the poor housekeeping and fluid management. This was observed during inspections this monitoring period. Biological effects were noted by the Council's biologist in the previous monitoring period and these have continued through this monitoring period.

The effects were due to the over irrigation of irrigation fluid to the irrigation area in such a manner that caused significant overland flow to occur. During the initial identification of the non-compliance (September 2020) the nozzle of the irrigator had been removed and the fluid was ponding and pooling, prior to overland flowing into the unnamed tributary of the Mangatengehu Stream. Overland flow, or evidence of overland flow was recorded on four occasions during the monitoring period.

It was noted that the Company purchased and operated new irrigator pods to negate the over irrigation when first identified in September 2020. However, the over use of these pods led to increased overland flow issues, ponding and the removal of pasture, all of which were non-compliances.

In addition, poor site material management also caused a discharge of hydrocarbon contaminated fluid to the site stormwater system. This was recorded on two separate occasions.

The initial biomonitoring survey, conducted in December 2020, identified a significant adverse effect to the instream biological communities. The three lower biomonitoring sites suffered the worst impacts to the instream communities found at any time in the life of consent (Figures 4-6).

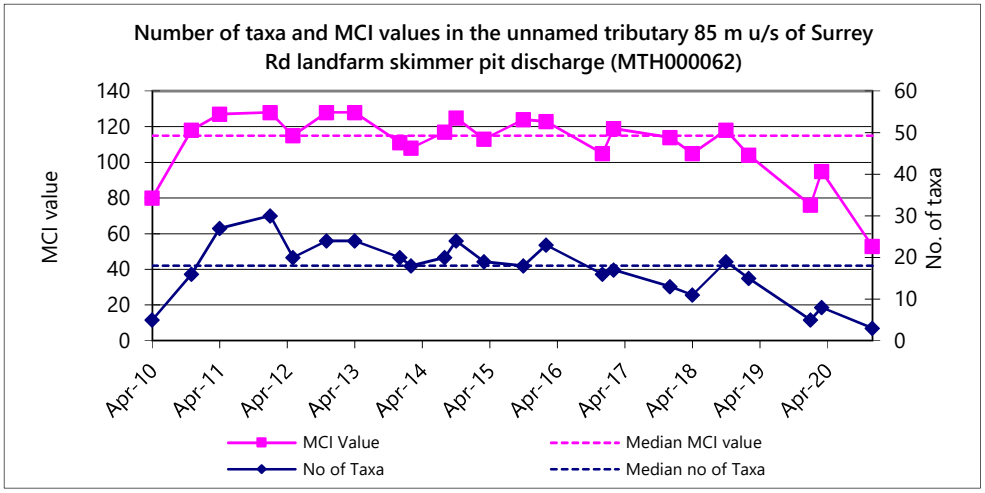

Figure 4 Numbers of macroinvertebrate taxa and MCI values recorded at site 2 in an unnamed tributary of Mangatengehu Stream December 2020

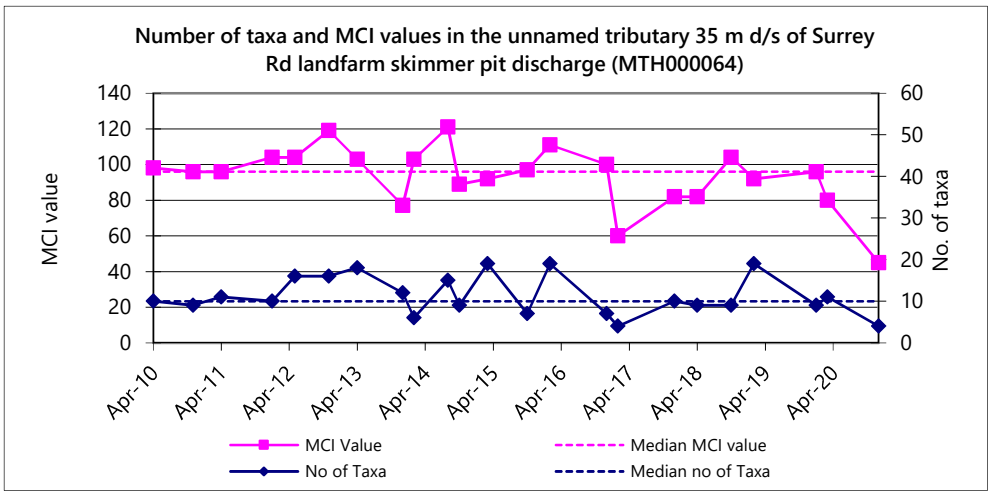

Figure 5 Numbers of macroinvertebrate taxa and MCI values recorded at site 3 in an unnamed tributary of Mangatengehu Stream December 2020

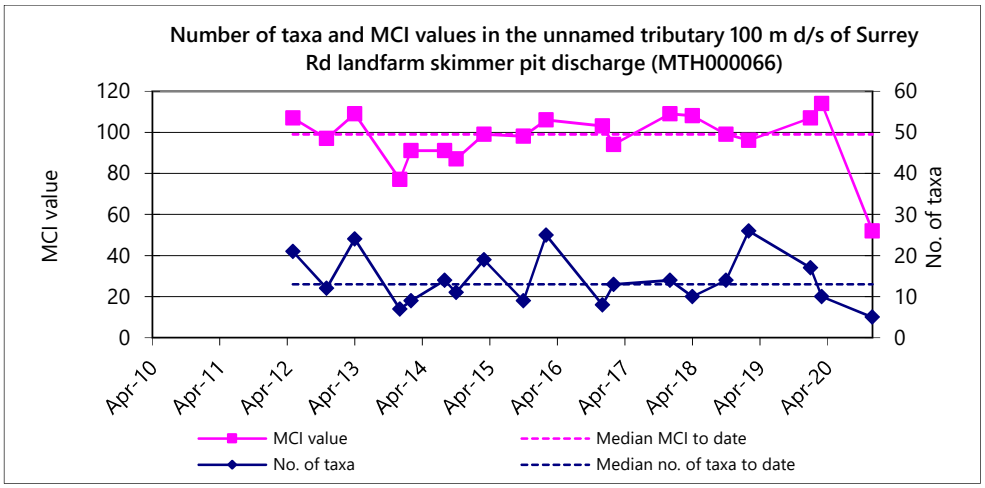

Figure 6 Numbers of macroinvertebrate taxa and MCI values recorded at site 4 in an unnamed tributary of Mangatengehu Stream December 2020

The second biomonitoring survey, conducted in March 2021, did identify some improvement within the biological communities of the unnamed tributary of the Mangatengehu Stream (Figures 7-9).

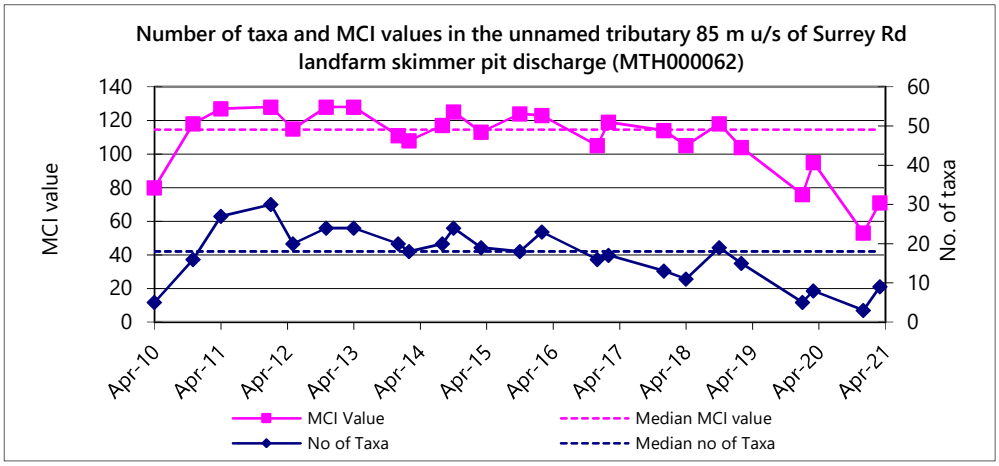

Figure 7 Numbers of macroinvertebrate taxa and MCI values recorded at site 2 in an unnamed tributary of Mangatengehu Stream March 2021

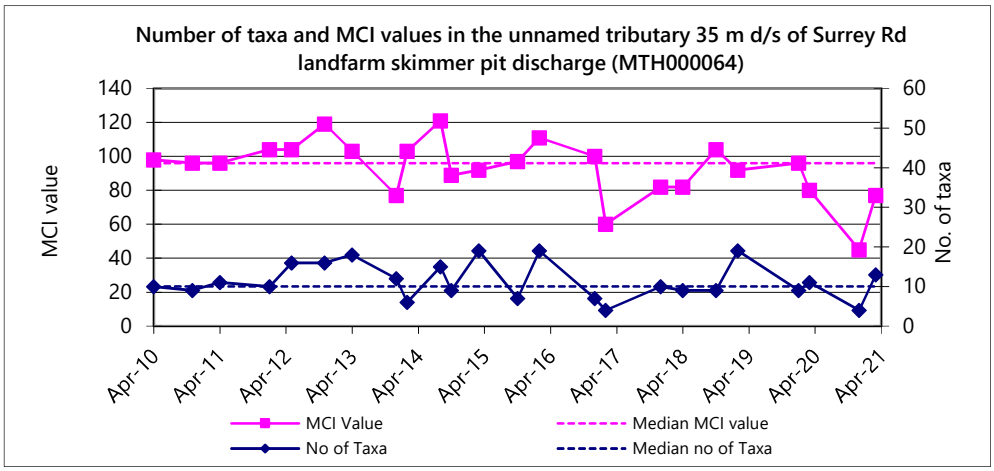

Figure 8 Numbers of macroinvertebrate taxa and MCI values recorded at site 3 in an unnamed tributary of Mangatengehu Stream March 2021

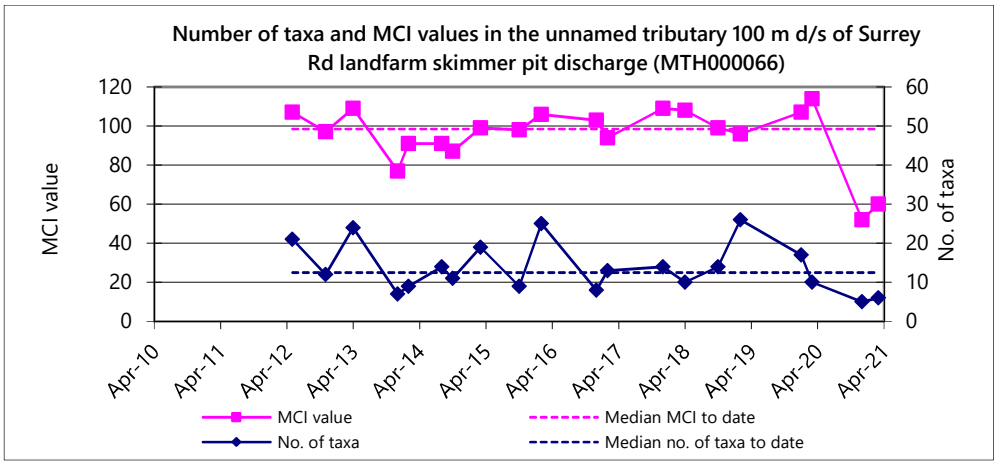

Figure 9 Numbers of macroinvertebrate taxa and MCI values recorded at site 4 in an unnamed tributary of Mangatengehu Stream March 2021

However, given the stark decline in the biological communities, specifically linked to site operations, which were observed through inspections, the consent holder's decision to cease operations, landfarm the majority of the remaining material (including sending material to a third party landfarm in Manutahi), remove the storage pits and re-contour the site, was the most practical option to ameliorate environmental impacts at the site.

The Council will continue to monitor the health of stream via biological survey and the results of this proposed monitoring will be conveyed in future reports.

In terms of landfarming, all drilling waste has now been landfarmed at the Surrey Road stockpiling facility. The two landfarmed areas paddocks 51 and 47 had good pasture strike. This was occurring at the end of the monitoring period.

It was noted and conveyed to the consent holder that landfarmed paddock, 87 B, required reseeding. The consent holder is aware of this and intends to remedy the pasture during the summer months. Pasture strike will be assessed during subsequent inspections.

Soil analysis this monitoring period indicated that all assessed areas remain above the limit for surrender for sodium and to a lesser degree total petroleum hydrocarbons (C10-C14 and C15-C36). These paddocks will continue to be assessed in the upcoming monitoring year.

In addition, the 60+ previously landfarmed paddocks will require action from the consent holder and the Company. Discussions have commenced between the Council and the two parties, with a decision pending in the 2021-2022 monitoring year.

3.3 Evaluation of performance

A tabular summary of the consent holder's compliance record for the year under review is set out in Tables 24-27.

Table 24 Summary of performance for consent 7559-1.4

Purpose: ***To discharge drilling wastes [consisting of drilling cuttings and drilling fluids] from hydrocarbon exploration activities with WBM and SBM onto and into land for the purpose of storage prior to disposal***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Shall adopt best practicable option	Inspections noted the discharge of contaminated stormwater to the unnamed tributary of the Mangatengehu Stream in contravention of an abatement notice	No
2. Install fit for purpose high grade synthetic liners for storage pits	Inspections noted material held in compromised storage cells liner. Infringed in previous monitoring period	No
3. Notify Council 48 hrs prior to stockpiling wastes	Notification provided	Yes
4. Limited to wastes generated in Taranaki including the offshore region	Review of delivery records	Yes
5. No hydraulic fracturing fluids contained within wastes	Review of delivery records	Yes
6. Volume of material stored shall not exceed 4,000 m^3 at any one time	Review of delivery records	Yes
7. All material spread under consent 7591 within a 12 month period	Inspections indicated material landfarmed within 12 months	Yes
8. No contamination of groundwater or surface water to exceed background concentrations	Groundwater and surface water monitoring	No Monitoring of GND2517 indicated petroleum hydrocarbons on three occasions. Overland flow from irrigator incident increased the TDS concentration within the unnamed tributary of the Mangatengehu Stream. TPH and oil and grease recorded in stormwater system

Purpose: *To discharge drilling wastes [consisting of drilling cuttings and drilling fluids] from hydrocarbon exploration activities with WBM and SBM onto and into land for the purpose of storage prior to disposal*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
9. Consent holder shall keep records of the waste from each well including the following. • Specific analysis • Storage commencement • Monitoring details, locations, methods	Records kept	Yes
10. The consent holder shall provide a report each year which includes information as per condition 9	No report provided though requested.	No
11. Review condition	Not required	N/A
Overall assessment of environmental performance and compliance in respect of this consent Overall assessment of administrative performance in respect of this consent		**Poor** **Poor**

Table 25 Summary of performance for consent 7591-1.2

Purpose: *To discharge drilling waste from hydrocarbon exploration activities onto and into land via landspreading*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Landfarming/ landspreading definition	N/A	N/A
2. Adoption of the best practicable option	Inspection identified issues	No Five infringement notices issued and one abatement notice
3. Prior to the exercise of this consent a management plan must be submitted	Plan submitted November 2009	Yes
4. Notify Council 48 hours prior to landspreading/ landfarming	Notifications to Council	Yes
5. Limited to wastes generated in Taranaki including the Taranaki basin	Consent holder's records	Yes
6. No hydraulic fracturing material in waste discharged	Consent holder's records	Yes
7. Consent authorises landfarming/ landspreading as per appendix I of consent	Consent holder's records	Yes

Purpose: *To discharge drilling waste from hydrocarbon exploration activities onto and into land via landspreading*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
8. Waste application layer shall not exceed: • 100 mm for TPH content of <50,000 mg/kg • 50 mm for TPH >50,000 mg/kg • In a rate and manner where no ponded liquids remain	Inspections and soil sampling	Former Derby Road site contains a waste layer greater than 100 mm, though concentration less than 5% TPH, mixed with water treatment sludge. Other landfarming areas close to 100 mm
9. The exercise of this consent shall not results in chloride exceeding 800 kg/ ha	Consent holder records	Not calculated in year under review
10. Nitrogen loading shall not exceed 1,000 kg/ha over any five year period	Consent holder records	Not calculated in year under review
11. Landspreading of liquid faction or the stormwater component of the storage pits shall be undertaken through a landspreader, injection spreader or irrigator	Inspection	No Irrigator not functioning as designed on three occasions
12. Areas where any discharge has occurred may receive future applications if the following conditions are met: 17, 19, 20, 21	Inspections	Yes
13. Areas landfarmed must be re-sown into pasture or crop as soon as practicable. If not achieved within two months additional measure must be undertaken	Inspections	Former Derby Road site re-vegetation issues are relenting Other recently landfarmed areas developing vegetation Old landfarming areas hold good pasture Paddock 87 B requires re-seeding. Consent holder aware and intends to mitigate

Purpose: *To discharge drilling waste from hydrocarbon exploration activities onto and into land via landspreading*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
14. No waste shall be applied within: • 12 m of boundaries • 12 m of named streams • 6 m of other water courses	Inspections	No Irrigator ponded and ran overland to unnamed tributary of Mangatengehu Stream
15. Liquid wastes which may flow overland shall not be discharged within 25 m of boundaries or water courses	Inspection	No See above. Abatement notice and infringement notices issued
16. Post application the material must be incorporated to a depth of 100 mm and the TPH concentration must be below 2% TPH	Inspections and sampling	Yes
17. After March 2027 constituents in the soil at any depth less than 500 mm shall meet the following standards • prior to areas being reused for disposal • at the time of expiry/cancellation/surrender	Inspections and sampling	Not required at present
18. The consent may not be surrendered unless the standards specified in condition 17 are met	Inspections and sampling	N/A
19. Concentration of metals in soil must comply with set guidelines	Sampling of soils	Yes
20. Conductivity must be less than 400 mS/m. If background soil conductivity greater than 400 mS/m, then waste application shall not increase conductivity by more than 100 mS/m	Sampling	Yes
21. Sodium absorption ratio [SAR] must be less than 8. If background soil SAR is greater than 8, then waste application shall not increase SAR by more than 1	Sampling	Yes
22. Total dissolved solids in surface water or groundwater shall not exceed 2,500 g/m^3	Sampling	Yes

Purpose: *To discharge drilling waste from hydrocarbon exploration activities onto and into land via landspreading*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
23. No contamination of groundwater or surface water to exceed background concentrations	Sampling	No Short term chemical impacts to groundwater and surface water Significant adverse effect noted during initial biological survey December 2020
24. Records to be kept by consent holder and made available to the Council	Records requested though not provided	Yes
25. Consent holder to report to Council by 31 August each year on records specified in condition 24	No report provided	Yes
26. Optional review provision re environmental effects	Not required	N/A
Overall assessment of environmental performance and compliance in respect of this consent		**Poor**
Overall assessment of administrative performance in respect of this consent		**Poor**

Table 26 Summary of performance for consent 5821-2

Purpose*: To discharge sludge and other residuals from water treatment plants in the New Plymouth and South Taranaki districts onto and into the land*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Adoption of best practicable option	Inspection	Yes
2. Exercise undertaken in accordance with application	Inspection and monitoring	Yes
3. Notification to be provided prior to exercise of consent	Notification provided	Yes
4. Notification 48 hours prior to undertaking disposal of sludge to site	No deliveries in period under review	Yes
5. Sludge to be spread as per application	Inspection	Yes
6. Ensure sludge stockpiles areas adequately bunded and no discharge of leachate to any water course	Inspection indicated no discharge at either of the two current storage sites	Yes

Purpose: *To discharge sludge and other residuals from water treatment plants in the New Plymouth and South Taranaki districts onto and into the land*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
7. No discharge of sludge to land within 25 m of any water course, including farm drains	Inspection. Surrey Road stockpiling site storage location spread post the end of the monitoring period.	Yes
8. Shall not exceed a total aluminium concentration of 55 µg/L within specific stream, farm drains or water course	Monitoring not required, no discharge	N/A
9. No area of land stripped for application may exceed 40 acres	Inspection	Yes
10. Post application, the area of land must be contoured and sown into pasture	Inspection indicated contouring and pasture strike	Yes
11. Exercise of consent shall not result in contamination of groundwater/ surface water or change in suitability of the water source	Monitoring and inspection	Yes
12. The exercise of consent shall not result in effects in surface water	No discharge to receiving waters in year under review	Yes
13. Is a lapse condition	Not applicable, consent in effect	N/A
14. Is a review condition	Not required at present	N/A
Overall assessment of environmental performance and compliance in respect of this consent Overall assessment of administrative compliance in respect of this consent		**High** **High**

Table 27 Evaluation of environmental performance over time

Year	Consent no	High	Good	Improvement req	Poor
2013-2014	6900-2	1			
	7911-1		1		
	7559-1			1	
	7591-1	N/A			
2014-2015	6900-2	1			
	7911-1	1			
	7559-1		1		
	7591-1.1	1			
2015-2016	6900-2	1			
	7911-1	1			

Year	Consent no	High	Good	Improvement req	Poor
	7559-1.3		1		
	7591-1.1		1		
2016-2017	6900-2	1			
	7911-1		1		
	7559-1.3			1	
	7591-1.1		1		
2018-2019	6900-2	Consent surrendered			
	7911-1	Consent surrendered			
	7559-1.4			1	
	7591-1.2				1
	5821-2	1			
2019-2020	7559-1.4				1
	7591-1.2				1
	5821-2	1			
Totals		9	6	3	3

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

3.4 Recommendations from the 2019-2020 Annual Report

In the 2019-2020 Annual Report, it was recommended:

1. THAT in the first instance, monitoring of consented activities at Surrey Road stockpiling facility in the 2020-2021 year continue at the same level as in 2019-2020.
2. THAT in the first instance, monitoring of consented activities at landspreading in the 2020-2021 year continue at the same level as in 2019-2020.
3. THAT in the first instance, monitoring of consented activities at water treatment sludge disposal in the 2020-2021 year continue at the same level as in 2019-2020.
4. THAT should there be issues with environmental or administrative performance in 2020-2021, monitoring may be adjusted to reflect any additional investigation or intervention as found necessary.

All four recommendations were undertaken this monitoring period. Due to the identification of non-compliances, additional inspections and samples were collected throughout the monitoring year.

3.5 Alterations to monitoring programmes for 2021-2022

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.

Planned changes for 2021-2022 monitoring programme include the potential for a surrender of the current stockpiling consent 7559-1.4. As current ground and soil conditions are covered by the landfarming consent 7591-1.2, the stockpiling consent, 7559-1.4, may be surrendered.

Groundwater, surface water monitoring will continue for one monitoring round in the 2021-2022 monitoring period. Biological monitoring will continue to monitor the recovery of the instream communities which have been significantly affected this monitoring year.

The landspreading programme will continue unchanged to monitor the degree of bioremediation over time within the former landfarmed areas. The final surrender assessment will also be discussed with the consent holder and Company.

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 2021-2022.

4 Recommendations

1. THAT in the first instance, monitoring of consented activities at Surrey Road stockpiling facility be scaled back to account for the decommissioned site. One round of groundwater and surface water will be undertaken. Then it will cease. Biological monitoring of the unnamed tributary of the Mangatengehu Stream will continue to be monitored for recovery post the significant impacts to the biology of the receiving environment found during the 2020-2021 monitoring period.
2. When consent 7559-1.4 is surrendered the biological monitoring of the unnamed tributary of the Mangatengehu Stream will be added to the landspreading compliance programme.
3. Monitoring of landspreading will remain unchanged with the inclusion of the biological monitoring of the unnamed tributary of the Mangatengehu Stream.
4. A decision shall be made in relation to the surrender assessment of the previously landfarmed area, which number over 60 paddocks.
5. THAT should there be issues with environmental or administrative performance in 2021-2022, 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.
Biomonitoring	Assessing the health of the environment using aquatic organisms.
BOD	Biochemical oxygen demand. A measure of the presence of degradable organic matter, taking into account the biological conversion of ammonia to nitrate.
BODF	Biochemical oxygen demand of a filtered sample.
Bund	A wall around a tank to contain its contents in the case of a leak.
CBOD	Carbonaceous biochemical oxygen demand. A measure of the presence of degradable organic matter, excluding the biological conversion of ammonia to nitrate.
cfu	Colony forming units. A measure of the concentration of bacteria usually expressed as per 100 millilitre sample.
COD	Chemical oxygen demand. A measure of the oxygen required to oxidise all matter in a sample by chemical reaction.
Conductivity	Conductivity, an indication of the level of dissolved salts in a sample, usually measured at 25°C and expressed in µS/cm.
Cu*	Copper.
Cumec	A volumetric measure of flow- 1 cubic metre per second (1 m^3s^{-1}).
DO	Dissolved oxygen.
DRP	Dissolved reactive phosphorus.
E.coli	Escherichia coli, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre sample.
Ent	Enterococci, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre of sample.
F	Fluoride.
FC	Faecal coliforms, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre sample.
FNU	Formazin nephelometric units, a measure of the turbidity of water
Fresh	Elevated flow in a stream, such as after heavy rainfall.
$g/m^2/day$	grams/$metre^2$/day.
g/m^3	Grams per cubic metre, and equivalent to milligrams per litre (mg/L). In water, this is also equivalent to parts per million (ppm), but the same does not apply to gaseous mixtures.
Incident	An event that is alleged or is found to have occurred that may have actual or potential environmental consequences or may involve non-compliance with a consent or rule in a regional plan. Registration of an incident by the Council does not automatically mean such an outcome had actually occurred.

Intervention	Action/s taken by Council to instruct or direct actions be taken to avoid or reduce the likelihood of an incident occurring.
Investigation	Action taken by Council to establish what were the circumstances/events surrounding an incident including any allegations of an incident.
Incident register	The incident register contains a list of events recorded by the Council on the basis that they may have the potential or actual environmental consequences that may represent a breach of a consent or provision in a Regional Plan.
L/s	Litres per second.
m^2	Square Metres.
MCI	Macroinvertebrate community index; a numerical indication of the state of biological life in a stream that takes into account the sensitivity of the taxa present to organic pollution in stony habitats.
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.
MPN	Most Probable Number. A method used to estimate the concentration of viable microorganisms in a sample.
µS/cm	Microsiemens per centimetre.
NH_4	Ammonium, normally expressed in terms of the mass of nitrogen (N).
NH_3	Unionised ammonia, normally expressed in terms of the mass of nitrogen (N).
NO_3	Nitrate, normally expressed in terms of the mass of nitrogen (N).
NTU	Nephelometric Turbidity Unit, a measure of the turbidity of water.
O&G	Oil and grease, defined as anything that will dissolve into a particular organic solvent (e.g. hexane). May include both animal material (fats) and mineral matter (hydrocarbons).
Pb*	Lead.
pH	A numerical system for measuring acidity in solutions, with 7 as neutral. Numbers lower than 7 are increasingly acidic and higher than 7 are increasingly alkaline. The scale is logarithmic i.e. a change of 1 represents a ten-fold change in strength. For example, a pH of 4 is ten times more acidic than a pH of 5.
Physicochemical	Measurement of both physical properties (e.g. temperature, clarity, density) and chemical determinants (e.g. metals and nutrients) to characterise the state of an environment.
Resource consent	Refer Section 87 of the RMA. Resource consents include land use consents (refer Sections 9 and 13 of the RMA), coastal permits (Sections 12, 14 and 15), water permits (Section 14) and discharge permits (Section 15).
RMA	*Resource Management Act 1991* and including all subsequent amendments.
SS	Suspended solids.
SQMCI	Semi quantitative macroinvertebrate community index.
Temp	Temperature, measured in °C (degrees Celsius).
Turb	Turbidity, expressed in NTU or FNU.
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 a Science Services Manager.

Bibliography and references

Ministry for the Environment. 2018. Best Practice Guidelines for Compliance, Monitoring and Enforcement under the Resource Management Act 1991. Wellington: Ministry for the Environment.

Cavanagh J E, May 2015: Land application of waste from oil and gas wells, Landcare Research.

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

Ministry for the Environment and New Zealand Water and Wastes Association 2003: Guidelines for the safe application of biosolids to land in New Zealand.

M-I Swaco 2009: Consent 6900-1, Condition 26 Annual Records, Boyd Landfarm, Inglewood.

M-I Swaco 2010: Consent 6900-1, Condition 26 Annual Records, Boyd Landfarm, Inglewood.

M-I Swaco 2010: Consent 7559-1, Condition 23 Annual Records, Boyd Landfarm, Inglewood.

M-I Swaco 2010: Consent 7591-1, Condition 17 Annual Records, Surrey Road Landfarm, Inglewood.

M-I Swaco 2012: Consent 6900-1, Condition 26 Annual Records, Boyd Landfarm, Inglewood.

M-I Swaco 2012: Consent 7559-1, Condition 23 Annual Records, Boyd Landfarm, Inglewood.

M-I Swaco 2013: Consent 6900-1, Condition 26 Annual Records, Boyd Landfarm, Inglewood.

M-I Swaco 2013: Consent 7559-1, Condition 23 Annual Records, Boyd Landfarm, Inglewood.

M-I Swaco 2014: Consent 6900-1, Condition 26 Annual Records, Boyd Landfarm, Inglewood.

M-I Swaco 2014: Consent 7559-1, Condition 23 Annual Records, Boyd Landfarm, Inglewood.

M-I Swaco 2015: Annual report for Consent 6900-1, Consent 7591-1, Colin Boyd Landfarms, Surrey Road, Derby Road, Inglewood, Taranaki.

M-I Swaco 2016: Annual report for Consent 6900-1, Consent 7591-1.1, 7911.1 and 7559-1.3, Colin Boyd Landfarms, Surrey Road, Derby Road, Inglewood, Taranaki.

M-I Swaco 2017: Annual report for Consent 7591-1.1 and Consent 7559-1.3 Colin Boyd landfarms, Surrey Road, Inglewood Taranaki.

M-I Swaco 2019: TRC annual summary 7559-104 and 7591-1.2 Surrey Road Landfarm.

Taranaki Regional Council 2005: Guidelines for the control of drilling waste disposal onto and into land.

Taranaki Regional Council, 2010: Boyd Landfarm Monitoring Programme Annual Report 2008-2009. Technical Report 2009-53.

Taranaki Regional Council, 2011: CD Boyd Drilling Waste Disposal Monitoring Programmes Annual Report 2009-2010. Technical Report 2010-78.

Taranaki Regional Council, 2012: CD Boyd Drilling Waste Disposal Monitoring Programmes Annual Report 2010-2011. Technical Report 2011-48.

Taranaki Regional Council, 2013: CD Boyd Drilling Waste Disposal Monitoring Programmes Biennial Report 2011-2013. Technical Report 2013-63.

Taranaki Regional Council, 2014: C Boyd Drilling Waste Disposal Monitoring Programmes Annual Report 2013-2014. Technical Report 2014-81.

Taranaki Regional Council, 2015: C Boyd Drilling Waste Disposal Monitoring Programmes Annual Report 2014-15. Technical Report 2015-86.

Taranaki Regional Council 2016: CD Boyd Drilling Waste Stockpiling Landfarm/Landspreading Monitoring Programme Annual Report. Technical Report 2016-85.

Taranaki Regional Council 2017: CD Boyd Drilling Waste Stockpiling Landfarm/ Landspreading Monitoring Programme Annual Report 2016-2017. Technical Report 2017-10.

Taranaki Regional Council 2018: CD Boyd Drilling Waste Stockpiling Landfarm/ Landspreading Monitoring Programme Annual Report 2017-2018. Technical Report 2018-41.

Taranaki Regional Council 2019: CD Boyd Drilling Waste Stockpiling Landfarm/ Landspreading Monitoring Programme Annual Report 2019-2019. Technical Report 2019-73.

Taranaki Regional Council 2020: CD Boyd Drilling Waste Stockpiling Landfarm/ Landspreading Monitoring Programme Annual Report 2019-2019. Technical Report 2020-11.

Taranaki Regional Council, 2001: Regional Fresh Water Plan for Taranaki.

Appendix I

Resource consents held by CD Boyd

(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:	Colin David Boyd P O Box 44 INGLEWOOD 4347
Decision Date (Change):	5 February 2014
Commencement Date (Change):	5 February 2014 (Granted: 14 December 2005)

Conditions of Consent

Consent Granted:	To discharge sludge and other residuals from water treatment plants in the New Plymouth and South Taranaki Districts onto and into land
Expiry Date:	1 June 2026
Review Date(s):	June 2015, June 2021
Site Location:	Surrey Road, Inglewood
Legal Description:	Secs 9, 10 & Pt Sec 13 Blk XII Egmont SD Lot 2 DP 344156 Blk XII Egmont SD Secs 17 & 18 Blk XVI Egmont SD (Discharge sites)
Grid Reference (NZTM)	1701925E-5652253N
Catchment:	Waitara
Tributary:	Mangamawhete Mangatengehu

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

General conditions

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

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

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

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

Special conditions

1. The 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.

2. The exercise of this consent shall be undertaken generally in accordance with the documentation submitted in support of the original application and any subsequent applications to change conditions. In the case of any contradiction between the documentation submitted in support of previous applications and the conditions of this consent, the conditions of this consent shall prevail.

3. The consent holder shall notify the Chief Executive, Taranaki Regional Council, in writing at least seven days prior to the exercise of this consent.

4. The consent holder shall notify the Taranaki Regional Council at least 48 hours prior to the transportation of the sludge to the disposal site, and again at least 48 hours prior to beginning the actual disposal operation. Notification shall include the consent number and a brief description of the activity consented and be emailed to worknotification@trc.govt.nz.

5. The sludge shall only be spread in the areas specified in application 4067 and 6784.

6. The consent holder shall ensure that sludge stockpiles are adequately bunded to ensure that there is no stormwater or leachate runoff to any surface watercourse, including farm drains.

7. The sludge shall not be deposited within 25 metres of the Mangamawhete Stream, the Mangatengehu Stream or the Waipuku Stream, or within 10 metres of any open drain or other watercourse.

8. The exercise of the consent shall not result in a total aluminium concentration exceeding 55ug/L in the Mangamawhete Stream, the Mangatengehu Stream or the Waipuku Stream or any open drain or watercourse including farm drains.

9. The area of bare land, stripped for receipt of the residuals, exposed at any particular time shall not exceed 40 acres.

10. As soon as practicable following discharge and incorporation, the discharge area shall be contoured and sown into pasture.

11. 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.

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

    a) The production of any conspicuous oil or grease films, scums or foams, or floatable or suspended material;
    b) Any conspicuous change in the colour or visual clarity
    c) Any emission of objectionable odour;
    d) The rendering of freshwater unsuitable for consumption by farm animals;
    e) Any significant adverse effects on aquatic life.

13. This consent shall lapse on the expiry of five years after the date of issue of this consent, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991.

14. 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 2009 and/or June 2015 and/or June 2021, 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 5 February 2014

For and on behalf of
Taranaki Regional Council

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A D McLay
Director-Resource Management

Discharge Permit

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

Name of Consent Holder:	Colin David Boyd PO Box 44 Inglewood 4347	
Decision Date (Change):	20 December 2018	
Commencement Date (Change):	20 December 2018	(Granted Date: 20 November 2009)

Conditions of Consent

Consent Granted:	To discharge drilling wastes (consisting of drilling cuttings and drilling fluids) from hydrocarbon exploration activities with water based muds and synthetic based muds, onto and into land for the purpose of storage prior to disposal
Expiry Date:	1 June 2027
Review Date(s):	June 2019, June 2025
Site Location:	Surrey Road, Inglewood
Grid Reference (NZTM)	1701847E-5651476N & 1701850E-5651480N
Catchment:	Waitara
Tributary:	Manganui Mangamawhete Mangatengehu

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. 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.

2. All waste shall be stored in pits that are lined with 'fit for purpose' high-grade synthetic liner or equivalent and the consent holder shall demonstrate, that the lined pits are suitable for storing liquid without leakage through the base or side walls. The consent holder shall monitor the integrity of the pit liners and repair or replace liners as required.

Notification and sampling requirements prior to discharge

3. The consent holder shall notify the Chief Executive, Taranaki Regional Council, (by emailing worknotification@trc.govt.nz) at least 48 hours prior to bringing wastes onto the site. Notification shall include the following information:

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

Discharge limits

4. Subject to condition 5, the exercise of this consent is limited to waste generated in the Taranaki region, including from outside the 12 nautical mile maritime limit within the Taranaki Basin.

5. Waste brought to the site shall not contain any hydraulic fracturing fluids.

6. The volume of material stored on the site shall not exceed 4000 m^3 at any one time.

7. All material must be spread onto land in accordance with consent 7591 as soon as practicable, but no later than 12 months after being brought onto the site.

Receiving environment limits for water

8. The exercise of this consent shall not result in any contaminant concentration, within surface water or groundwater, which after reasonable mixing, exceeds the background concentration for that particular contaminant.

Monitoring and reporting

9. The consent holder shall keep records of the wastes from each individual well, including:

    a) composition of wastes, including concentrations of Metals (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn), Salts (Barium, Calcium, Chloride, Magnesium, Sodium, Potassium), Hydrocarbons (Total Petroleum Hydrocarbons, Mono Cyclic Aromatic Hydrocarbons and Poly Cyclic Aromatic Hydrocarbons) and Nitrogen;
    b) dates of commencement of storage;
    c) 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 on request.

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

Review

11. 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 2019 and/or June 2025, 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 20 December 2018

For and on behalf of
Taranaki Regional Council

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A D McLay
Director - Resource Management

Discharge Permit

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

Name of Consent Holder:	Surrey Road Landfarms Limited PO Box 44 Inglewood 4347	
Decision Date (Change):	20 December 2018	
Commencement Date (Change):	20 December 2018	(Granted Date: 21 January 2010)

Conditions of Consent

Consent Granted:	To discharge drilling waste cuttings (consisting of drilling cuttings and drilling fluids) from hydrocarbon exploration activities with water based muds and synthetic based muds onto and into the land via landfarming, landspreading, injection spreading and irrigation
Expiry Date:	1 June 2027
Review Date(s):	June 2019, June 2025
Site Location:	Surrey Road, Inglewood
Grid Reference (NZTM)	1701750E-5652370N & 1701750E-5652370N
Catchment:	Waitara
Tributary:	Manganui Mangawmawhete Mangatengehu Waipuku

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. landfarming means the discharge of drilling wastes from vehicles, tanks, or other containers onto and into land, with spreading, or incorporation into the soil as soon as practicable; and
    b. landspreading means the discharge to land of the liquid fraction of drilling wastes. This includes the stormwater component of the storage cells through the use of a landspreader and/or irrigator and/or injection spreader. Throughout the application of the liquid fraction the consent holder shall maintain pasture cover at all times.

2. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects on the environment from the exercise of this consent. For the purpose of this consent, the best practicable option will include undertaking the landfarming/landspreading/injection spreading of drilling waste during extended periods of dry weather.

3. Prior to the exercise of this consent, the consent holder shall provide, to the written satisfaction of the Chief Executive, Taranaki Regional Council, a landfarming management plan to demonstrate the activity will be conducted to comply with all of the conditions of this consent. The management plan shall be reviewed annually 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) methods used for the mixing and testing of different waste types;
    f) procedures for landfarming drilling wastes (including means of transfer from stockpiling area, means of spreading, and incorporation into the soil);
    g) contingency procedures;
    h) sampling regime and methodology; and
    i) post-landfarming management, monitoring and sites reinstatement.

4. The consent holder shall notify the Chief Executive, Taranaki Regional Council, (by emailing worknotification@trc.govt.nz) at least 48 hours prior to landfarming/landspreading/injection spreading waste from each separate storage cell. Notification shall include the following information:

   a) the consent number;
   b) the name of the well(s) from which the waste was generated;
   c) the type of waste to be applied;
   d) the volume of waste to be applied;
   e) the specific concentrations of Metals (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn), Salts (Barium, Calcium, Chloride, Magnesium, Sodium, Potassium). Hydrocarbons (Total Petroleum Hydrocarbons, Mono Cyclic Aromatic Hydrocarbons and Poly Cyclic Aromatic Hydrocarbons) and Nitrogen in the waste prior application to land;
   f) the specific location and area over which the waste will be applied; and
   g) the method of application.

   In order to demonstrate compliance with conditions 8, 9, 10, 11, 16, 19, 20, and 21 of this consent.

5. Subject to condition 6, the exercise of this consent is limited to waste generated in the Taranaki Region, and from outside the 12 nautical mile maritime limit, within the Taranaki Basin.

6. Waste discharged shall not contain any hydraulic fracturing fluids.

7. This consent authorises the application of material to land only within the area indicated on the attached map (Appendix 1).

Discharge limits

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

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

9. The exercise of this consent shall not result in a chloride loading exceeding 800 kg/ha.

10. The nitrogen loading (including that from any application of nitrogen fertiliser) over any area where drilling wastes are applied, shall not exceed 1000 kilograms per hectare over any 5 year period.

11. Landspreading of liquid fraction of drilling wastes and or stormwater component of the storage cells shall be undertaken through the use of a landspreader or injection spreader or irrigator. Throughout the application of the liquid fraction the consent holder shall maintain pasture cover at all times.

12. The areas where any discharge has occurred may receive future applications of material only if they meet the standards defined by conditions 17, 19, 20, 21 of this consent.

13. As soon as practicable following the landfarming of wastes the discharge area shall be re-sown into pasture (or into crop). If revegetation cannot be established within two months of the discharge, the consent holder shall undertake appropriate land stabilisation measures to minimise wind and/or stormwater erosion.

14. No waste shall be discharged within:

    a) 12 metre(s) of property boundaries; or
    b) 12 metre(s) of the Mangamawhete, Mangatengehu and Waipuku Streams; or
    c) 6 metre(s) of any other surface water course (including farm drains).

15. Any liquid drilling waste which may flow over land, shall not be discharged within 25 metre(s) of property boundaries or surface water courses (including farm drains).

Receiving environment limits for soil

16. As soon as practicable following the application of drilling wastes to land, the consent holder shall incorporate the material into the soil to a depth of at least 250 mm for landfarming and 100 mm for the injection spreader, so that the hydrocarbon concentration at any point in the soil/waste mix is equal to or less than 20,000 mg/kg (2%) dry weight at any point.

17. After 1 March 2027 (three months before the consent expiry date), constituents in the soil at any depth less than 500 mm shall meet 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)	

The requirement to meet these standards shall not apply if, before 1 March 2027, the consent holder applies for a new consent to replace this consent when it expires, and that the application is not subsequently withdrawn. These conditions also apply:

a) prior to drilling wastes being discharged onto an area that has previously been used for the disposal of drilling wastes; and
b) at the time of expiry, cancellation, or surrender of this consent.

18. This consent may not be surrendered unless the standards specified in condition 17 have been met.

19. The concentration of metals and salts in the soil layer containing discharged material shall comply with the following criteria:

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

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

21. After incorporation of the waste within the soil, the sodium absorption ratio (SAR) of the waste soil mix shall not be more than 3 units higher than background soil SAR, or exceed a SAR of 8. Alternatively if the soil SAR exceeds 8, the application of the waste shall not increase the SAR by more than 1.

Receiving environment limits for water

22. The exercise of this consent shall not result in a level of total dissolved salts within any surface water or groundwater of more than 2500 g/m^3.

23. The exercise of this consent shall not result in any contaminant concentration, within surface water or groundwater, which exceeds the background concentration for that particular contaminant, as determined by the Chief Executive, Taranaki Regional Council.

Monitoring and reporting

24. For all waste discharged, the consent holder shall keep records of the following:

    a) the source i.e. the well from which it originated;
    b) composition of wastes, as analysed in condition (4 e);
    c) application areas, including a map showing individual disposal areas with GPS co-ordinates;
    d) volume of wastes applied;
    e) dates of commencement and completion of application events;
    f) 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 on request.

25. The consent holder shall provide to the Chief Executive, Taranaki Regional Council, by 31 August of each year, a report on all records required to be kept in accordance with condition 24, for the period of the previous 1 July to 30 June.

Lapse and review

26. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2016 and/or June 2017 and/or June 2018 and/or June 2019 and/or June 2025 for the purpose of ensuring that the conditions area 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, or to take into account any Act of Parliament, regulations, national policy statement, and national environmental standard which is relevant to this consent.

Signed at Stratford on 20 December 2018

For and on behalf of
Taranaki Regional Council

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A D McLay
Director - Resource Management

Appendix 1