Remediation New Zealand Ltd
Uruti composting facility

Monitoring Programme

Annual Report

2022-2023

Technical Report 2023-05

Working with people | caring for Taranaki

Taranaki Regional Council

Taranaki Regional Council
Private Bag 713
Stratford

ISSN: 1178-1467 (Online)
Document: 3176864 (Word)
Document: 3202386 (PDF)
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Executive summary

Remediation New Zealand Ltd (the Company) operates a composting facility and worm farm which produces vermicast. It is located on State Highway 3, Mokau Road, Uruti, Taranaki.

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

This report for the period July 2022 to June 2023 describes the monitoring programme implemented by the Taranaki Regional Council (the Council) to assess the Company's environmental and consent compliance performance during the period under review. The report also details the results of the monitoring undertaken and assesses the environmental effects of the Company's activities.

The Company holds nine resource consents, which include a total of 135 conditions setting out the requirements that the Company must satisfy. The Company holds one consent to allow for discharges to air, and one consent to allow the discharge to land and water (both of which expired in 2018). One consent allows the discharge to water, and there are six land use consents. Consent 6211-1, to realign and divert the Haehanga Stream in the Mimitangiatua catchment for land improvement purposes, expired on 1st June 2021. This is now a permitted activity. In March 2021, the Council held a hearing of applications by the Company for renewal of the two expired consents. A further hearing is scheduled for November 2023. The Company is allowed to continue exercising the expired consents while the appeals are being considered.

The Council's monitoring programme for the year under review included 11 scheduled inspections (and additional specific visits), 130 water samples collected for physicochemical analysis (surface and groundwater), one biomonitoring survey of receiving waters, a soil survey across all irrigation areas, and 81 odour surveys. Because of matters raised during the first Environment Court hearing and because of numerous ongoing complaints, the Council monitoring (requiring both inspections and sampling) extended beyond that originally planned. The Council's annual monitoring programmes may be extended and additional costs recovered where additional Council work is necessitated.

The monitoring showed that the Company was in compliance with their consent requirements for six of their eight active consents, which related to culverts, fish passage and quarry operations. However, operational and site practices are still highly variable, particularly in relation to consent 5838-2.2 regulating the discharge of waste, treated stormwater and leachate to land and consent 5839-2 to discharge emissions to air.

Changes to infrastructure and some operational procedures such as the rehabilitation of the materials drop-off pond, the timing of irrigation activities to drier months, the reduction in the areal extent of Pad 1, the reduction in the size of the Pad 2 paunch dewatering pond and the bunding around the north-eastern vermiculture which were made during the year have brought improvements to some aspects of the Company's administrative and environmental performance.

These improvements have been primarily evident in respect of the degree of environmental effects caused by the Company's air discharges relative to previous years. Offsite odour was detected on about one-third (30%) of Council surveys (which is an improvement on the proportion in the previous year (44%)), although the number of complaints received increased in the year under review. Increased wastewater aeration, better vegetation cover of Pad 3, and a smaller Pad 1 would serve to reduce odour strength. However, the findings from on-site inspections and odour surveys by the Council and the complaints record indicated there remains a need for improved composting and wastewater management if non-compliance is to be eliminated. There remains the potential for levels of odour offsite, even if they do not reach the threshold of being offensive and objectionable on an acute basis, to cumulatively still have an impact that is unacceptable to the neighbouring community. However, it is noted that no offensive and objectionable odours were encountered at the boundary during any of the Council officers inspections.

Surface water was found to be impacted beyond consent limits, for at least one monitoring site and one or more contaminants, on more than half of the scheduled surveys of the Haehanga Stream. The Council undertook further enforcement action by way of Infringement Notices at the end of the year under review in respect of degraded water quality discovered on 4 October 2022 and again on 23 March 2023. Impacts on the Mimitangiatua awa were measureable but usually not significant in terms of recognised environmental thresholds. Detailed investigation and remediation during the year of the unauthorised long-term seepage from the southern end of Pad 3 that was under abatement notice was undertaken by the Company.

While groundwater quality is generally improving in respect of some markers of irrigation, from the peak levels of some contaminants evident in previous years, this is not the case for all irrigation areas, and in particular nitrogen species (ammonia and nitrate) in the applied irrigation wastewaters (where their concentrations are increasing) and in the receiving groundwater warrant continued close surveillance.

Irrigation of wastewater during the year led to mass loadings of nitrogen per hectare that were well in excess of those recommended by the Council and the description of N loadings previously provided by RNZ. As was the case for the 2021-2022 year, the rates of application in 2022-2023 raise questions about whether the ability of pasture to take up nitrogen could be or is being surpassed. On the other hand, the timing and volume of irrigation events in 2022-2023 suggest that these inputs were being managed more intentionally as a means of utilising pasture uptake for optimal nitrogen capture and treatment, rather than as a means to prevent the irrigation pond from overflowing.

Soil sampling in the new irrigation area L6 prior to its use (in 2021-2022) indicated that drilling wastes or contaminated compost had been spread or applied in the field, contrary to the consent. While soils in the remaining irrigation areas also show evidence of the re-distribution of contaminants derived from drilling wastes or the treated sawdust (unauthorised) that has been blended with the drilling wastes in the past, or of contaminated compost, levels of contamination are not of concern in terms of recognised soil quality criteria. However it should be noted that monitoring shows increasing trends in some key parameters within irrigation areas L3, L4 and L5. A Detailed Site Investigation of levels of contamination across the Uruti property was provided to the Council during the year, and results and their implications were under Council review at the end of the year.

During the year under review, despite compliance with a number of consents, the monitoring indicated poor management of the maintenance of water quality within the Haehanga Stream, leading to an overall categorisation of administrative and environmental performance as 'poor'. Delivery of best practices for odour minimisation and mitigation was observed to be variable during the year. While a number of complaints were unresolved, the absence of any proven episode of offensive or objectionable odour together with the efforts made by RNZ to improve odour control at the site has meant the categorisation of the environmental effects of the exercise of the air discharge consent during the year as 'good'.

In summary, during or as a consequence of their activities and effects during the 2022-2023 year, RNZ were issued one Abatement Notice for a non-compliant discharge to air, and three Infringement Notices for non-compliant discharges to land/water. The latter were in respect of a situation found during the previous monitoring period, and two incidents during the year under review. A breach of the RAQP was addressed without formal enforcement. In the previous monitoring year, there had been five unauthorised incidents recording non-compliance in respect of this consent holder, leading to three infringement notices and consideration of further action in respect of the remaining two incidents.

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

In terms of overall environmental and compliance performance by the consent holder over the last several years, this report shows that the consent holder's performance continued to be rated as poor in the year under review. This grading relates especially to issues around water quality.

This report includes recommendations for the 2023-2024 year, including liaising with RNZ and the Council's analytical laboratories to resolve discrepancies in measurements of ammoniacal and total nitrogen in irrigated wastewaters. As noted above, the Environment Court is considering the Company's application for consents to continue to discharge to land, water and air from its composting and vermiculture activities. These, and other consents held by the Company remain in effect. As such, the Council has prepared an appropriate interim monitoring programme based on the expired consents and the Company's environmental and administrative performance.

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1 Introduction

1.1 Compliance monitoring programme reports and the Resource Management Act 1991

1.1.1 Introduction

This report is for the period July 2022 to June 2023 by the Taranaki Regional Council (the Council) on the monitoring programme associated with resource consents held by Remediation NZ Ltd (RNZ/the Company). The Company operates a composting and vermiculture facility together with associated wastewater treatment and disposal systems situated on State Highway 3 at 1460 Mokau Road, Uruti, in the Haehanga sub-catchment of the Mimitangiatua catchment.

The report includes the results and findings of the monitoring programme implemented by the Council in respect of the consents held by the Company that relate to land use consents and discharges to land and water within the Mimitangiatua catchment, and to an air discharge permit held by the Company to cover emissions to air from the site. It also references studies undertaken by the Company's consultants, as directed by the Environment Court or otherwise. Two consents, for discharges to land and water, and to air, have expired and renewal was declined by the Council. The Company appealed the Council's determination to the Environment Court, and is allowed by provisions in the *Resource Management Act 1991* (RMA) to continue to exercise the expired consents until the Court has reached its own determination. Court proceedings are continuing.

One of the intents of the RMA is that environmental management should be integrated across all media, so that a consent holder's use of water, air, and land should be considered from a single comprehensive environmental perspective. Accordingly, the Council generally implements integrated environmental monitoring programmes and reports the results of the programmes jointly. This report discusses the environmental effects of the Company's use of water, land and air, and is the 14th annual report by the Council for the Company. The Uruti facility was previously owned by other parties, and there are a further seven reports for earlier activities at the Uruti facility. RNZ also operate or have operated vermiculture and soil conditioner blending and distribution facilities at two sites in Brixton. Up until 2020-2021 the Council prepared a single report covering all the activities of the Company in the region, but now has separated out the reporting into individual publications.

1.1.2 Structure of this report

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

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

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

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

Section 4 presents recommendations to be implemented in the 2023-2024 monitoring year.

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

1.1.3 The Resource Management Act 1991 and monitoring

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

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

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

1.1.4 Evaluation of environmental and administrative performance

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

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

1.2 Catchment overview

The Haehanga Stream is a small stream, forming a tributary of the much larger Mimitangiatua awa catchment. It runs from south-east to north-west. Almost the entire valley formed by the Stream is owned by the Company, and consists of steep eroded hillsides, multiple side gullies, and small river flats distributed along its length. The area receives more rainfall than the northern Taranaki coastline to the south-west. Soils are generally poor and highly erodible. Patches of bush and planted trees cover most of the hillsides, with the Company's facilities and pasture grasses over the remainder and the flats. While the grasslands were previously grazed, the Company removed all livestock from the property in the previous year, and the

[1] The Council has used these compliance grading criteria for approximately 20 years. They align closely with the 4 compliance grades in the MfE *Best Practice Guidelines for Compliance, Monitoring and Enforcement*, 2018

grasslands are now solely used as wastewater irrigation zones, with pasture growth managed on a cut-and-carry basis. Riparian and hillside planting is being established.

1.3 Process description

The Company's operations include composting, quarrying and vermiculture operations at Mokau Road, Uruti, and vermiculture operations at Waitara Road, Brixton. The Waitara Road site also has a processing facility which blends and refines the finished products. Compliance at the Waitara Road facility is reported separately.

The Mokau Road, Uruti composting site was established in late 2001, following removal of composting operations from the old Winstone Aggregates quarry site, Manutahi Road, Bell Block. The closure of the composting operations at the former site was due to the nature of the activity being incompatible with the surrounding rural residential land use because of unacceptable off-site odour incidents. The vermiculture production facilities have been operating at Waitara Road since 1998.

The current site at Uruti accepts a range of waste streams which include paunch grass, poultry waste and mortalities, greenwaste, and sheep skins. Drilling wastes had been accepted for about 15 years, but acceptance of drilling waste was ceased in January 2021. The acceptable material list is set out in appendix I, consent 5838-2.2. Further materials have been added to the acceptable material list specified in the consent over time and these materials have been agreed between the Company and the Council prior to acceptance. In certain cases, trials have taken place, to add confidence in the treatment of the proposed composting waste stream. The raw materials are converted, via vermiculture or composting, into marketable biological products intended for use as a fertiliser and/or soil conditioner. However, there are also bulk stockpiles of non-marketable material at the site, primarily on Pad 3. RNZ is committed to remediating and/or removing this material[2].

The composting operation at the Uruti site generates a significant amount of leachate and contaminated stormwater from three main processing areas. These are the greenwaste/animal protein composting pad (Pad 1), the paunch pad (pad 2), and the drilling wastes pad (pad 3). The wastewater collection and wetland treatment system for the vermiculture facility discharges to the Haehanga Stream, while wastewater from the composting facility and drilling wastes pad is irrigated after interim storage onto land in the valley. These systems are described more fully below.

Pad 3 holds drilling muds, fluids and cuttings which have been mixed with sawdust and/or other organic material such as poultry waste. This very large pile was originally turned to stimulate the composting process in the initial phase. The Company noted that it had been unable to find a market for the drilling wastes, due to market perception, but in any case Council and RNZ monitoring has found it to contain toxic contaminants at concentrations that make it unsuitable for uncontrolled distribution. Some of this material has been distributed elsewhere on the site.

Any rainfall runoff and leachate that is generated on Pad 3, drains into the irrigation settlement and storage ponds. A separator treats the leachate and stormwater from pad 1 where greenwaste, sheep skins, poultry byproducts, and other animal-derived wastes are routinely composted, prior to it flowing into the irrigation settlement and storage ponds. The treated liquid is then irrigated intermittently to cut-and-carry pasture on a number of irrigation areas. Harvested pasture is taken offsite for sale. Prior to and during the year under review, the configuration and number of wastewater system ponds formerly in use was modified by the Company, in part to reduce the number and intensity of odour sources.

2 *Pers comm*, Gibson-Bedford 21 February 2023

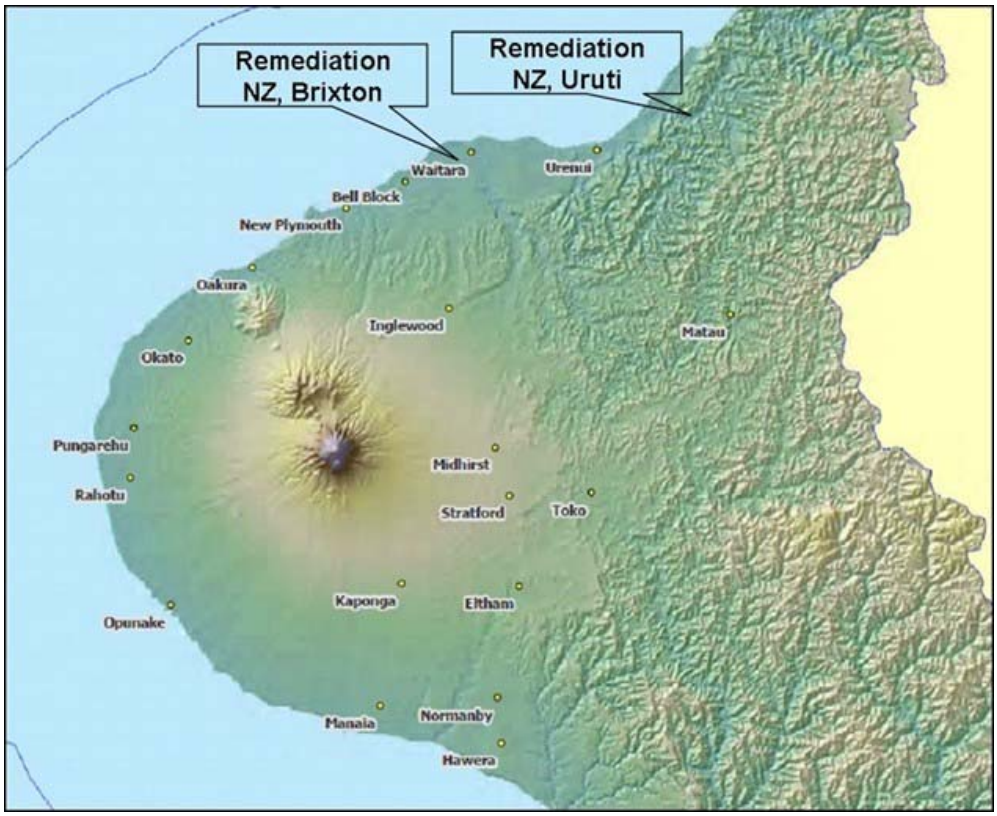


Figure 1 Regional locations of the Company assets on Waitara Road, Brixton and Mokau Road, Uruti

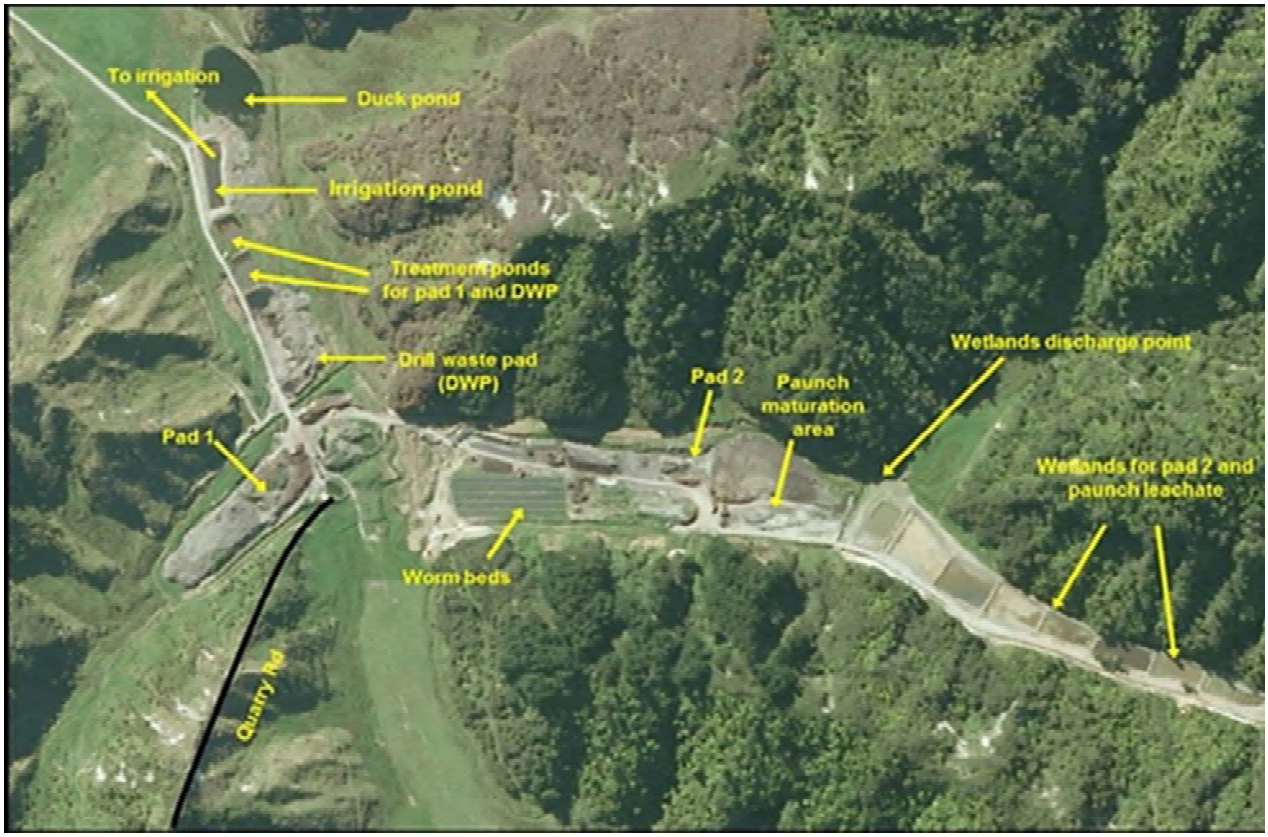


Figure 2 Site map of operational areas RNZ Uruti

Pad 2, the paunch pad, is where paunch (semi-digested grass from animal stomachs) from supplying abattoirs is delivered. Leachate generated from the paunch deposited on the pad flows into a single large pond, from where it is pumped up to the top of a seven-tier constructed wetland. This wetland is planted out with the bulrush raupō which is intended to function as a nitrogen sink for the ammonia-rich paunch leachate. Under dry conditions the water from the bottom pond of the wetland is reticulated back to the top tier of the wetland. Under high flow conditions the wetland discharges the treated stormwater/leachate to a tributary of the Haehanga Stream. During the year, the Company continued works to reduce the size of the Pad 2 pond. The Company has also signaled an intention to re-configure the pad and pond, to eliminate direct discharge to the tributary of the Haehanga Stream, but had not begun any works on the site to this effect, at the time of preparation of this report.

The dewatered paunch is routinely fed to the worm beds which are located in this area of the site.

The Company also have a pea gravel quarry within the Uruti site. The quarry was operated for a short period within this monitoring period, after being idle for some time.

1.4 Resource consents

The Company holds nine 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 3.3 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.

Two consents expired at the end of the 2020-2021 monitoring period. One was renewed (6212-1), while the other (6211-1) has lapsed. Two other consents have expired (5838-2.2 and 5839-2), but given that the Company applied within RMA timeframes for renewal, it is allowed to continue to operate under the expired consents until the applications for renewal are determined. While the Council declined to renew these two consents, an appeal by the Company to the Environment Court means the consents remain in effect in the interim. At the time of preparation of this report, the next hearing session of the Court is scheduled for November 2023.

Table 1 Resource consents held by the Company

Consent number	Purpose	Granted	Review	Expires
Air discharge permit				
5839-2	To discharge emissions into the air, namely odour and dust, from composting operations	May 2010	June 2017	June 2018 Declined May 2021 RNZ continue to exercise (RMA S.124) while Court decision on renewal pending
Discharges of waste to land and water				

Consent number	Purpose	Granted	Review	Expires
5838-2.2	To discharge: a) waste material to land for composting; and b) treated stormwater and leachate from composting operations onto and into land in circumstances where contaminants may enter water in the Haehanga Stream catchment and directly into an unnamed tributary of the Haehanga Stream	August 2015	June 2017	June 2018 Declined May 2021 RNZ continue to exercise (RMA S.124) while Court decision on renewal pending
Land use permits				
5938-2	To use a twin culvert in the Haehanga Stream for vehicle access purposes	September 2015	June 2021	June 2033
6211-1	To realign and divert the Haehanga Stream in the Mimitangiatua catchment for land improvement purposes	Expired 1 June 2021. Now a permitted activity		
6212-2	To erect, place, use and maintain a culvert and associated structures[s] in the bed of the Haehanga Stream in the Mimi catchment for access purposes	Application for renewal received February 2021	-	Under Council consideration
10547-1	To replace an existing culvert in an unnamed tributary of the Haehanga Stream, including the associated disturbance of the stream bed	March 2018	June 2021	June 2033
10825-1*	To realign a section of two unnamed tributaries of the Haehanga Stream for land improvement purposes	June 2020	June 2027	June 2039
10843-1*	To modify a culvert to provide for fish passage, in an unnamed tributary of the Haehanga Stream. Including associated disturbance of the stream bed	June 2020	June 2027	June 2039
Discharge to water				
10063-1	To discharge treated stormwater from a quarry site, into an unnamed tributary of the Haehanga Stream	March 2015	June 2021	June 2027

1.5 Monitoring programme

1.5.1 Introduction

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

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

The scheduled monitoring programme for the Company site consisted of five primary components.

1.5.2 Programme liaison and management

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

- ongoing liaison with resource consent holders over consent conditions and their interpretation and application;
- discussion over monitoring requirements;
- preparation for any consent reviews, renewals or new consent applications;
- advice on the Council's environmental management strategies and content of regional plans; and
- consultation on associated matters.

1.5.3 Site inspections

The Uruti site was visited 10 times during the monitoring period for full site inspections. There were multiple additional pro-active surveys for assessment of offsite odour outside normal working hours. Further visits were also undertaken to deliver sampling surveys of surface water, groundwater, catchment ecology, and soil. Additional site visits were triggered by complaints, generally received afterhours and concerning allegations of offensive odour (Section 2.5.3).

With regard to consents for the abstraction of or discharge to water, the main points of interest were processes with potential or actual discharges to receiving watercourses, including contaminated stormwater and process wastewaters.

Air inspections focused on site 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 Company was obliged to provide monthly records of incoming materials. The neighbourhood was surveyed for environmental effects on both air quality and water quality (Haehanga Stream and Mimitangiatua awa).

1.5.4 Chemical sampling

As the Company holds resource consents specifically related to discharges to land and water, the Council monitors the wastewaters, surface water, groundwater and soil at the Uruti site. The Council undertook sampling within the wastewater systems (to identify environmental loadings) and of the discharges from the site and the water quality upstream and downstream of the discharge point sources and mixing zone.

Surface water analysis

Surface water samples were collected from up to 15 specific monitoring locations on the Haehanga Stream and associated unnamed tributaries (Figure 3). The samples collected were tested for a range of analytes, as identified in Table 2. The Council assessed these surface water locations on six occasions during the monitoring period.

The Council has also installed an in-stream continuous monitoring device at the downstream boundary of the property. It assesses a few core water quality parameters. As field sensors of the requisite accuracy and reliability become available, the Council will look to add in-situ measurements of pollutants to this device.

Spot field parameters were collected for field screening purposes. These data were collected via a Yellow Springs Instrument (YSI) multi-parameter probe and assessed for pH, dissolved oxygen, conductivity, temperature and oxidation and reduction potential.

Three additional surface water locations were monitored on the Mimitangiatua River, to assess for any influence from the Haehanga Stream. The third of these sites was added during the year, and is used to

assess how far downstream any effects of the inflow from the Haehanga Stream may extend, after initial mixing.

Groundwater analysis

The Uruti site contains an active groundwater monitoring network, as required by resource consent 5838-2.2. The Council's monitoring well network is comprised of seven wells (Figure 8). The network was monitored quarterly this period and was assessed for the analytes identified in Table 2.

Low-flowrate sampling is undertaken via a peristaltic pump. Prior to sample collection, Council field staff undertook a well stabilisation procedure. This requires that readings for field parameters (which are assessed through the use of a YSI multiple parameter probe) have stabilised to within 8% over a five minute period, or within three well volumes, prior to the sample being collected.

A survey into contamination across the property was undertaken by the consultants PDP on behalf of the Company during the year, as directed by the Court. This survey included the installation of four additional bores in the vicinity of Pad 3 and the irrigation wastewater holding pond, in order to assess for leakage from the pond and/or Pad 3.

Soil analysis

Representative soil sampling was undertaken on the site specific irrigation areas (9 areas, Figure 9) to identify any emerging issues that might arise as a direct result of irrigation to these areas. Two soil samples (shallow and deep layers) were collected from each irrigation area this monitoring period. With the commissioning of irrigation area L6 in 2021-2022, the total area available for irrigation has increased to 15.96 ha.

Soil sampling was undertaken by two means. The first was with a soil corer which was inserted to a depth of 350 mm+/- below ground level (bgl), whereby ten soil cores are collected along a transect across an irrigated area. The ten cores are then composited to gain one representative sample. The second method was undertaken through a footstool sampler, which removes a surface plug of 70 mm bgl. In this case 20 plugs are collected and combined to gain one representative composite sample.

The rationale for the additional shallow (7 cm bgl) samples were to ascertain for any major difference between the shallow (70 mm) or deeper (350 mm) core. The shallow sample reflects recent irrigation activity, while sampling to a deeper level gives a more meaningful picture of suitability for land use.

The analyses undertaken by the Council in respect of soil are included in Table 2.

Table 2 Monitoring analyte by medium

Surface Water Analytes	
Calcium Biochemical Oxygen Demand (BOD) Benzene Toluene Ethylene Xylene Temperature Suspended Solids Conductivity Total Petroleum Hydrocarbons (TPH) C_7-C_{36} C_7-C_9 C_{10}-C_{14} C_{15}-C_{36}	pH Chloride Potassium Magnesium Un-ionised ammonia Ammoniacal nitrogen Nitrite-Nitrate nitrogen Organonitrogen and organophosphorus pesticides screen Hydrogen sulphide screen (total sulphide , un-ionised hydrogen sulphide) Methylene blue activated substances (MBAS) Dibutyltin Tributyltin Triphenyltin

Discharge Analytes (Irrigation pond WTS discharge)	
Un-ionised ammonia pH Conductivity Total suspended solids Temperature Ammoniacal nitrogen Nitrite-nitrate nitrogen Total calcium Total magnesium Total potassium Sodium Absorption Ratio Total sodium Chloride Total nitrogen Dissolved arsenic Dissolved barium Dissolved cadmium Dissolved chromium Dissolved copper Dissolved lead	Acid soluble lead Dissolved mercury Dissolved nickel Dissolved zinc Total Kjeldahl Nitrogen (TKN) Carbonaceous Biochemical Oxygen Demand Total Petroleum Hydrocarbons (TPH) C_7-C_{36} Benzene Toluene Ethylene Xylene (BTEX) Acid soluble barium Total barium Organonitrogen and organophosphorus pesticides screen Hydrogen sulphide screen (total sulphide , un-ionised hydrogen sulphide) Methylene blue activated substances Dibutyltin Tributyltin Triphenyltin
Groundwater Analytes	
Benzene Toluene Ethylene Xylene Chloride Total Petroleum Hydrocarbon (TPH) Total calcium Total magnesium Total sodium	Un-ionised ammonia Ammoniacal nitrogen Nitrite-nitrate nitrogen Total Dissolved Salts Temperature Level Dissolved barium Acid Soluble barium Organonitrogen and organophosphorus pesticides screen
Soil Analytes	
Calcium Chloride Conductivity Potassium Moisture factor Sodium Absorption Ratio (SAR) Arsenic Cadmium Chromium Copper Lead Nickel	Mercury Zinc Magnesium Sodium Ammoniacal nitrogen Nitrite-nitrate nitrogen pH Total Petroleum Hydrocarbons (TPH) Poly-cyclic aromatic hydrocarbons (PAH) BTEX Organonitrogen and organophosphorus pesticides screen

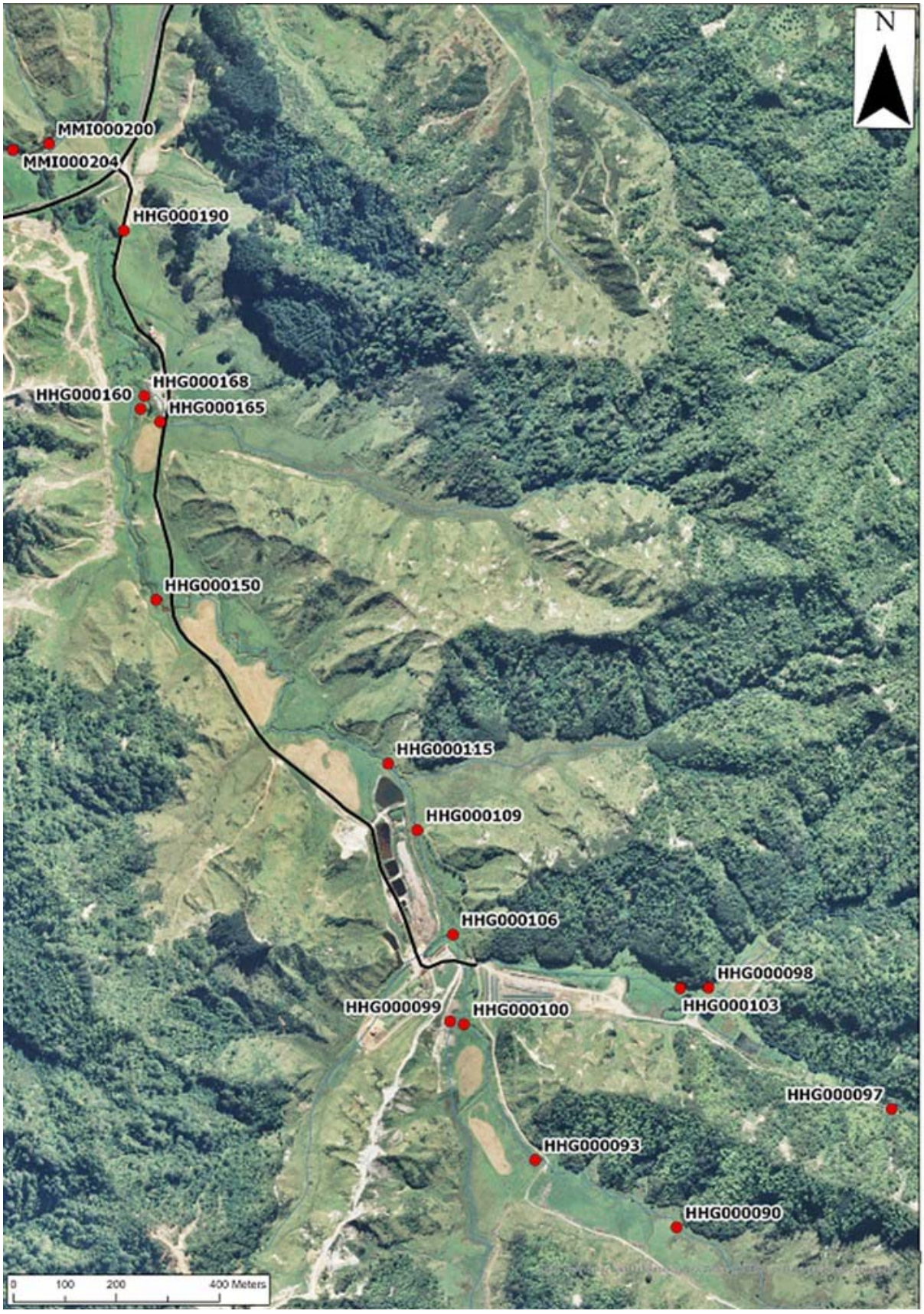


Figure 3 Surface water sampling locations RNZ Uruti

1.5.5 Biomonitoring surveys

A biological survey was performed on one occasion in the Haehanga Stream, an associated unnamed tributary, and an offsite reference location, at eight locations this monitoring period on 11 April 2023. This was undertaken in order to determine whether or not the discharge of treated effluent to land and water, as a process of the exercise of consent, and/or discharges of leachate or runoff, had a detrimental effect on macroinvertebrate communities in the stream.

A summary of this survey is provided later in this report in Section 2.3.

1.5.6 Odour surveys

Council staff undertook a large number of reactive and proactive surveys to ascertain whether the activities of RNZ were causing offensive odours to be present beyond the site boundary. Surveys were conducted in accordance with the guidance provided by Ministry for the Environment (MfE, 2016).

2 Results

2.1 Inspections

Consent 5838

To discharge:

a. waste material to land for composting; and

b. treated stormwater and leachate from composting operations
onto and into land in circumstances where contaminants may enter water in the Haehanga Stream catchment and directly into an unnamed tributary of the Haehanga Stream.

27 July 2022

The routine inspection was undertaken to assess compliance monitoring. It was intended that sampling would be undertaken with this inspection, however due to the rivers being in fresh the associated sampling was not undertaken. The inspection was undertaken in wet weather conditions, with all streams in the catchment including the Mimitangiatua in fresh flow. Sampling was re-scheduled for the coming weeks.

The high flows meant the twin culverts on the property were discharging at near capacity. The inspection found that due to a large amount of recent rainfall in the area all irrigation fields on the property were sodden. Stormwater had accumulated in low points on some of the irrigation areas. This standing water was clear, and not dark in colour that would be associated with recent irrigation. The duck pond was near capacity on the property, and the Company were advised that this should be monitored to ensure that it does not overflow into the Haehanga Stream.

An inspection of the irrigation pond found that the aerator was in operation, resulting in a DO reading of approx. 7 mg/l. The irrigation pond was full to near capacity. This resulted in stormwater back-flowing into the upstream settling pond and also into the ring drain about the drilling mud pad. There was no overflow to land from the system, however the fact that the storage was at capacity was discussed with the site manager and a follow up email was also sent to the managing director of the Company to ensure that they were aware of their consent requirements. On visual inspection of the drilling mud pad it did not appear that any further material had been added to the pile. An inspection of the truck wash area found that the previous truck wash ponds had been infilled, and a pipe installed leading from the truck wash area to the settling pond via a riser. The truck washing was now undertaken on a concrete pad. The washwater is then discharged off the pad via a pipe, where it flows within an open drain for approx. 10 m before entering the subsurface piping work leading to the wastewater settling pond At the point of entering the pipe work the washwater mixes with the stormwater which is piped from the composting pad (Pad 1) to this location.

The inspection of the composting pad found that the windrows were able to be clearly identified with a good volume of bark/woodchip placed over the freshest of the wind rows. All freshly delivered material had been blended into the windrows, and there was no exposed fresh waste deliveries observed at the site. The drop off area was found to be very clean and tidy. However, some stormwater had collected at the lowermost end of the perimeter drains around the composting pad. This was slowly discharging off the pad via the subsurface piping to the settling and irrigation ponds. The ponded stormwater was limited to the lowermost section below the freshest windrow. This was expected in the current weather conditions. It was observed that no stormwater was accumulating about the windrows, meaning the 'feet' of these windrows remained free of stormwater. A small pile of woodchip type material was potentially blocking a section of the ring drain, which had the potential to restrict stormwater from getting to the discharge point for the drain. This was identified to the site manager, who undertook work to clear the material.

It was noted that some of the wrapped bails of contaminated sawdust had been removed from site, which was positive to see. An inspection of the worm beds found that they were all covered. The paunch pond was

full, however sufficient freeboard remained to receive further stormwater. No pumping into the wetland treatment system was taking place during the inspection. An inspection of the wetland treatment system found that it was discharging at a high rate into the tributary of the Haehanga Stream as a result of the rainfall. This discharge was entering a highly turbid stream that was in fresh, with the wetland discharge being significantly less turbid than the receiving environment. Immediate mixing was observed within the mixing zone of the tributary of the Haehanga Stream.

The Council advised the Company of two further matters for attention:-

- to clean out all silt traps about the lower wormbed area and the traps that receive stormwater off the laydown area for the composting pad (near the entrance point to the quarry track); and
- to re-cover the processed compost pile that was stored adjacent to the paunch pond, as it appeared that wind had dislodged the plastic cover.

4 August 2022

A full sampling run was undertaken (delayed from 27 July 2022 due to adverse conditions).

18 August 2022

The inspection was undertaken as part of routine compliance monitoring. The inspection was undertaken during steady rainfall with rising stream flows throughout the property.

The inspection found that all stormwater from the drilling mud pad (Pad 3) and the composting pad (Pad 1) was being captured and directed to the settling pond and irrigation pond. The settling pond was full and the irrigation pond had approximately 0.5- 0.7 m free board within it. The aerator was operating within the irrigation pond. All stormwater was flowing freely with no blockages or obstructions within the ring drains and associated piping. The truck wash area was clean and tidy with all stormwater from that area being collected and directed to the pipe leading to the settling pond. The concrete sandtrap wedge had not yet been installed at the truck wash facility.

The composting pad was in good order with stormwater draining freely from about the windrows. All product was mixed within the windrows, with no unprocessed product noted at the site. A good layer of bark was observed covering the first two windrows. The drop-off area was also clean and tidy.

The wetland treatment system was full and discharging as a result of the rainfall. The paunch pond had approximately 0.5 m free board and no pumping to the wetland treatment system was taking place at the time of the inspection. All worm beds (except one which was being processed) were covered.

An inspection of the irrigation areas found that grass on L2 and L3 had recently been cut and bailed. All other irrigation areas had good grass cover. No irrigation was taking place during the inspection, as the conditions were not suitable. An inspection of the ring drains about L4 and L5 found them to be open and free flowing.

The Company were again directed to undertake works to re-cover the stored compost pile that was located adjacent to the paunch pond, as it appeared that the wind had dislodged the covers, exposing portions of the pile to the weather.

4 October 2022

The inspection was undertaken as part of routine compliance monitoring. It included a full surface water sampling run during the inspection.

The inspection found that all worm beds were covered, with the area about the worm beds being well vegetated. The wetland was discharging from the final pond into the tributary of the Haehanga Stream. The discharge was tea-coloured. Earth had been stockpiled adjacent to the paunch pond. This material had been excavated from the adjacent hill side and will be used to infill the paunch pond to reduce the size down to

the consent requirement. At the time of the inspection there was no pumping from the paunch pond to the WTS with approx. 0.3-0.4 m free board remaining within the pond.

The bail wrapped LOSP treated sawdust that were currently still stored on site were slowly being exported off site for disposal. An inspection of the composting pad found that there were currently five large windrows on the pad, which took up the full pad footprint. A good cover of bark was observed across the windrows. Standing water was limited at the drop off area within the composting pad and all windrows had dry feet. Work was still required to complete the truck wash plan as designed with the concrete sand trap yet to be installed. The Company were requested to provide the Council with a timeline for the completion of this work. The drilling wastes pad was now well grassed across the full stockpile. The wastewater irrigation pond was full but was being managed to prevent overflow, noting that winter-spring was a challenging time of the year to manage stormwater at the site given the rainfall volumes and the limited ability of the soils to uptake any irrigation fluid.

30 November 2022

An inspection was undertaken at the composting facility as part of routine compliance monitoring. The inspection was undertaken in fine weather conditions. However, previous wet weather meant that all streams on the property were turbid and elevated.

The inspection found that work was ongoing on the site both in terms of accepting and processing waste via composting and worm farming activities, and in terms of site improvements across the site. Upgrade plans for the site were discussed with the site manager. Much of the work was in its early stages, and the site management team required good periods of fine weather to allow the completion of some of the works as these involved earthworks.

The site inspection found that all except the uppermost irrigation field had been cut for hay, with the product being removed from site. The removal of the grass from the fields would greatly assist in the irrigation activities on the site as the process of evaporation would increase by the covering of long grass being removed from the fields.

An inspection of the irrigation pond found that it was full (as would be expected due to the current wet weather). The aerator was operational and the DO meter was recording a DO reading of 7.93 mg/l within the pond. No irrigation was taking place on the site; the site manager expected irrigation to recommence following some further rain that was expected in the coming days. An inspection of the settling pond found that it was full and discharging into the irrigation pond via the pipe as designed. No works had been undertaken in or about the drilling mud pad, with the waste pile grassed.

The truck wash area was inspected and although all washing activities were now undertaken on a concrete pad, there remained a small area where the washings would discharge across land (1-2 m) before re-entering a pipe which captures contaminated stormwater from both the truckwash pad and the composting pad and directs it to the settling pond. The Company's general manager was phoned following the inspection to ascertain when the concrete sandtrap would be installed at the truck wash pond. Installation of this equipment would ensure that all discharges remain within sealed infrastructure. The general manager advised that he would chase this up with the supplier and report back. The Company were directed to ensure that this work is completed as soon as possible.

An inspection of the composting pad found that a load of feathers had been delivered at the site to be incorporated into composting piles. Mature compost from the upper end of the composting pad was being removed from site for sale. The removal of product from the upper area of the pad was the first stage towards reducing the composting pad size back to the consented size. The configuration of the reduced composting pad size had been calculated by RNZ and earthworks were be undertaken in the drier months to reduce the pad to the required size. This work would involve the construction of a large bund across the former upper pad to reduce its drainage footprint. The area of the pad beyond the bund will have all

material removed and will then be grassed to control sediment loss from this area. Once the area is stabilised with grass it is planned to divert the clean stormwater from the treatment system. This will assist in managing the volume in the irrigation pond. As a result of the work being undertaken to reduce the footprint, the remaining pad area was full with compost (fresh, partially processed, and mature). The site manager will continue to process this compost and remove the mature compost from site to ensure that appropriate windrows can be maintained on the new small footprint.

It was noted that a large majority of the LOSP treated, wrapped sawdust bails had now been removed from site with approximately one further truck load of bails still remaining on the site.

All wormbeds had been recently fed with mature paunch. This was to ensure the worm beds remain productive but also to remove material from the paunch pond and pad, to allow the site manager to manage the infilling of the pond, in order to reduce its stormwater catchment and thus the loading on the wetland treatment system. At the time of the inspection, further progress had been made on infilling the paunch pond with clean papa material taken from an adjacent spur on the property. This process involved pumping down the stormwater level in the pond as far as possible and then removing the paunch from a section of the pond before infilling it with clean solid material. Works had commenced at the 'drop off' end (western end) of the pond and pad, and would continue to advance towards the wetlands until it meets the required footprint size. At the time of the inspection, due to the wet weather, this works had not progressed in recent weeks. The site manager was planning on completing this work once there is an improvement in the weather. The infilled area had been battered away from the pond to ensure that any stormwater collected on the infilled section of the pond was directed away from the pond and was not able to discharge into the pond. The Council requested the site manager to seed this area to ensure that the clean water areas are well stabilised.

Sediment traps about the truck loading and turning area had been cleaned out and redesigned to increase the stormwater retention time. As previously discussed, an improved sediment capture and treatment system for the area needed to be developed.

A large portion of the stockpiled compost adjacent to the paunch pond remained on site. It was intended to remove this product from site for sale following the completion of the compost removal requirements at the upper end of the composting pad. The site manager was utilising a surface water monitoring device to ensure the site operations were not resulting in adverse readings of water quality.

In summary, works that were being or were to be undertaken at the site, to comply with the resource consents and/or abatement notices:-

- installation of the sandtrap at the truck wash pad;
- continued works to reduce the footprint of the composting pad;
- continued works to reduce the footprint of the paunch pad/pond;
- removal of the stockpiled compost adjacent to the paunch pond;
- removal of the last of the LOSP bails;
- grass seed areas subject to the site earthworks ensure that clean stormwater areas are stabilised and sediment generation is minimised.

12 December 2022

A full surface water sampling run was undertaken across the RNZ site. It was observed that work was being carried out on the aerator within the irrigation pond and therefore the aerator was not in operation. No irrigation was taking place at the time of the inspection. The wetland was discharging and samples were taken to assess compliance with resource consent conditions.

31 January 2023

The inspection was undertaken as part of routine compliance monitoring, in fine weather conditions with the stream in base flow conditions.

The inspection found that irrigation area L6 had recently been cut for hay with the hay being exported off the property. All irrigation fields had good grass cover, but were not excessive in length which means that evaporation of irrigation material will occur across the pasture. It was noted that the uppermost irrigation area was damp, but the rest of the irrigation areas appeared to be in good order. No irrigation was taking place at the time of the inspection.

An inspection of the drilling mud pad found that the bund was in place to ensure all stormwater is collected and directed to the irrigation pond. The material on the drilling mud pad was well vegetated with grass, and was therefore stabilised. No further material had been placed on the pad. The irrigation pond was full with approximately 1m free board remaining to cope with any rainfall. The aerator was in operation on the irrigation pond with a DO reading of 6.93 g/m^3, meaning effective aeration and avoidance of anaerobic conditions that lead to offensive odours.

The concrete sand trap was in place at the lower end of the truck washdown area. The site manager advised that washwater from within the sandtrap is removed and placed into a honey wagon on site if it is odorous. It is then discharged into the irrigation pond. Work has been completed in reducing the footprint of the composting pad to ensure compliance with the resource consent conditions is re-established. The site manager advised that the pad had been measured and is within the acceptable size limit. A large bund is in place at the northern and southern ends of the pad to ensure that it remains within its required size. The previously used section of the pad had been planted and seeded with grass. On inspection it was found that the grass was beginning to grow, however until such time as this area is stabilised, the stormwater runoff was still being collected and directed to the irrigation pond via the settling pond. A large volume of compost is currently on the composting pad with a majority of this being mature compost which was in the process of being exported from site for market. The works to the composting pad had also reduced the area of standing water within the pad area with only a small amount noted about the discharge pipe from the pad area.

The sediment trap next to the access track leading to the worm beds had also recently been cleaned out. The Council recommended further sediment controls in this area to ensure appropriate retention and treatment of the stormwater was achieved. Work was ongoing to reduce the footprint of the paunch pond, however significant gains had already been made in this area with the pond greatly reduced in size over recent months. Further reduction was still required. A small bund had been constructed about the reclaimed edge of the pond to ensure all clean stormwater (rainfall from areas free from raw or processed material) is directed away from the pond and not into it. The Council recommended that the reclaimed areas of the pond (exposed soil) is grassed to stabilise the area. The inspection found that a small tea-coloured discharge was flowing from the wetland into the tributary. This was likely a result of recent rainfall and not from pumping of paunch pond stormwater. No change in clarity of the stream was noted as a result of the discharge.

Four new groundwater bores had been installed at the property by the Company's consultant. One is between the irrigation pond and the drilling mud pad; two are installed between the irrigation and settling ponds and the site access track; and the last installed between the drilling mud pad and the unnamed tributary of the Haehanga Stream at about the location where previous contamination of the stream has been recorded during summer low flow sampling runs.

28 February 2023

An inspection of the composting facility was undertaken as part of routine compliance monitoring. The inspection was undertaken in fine weather conditions, with the site under normal operating conditions.

The inspection found that pasture on irrigation areas L6, L5, L4, L3, L1, U2 and U2 had been cut and bailed, with the bails being loaded onto trucks and exported from the property at the time of the inspection. Due to the need for access to the irrigation paddocks to collect and load the trucks, no irrigation was taking place during the inspection. The irrigation pods had been returned onto L6, however all other pods had been removed from the irrigation areas to allow for vehicular access while the pasture was being harvested.

An inspection of the irrigation pond found that it was full with approximately 300-400 mm free board. The Council advised that this needed to be lowered in a considered manner to ensure that it is maintained at a low level in case of future rainfall. The aerator was operating within the irrigation pond with a DO recording of 5.15 mg/l, indicating satisfactory aeration and avoidance of anaerobic conditions that would generate offensive odours. The settling pond was full.

An inspection of the drilling mud pad found that the ring drain was in place, capturing and directing all storm water to the irrigation pond as intended. No works have been undertaken within the drilling mud pad with the area remaining well vegetated. An inspection of the truck wash facility found that the concrete sand trap was working well and appeared to be regularly cleaned out to ensure capacity was maintained within the trap and that odour-generating material is removed. It was observed that truck-washings were still able to escape through the concrete blocks at the rear of the wash pad. Although the wash water enters a small swale where it is directed to the sand trap ensuring that there are no discharges from this area, there is a risk that the wash water following this pathway can result in some odour generation of the residual material. The inspecting officer recommended that the gaps between the concrete blocks were filled with cement to ensure all wash water is captured and directed as intended to the sand trap via the designated pipe.

An inspection of the composting pad found that there were now two main windrows on site. One comprised mature compost which was being screened and exported from site, and the other was a smaller windrow of new material that was at the commencement of the composting process. Although the pile of mature compost was large, the inspecting officer noted progress with regards to its removal from the site. Space had been created at the upper end of the pad (which had been reduced in size to meet the consent conditions) to allow space for the screen to operate. The ring drain at the rear of the pad had been slightly blocked as a result of the movement of product. This would not result in any discharges from the dirty water catchment, but could potentially result in the stormwater pooling within the upper section of the ring drain as it was prevented from flowing to the pad drain's discharge point. This was identified and quickly remedied by staff on site. With the composting process requiring movement and turning of product the Company were instructed to ensure the ring drains are always open so that stormwater and leachate can flow freely to the discharge point from the perimeter drain.

An inspection of the upper pad area, which is not decommissioned, found that the grass was beginning to take but remained patchy. Stormwater from this western area was still being captured and directed to the irrigation pond until such time as the catchment is clean from compost residuals.

An inspection of the drop off area at the composting pad found that all fresh product was covered and blended, with a good stock of green waste/vegetative compost available onsite to blend with other inwards goods. The Company was instructed to ensure that the clean stormwater areas about the composting pad was kept clean of contaminants associated with the composting process.

It was noted that the grass seed placed on the lower constructed bund of the composting pad was also beginning to grow. This would stabilise the bund and prevent sediment being discharged from the batters during wet weather events. The Council inspector had had discussions with Company staff on site previously regarding the risk of sediment being mobilised about the clean catchment areas. The site manager was directed to refer to the *Waikato Guidelines for Soil Disturbance* for guidance in minimising and treating sediment laden storm water. More use of stabilisation and sediment retention ponds should be considered.

The worm beds were inspected and all were found to be covered and not recently harvested. Good grass growth, which provides for filtration of storm water was developing between the rows. Works had been undertaken to construct a designated stormwater catchment about the area adjacent to the lower worm beds that was being used to store small amounts of aggregate from the Company quarry. This works involved the creation of a U-shaped bund to separate clean and potentially dirty storm water. The bunds are approx. 400-500 mm in height. Sediment pits were in place at the two lowermost corners of the bunds. This would ensure all stormwater is captured and directed to the sediment traps before being discharged from the site into the adjacent drain. The Company were recommended to grass seed the bunds to ensure that they become stabilised. They were also advised to monitor the water quality discharging from the two sediment traps, and if the water quality did not comply with the consent, then they should consider replacing the traps with Decanting Earth Bunds (as described in the Waikato Guidelines).

Work had also been ongoing to reduce the size of the paunch pond. This work had been significant, with the pond greatly reduced and with further reduction in size planned. This reduction in size will greatly reduce the volume of storm water that is required to be treated through the wetland treatment system. A tidy bund had also been constructed around the edge of the reduced pond to ensure that all uncontaminated stormwater from clean areas adjacent to the pond was directed away from the pond and not into it. An inspection of the wetland found that there was a small tea-coloured discharge into the tributary of the Haehanga Stream as a result of recent rainfall. The wetland system contained pooled water throughout the system. All worm beds in the upper area were covered with a stormwater swale constructed and planted about the lower perimeters of the beds.

23 March 2023

A routine compliance monitoring inspection was undertaken to assess compliance with resource consent conditions. The inspection was carried out in fine and calm conditions with an early morning temperature between 7 and 9 degrees Celsius.

Inspection of irrigation fields indicated no issues. It was considered that the work undertaken over previous months to harvest hay had left no observable detrimental effects concerning the soil's ability to absorb irrigated wastewater. No discharge by way of irrigation pod system was observed at time of visit.

A thorough inspection around the bottom ring plain of the drilling mud mound found small pockets off water from the mound were evident at its base, however the drainage channels around the mound appeared to be doing their job by allowing the run off to empty into the irrigation pond without any overflow anywhere else. Vegetation was well established on and around the mound which further provides more efficient filtration in this area.

The truck washdown area appeared reasonably clean. As previously noted to the Company, some benefit could be gained from plugging the gaps in the concrete backstop of the pad, to allow for a more controlled pathway of water through the sand trap area and to minimise any spread beyond the area.

Inspection of the compost pad indicated that product had been arranged into windrows since the last inspection. Inspection of the ring drain around the pad found minimal instances of static or pooled water. The area appeared to allow for sufficient drainage at time of visit. The grass growth on the area beyond the upper (southern) end of the pad seemed to be taking well, although still quite patchy, Storm water from this area was still being directed to the irrigation pond until such time that the area could be deemed a clean catchment area.

Inspection of the paunch pond found works continuing to reduce its size. There appeared to be enough bunding to ensure no escape of water from this area. Care needed to be taken during the scale down process in this area to avoid sediment transport.

14 April 2023

A routine inspection of the composting facility was undertaken to assess compliance against resource consent conditions.

The upper and lower irrigation fields were set up with spray pods ready to irrigate as needed. These were not discharging at the time of the inspection. Grass from some areas had been cut and bailed ready for removal offsite.

The irrigation pond/settling pond and drilling mud pad were inspected. The irrigation pond was being aerated at time of visit, including for the majority of the day while the Council inspector was on site. Aeration monitor display was reading at 6.61 mg/l. The water levels in the irrigation pond appeared safe with adequate freeboard available to handle incoming fluids and any rainfall event.

The inspection of the ring drain around drill mud pad found no issues in terms of its ability to direct any runoff from the pad to the irrigation pond, however, thick vegetation on the north east corner made it difficult to carry out a full inspection of the pond's perimeter. A small amount of clearing may be required to be able to better assess the integrity of the ring drain in this area and to be able to walk around it unobstructed. The drilling mud pad overall appeared well vegetated. The officer spoke with the site manager who advised that works were about to be undertaken near the top east end of the drill pad pertaining to the possible leaching taking place. The site manager advised he would keep the Council advised of that process.

Upon inspection, the settling pond appeared to have no issues. Inspection of the composting pad found a small delivery of chicken carcasses and eggs was ready to be added to the composting pile at the north end of the pad. There was also a separate pile of green matter adjacent to it. The compost pad is windrowed with the mature compost at the south end of the pad. The pad was well accommodated in terms of ring drainage. Minimal run off from the pad or accumulation of storm water was observed at this time due to the relatively dry conditions over the past 24 hours. No obstructions or barriers around the ring drain were present.

The re-grassed area near the upper north end of the pad appears to be re-established, though still patchy in areas. Minimal run off from this area was observed at this time, but any storm water collected was directed to the irrigation pond until the area can be deemed clean enough to be redirected to surface water. Inspection of truck wash facility and surrounding area revealed some changes, in that the sand trap was now retrofitted with a solid wood cover. This is presumably to mitigate odour while providing an added layer of safety around the sand trap.

The worm beds were inspected at this time. Most were covered with the exception of one row where compost was being added at time of visit. Vegetation was starting to take hold between the rows.

The small pile of quarried aggregate adjacent to the main section of worm beds had been bunded with sediment/silt traps to mitigate excessive solids entering the nearby stream. The bunding appeared adequate to contain any runoff. The Company was requested to continue to monitor this area, to ensure the current arrangement of sediment traps was equipped to handle the solids going through them. As previously noted, larger decanting earth bunds for small catchments may also be an option. The paunch pond and wetland areas were inspected. The paunch pond was about the same reduced size as found on the previous inspection. The bunding around the paunch pond has been adequately constructed to contain the contents being held in it. No pumping was taking place to transfer wastewater from the paunch pond to the upper area of the wetland at the time of inspection. This would occur as needed. A Company staff member onsite stated it was pumped recently within the last week or two. A small discharge was noted coming from furthest end of the wetland and entering the tributary of the Haehanga Stream. This discharge appeared as a very light tea colour. No deleterious effects were noted downstream as the wetland filtration ability appears to be functioning as intended.

The Company were reminded to maintain awareness of the north bank of the open surface pond in the wetland, where a thinned out embankment wall exists. There was no indication to suggest any failures exist at present, but general awareness was warranted to see that it does not degrade further to compromise the integrity of the pond wall. The movement of wild animals through this area was noted as a possible reason for its deterioration.

A quarry inspection was also undertaken. Currently it was not in operation. There was a discussion with on-site staff of the need to keep a watchful eye on where the stormwater down the steep quarry road is ending up. Two sediment traps exist at the base, as well as various interception cut outs along the bunding of the road further up at elevated levels to direct drainage into the vegetation along the hillside. The arrangement of multiple exit points for stormwater throughout the quarry road, hopefully reduces any increased deluge at the base. The Company was requested to monitor the sediment traps at the base of the quarry road, to ensure storm water is not bypassing these systems during times of high rainfall.

28 April 2023

A Council compliance officer met onsite with the Site Manager at the Remediation site specifically to inspect the area at the southern end of Pad 3, where works were underway to abate seepage from this locality into a tributary of the Haehanga Stream. The Site Manager explained what had been discovered, with the base layer of rock acting as a conduit for potential leaching out from the top end of the drill mud pad to create a flow path into the tributary. The investigating company who had identified the issue had recently been on site. A full report was anticipated in due course. RNZ were well aware that the area needed to be restored as effectively as possible so as to mitigate any further issues in this area. A digger was operating to bring in papa rock to create a seal within a moderately deep interception trench that had been excavated, particularly along the face of the top (southern) end of the pad which remained exposed at this time. The Site Manager advised this end of the pad will be re-grassed once they have restored the area, and in addition the ring drain at this end was to be re-configured to link it back up with the perimeter drain around the pad to contain any residual runoff. The Council compliance officer advised the Site Manager they would be back in the coming fortnight to conduct a full inspection at the site, including the works in this area so that the completed works can be better assessed.

8 May 2023

The routine monitoring inspection of the Company's composting and vermiculture operations and associated activities was undertaken to assess compliance with resource consent conditions. The inspection was undertaken with an air temperature of 19 degrees Celsius and a very light north east breeze.

The irrigation pond was found to be well-agitated at the time of inspection. Its level appeared quite full although no runoff or spill over was observed. The Company was requested to monitor the surrounds to ensure the pond did not breach its banks. The DO recording was at 2.59 mg/l O^2. This was lower than typical, although still satisfying the air experts' recommendation of a minimum of 2 mg/l.

The officer conducted an inspection of the drilling mud pad and the recent works completed at the top end nearest shipping containers placed on the site to form a covered storage area in due course. The ring drain has been re-established at the top (southern) end to join back up with the rest of the perimeter drain. This area may be yet to be tested in terms of its ability to intercept and contain runoff, especially during high rainfall. The Company were requested to monitor its ability of the newly re-established section of ring drain to contain and direct surface runoff, and to consider making the ring drain a bit deeper if any issues arise in terms of drainage. It was noted that in due course, re-vegetating the top end of the drill mud pad may provide a greater level of absorption, stability and filtration to avoid that potential. Bunding has been established to mitigate any runoff or contaminants being transferred between the composting area and the drill mud pad.

Inspection of the composting pad was undertaken during increased activity on the pad, and digger operations were underway, moving product along the windrows. The raw materials drop off area on the pad appeared minimal in terms of any received animal remains at time of inspection. Adjacent to this area were piles of green waste and other vegetative compost ready to be blended when incoming product arrives onsite.

Remediation staff had proactively identified a small area of smoking compost which appeared to be in the process of self-combusting, and moved it off to the side away from the rest of the pad in order for it to settle and not compromise the other larger areas of the composting pad. The rest of the pad appeared to be without any issues. The ring drain was containing any contaminants coming off the pad and directing them through to the settling pond. The grassed area beyond the top of the compost pad shows some signs of further growth, particularly at the very top which appeared more grassy at this time than previously. Some other lower areas remain patchy. Any storm water exiting from this area still needed to go through to the irrigation pond until such a time the area may be considered stable and clean enough to divert into a stream.

The Council officer undertook inspection of the two worm bed locations. The larger section of worm beds were all covered. Minimal changes to these areas was noted. No harvesting operations were occurring at this time. The larger quarried aggregate mound situated between the larger worm bed area and the paunch pond remained unchanged. Sediment pits situated on the lowermost two corners of this mound are in place to capture sediment and provide filtration for the run off from it. This area still remains largely exposed and as previously suggested to the Company in an earlier inspection, some merit may be seen in grassing the bunding around it to give it an added measure of stability and integrity in terms of handling any potential contaminants flowing from this area, to water. The area around the paunch pond remained unchanged in terms of size since last inspection. Some consideration may be afforded to vegetate or grass the area around the paunch pond to provide an enhanced potential for filtration and absorption of possible contaminants.

Inspection of the wetland revealed a small discharge to the tributary of the Haehanga Stream. This was observed as light tea in colour. No negative effects were detected or observed downstream from this discharge. The different sections within the wetland system appeared to be providing adequate filtration. No odours associated with composting or waste water were detected from the upper to lower section of the wetland. The area previously identified midway up the wetland with a thinned out embankment, possibly from wild animals moving along the ridges on that side revealed no further deterioration but the Company were instructed to remain aware of it and to monitor any potential changes which may compromise the integrity of the wetland, and the adjacent tributary.

Irrigation areas L1, 3, 4, 5, 6 and U2 were not in use at the time of inspection. These areas appeared well enough contained and providing adequate drainage and absorption in the area, given the recent increased rainfall over the previous week.

13 June 2023

A monitoring Inspection was undertaken to assess compliance with resource consent conditions covering the discharge of waste material to land for composting, and treated storm water and leachate from composting operations; onto and into land in circumstances where contaminants may enter water in the Haehanga Stream catchment and directly into an unnamed tributary of the Haehanga Stream. The inspection was carried out in fine and calm conditions.

Inspection of the Irrigation pond found the level to be high with little freeboard. The onsite DO. recording registering at the time was 0.15 mg/l. This indicated anaerobic conditions in the pond, which would lead to significant odour release if not remedied. RNZ have given an undertaking to ensure the concentrations of dissolved oxygen never fell below 2.0 mg/l. There was no aeration at the time of inspection, as mixing is on a timer. This was therefore a breach both of their undertaking and of the consent requirement to implement

best practicable options to avoid or minimise odours[3]. Minimal odours were detected coming off the pond at the time of inspection. The Council officer had a telephone discussion with the site manager to stress the importance of monitoring the pond to ensure it remains contained and taking any windows of opportunity to pump the pond out to the irrigation pods around the site.

Inspection of the drill mud pad found the top end where recent works were completed was starting to green over albeit with limited grass coverage at this time There will be a continuing focus on the pad over the coming months to ensure it remains structurally sound and that any run off is contained in the ring drain system. There were discussions with the site manager concerning the far side of the drill mud pad adjacent to the stream where the vegetation had been flattened out to allow for remedial works to be undertaken. This area was now in need of some restructuring in terms of re-establishing the ring drain and bunding to reinforce it. Some areas were level with the track which may potentially create a run off risk from the pad directly across to the stream. It was suggested to the site manager that it might be beneficial to prioritise this area to ensure it is contained as it was before those works began.

Inspection of the composting pad found there were nil operations occurring at time of inspection, apart from a previous small shipment of chickens. There appeared to be some vegetative compost and green waste ready to be blended into the pad. Some emphasis by RNZ was encouraged to ensure that the pad is kept contained, so that individual piles do not exist beyond the containment area, as it is important for any leachate to be captured and directed into the wastewater containment and storage system. The area between the shipping containers where compost storage has accumulated since the last inspection was discussed with the site manager. Unless adequate control measures were put into place, such as capturing leachate runoff, there can be no assurance that any run off from this area wasn't making its way into the surrounding environment from this location. The site manager advised that this pile would be moved in the coming week.

The Council officer also noted there could be additional merit in plugging the gaps in the bottom portion of the cement blocks around the truck wash area, to keep washwaters contained flowing through a single directed channel.

Inspection of the wetland and paunch pond area found that although the pond had decreased in size, its level was fairly elevated and almost level with the ground leading to the adjacent stream. Increased monitoring by RNZ of this area and pumping effluent into the wetland treatment system if need be to ensure water does not breach the area, was raised with the site manager. A small discharge coming down from the wetland appeared clear.

Inspection of the irrigation fields L1, L3, L4, L5, L6 and U2 found that no wastewater was being discharged to them at time of inspection. The Council officer noted that when possible, with an extended forecast of fine weather, RNZ should ensure every effort was being made to irrigate to land in order to take advantage of any small window of opportunity. This was discussed with the site manager, who advised he had been irrigating and would continue to do so.

Consent 5839

To discharge emissions into the air, namely odour and dust, from composting operations between 1731704E-5685796N, 1733127E-5684809N, 1732277E-5685101N, 1732451E-5684624N, and 1732056E-5684927N

6 July 2022

An inspection was undertaken within the Mimitangiatua Valley to assess compliance with resource consent conditions with regards to the discharge of odours off site from the RNZ-Uruti composting facility. At the

[3] Remediation New Zealand progress update 16 December 2022: 'Install aeration that switches on automatically when DO drops below 2.0 mg/l'

time of the inspection the weather conditions were fine with a slight breeze. A heavy fog was noted throughout the valley with the air temperature being 6-7 degrees Celsius throughout the inspection. Cold air drainage conditions were noted within the valley.

Odour scouting was undertaken extending from the entrance to Jones Quarry, up to 1587 Mokau Road. No odours were noted within the Mimitangiatua Valley up catchment of the Haehanaga Valley. No odours were detected at Jones Quarry. Odour was detected at the entrance to the Remediation NZ property, and also at the metal park-off area beside the highway, to the west of the Haehanga Stream Bridge. This odour was noted as a compost odour with a slight smoke odour also associated with it. The odour surveys noted that these odour ranged in intensity between #1 and #2. An assessment against the FIDOLT factors found that the odours beyond the site boundary were not offensive or objectionable and were within resource consent parameters.

27 July 2022

The inspection was undertaken to assess compliance with resource consent conditions. The officer arrived at the site boundary at 08:01 hrs. At the time of the odour surveys the weather conditions were 13 degrees Celsius air temperature with light rain, and noting significant rainfall in the preceding 48 hrs. There were overcast conditions with high cloud. A blustery southerly wind was blowing which was generally blowing up the Uruti Valley.

Two odour surveys were undertaken to assess odour emissions beyond the boundary of the property. One survey was undertaken at the metal park-off area south of the Haehanga Stream, and a further survey was undertaken at the site entrance. No odours were detected at either locations. No dust was noted discharging off the property, with the only source being the site access track which was wet at the time of the inspection.

An inspection of the site found that the aerator was operating within the irrigation pond and the DO was recording at approximately 7.0 mg/l. The settling pond was also full but the aerator on this pond was not operating at the time of the inspection. A very slight odour was noted within the immediate vicinity of the pond, however this would be noted as a #1 on the odour intensity scale. The composting pad was full, with turning of the windrows planned for later in the week. The initial windrow had a good cover of bark/wood chip over it to help reduce the odour. Materials appeared well blended within the windrows. Some standing water was noted at the lowermost end near the drop off area. This was contained to a small area with the windrows being largely on free draining base. The pooled water was slowly discharging off the pad through to the settling pond, however with the recent rainfall volumes it was to be expected that some stormwater was being held at the lower end of the pad while it was draining away to the irrigation pond. Odours about the composting pad were again very limited. No unblended material was noted about the drop off pit or lower end of the composting pad, meaning all product was within the windrows. A stockpile of mature compost/greenwaste pile was observed onsite, ready to include in the blending process with other material as it comes to site.

All wormbeds were covered. No significant odour sources were noted at the property during the inspection.

4 August 2022

The evening (after hours) inspection was undertaken to assess odour discharges from the RNZ - Uruti composting facility. Inspection was undertaken between 19:54 hrs and 21:39 hrs. At the time of the inspection the weather conditions were fine with a 9 degree Celsius air temperature. Heavy fog was present throughout the valley with a very light easterly air movement. Cold air drainage conditions existed throughout the inspection.

Odour scouting was undertaken between the entrance to Jones Quarry and along Mokau Road to 1587 Mokau Road. No odours were noted within the Mimitangiatua Valley north-east of the site entrance. Odour surveys were undertaken at the entrance to Jones Quarry. No odours were noted at this monitoring site.

Further odour surveys were undertaken at the entrance to Remediation's property and at the park-off area to the west of the Haehanga Stream, adjacent to the highway. Noticeable odours were noted in both locations. These odours were assessed to be between #0 and #2 on the FIDOLT scale. An assessment of the odours being discharged from the site against the FIDOLT factors found that the site was compliant with regard to odour.

10 August 2022

An evening pro-active inspection was undertaken to assess compliance with resource consent conditions. Inspection was undertaken in fine weather conditions with all road surfaces dry except for a heavy dew on the grass. Skies were clear, with an air temperature of 8 degrees Celsius dropping to 7 degrees Celsius during the inspection. At the commencement of the inspection a light easterly wind was noted. However this changed to more of a southerly breeze during the inspections.

Odour scouting was undertaken extending from the entrance to Jones Quarry through to 1587 Mokau Road, Uruti. No odours were noted throughout the extent of the odour scouting locations. Odour surveys were undertaken at the site entrance and at the entrance to Jones Quarry. No odours were detected. No complaints were received across the evening.

18 August 2022

Inspection of the Company's property was undertaken as part of routine compliance monitoring. Inspection was undertaken in wet weather conditions with a steady rainfall noted throughout the inspection. The air temperature was noted at 16 degrees Celsius with total cloud cover and a moderate north-east wind.

Odour scouting was undertaken along SH3 extending from Jones Quarry through to the site entrance to the facility. No odours were detected at any off site locations.

An onsite inspection noted that the irrigation pond was full with approximately 0.5 m free-board. The aerator was in operation on the irrigation storage pond with foaming noted on the surface. A slight odour was noted within the immediate vicinity of the pond, however this was not detected beyond approximately 10 m from the pond edge. All worm beds were covered except one which was being processed (noting that processing was recommencing following an improvement of the weather).

An inspection of the composting pad found that it was well organised with a good layer of bark placed upon the freshest two windrows. Stormwater was flowing freely away from the base of the windrows and all fresh product had been blended into the composting windrows with no unprocessed product noted about the site. The storage pile of compost adjacent to the paunch pond still remained in place however some material from the top end had been removed from site.

The Company were directed to undertake works to ensure that this pile was completely covered, as recent wind had caused portions of the compost pile to become exposed due to the lifting and disturbance of the covers.

25 August 2022

An early morning odour assessment was undertaken to assess compliance with resource consent conditions in relation to the discharge of odour beyond the boundary of the property at the RNZ composting facility at Uruti. At the time of the survey there was a light breeze drifting down within the valley, in 10 degrees Celsius air temperature. Road surfaces were dry with a small amount of fog noted within the valley hugging the south sides of the valley walls.

Odour scouting was undertaken between the entrance to Jones Quarry through to 1587 Mokau Road. A thin odour plume was detected off site at the small metal park-off area immediately to the south of the Haehanga Bridge, beside the highway. An odour assessment was undertaken at this location (07:34 hrs) and odours were detected and measured to be approximately #1 on the odour intensity scale. The odour was

best likened to a composting odour. An assessment of the odour intensity off site against the FIDOLT factors deemed the odour to be in compliance with resource consent conditions. No odours were detected at any other locations, however further surveys were undertaken at the site entrance and at the entrance to Jones Quarry. A follow-up odour survey was undertaken south of the Haehanga Bridge at 08:59 hrs. At this time the odour had dissipated and no odours were noted in the area.

1 September 2022

An evening odour assessment was undertaken to assess compliance with resource consent conditions in relation to the discharge of odour beyond the boundary of the property at the RNZ composting facility at Uruti. At the time of the survey (19:40 hrs) there was a light breeze drifting down with valley in cool/cold air temperatures. Road surfaces were dry. The sky was mostly clear with small patches of clouds noted.

An odour assessment was undertaken at the entrance to RNZ. The assessment found that the odours would have been objectionable if they occurred frequently. The bulk of the assessment found weak to very weak compost odours, but there was a very short duration (30 seconds) of distinct to strong rotting meat odour that was considered objectionable. No odour was detected upwind of the site (north of the property towards Mt Messenger). The final odour survey was carried out at an area downwind (metal pit pull-off beside the highway). Odours were constantly detected and varied between weak to very weak compost and sulphurous odours. The odours were not considered objectionable.

A site visit onto the RNZ property was not carried out.

14 September 2022

Inspection was undertaken at the RNZ- Uruti composting facility to assess compliance with the odour parameters of the resource consent (off-site performance). No on-site inspection was undertaken during the odour assessment. The assessment and subsequent odour surveys found no odours being emitted from the composting facility.

4 October 2022

A site inspection was undertaken as part of routine compliance monitoring. The inspection was undertaken in fine weather conditions with 13 degree Celsius air temperature and 5/6 cloud cover.

Odour scouting was undertaken along the site boundary adjacent to Mokau Road. No odours were detected during the scouting exercise.

The inspection found that all worm beds on site were covered. The large compost storage pile located adjacent to the paunch pond remains in place. A very small portion of the material at the upper end of the pile had been removed, however a large majority of the pile remained onsite. Five large composting windrows were present within the composing pad, with the full extent of the pad currently being used for composting operations. The composting windrows had bark cover across them. Limited odours were noted about the pad. The lower end of the pad was being tidied up with a digger at the time of the inspection, to ensure all stormwater was able to drain freely from about the windrows and unblended material was being added to the composting windrow. No works had taken place about the drilling mud pad. A good grass cover was beginning to develop across the pile, however it was noted that this often dies off during the dry summer months, and therefore vegetation of this pile is a seasonal occurrence.

25 October 2022

Evening inspection was undertaken outside working hours, as part of proactive monitoring of potential odour emissions from the Remediation (NZ) Limited, Mokau Road - Uruti composting facility. Two Compliance Officers jointly completed two odour surveys between 20:15 and 20:40 hrs. At the time of conducting the surveys, the air was still, with no noticeable wind direction. Air temperature was between

12 degrees Celsius. All surfaces were dry with no rain in the area preceding or during the inspection and there was cloud cover over the majority of the sky.

Odour surveys were undertaken at the entrance to RNZ and outside 1587 Mokau Road. The investigation this evening found that there was no noticeable odour at the two sites. No on-site inspection was undertaken at RNZ as there was no breach of consent.

30 November 2022

The inspection was undertaken as part of routine compliance monitoring. It was undertaken in overcast weather conditions with air movement reasonably still developing into a light breeze blowing up the Haehanga valley (away from the highway) during the inspection.

Odour scouting was undertaken, extending from Jones Quarry entrance through to 1587 Mokau Road. No odours were detected along the valley floor, outside the RNZ property, which was in line with the slight up-valley wind direction noted.

An inspection of the site found no indication of unauthorised materials at the site. The irrigation pond was full and the aerator was in operation. The DO meter within the pond was reading 7.93 mg/l. No odours were detected being emitted from the irrigation pond. However some odours were detected within the immediate vicinity of the settling pond.

The drilling mud pile was well grassed and no odours were detected being emitted from this pile. It was noted that no odours have been detected from the solid drilling mud pile since RNZ ceased placing new material onto the pile.

Some work was being undertaken to reduce the size of the composting pad. This involved moving some of the compost material on the pad to prepare it for the size reduction. All new material being brought to site was being blended at the time of the inspection. Site practices recently developed at the facility include quickly blending new material delivered to site. This was having a positive effect in reducing odour at the site. The removal for sale of more compost from the property was planned in the coming weeks to ensure room was available for the processing of further material.

All worm beds on the site were covered. The paunch pond was in the process of being reduced in size. This may reduce odours at the site and would reduce pressure on the wetland treatment system.

8 December 2022

The purpose of the inspection was to undertake a proactive odour survey. At time of arrival, it was observed that there was light air movement from the south-east, with 6/8 cloud cover, and the temperature was approximately 18 degree Celsius. Odour surveys were undertaken by two compliance officers.

Surveys were completed at various locations along Mokau Road, to the north east and the west of the Remediation property entrance. A very weak, intermittent composting odour was detected, at the Remediation entrance and also west of the Haehanga Road Bridge. However, the odour survey found that while odour was detected at two locations, overall no odour was detected or considered objectionable, at any frequency or any duration.

12 December 2022

An odour survey was undertaken at RNZ Uruti to assess compliance with resource consent conditions. At the time of the inspection the weather conditions were overcast, with 4/6 cloud cover and 16 degree Celsius air temperature. The road surface was dry and a heavy dew was noted on the grass. Wind was detected between a north to east direction (Across and up the valley away from the highway).

An odour survey was undertaken at the metal park-off area to the west of the Haehanga Stream, beside the highway. No odours were detected at this location. A second odour survey was undertaken at the site entrance, and no odours were detected at this location. Odour scouting was undertaken along Mokau Road

to 1587 Mokau Road – no odours were detected. An inspection on the RNZ site noted that maintenance was being undertaken on the aerator and therefore it was not operating. Some composting odours were noted about Pad 1, however these were light in nature. No material was being moved.

16 December 2022

An odour survey was undertaken at RNZ Uruti together with RNZ's odour scout. At the time of the inspection the weather was recorded as 21 degree Celsius air temperature, in fine but overcast weather conditions. A very still to light NW wind direction was noted, however this did swirl during the inspection. Upon arrival at the site the deodorisers were in operation, however they were turned off at about 06:30 hrs once staff onsite determined that there were no odours being emitted from the site beyond the property boundary.

The purpose of the surveys were to assess the degree of consistency between the Council officer and the contracted odour scout acting on behalf of the Company. The inspection noted that no odours were detected along Mokau Road. Parallel odour surveys were undertaken at the twin culverts and adjacent to pad 1. Odour scouting was also undertaken at the site entrance and near the upper irrigation area referred to as the 'valley forks'. No odours were detected at these locations and therefore no full odour surveys were undertaken.

When comparing odour surveys and speaking with the RNZ odour scout during these surveys, it appeared that the two personnel found very similar odour assessment at odour intensities of between #2 – #4. There was a slight difference in noting odours at the lower intensity level of #1 and it was suspected that this was due to the very light nature of the odour and differing odour sensitivity. Further comparison surveys were to be undertaken over the summer period.

During the odour inspections, it was noted that the upper (south-west) portion of Pad 1 had had the compost removed and was no longer an operational portion of the site. Some mature compost had been spread over the area to provide a medium for vegetation growth above the compacted papa layer of the pad base. This compost had been grass-seeded and planted with some larger grasses. A section of the bund between this disused portion of the pad and the operational section had been removed to allow storm water from the disused section of the pad to still discharge into the irrigation pond via the Pad 1 drainage system. This was necessary until such time as the disused section of the pad is stabilised and only clean storm water is being generated from this area. Once this occurs the runoff stormwater can be directed away from the treatment system.

It was also noted that the concrete sand trap for the truck wash pad had arrived onsite and was to be installed in the coming week.

21 December 2022

A proactive inspection was carried out along the Mimitangiatua Valley to detect off site odours regarding RNZ-Uruti composting facility. On the arrival of the Council officer at the first observation site at 20:30 hrs 1460 Mokau Rd, the weather conditions were raining with thunderstorm. Wind direction was SE with wind velocity of 3. Temperature was 15 degree Celsius.

An odour survey was taken and no odours were detected at this boundary location The next odour survey was taken at 1589 Mokau Rd, at 20:51 hrs. Weather conditions were light rain, with thunderstorms moving away, cloudy with wind SE velocity at 0, gentle breeze ,temperature 16 degrees Celsius. No odour was detected during the survey. A final survey was carried out at entrance to Jones Quarry at 21:08 hrs. Weather conditions: the rain had stopped, cloudy, SE wind, velocity 3 gentle breeze, temperature 16 degrees Celsius. No odour was detected.

3 January 2023

A proactive odour assessment was undertaken to assess compliance with resource consent conditions in relation to the discharge of odour beyond the boundary of the property at the RNZ composting facility at Uruti. The survey was undertaken by two Council officers. At the time of the survey there was a light NE breeze throughout the locations and 21 degree Celsius temperature. Odour surveys were undertaken at Jones quarry entrance, at 1589 Mokau Road, and at the entrance of RNZ 1460 Mokau Road.

No odours were detected at any of these locations. The site was compliant with the conditions re offsite effects of the air resource consent.

18 January 2023

A proactive odour assessment was undertaken to assess compliance with resource consent conditions in relation to the discharge of odour beyond the boundary of the property at the RNZ composting facility at Uruti. The survey was undertaken by two Council officers. At the time of the survey there was a light SE breeze throughout the locations and 22-23 degrees Celsius temperature.

Odour surveys were undertaken at Jones quarry entrance, at 1589 Mokau Road, and at the entrance of RNZ at 1460 Mokau Road. No odours were detected at any of these locations. The site was compliant with the conditions of the air resource consent.

20 January 2023

A proactive odour survey was completed, at various locations along Mokau Road, to the north and west of the RNZ site entrance. Weather conditions: mostly light air from the south-east, 13 degrees Celsius, clear night/dawn sky. A mist was rolling down the valley (towards the highway), and began to clear around 06:45 hrs.

A very slight, intermittent composting odour was detected at the site entrance. However, it soon dissipated till no odour was detected. At times a smoke/burning odour was detected, when the light air shifted to the north, but the Council officer did not consider that the odour was associated with the composting facility. The officer determined that the outcome of survey was that while he did detect an odour, he did not consider it would be offensive or objectionable at any location.

31 January 2023

An inspection of the composting facility was undertaken as part of routine compliance monitoring. Inspection was undertaken in fine weather conditions. At the time of the inspection the weather was noted to have an air temperature of 21 degrees Celsius with total high cloud cover. Wind was noted on the RNZ weather station as a NW direction at a speed of 2 m/s. No rainfall was noted throughout the inspection with all road surfaces being dry.

The first odour survey was undertaken at the entrance to Jones Quarry. No odours were detected. Odour scouting was then undertaken at the metal pit nearer the site (west of Haehanga Bridge and beside the highway), and no odours were detected. Further odour surveys were undertaken at the metal park off area immediately west of the Haehanga Bridge and again at the site entrance. No odours were detected at either of these locations. Odour scouting was carried out near 1587 Mokau Road and again no odours were detected.

No odours were detected at the site office. A composting odour was detected on the site access track between the twin culverts and the composting pad, adjacent to L3. This was a composting odour and appeared to be associated with a digger operating on the composting pad to turn the mature compost at the upper end of the pad. The aerator was operational on the irrigation pond with a DO reading of 6.93 g/m^3. Very slight odour was detected within the immediate vicinity of the pond, however this quickly dissipated. The concrete sandtrap had been installed on site to help remove grit and sand from the

washdown process. The site manager advised that this is pumped out when it is noticed that the sandtrap is odorous, to assist to reduce passive odours on the site. Contents of the trap are removed via a slurry tanker on site with the washwater being discharged into the irrigation pond.

The composting pad was very full with compost as a result of reducing the size of the pad at the southern end. A majority of the material was mature compost and this was being exported from site for market. RNZ were making an effort to remove the mature compost from the site to allow for more space to better compost the raw material that is being delivered on site. No unauthorised material was observed on site. The site manager advised that the work to reduce the composting pad size was now complete and with the new size being within consent conditions (special condition 2). Work had also been undertaken to remove standing water from the pad area by lifting the level of the pad to allow it to drain via gravity into the perimeter drains and the drain discharge pipe and then into the irrigation pond via the settling pond. Only slight ponding was observed at the approach to the discharge pipe.

A good volume of bark was present onsite, with a good cover noted across the compost that had not yet matured. A lesser amount of bark was noted within the matured compost. Work had also been undertaken to reduce the size of the paunch pond. This had resulted in a significant reduction in size, with further works planned during summer to complete upgrade. The drilling mud pad material was well vegetated with grass, and no odours were found to be emanating from this material.

1 February 2023

A proactive odour survey was completed by two compliance officers, at various locations along Mokau Road, both north and west of the RNZ site entrance. Weather conditions: mostly light air to light breeze, ranging from the north to northwest to west, 22 degrees Celsius, half cloud/dusky sky.

The survey found that no composting facility type odour was detected at any location.

21 February 2023

Inspection was undertaken for proactive compliance monitoring purposes. Odour surveys were taken at four sites, one upwind and three down wind. No odour detected at any location. The temperature range during all four surveys was between 19-21 degrees Celsius and there was light wind with considerable cloudiness. The property was compliant with the conditions on the air discharge consent at the time of inspection.

28 February 2023

The inspection of the RNZ composting facility was undertaken as part of routine compliance monitoring. It was undertaken in fine weather conditions, with no rainfall within the preceding 24 hours and dry conditions throughout the inspection. At the time of the inspection the air temperature was recorded as 16 degrees C with less than 50% cloud cover. The wind direction was NW with an average wind speed of 1 m/s as recorded by the RNZ weather station on site.

Odour scouting activities were undertaken between the entrance to Jones Quarry and the park off area on the true left of the Haehanga Stream bridge at Mokau Road. A full odour survey was undertaken at the park off area, and while a slight odour was immediately detected upon arrival no further odours were detected throughout the odour survey. A second odour survey was undertaken at the RNZ site entrance and no odours were noted. No odours were detected at the site office or further up site at the twin culverts

No deodorisers were operational on site at the time of the inspection. An inspection of the settling pond found that the aerator was operational with a DO reading 5.15 mg/l noted on the recording device at the facility. A light odour could be detected within the immediate vicinity of the settling pond and irrigation pond.

An inspection of the composting pad found two distinct piles of material, the larger being mature compost which was in the process of slowing being processed from the upper most end and exported from site. The

second smaller pile was the fresh material that had arrived at site and was still in the composting process. All fresh material was covered and blended with vegetative compost and no exposed product was noted about the pile. A good stockpile of product was also noted adjacent to the most recent windrow. General composting odours were noted about the composting pad, however these were light in nature. No compost was being turned or processed during the inspection. Very limited standing water was noted around the base of the composting pad with only a small volume noted at the approach to the discharge pipe from the pad. The composting pad had been reduced in size to satisfy the consent conditions, with runoff stormwater still being collected off the upper (disused) pad, but noting that this area had been grassed. The site manager planned to continue to process the mature compost on the composting pad and export it from site for sale

Work was also ongoing to reduce the size of the paunch pond. While this had significantly reduced in size, further works were planned to decrease it further. All wormbeds on site were covered.

An inspection of the drilling mud pad found that no works had been undertaken in this area with the solids drilling mud pile being very well vegetated with no exposed areas of product noted.

2 March 2023

The inspection was undertaken for proactive compliance monitoring. Odour surveys were taken at three sites. No odour was detected at any of the three locations. The temperature range during all three surveys was between 19-20 degrees Celsius and the wind speed was between a gentle breeze and a light breeze, with considerable cloudiness. The property was compliant with the conditions of the air discharge consent at the time of inspection.

8 March 2023

A proactive odour survey was carried out to assess for offsite odours at the RNZ Uruti composting facility. The weather at the time of the investigation was overcast, warm, and 21 degrees Celsius, with a westerly wind at a velocity of 2 m/sec. An odour survey was first was carried out at 1585 Mokau Road (upwind of the RNZ property). No odour was noted. The second odour survey was undertaken at the RNZ site entrance. No odour was noted. The third survey was undertaken at the entrance of Jones Quarry, and again no odour was detected. Overall at the time of inspection, the site was deemed to be operating within resource consent conditions.

22 March 2023

A proactive compliance monitoring inspection was undertaken to assess compliance with resource consent 5839-2 which allows discharge of emissions into the air, namely odour and dust, from composting operations.

Surveys were undertaken in clear weather conditions with light wind at 11 degrees Celsius by two compliance officers. Each officer completed seven odour surveys.

The first survey was completed at 06:50 hrs at the gates of Remediation NZ. A weak odour of compost was detected. However this was not considered objectionable or offensive. Additional surveys were also completed as follows: 1587 Mokau Road (at 07:07 hrs, no odour detected), the gravel pit on Mokau Road (at 07.25 hrs, no odour detected), and Uruti Quarry (at 07:40 hrs, no odour detected). An additional survey was then taken again at 1587 Mokau Road (at 08:12 hrs, no odour detected), and two more at the gates of Remediation NZ (at 07:55 hrs and 08:26 hrs), which again found a weak odour of compost, though not considered to be objectionable. The officers agreed that Resource Consent 5839-2 was complied with at the time of inspection.

23 March 2023

The compliance monitoring inspection was undertaken to assess compliance with resource consent conditions. The inspection was completed in fine and calm conditions.

The proactive odour surveys were initiated onsite at 07:30 hrs. Temperature was recorded at 7 degrees Celsius and the wind direction recorded as being at a south-east orientation (towards the highway). The locations for initial onsite compliance monitoring involved odour surveys taken upwind, at the road entrance to the RNZ site, and downwind of site.

Upon initial survey there was a detection of odour at the central location of the roadway entrance to the site. The odour persisted throughout the two surveys taken at that location, though can only be described as very weak in terms of intensity and tone. A survey taken upwind at 1587 Mokau Road detected no odours related to the operations at the RNZ site. Two odour surveys completed just west of the Haehanga stream beside main State Highway 3, detected odours being very weak to weak on the intensity scale.

It was noted that a truck with a full load of product was observed leaving the site at the time of the odour surveys, which indicated the shifting and over turning of compost was likely occurring in order to load the truck at that time. No deodorisers were in use at that time, as it was now considered their use required a resource consent which had not yet been obtained. The same intensity of odours was noted at the site office, and marginally greater intensity at and immediately around the composting pad. A pile of tree bark was noted at the composting pad, which was to be used to cover the raw compost in an effort to mitigate odours emitted, and a green waste pile was also noted. The compost pile this time was sectioned into windrows to further indicate different stages of maturing compost, the most mature of the piles being at the upper most (south-west) end of the pad. A digger was present and operating in and around the centre of the pad, and some product was being over turned and shifted about here. Not a lot of runoff water was observed sitting at the base of the piles at this time.

Inspection of the main irrigation pond indicated it was not being mixed at time of inspection. The onsite recording device displayed the dissolved O_2 reading as being 5.70 mg/l. The main irrigation pond had approximately three quarters of a metre left of freeboard space.

Inspection of the perimeter around the adjacent drilling mud mound found no issues. There was good vegetative growth on and around the mound to absorb any potential run off of any contaminants. Some small pockets of water runoff were observed but these looked to be contained.

Inspection of the areas around the worm beds, paunch pond and wetland areas indicated some activity in terms of bringing in soil and earth to reduce the size of the immediate area of the paunch pond, which appears to already have been greatly reduced in size. An inspection of the wetland area above the paunch pond indicated no pressing issues, however, the Company were advised to keep an eye on the north bank of the wetlands about half way up where it looked as though a distinctive game trail had been established (possibly the movement of wild pigs or goats) that had broken away and narrowed the top of the embankment, and could possibly compromise the bank's stability in the nearby stream.

28 March 2023

A proactive odour survey was carried out in the early morning of 28 March 2023. The weather was overcast with little wind and fine weather. A down valley air flow was detected. The temperature was cool but not cold.

The first odour survey was undertaken 30 m south of the Haehanga Bridge in a highway lay-by and commenced at 05:45 hrs. The survey was 30 minutes long and no odour was detected during this period. The second survey was an upwind assessment at 1587 Mokau Road. This survey commenced at 06:20 hrs and lasted 17 minutes. No odour was detected.

The third survey was at the Remediation NZ site entrance. This survey was approximately 22 minutes. A distinct/strong odour was detected after 18 minutes. The odour was a mix of compost and rotten meat. A further distinct odour with the same characteristics was detected nearly three minutes later. It was noted that for a period the light down valley air flow picked up to a light breeze.

A further survey was then completed 30 m south of the Haehanga Bridge. A light down valley air flow was present. Odour, with the same characteristics as observed earlier at the entrance to Remediation, was detected after approximately five minutes. The odour was weak to distinct in intensity and had a negative (unpleasant) hedonic tone.

The last survey was at the house at 1415 Mokau Road. A ten minute odour survey was completed. Weak odour (same characteristics as at other sites) was detected a couple of times. Overall, there were long periods where no odour was detected. The odour that was detected along State Highway 3 was considered to be objectionable if it were to occur on a regular or frequent basis. The odour detected at the house was not considered objectionable at the time of survey.

5 April 2023

Monitoring was undertaken to check compliance with resource consent conditions. Two Council officers completed odour assessments and odour surveys, at various location along Mokau Road, Uruti, in the morning, between 05:50 hrs to 07:17 hrs. On arrival, climate conditions were a light air from the south east to east, night sky with a temperature of 7 degrees Celsius. During the monitoring, climate conditions did change. As dawn broke, wind strength at times increased to a light breeze, shifting from south east to north-east then northwest, the temperature dropped to 6 degrees Celsius, and a valley mist was present but dissipated during the course of the monitoring,

A composting type odour was detected at one location. However, overall the outcome of the monitoring was that it was considered odour would not be objectionable at any location for any duration or frequency. A complaint was then received at 07:50 hrs, alleging an offensive odour had been experienced west of the composting facility, at various locations along Mokau road, Uruti at approximately 07:30 hrs. Climate conditions at the time were light breeze from the south east to east, a clear sky, with a temperature of 7 degrees Celsius. As one Council officer was still in the area, they completed odour assessments at the locations given by the complainant. No composting type odour was detected. They spoke with a potentially affected party, downwind of the composting facility, regarding the alleged offensive odour. They had not detected any odour, from the composting facility that morning or in the days prior. The Council officer completed the assessments at 08:47 hrs. No further action was taken.

14 April 2023

Early morning monitoring was undertaken to check compliance with resource consent conditions. Two Council compliance officers completed odour assessments and odour surveys, at various location along Mokau Road, Uruti, in the morning, between 05:55 hrs to 07:10 hrs. On arrival, climate conditions were light air from the south and a night sky with a temperature of 13 degrees Celsius. During the monitoring, climate conditions did change as dawn broke. Wind strength remained at a light air, but did shift from north-east to north-west.

The overall outcome of the assessment was that no composting type odour was detected at any location.

14 April 2023

A second inspection was undertaken on the same day, in daylight conditions and focused on the on-site activities of the Company. The inspection of RNZ composting location was undertaken to assess compliance with operational and site management resource consent conditions. The inspection was undertaken in mild conditions with no rainfall within the previous 24 hours. Conditions were dry during the time of inspection.

There were no initial impressions of odour at the site entrance upon arrival to the site. No odours were detected in the stretch between the site office and location of the twin culverts. DO reading on the irrigation pond at time of inspection was recorded at 6.61 mg/l, which was taken directly from the display on the recording device inside the hut adjacent to the pond. No odours were detected at this location.

No operations in and around the composting pad in terms of turning the material were underway. However, a small shipment of chicken carcasses and eggs were delivered onto the receiving area of the pad ready to be added to the composting process. Associated odours were detected from this, as were the general odours from the composting pad as a whole. Such odours were considered to be mild in nature at this time. Vegetative compost and sawdust were available to mix into the process and mitigate the potential for offensive or objectionable odours being detected beyond the boundaries of the facility.

The Company were instructed to ensure any poultry industry waste, egg shells etc., were processed sooner than later as to mitigate any persistence in odours which may intensify beyond the composting pad, especially if left over a weekend.

Inspection of the drilling mud pad found no issues in terms of odours emitted at this time. The stockpile was well vegetated which would provide filtration and absorption, and was for the most part stable across the stockpile. The site manager indicated that some works would commence shortly at the top end (southern end) of the pad to identify the location and pathway of a leachate seepage in that area. At this time air deodorisers were being utilized without added deodorants, as it has now been determined this would require an additional consenting process.

The site was deemed compliant with the resource consent at this time.

19 April 2023

An off-site proactive odour survey was carried out by two Council compliance officers. The surveys were carried out between 06:50 hrs and 07:50 hrs Wednesday morning, outside normal working hours. It had previously been raining in New Plymouth, but there was no rain at Uruti. Weather conditions were warm (17 degrees Celsius), cloud cover 7/8, and the wind was calm/breeze from the NE.

Odour surveys were carried out at three locations. At 1587 Mokau Road, beginning at 06:57 hrs, no odour was detected. At 1460 Mokau Road (the entrance to Remediation) the survey commenced at 07:14 hrs. The gates to Remediation's site were open. Slight odour was detected for brief period after a few minutes, but the odour was not objectionable (category #1 on odour scale). At 13:20 hrs Mokau Road (entrance to Jones Quarry) no odour was detected. The outcome of the surveys was that no objectionable odour was detected and compliance was maintained.

27 April 2023

Proactive off-site odour monitoring was undertaken to check the Company's compliance with resource consent conditions, after hours. The inspection was undertaken during fine weather by two Council compliance officers. Four odour surveys were taken between 19:00 hrs and 20:00 hrs. During the odour surveys the temperature was between 12 and 14 degrees Celsius and there was a light wind blowing from the south (from the RNZ property towards the highway). The extent of cloud cover could not be assessed due to the surveys being undertaken after sunset.

Odour surveys were conducted at four sites along Mokau Road, Uruti. The first inspection was outside 1587 Mokau Road, with no odour present for the duration of the survey. The second survey was conducted outside the gates of RNZ, with a very weak compost odour detected for less than half a minute. This level of odour was deemed to not be offensive and/or objectionable at this location for any period of time.

The third survey was taken at the gravel pit, with no odour detected for the duration of the survey. The final survey was taken outside Jones Quarry, with no odour detected. Inspection found the Company to be compliant with their consent.

2 May 2023

A proactive off-site survey for odour was carried out afterhours by two Council compliance officers. Surveys were carried out between 19:30 and 20:30 hours. The weather at the time was unseasonably warm, at a balmy 18 degrees Celsius and with nil breeze until the last inspection at Jones Quarry where the wind increased from a category 0 to 1. The cloud cover averaged 4/8.

Odour surveys were carried out at four locations. At 1589 Mokau Road there was no odour. At 1640 Mokau Road no odour was detected. At the roadside gravel patch near 1640 Mokau Road, there was nil odour. At 1320 Mokau Road/Jones Quarry there was nil odour.

In summary, no odour was detected at any of the survey locations. Air discharge from the Company site was compliant with their consent.

8 May 2023

Off-site odour monitoring was undertaken outside normal working hours to check compliance with resource consent conditions. Two Council compliance officers completed odour assessments and odour surveys, at various location along Mokau Road, Uruti, in the morning, between 07:30 to 08:00 hrs. On arrival, climate conditions were, with light airs from the North, night sky, with a temperature of 16 degrees Celsius. During the monitoring, climate conditions did change as dawn broke, but wind strength remained at a light air.

The overall outcome of the assessment was that no odour was detected.

8 May 2023

An onsite compliance monitoring inspection was undertaken to assess compliance with resource consent conditions. Onsite odour scouting was carried out. The air temperature was 19 degrees Celsius, with a northeast wind at 19 km per hour. Sky conditions were overcast.

No odours were detected at the site entrance. Proceeding onsite, no odours were detected at the site office and docket station. Proceeding further into the site, some odours were detected at the irrigation pond and also further up at the composting pad. These were deemed as distinct, however these were the only locations where odours were detected on this day and odour did not drift beyond the boundary of the site. At the time of inspection, some processing activities were underway turning the product on the compost pad, which created the odour output detected at that location. Adding to that was a small pile of compost that had started to self-combust but had been moved away from the rest of the compost in order to simmer out. Some odours consistent with burning were detected from the small pile, though they were not considered to be overly prevalent beyond that location.

The drill mud pad had been recently disturbed to undertake works to remedy leachate extending out from underneath, though remedial works have been completed and this area reinstated, albeit with exposed soil until vegetation can establish itself again. No odours were detected from such works completed on the drill mud pad.

At the time of the inspection the mechanical deodorizers are not being used. This requires additional consent around the use of deodorant dispersed into the air.

17 May 2023

A proactive survey was carried out by two Council compliance officers after normal working hours. The surveys were undertaken between 19:20 and 20:45 hrs. The weather at the time was a cool 10 degrees Celsius and nil breeze. All the surveys at all locations were undertaken in foggy conditions. Odour surveys were carried out at four locations. At 1589 Mokau Road, no odour detected. At 1460 Mokau Road, very weak odour was detected intermittently over the 10 minute period of observation. Beside the Haehanga Bridge, very weak odour was detected intermittently over the 10 minute observation period. At the gravel patch beside State Highway 3 near 1460 Mokau Road, no odour was detected. The locations where odour

was detected were both close to the entrance of RNZ. The level of odour at both sites was not deemed to be objectionable, therefore discharges from the RNZ site were compliant with consent conditions at the time of inspection.

25 May 2023

A proactive odour assessment was carried out to determine whether odours from Remediation NZ's Uruti Valley site were discharging beyond the boundary of the property, and to assess whether these odours could be considered offensive and objectionable in nature. At the time of inspection there was a clear sky with low fog in the valley. The wind was light and it was noted that the wind direction was variable within the Valley. It was cold at 4-5 degrees Celsius.

Odour assessments were carried out just south of the Haehanga Bridge in a layby, further south at a metal pit, and north of the site at 1585 Mokau Road. All odour measurements failed to detect any odour that could be associated with the composting activity at the Remediation site.

2 June 2023

A proactive odour survey was carried out by two Council officers to assess compliance with consent 5839-2 by RNZ, to discharge emissions into the air, namely odour and dust, from composting operations. Both officers completed three odour surveys which were carried out between 06:55 and 07:30 hours, in overcast and moderately cool conditions of 16 degrees Celsius with a light north-westerly breeze (i.e. up the Haehanga Valley, away from the road and local community).

The first odour survey was undertaken at 06:55 hrs at 1589 Mokau Rd, just after very heavy rain had stopped. The officers detected no odour. The second survey was undertaken at 07:07 hrs at the roadside boundary of RNZ in light rain. Again no odour was detected. The third odour survey was undertaken at the gravel pit adjacent to the RNZ property entrance, at 07:30 hrs. Again no odour was detected.

The officers determined that consent conditions were being complied with at the time of inspection.

8 June 2023

Monitoring was undertaken to check compliance with resource consent conditions at the RNZ Uruti facility. Two council officers .completed odour surveys and odour assessments at 3 locations along Mokau Road, Uruti, at 1578 and 1460 Mokau Rd and at the gravel pit, on the southern side of the entrance to the RNZ property. These surveys were carried out in the morning, between 06:15 to 06:50 hrs. At the time of the arrival of the officers, climate conditions were light air movement from the south (i.e. towards the road from the RNZ facility) a night sky, with a temperature of 2 degrees Celsius. During the monitoring period, dawn broke but the wind strength remained light. No composting type odour was detected at any monitoring location.

13 June 2023

The compliance monitoring inspection was undertaken to assess compliance with resource consent conditions controlling the discharge of emissions into the air, namely odour and dust from composting operations.

The site inspection was carried out in fine and calm conditions. Before entry to the site, three proactive air surveys were completed at five offsite locations near the RNZ site, being at 1387 and 1358 Mokau Road, just west of the Haehanga Stream Bridge and in the area near to the site entrance. All surveys found no detection of odours coming from the RNZ site. Weather conditions at the time were recorded as 7 degrees Celsius with a very light breeze from a southerly direction (i.e. down the Haehanga Valley towards the road). The preceding 48 hours were noted as having been dry with no rainfall. Cold air drainage and fog at the time of inspection time was dissipating down through the narrow valleys but were bringing no indications of odour.

No detection of odours related to composting operations were detected at the site office or the area around the weighbridge. The first detection of light to moderate odours were detected at locations further into the valley, starting at the irrigation pond. Inspection of this area found no agitation of the pond was occurring at time of inspection. The DO registering on the electronic interface inside the shed was reading 0.15 mg/l. The minimum DO as stipulated by air quality experts was that the DO should be at least 2.0 mg/l.

No turning or other processing operations were occurring on or around the composting pad at this time. A small shipment of chicken wastes had been recently delivered. For the most part, the compost pile had enough vegetative cover to mitigate any odours from the pad, and exposed product was being kept to a minimum.

The Council officer noted that every effort should be made to ensure that the spread of compost piles should not encroach beyond the containment area of the compost pad. Effective containment of leachate, required that it must be directed through the designated drainage channels so as not to cause increased emissions into the air and consequently odour beyond the property.

The former, upper area of the Pad which is now grassed still apparently had a heavy layer of compost on its ground surface. The Council officer directed that any runoff from this area must remain contained in the current system until such time it is deemed clean.

The southern end of the drilling mud pad had recently had reinstatement works completed. Any disturbance to the pad had been re-grassed. Other necessary works included work to re-establish the ring drain in order that any leachate from this area would be captured and directed into the irrigation storage lagoon.

No changes to the paunch pond were observed on this visit. The need to ensure this area remains bunded and stabilised was discussed with the site manager.

22 June 2023

Monitoring was undertaken to check compliance with conditions on the resource consent for discharge of emissions to air. Two officers completed odour assessments and odour surveys at various locations along Mokau Road, Uruti, in the morning, between the hours 0555 to 0730. Weather conditions at the time of arrival were moderate breeze from the east, night sky, with recent showers and a temperature of 14 degrees Celsius.

During the monitoring, climatic conditions did change to dawn skies, overcast with wind strength and direction shifting between moderate to light breeze blowing from east-south/east-south (ie tending to be towards the general direction of the highway from the RNZ property). Near the completion of the monitoring, the wind direction shifted and came from the north.

The overall outcome of the proactive monitoring was that no composting type odour was detected at any location. The site was deemed to be operating within resource consent conditions re offsite odour effects at the time.

29 June 2023

Proactive monitoring was undertaken to check compliance with conditions on the consent for emissions to air. Two officers completed odour assessments and odour surveys, at various location along Mokau Road, Uruti, in the morning, between the hours of 0555 to 0700. At the time of arrival, climatic conditions were that there was light air from the south-west, a night sky, with recent showers and a temperature of 11 degrees Celsius.

During the monitoring, climate conditions did change to dawn and a mostly clear sky. Wind strength and direction shifted between light air to light breeze from south-west to north-east.

The overall outcome of the proactive monitoring was that no composting type odour was detected at any location. The site was deemed to be operating within resource consent conditions at the time.

Consent 5938

To use a twin culvert in the Haehanga Stream for vehicle access purposes.

27 July 2022

Inspection of the twin culverts on site was undertaken as part of routine compliance monitoring, in wet weather conditions, following reasonable rain in the preceding days. At the time of the inspection the stream was flowing in a fresh. An inspection of the twin culverts found that both culverts were open and free of any blockages and/or obstructions. They were flowing at near capacity. An inspection of the head walls about the culvert found that they were in place and appeared stable. No issues were identified at the time of inspection.

18 August 2022

Inspection of the twin culverts on site was undertaken as part of routine compliance monitoring, in wet weather conditions, and with the stream rising in flow throughout the inspection. An inspection of the twin culverts found that both culverts were open and free of any blockages and/or obstructions. An inspection of the head walls about the culvert found that they were in place and appeared stable. The downstream riffles were stable and secure ensuring that the static water level through the culvert was at a level to ensure fish passage No issues were identified at the time of inspection.

However, during the inspection it was noted that the culvert at the entrance to the L4 irrigation area was being eroded on the downstream site, due to a combination of culvert discharge and overland flow into the stream at the same point. RNZ were directed to undertake monitoring and remedial works.

30 November 2022

Inspection was undertaken to assess compliance with resource consent conditions. The inspection was undertaken in fine weather following recent rain, Streams on the site were in elevated flow. The inspection found that the twin culverts were free of blockages and or obstructions with the stream flowing reasonably evenly through both culverts. Fish passage was being provided for. The downstream riffles were stable and secure ensuring that the static water level through the culvert was at a level to ensure fish passage. No issues were identified during the inspection.

31 January 2023

Inspection was undertaken in accordance with compliance monitoring, in fine weather and with baseline flows. The culverts were found to be open and free flowing with the stream flowing evenly through both culverts. The headwalls were in place and visually secure. No fish passage obstructions were noted during the inspection, and fish passage was provided for through the riffles. No issues were identified at the time of inspection.

28 February 2023

The Haehanga Stream was observed to be at its usual dry weather levels. Inspection of the twin culverts found that they were both open and free-flowing, with no signs of blockages and/or obstructions. The headwalls were in place and secure.

However, both culverts had become perched, creating a barrier to fish movement. The uppermost rock riffle below the culvert had been washed out, dropping the streambed. The riffle needed to be re-instated to a height that ensured there was sufficient flow depth and reduced flow velocity to allow fish passage. Reinspection would occur in March.

23 March 2023

RNZ staff assured the Council officer that works were in hand to re-construct the washed-out riffle. A new delivery of rocks to the site were to be used for this purpose. Reinspection was to occur in April.

The headwalls were in place and appeared secure with no signs of erosion about the culvert. The riffles placed upon the stream bed below the culvert were in place and stable.

14 April 2023

Inspection of the twin culvert onsite was undertaken to assess compliance with resource consent conditions. Heavy rain preceded the visit. Inspection of the area found that a new riffle was in place and improving stream flow. Sediment and silt were building up as desired, with free flow through the centre of the riffle. Static levels indicated that the culverts themselves remained unobstructed and freely flowing. While bare soil had been exposed where the excavator had been placed to install the rocks, this bare area was some metres back from the stream with intervening grass vegetation. While the stream was running turbid, this was from upstream effects. Compliance with the consent had been re-established.

8 May 2023

Inspection was undertaken as part of routine compliance monitoring. Water flow through both culverts was steady. An inspection of the headwalls and embankments found that they were in place and apparently secure. Water levels downstream had risen to the level passing through the culverts, and so fish passage was no longer impeded. The right hand culvert still appeared slightly perched, but sediment may continue to accumulate immediately downstream which would increase the static water level, thus providing for fish passage. No issues were identified at the time of the inspection, and it was considered consent compliance had been re-established.

Consent 6212

To erect, place, use and maintain a culvert and associated structure[s] in the bed of the Haehanga Stream in the Mimitangiatua catchment for access purposes.

27 July 2022

Inspection of the culverts on the property were undertaken as part of routine compliance monitoring. The inspection was undertaken in wet weather conditions. Both the Haehanga Stream and the Mimitangiatua awa were in fresh, with highly elevated and silt-laden flows. An inspection of the culvert beneath the access track to the worm beds found that it was open and free flowing, to half depth with no instream obstructions. The headwalls were in place and visually appeared to be stable with no signs of erosion about the culvert.

18 August 2022

An inspection was undertaken as part of routine compliance monitoring, in wet weather with stream flows rising. The culverts on site were found to be open and free flowing. No blockages and/or obstructions were observed. Fish passage through both culverts was provided for. No issues were noted at the time of inspection.

6 December 2022

Flows in streams were elevated. An inspection of the culvert under the access track to the lower worm beds and the smaller culvert adjacent to this point found that both culverts were open and free of any blockages and/or obstructions. All headwalls were inspected and found to be secure with no signs of failure.

Fish passage in the upper culvert (that provides access to the upper irrigation fields) and the culvert in the tributary flowing beside the wetland treatment system was being provided for. However, the culvert under the vermiculture bed access track needed improvement, by placing riffles downstream and increasing static

water level through the culvert and at its exit. Similar works undertaken at the twin culverts (see notes for consent 5938 above) had been successful.

31 January 2023

Inspections of the culverts onsite were undertaken as part of routine compliance monitoring, in fine weather with baseline flows in the streams. Inspection found that the culverts on site were open and free flowing with no signs of blockages and/or obstructions. Head works were secure and free from erosion. A load of rocks had been delivered, and were to be used to construct a downstream riffle at the vermiculture bed access track culvert. The works were to be undertaken during a forthcoming period of fine weather. No other issues were identified at the time of inspection.

28 February 2023

Inspection was undertaken in fine weather, with a steady flow in the streams within the Haehanga catchment. The works to improve the downstream riffle beside the culvert under the access track from the composting area to the vermiculture beds had been undertaken. The culvert itself was open and free from obstruction, and the headwalls were secure. However, stream flow was against the left bank rather than in the centre of the stream, which meant streambank erosion was a potential risk. The rocks had also not been well graded in their placement, so that a dam lip had been created within the stream. This could form a barrier to passage. The Company were instructed to monitor the situation and relocate rocks as necessary.

In the same inspection it was also found that the culvert below the wetland treatment system discharge had become blocked, forcing flows through a higher culvert that did not offer fish passage. The Company were instructed to either clear or remove the culvert altogether.

23 March 2023

The culverts on the property were inspected in fine weather with a steady flow in the streams in the catchment. It was found that the stream flow through the access track culvert to the vermiculture beds was flowing unimpeded. The stream flow was more centred than previously, although further rock relocation to create a well-formed U-shape with gradual changes in angle was advised.

Works had also been undertaken in the culvert below the wetland treatment system, to unblock the culvert and thus provide for fish passage. The timely completion of these works was noted by the Council.

14 April 2023

An inspection of the culverts on site was undertaken in dry weather and with steady flow in the streams. It was found that flow through the reconstructed riffle was improved and was expected to provide adequate fish passage. The Council officer was concerned that silt traps to provide filtration of surface flows before they entered the stream should be checked to ensure they functioned as they should.

8 May 2023

An inspection was undertaken as part of routine compliance monitoring. Stream turbidity was noted to be high, after periodic rain during the previous 24 hours. The inspection itself was undertaken in fine weather conditions. An inspection of the culverts onsite found that they were open and free flowing with no blockages and/or obstructions. The riffle below the culvert providing access to the vermiculture area was performing well, and the culvert below the wetland was flowing unobstructed. No issues were found as a result of this inspection. The site was considered compliant with the consent.

Consent 10063

To discharge treated stormwater from a quarry site, into an unnamed tributary of the Haehanga Stream.

2021-2022

At the last inspection of the previous year (March 2022), it was noted that the quarry was not currently operational. However it was noted work had been undertaken on the site access track in preparation for excavation to recommence within the quarry. These works included the installation of two sediment traps to receive and treat stormwater from the access track. Further work was requested to control the stormwater on the lower section of the access track, to prevent the likelihood of sediment-laden stormwater running off the lower portion of the access track into the stream at the base. This work was completed immediately upon request and consisted in the installation of further cut-off drains and a large bund at the base of the track to direct stormwater off the track and into the adjacent paddock, where it would be filtered by the grass before becoming a diffuse discharge during heavy rain into the adjacent stream. RNZ were instructed to monitor this track during rainfall events to ensure that all stormwater entering surface water contains a suspended solid limit of less than 100 gm/m^3, to ensure compliance with resource consent conditions.

31 January 2023

The inspection was undertaken as part of scheduled compliance monitoring. It was found that the quarry was again operational on a small scale. Metal had been excavated and stockpiled beside the worm beds. The access track had been upgraded, with enhanced sediment retention and cut-off drains. The lower section of the access track up the hillside would need improved stormwater management to avoid sediment runoff entering the stream at the culvert crossing. The Company was directed to ensure that removed overburden was not simply pushed down banks from where it could enter the upper catchment tributaries of the Haehanga Stream. Silt controls around the stockpile were also discussed, with options for improvement presented.

14 April 2023

The inspection was undertaken as part of scheduled compliance monitoring. Weather was fine and dry, with no surface stormwater flows observed. The quarry was not active. The inspection noted various works undertaken to control stormwater and sediment, including capture areas and cut-out drains along the track with grassed reception areas to filter the diverted flows. Sediment traps were in place beside the Haehanga Stream. The Company were directed to monitor the effectiveness of the pits in meeting the consent's sediment limit.

While there were exposed areas across the quarry working platform, it was considered that the bunding was sufficient to prevent large quantities of aggregate or rock escaping the area. The Company were again reminded not to discharge overburden down embankments.

The site was consider to be in compliance with consent 10063.

8 May 2023

The quarry was inactive, and would be re-assessed at the next scheduled inspection.

Consent 10547

To replace an existing culvert in an unnamed tributary of the Haehanga Stream, including the associated disturbance of the stream bed.

27 July 2022

Inspection was undertaken as part of routine compliance monitoring, in wet conditions with the streams in fresh. It was observed that the culvert was open and free flowing, at about one-third capacity and clear of any obstructions and/or blockages. However, there seemed to be an obstruction at the entrance to the culvert causing a disturbance to stream flow. Given the level of flow in the stream at the time, this could not be investigated further at the time, but the Company were instructed to inspect the stream and culvert

again when it was safe to do so. An inspection of the headwalls found that they were all in place and apparently stable with no signs of erosion about the approaches or exit of the culvert.

18 August 2022

Inspection was undertaken as part of routine compliance monitoring. The inspection of the stream and associated culvert found that the culvert was free of any blockages and or obstructions, allowing the stream to flow through the culvert freely. The headwalls of the culvert were in place and appeared secure, with no signs of erosion of the banks within the vicinity of the culvert.

30 November 2022

Inspection was undertaken as part of routine compliance monitoring, in dry weather following recent wet conditions. Flows were elevated. It was found that the culvert was open and free flowing with no blockages and/or obstructions. Both headwalls were in place with no signs of recent erosion or slumping. No issues were noted at the time of inspection.

31 January 2023

Inspection was undertaken as part of routine compliance monitoring. The stream at the time was flowing freely through the culvert with no signs of blockages and or obstructions within the culvert. The headwalls were well vegetated and visually secure with no evidence of scour, failure or erosion. No issues were identified at the time of the inspection.

28 February 2023

Inspection was undertaken as part of routine compliance monitoring. The inspection found that the culvert was open and free-flowing, with no blockages and/or obstructions. There was only a very low flow through the culvert. No obstructions to fish passage were noted. Both headwalls were in place and secure with no erosion noted about the headwalls or culvert. No issues were identified at the time of the inspection.

23 March 2023

A routine inspection was undertaken to assess compliance with resource consent conditions. The culvert was open and free flowing with no blockages and/or obstructions throughout the length of the culvert. No fish barrier noted. The headwalls were in place and stable, well vegetated and showing no signs of erosion. No issues were identified at the time of the inspection.

14 April 2023

A routine inspection was undertaken to assess compliance with resource consent conditions. The culvert was open and free flowing with no blockages and/or obstructions throughout the length of the culvert. No fish barrier noted. The headwalls were in place and stable, well vegetated and showing no signs of erosion. No issues were identified at the time of the inspection. The Company was considered compliant with the consent on this visit.

8 May 2023

An inspection was undertaken to assess compliance with resource consent conditions. An inspection of the culvert found that it was open and free flowing with no signs of blockages or obstructions. Both upper and lower headwalls were visually secure with well-established vegetation about the concrete headwalls. No obstructions to fish passage were observed at the time of the inspection. The Company was considered compliant with the consent on this visit.

Consent 10825

To realign a section of two unnamed tributaries of the Haehanga Stream for land improvement purposes.

18 August 2022

The inspection was undertaken as part of routine compliance monitoring, to assess compliance with the resource consent conditions for the stream realignment. The inspection was undertaken during wet weather with rising river levels.

The inspection of the works found that the stream was flowing freely throughout the length of the realignment, with no evidence of blockages or obstruction. The banks were well vegetated with grass, and there were no signs of erosion or scour. Riparian plantings were in place, although the Council had requested additional planting at the stipulated density and extent, in order to meet the consent conditions.

30 November 2022

The inspection was undertaken as part of routine compliance monitoring. The inspection found that the bank batters were holding well. A small slump in the bank was noted.

In a subsequent conversation with the managing director of the Company (2 December 2022), the Company was asked to confirm the status of riparian planting as required to ensure compliance with the consent. At this time compliance could not be confirmed, pending the data review. The property had been destocked, and so it was no longer necessary to comply with streambank fencing requirements.

31 January 2023

Inspection was undertaken as part of routine compliance monitoring. The weather was fine and streams were at base flows. The inspection found that the realigned section of the stream (i.e. adjacent to the entrance and security gate) was open and free flowing throughout the length of the realignment. There were no blockages or obstructions. Fish passage was also being provided for throughout the realignment and the culvert beneath the site access track. Riffles and ponds are beginning to develop in the stream.

The consent also provides for a second section of stream to be realigned. This had not yet been implemented. Although riparian planting had been undertaken along the length of the realignment, infill plantings were still required to provide consent compliance and a better canopy and shading effect for the stream.

28 February 2023

Inspection was undertaken as part of routine compliance monitoring. Inspection of the realigned stream stretch showed it was open and free-flowing, with no evidence of obstruction to fish passage. Habitat was beginning to re-establish, and there were no signs of streambank erosion or slumping. No issues were noted at the time of inspection.

23 March 2023

Inspection was undertaken as part of routine compliance monitoring. Inspection of the realigned stream stretch showed it was open and free-flowing, with no evidence of obstruction to fish passage. Habitat planting was flourishing, and there were no signs of streambank erosion or slumping. No issues were noted at the time of inspection. The consent was being complied with at this time.

14 April 2023

Inspection was undertaken as part of routine compliance monitoring. Inspection of the realigned stream stretch showed it was open and free-flowing, with no evidence of obstruction to fish passage. Habitat planting was flourishing, and there were no signs of streambank erosion or slumping. No works had been undertaken in the second section of stream for which realignment has been consented.

8 May 2023

The inspection was undertaken to assess compliance with resource consent conditions. The realigned stretch of stream was found to be open and free flowing with no obstructions to fish passage noted. The

general area appeared well-grassed along the embankments, to provide added structural stability. The site was considered compliant with the consent at this time.

Consent 10843

To modify a culvert to provide for fish passage, in an unnamed tributary of the Haehanga Stream, including associated disturbance of the stream bed.

18 August 2022

Inspection was undertaken as part of routine compliance monitoring, in wet weather, with base flows that were however rising rapidly. Inspection of the culvert (which is located just inside site entrance beside the security gate) found that it was open and free-flowing. No scouring or erosion was observed around the culvert, but one of the concrete block wall sections on the upper headwall had become dislodged. The Company were instructed to repair it when opportunity arose.

30 November 2022

Inspection was undertaken as part of routine compliance monitoring. All streams had elevated flows as a result of recent rainfall. The inspection found that the culvert was open and free flowing with no blockages and or obstructions. The head wall on the downstream side was secure and in place. However, the upstream headwall remained slumped as noted previously. The Company was reminded to undertake repairs when opportunity arose.

31 January 2023

Inspection was undertaken as part of routine compliance monitoring. All streams had baseline flows as a result of recent fine weather. Inspection found that the realigned stream leading to the culvert was open and free-flowing, with no obstructions. While banks above and below the culvert remained stable, the Company were again reminded of the need to undertake repairs of the upper headwalls.

28 February 2023

Inspection of the culvert was undertaken as part of routine compliance monitoring. The inspection was undertaken in fine weather conditions, with reasonable flows in the streams. The inspection found that the stream was flowing freely through the culvert with no signs of blockages and/or obstructions within or in the vicinity of the culvert. While the concrete headwall above the culvert had not slipped further, the Company were again reminded of the need to restore the wall.

23 March 2023

Inspection was undertaken to assess compliance with resource consent conditions. The inspection was undertaken in fine weather conditions. The culvert remained embedded within the bed of the stream and was not perched, with flow unobstructed. The Company were again reminded of the need to repair the displacement of the headwall above the culvert, which was now a matter that had been outstanding for more than a year.

14 April 2023

Inspection was undertaken to assess compliance with resource consent conditions. The inspection was undertaken in fine weather conditions, although there had been intermittent periods of sustained rain in the previous few days. The stream was free-flowing without any obstruction through the culvert. The Company were again reminded of the need to repair the displacement of the headwall above the culvert. This was a matter that had been outstanding for much more than a year. There were no signs of other erosion or obstruction around the culvert.

8 May 2023

Inspection of the culvert located at the site entrance (security gate) was undertaken as part of routine compliance monitoring. The inspection found that the culvert was open and free flowing. The Company were again reminded of the need to repair the displacement of the headwall above the culvert.

2.2 Water

2.2.1 Results of discharge and receiving environment monitoring

2.2.1.1 Surface water monitoring locations

The Company holds consent 5838-2.2 to allow the discharge of waste material to land for composting, and of treated stormwater and leachate from composting operations onto and into land, in circumstances where contaminants may enter water in the Haehanga Stream catchment, and directly into an unnamed tributary of the Haehanga Stream. The Haehanga Stream itself and associated tributaries were sampled at a total of up to 15 sites (Figure 3), on six scheduled occasions in the 2022-2023 period. Full surveys were undertaken on 4 August, 4 October, and 12 December 2022, and on 25 January, 23 March, and 2 June 2023.

In addition PDP undertook a catchment survey of surface water quality on 23 February 2023 on behalf of the Company, as part of an investigation into the levels and consequences of contamination across the Uruti property.

The Wetland Treatment System (WTS) on Pad 2 (Figure 2) functions by pumping primarily ammonia-enriched fluid from the paunch mixing pond, to the top of a multi-tiered wetland treatment system. The wetland has been planted with the bulrush raupō. This is intended to treat nutrient-enriched water though assimilation, while the dense planting of the raupō may act as a filter for particulate matter and associated contaminants. Discharge sample location IND003008 is at the point of entry from the last wetland pond into the tributary of the Haehanga Stream. The discharge is periodic, as flow is returned preferentially to the head of the WTS in order to maintain water levels within the wetland, The condition of the tributary receiving the discharge is assessed by sampling conducted at Site HHG000103, approximately 40 m downstream of the point of WTS discharge, and comparing results with those for HHG000098, located just above the discharge. Water quality at HHG000098 can be affected by diffuse runoff from adjacent vermiculture beds.

Sites HHG000090 (main stem) and HHG000097 (tributary) can be considered upstream or baseline sites. They are located above the upper irrigation fields and composting and vermiculture facilities.

Sites HHG000099 and HHG000100 are below the upper irrigation fields, while HHG000109 is adjacent to the main composting facilities and HHG000115 lies below them. Site HHG000150 is adjacent to the lower irrigation fields, and HHG000165 is on an unnamed tributary flowing from a new irrigation area (used for the first time late in the 2021-2022 period) and entering the main stem of the Haehanga Stream between sites HHG000160 (just upstream of the confluence) and HHG000168 (downstream). HHG000190 is the lowest site in the Haehanga, above its confluence with the Mimitangiatua awa and close to the boundary of the RNZ property.

Sites MMI000200 and MMI000204 were established during the 2021-2022 year. They are located in the Mimitangiatua awa, respectively above the confluence with the Haehanga Stream and below the mixing zone of the two water courses. The effects of any discharges carried down the Haehanga Stream into the Mimitangiatua awa will be seen in changes in MMI000204. In the year under review, the Council also regularly sampled at a new site MMI000210, 150 m below the confluence, to ascertain how far downstream effects may be distributed.

Site IND002044 is the irrigation water reservoir. This wastewater is not discharged to surface water, but irrigated to land in both the upper and lower catchment. Excessive application rates or irrigation during periods of rainfall or high soil moisture increases the risk of runoff or rapid shallow subsurface infiltration and subsequent migration into the Haehanga Stream.

Council confirmed unauthorised seepage discharges during 2021-2022 emerging into the tributary running to the south of Pad 3 above established site HHG000106. During the year under review, PDP consultants undertook further investigations into the source of this seep on behalf of the Company. Their findings and remedial works are included in the discussion below.

2.2.2 Presentation and discussion of surface water results

The results of the scheduled surface water sampling surveys are presented in Table 3 to Table 8 below.

The discharge from the WTS (IND003008) has been included in the results to provide context to the results of the receiving waters below this point source discharge (HHG000103). Analytes of total petroleum hydrocarbons (TPH), benzene, toluene, ethylbenzene and xylenes (BTEX), were analysed at numerous sites across all monitoring rounds. None were identified above the LOD. As such these have been omitted from the results.

Guidance documentation (MfE, 2018) sets out the means of calculating compliance with the national compulsory maximum value for ammoniacal nitrogen in water as required by the National Policy Statement for Freshwater Management 2020 (NPS-FM), expressed in terms of the toxicity of a solution containing ammoniacal nitrogen at pH 8. In the tables below, the measured (field) ammoniacal concentration has been used as the basis to calculate the equivalent concentration of ammoniacal nitrogen that would have the same toxicity when at pH 8. The current (expired) consent does not require RNZ to meet the NPS-FM total ammoniacal nitrogen attribute standard (national bottom line) or target attribute state, but it has been raised as a matter of consideration before the Environment Court.

The most significant parameters for assessing potential environmental effects on water quality and stream health are ammonia (toxicity), biochemical oxygen demand (excessive organic enrichment leading to undesirable slime growths; and depletion of dissolved oxygen within the water column), dissolved oxygen (loss of life-sustaining ability), suspended solids (abrasive damage to flora and fauna, and smothering of habitat), nitrate-nitrogen (eutrophication and toxicity), and *E. coli* (indicator for pathogenic microorganisms). Any exceedance of a consent condition is shown by red text, or the NPS-FM by orange highlighting.

Council records of rainfall at a meteorological monitoring station a few kilometres south of the RNZ property show that measured across the four days preceding each of the seven surveys, rainfall prior to 4 August 2022 was somewhat wetter than usual (33 mm, or 8 mm/day, cf an annual daily average of 6 mm); for 4 October was considerably heavier (65 mm, or 16 mm/day); for 12 December was likewise considerably heavier (40 mm, or 10 mm/day); for 25 January 2023 was dry (0 mm for the last 10 days); for 23 March was considerably heavier than usual (45 mm, or 11 mm/day); and for 2 June slightly wetter (27 mm, or 7 mm/day). The weather preceding the PDP survey of 23 February 2023 was dry (no rain for the preceding 7 days).

Table 3 Surface water monitoring 4 August 2022

04/08/2022	NH3	pH	*E. coli*	EC	EC	TSS	Temp
Site	g/m^3	pH Units	cfu/100 ml	mS/m	µS/cm	g/m^3	°C
Consent 5838-2.2 condition 11 max	>0.025		540[3]				
HHG000090	0.00008	7.3	250	15.1	151	27	12.2
HHG000093	0.00081	7.2	280	14.8	148	23	12.0
HHG000099	0.0048	7.5	700	17.9	179	167	12.4

04/08/2022	NH3	pH	*E. coli*	EC	EC	TSS	Temp
Site	g/m³	pH Units	cfu/100 ml	mS/m	µS/cm	g/m³	°C
Consent 5838-2.2 condition 11 max	>0.025		540[3]				
HHG000100	0.0034	7.3	300	16.9	179	120	12.0
HHG000097	0.00021	7.4	140	17.6	176	121	11.5
HHG000098	0.00045	7.2	260	16.3	163	78	11.6
IND003008	0.175	7.5	500	39.7	397	11	13.1
HHG000103	0.0066	7.2	260	16.9	169	83	11.8
HHG000106	0.00089	7.5	900	19.0	190	190	12.3
HHG000109	0.0051	7.3	400	17.8	178	-	11.7
HHG000115	0.0067	7.4	800	17.8	178	-	11.6
HHG000150	0.0050	7.3	1,000	17.9	179	137	11.6
HHG000160	0.0047	7.2	700	18.0	180	146	11.6
HHG000165	0.00068	7.1	180	17.7	177	43	11.9
HHG000168	0.0039	7.2	600	18.2	182	144	11.6
HHG000190	0.0041	7.2	360	17.9	179	-	11.6
MMI000200	0.00010	7.1	430	10.2	102	139	12.0
MMI000204	0.00047	7.1	480	11.0	110	130	12.0
	Total Sodium	Chloride	Total ammoniacal nitrogen	Total ammoniacal nitrogen with equivalent toxicity at pH 8	NNN	DCBOD	CBOD
Site	g/m³	g/m³	g/m³	g/m³	g/m³	g O_2/m³	g O_2/m³
Consent 5838-2.2 condition 11 max		>150		>0.4[4]		>2.0	
HHG000090	9.3	11.6	0.020	0.01	0.136	<1.0	
HHG000093	9.4	12.1	0.23		0.142		
HHG000099	-	13.3	0.70		-	<1.0	
HHG000100	9.5	13.0	0.86		0.110	<1.0	
HHG000097	-	13.2	0.040		0.035		
HHG000098	-	13.3	0.148		-		
IND003008	-	20	22	12.3	2.8	-	
HHG000103	-	14.2	1.78	0.81	-	<1.0	
HHG000106	-	11.2	0.132		-	<1.0	
HHG000109	-	13.6	1.24	0.59	-	<1.0	
HHG000115	10.3	13.7	1.27	0.65	0.22	1.9	
HHG000150	10.2	14.2	1.26	0.60	0.25	<1.0	
HHG000160	10.4	14.6	1.30	0.59	0.26	<1.0	
HHG000165	10.9	14.4	0.26		0.21	<1.0	
HHG000168	10.5	14.5	1.21	0.55	0.26	<1.0	
HHG000190	-	14.7	1.23	0.56	-	-	<1.0
MMI000200	8.2	11.9	0.034		0.197		
MMI000204	8.5	12.2	0.158	0.07	0.20		

[1]Calculated as per MfE 2018. Not a consent condition

Rainfall prior to 4 August 2022 was somewhat wetter than usual (33 mm, or 8 mm/day, cf an annual daily average of 6 mm). There had been a very large volume of wetland treatment system (WTS) discharge between 25-29 July, with much smaller discharges on 2-3 August, and continuing on the day of the survey. Such a discharge would primarily affect water quality at HHG000103, by comparison with that at sites HHG000097 and HHG000098. RNZ have reported that there was no irrigation from mid-July up to the time of the freshwater survey in August.

Surface water monitoring on 4 August 2022 (Table 3) indicated the following:

- In-stream temperature ranged 11.5–13.1 °C.
- Un-ionised ammonia was not found above the consent limit (0.025 g/m^3) at any in-stream location. It ranged between 0.00008 and 0.0067 g/m^3. The most elevated was recorded at HGG000115 which is in the middle of the property and below Pads 1 and 3. Un-ionised and total ammonia increased more than 10-fold below the WTS discharge by comparison with concentrations above.
- Total ammoniacal nitrogen (NH4) results adjusted to pH 8 as per the MfE guidance have been calculated for the sites in the lower reaches of the Haehanga catchment. Total equivalent toxicity was found to exceed the NPS-FM attribute limit at all sites in the tributary below the WTS discharge and at all downstream sites in the main Haehanga stem. The toxicity was found to be up to double the maximum total ammonium toxicity concentration permitted by the NPS-FM. While the total ammoniacal nitrogen concentration in the Mimitangiatua awa below its confluence with the Haehanga was five times that upstream, it remained well below the NPS-FM limit.
- pH remained in a very narrow band, of 7.2–7.5 (7.1 in the Mimitangiatua awa).
- Electrical conductivity increased in strength down the catchment.
- Chloride concentration also increased down the catchment ranging 11.6-14.7 g/m^3 within the receiving waters (and was almost double those concentrations in the discharge from the WTS). There was a small increase in chloride in the tributary below the WTS discharge.
- Dissolved carbonaceous biochemical oxygen demand (DCBOD) was recorded above laboratory limit of detection at Site HHG000115. The measured concentration at this site was just within the consent limit.
- E. coli monitoring fluctuated greatly ranging from 140 cfu/100 ml at one of the upstream sites, to 360 cfu/100 ml at the downstream property boundary. The most elevated count was recorded at HGG000150 with 1,000 cfu. While generally lower than on other occasions at most sites below the background sites, bacteriological counts indicated that waters still remained unsuitable for recreational or other contact usage.
- By every measure except total suspended solids, the Mimitangiatua awa was compromised to some extent by the inflow from the Haehanga Stream although not to the extent of breaches of national standards or guidelines.

Table 4 Surface water monitoring 4 October 2022

04/10/2022	NH_3	pH	*E. coli*	EC	EC	TSS	Temp
Site	**g/m³**	**pH Units**	**cfu/100 ml**	**mS/m**	**µS/cm**	**g/m³**	**°C**
Consent 5838-2.2 condition 11 max	>0.025		540[3]				
HHG000090	<0.00009	7.6	460	13.6	136	4	12.8
HHG000093	0.00159	7.6	600	16.0	160	18	11.9
HHG000099	0.0025	7.8	1,200	19.4	194	25	12.3
HHG000100	0.00062	7.5	380	13.8	138	6	11.9
HHG000097	0.00058	7.6	90	16.3	163	41	11.3
HHG000098	0.00059	7.5	270	15.8	158	40	11.5
IND003008	1.20	7.8	6,300	71.9	719	22	16.8
HHG000103	0.085	7.7	1,600	20.1	201	28	16.8
HHG000106	0.00141	7.3	1,000	20.3	203	-	13.3
HHG000109	0.0142	7.7	1,200	18.4	184	-	11.7
HHG000115	0.0155	7.7	1,400	18.0	180	-	11.8
HHG000150	0.0126	7.5	1,100	18.7	187	14	11.6
HHG000160	0.0064	7.3	1,600	18.9	189	38	11.6
HHG000165	0.00177	7.3	400	17.3	173	19	11.9
HHG000168	0.0106	7.6	1,200	19.0	190	28	11.6
HHG000190	0.0126	7.6	1,100	19.0	190	-	11.6
MMI000200	0.00010	7.1	280	9.1	91	31	13.5
MMI000204	0.00031	7.2	600	9.5	95	33	13.4
	Total Sodium	**Chloride**	**Total ammoniacal nitrogen**	**Total ammoniacal nitrogen with equivalent toxicity at pH 8**	**NNN**	**DCBOD**	**CBOD**
Site	**g/m³**	**g/m³**	**g/m³**	**g/m³**	**g/m³**	**g O_2/m³**	**g O_2/m³**
Consent 5838-2.2 condition 11 max		>150		>0.4[5]		>2.0	
HHG000090	8.9	6.7	<0.010	<0.006	0.151	<1.0	
HHG000093	9.2	8.0	0.199		0.140	<1.0	
HHG000099	-	8.7	0.196		-	<1.0	
HHG000100	9.3	7.1	0.090		0.141	<1.0	
HHG000097	-	7.9	0.070		0.053	<1.0	
HHG000098	-	8.1	0.080		-	<1.0	
IND003008	-	19.6	59	45	1.03	-	
HHG000103	-	9.7	5.3	0.71	-	1.3	
HHG000106	-	10.2	0.31		-	<1.0	
HHG000109	-	9.2	1.41	0.96	-	<1.0	
HHG000115	10.3	9.5	1.48	1.00	0.30	<1.0	
HHG000150	11.0	11.3	1.72	0.96	0.36	<1.0	
HHG000160	11.3	11.8	1.64	0.78	0.39	<1.0	
HHG000165	10.7	10.0	0.42	-	0.130	<1.0	
HHG000168	11.7	11.6	1.41	0.87	-	<1.0	
HHG000190	-	11.8	1.42	0.87	0.36	-	1.1
MMI000200	8.2	8.5	0.00010		0.114	<1.0	
MMI000204	8.3	8.7	0.079	0.04	0.124	<1.0	

[1]Calculated as per MfE 2018. Not a consent condition.

Rainfall for 4 October was considerably heavier (65 mm, or 16 mm/day) than the annual daily average for the site (6 mm/day). This would mean significant dilution of any discharges. There were moderate discharges from the WTS on 3 and 4 October 2022. RNZ advise that there was light irrigation on L1, L2, L4, and U3 in the days prior to the survey. Any effects would show primarily in the water quality at HHG000093, HHG000150, and HHG000165.

Surface water monitoring round two 04 October 2022 (Table 4) indicated the following:

- In-stream temperatures ranged from 11.3 to 16.8 °C.
- Un-ionised ammonia was found above the consent limit (0.025 g/m^3) at site HHG000103, the site at the boundary of the permitted mixing zone in the tributary receiving the discharge from the WTS. The concentration of un-ionised ammonia at this point was more than 3 times the consent limit, and was about a 100-fold increase over the un-ionised concentration above the WTS discharge.
- Total ammoniacal nitrogen (NH4) results adjusted to pH 8 have been calculated for the sites in the lower reaches of the Haehanga catchment, together with the uppermost site as a baseline comparison. When equivalent toxicity is calculated, the ammoniacal toxicity at most of the sites in the lower catchment (including at the boundary site) was found to be up to 2.5 times the maximum total ammonium concentration toxicity permitted by the NPS-FM.
- pH ranged 6.7–7.3- 7.8 in the Haehanga Stream, and was slightly lower in the Mimitangiatua awa.
- Electrical conductivity increased in concentration down the catchment, and was clearly influenced by the discharge from the WTS as well as various diffuse sources.
- Chloride concentration also increased down the catchment ranging 6.7 to 11.8 g/m^3 with the highest recordings located low in the catchment at HGG000160 and HHG000190, the latter being the boundary site.
- Dissolved carbonaceous biochemical oxygen demand (DCBOD) was recorded above the laboratory limit of detection at one site, HHG000103, below the discharge into the tributary of the Haehanga Stream receiving the discharge from the WTS. The DCBOD results indicate the consent limit was being met at all sites.
- CBOD was recorded at 1.1 g O_2/m^3 at HGG000190. The concentration was within the consent condition.
- *E. coli* monitoring of receiving waters ranged from 90 to 1600 cfu/100 ml. At most sites below the control sites, bacteriological counts indicated that waters were unsuitable for recreational or other contact usage.
- Water quality at site HHG000093 appears to show some slight deterioration by comparison with HHG000090, which may reflect the spraying of wastewater on U3 preceding the survey. Likewise, there are slight increases in a number of markers of water quality, from HHG000115 to HHG000165 which are consistent with impacts from irrigation on adjacent fields.
- By every measure, the Mimitangiatua awa was compromised to some extent by the inflow from the Haehanga Stream. Below the confluence, the Mimitangiatua awa failed to meet the national bottom line for bacteriological quality although meeting it upstream.

The Council imposed an Infringement Notice (fine) on RNZ for the breach of the unionised ammonia limit discovered on 4 October 2022.

Table 5 Surface water monitoring 12 December 2022

SW1 12/12/2022	NH_3	pH	*E. coli*	EC	EC	TSS	Temp
Site	g/m^3	pH Units	cfu/100 ml	mS/m	µS/cm	g/m^3	°C
Consent 5838-2.2 condition 11 max	>0.025		540[3]				
HHG000090	<0.00007	7.3	600	14.1	141	3	16.8
HHG000093	0.00028	7.3	500	15.0	150	6	17.1
HHG000099	0.00156	7.7	1,300	20.9	209	5	15.2
HHG000100	0.00086	7.5	500	17.9	179	9	16.2
HHG000097	0.00041	7.4	1,500	16.9	169	17	14.5
HHG000098	0.00039	7.4	1,200	14.2	142	11	15.0
IND003008	0.58	7.7	13,000	51.7	517	19	20.0
HHG000103	0.0153	7.4	2,500	17.9	179	13	15.4
HHG000106	0.0037	7.4	1,000	22.5	225	-	15.6
HHG000109	0.0032	7.4	3,000	18.4	184	-	15.7
HHG000115	0.0033	7.5	4,000	18.9	189	-	15.8
HHG000150	0.0024	7.3	4,000	19.6	196		15.7
HHG000160	0.0020	7.2	1,800	18.9	189		15.9
HHG000165	0.00031	6.8	1,000	19.0	190		14.7
HHG000168	0.00182	7.2	1,500	19.6	196		16.0
HHG000190	0.00149	7.2	1,900	19.5	195		16.2
MMI000200	0.00010	7.2	1,500	8.8	88	15	17.1
MMI000204	0.00020	7.3	1,600	9.3	93	16	17.1
	Total Sodium	Chloride	Total ammoniacal nitrogen NH_4	Total ammoniacal nitrogen with equivalent toxicity at pH 8[1]	NNN	DCBOD	CBOD
Site	g/m^3	g/m^3	g/m^3	g/m^3	g/m^3	$g\ O_2/m^3$	$g\ O_2/m^3$
Consent 5838-2.2 condition 11 max		>150		>0.4[6]		>2.0	
HHG000090	9.5	6.1	<0.010	<0.005	<0.002	<1.0	
HHG000093	9.6	6.4	0.047		0.010	<1.0	
HHG000099	-	7.6	0.127		-	<1.0	
HHG000100	10.0	8.4	0.094		0.060	<1.0	
HHG000097	-	6.9	0.063		0.085	<1.0	
HHG000098	-	7.2	0.062		-	-<1.0	
IND003008	-	18.4	28	19	3.2	-	
HHG000103	-	8.1	2.0	1.03	-	<1.0	
HHG000106	-	12.7	0.51	0.26	-	<1.0	
HHG000109	-	9.4	0.42	0.21	-	<1.0	
HHG000115	10.9	9.5	0.35	0.20	0.35	<1.0	
HHG000150	11.8	12.5	0.45	0.21	0.43	<1.0	
HHG000160	11.9	13.0	0.42	0.19	0.46	<1.0	
HHG000165	11.8	10.1	0.191	0.07	0.114	<1.0	
HHG000168	11.7	12.9	0.40	0.18	0.45	<1.0	
HHG000190	-	12.3	0.31	0.14	-	-	<1.0
MMI000200	7.6	7.5	0.019	0.008	0.047	<1.0	
MMI000204	8.2	8.1	0.036	0.017	0.072	<1.0	

[1]Calculated as per MfE 2018. Not a consent condition

Rainfall in the few days prior to 12 December was considerably heavier (40 mm, or 10 mm/day) than usual for the Uruti property (6 mm/day. This would have meant significant dilution of any discharges to surface waters. There was a moderate discharge flow from the WTS on 9 and 12 December. RNZ did not supply data for flows from the WTS on 10 and 11 December. Over the same period, RNZ applied wastewater by irrigation to fields L2, L3, L6, and U1. Any effects upon water quality would primarily be noted at monitoring sites HHG000168, HHG000165, HHG000150, and HHG000100.

Surface water monitoring on 12 December 2022 (Table 5) indicated the following:

- In-stream temperatures ranged from 14.7 to 17.1 °C.
- Un-ionised ammonia was on this occasion within the consent limit (0.025 g/m^3) at site HHG000103, the site at the boundary of the permitted mixing zone in the tributary receiving the discharge from the WTS. Un-ionised and total ammonia in the tributary increased some 30-fold below the discharge.
- Total ammoniacal nitrogen (NH4) results adjusted to pH 8 have been calculated for the sites in the lower reaches of the Haehanga catchment, together with the uppermost site as a baseline comparison. When equivalent toxicity is calculated, the ammoniacal toxicity at most of the sites in the lower catchment in this survey were within the maximum total ammonium concentration toxicity (national bottom line) permitted by the NPS-FM. However, the calculated ammoniacal toxicity exceeded the national bottom line at site HHG000103, by 2.5 times.
- pH ranged 7.2-7.7 in the Haehanga Stream, and was at the bottom of this range in the Mimitangiatua awa.
- Electrical conductivity increased in concentration down the catchment, and was clearly influenced by the discharge from the WTS as well as various diffuse sources. There was a significantly elevated conductivity reading at site HHG000106, the site in the tributary below Pad 3 where on previous occasions a contaminated inflow has been detected, generally around February each year. Elevated readings for chloride and ammonia were detected at the same site.
- Chloride concentration also increased down the catchment ranging 6.1 to 13.0 g/m^3 with the highest recordings located low in the catchment at HGG000160 and HHG000168, near the boundary site. There were slight increases in parameters such as conductivity and chloride in the tributary below the WTS discharge.
- Dissolved carbonaceous biochemical oxygen demand (DCBOD) was not recorded above the laboratory limit of detection at any site. The DCBOD results indicate the consent limit was being met at all sites.
- CBOD was not recorded above the laboratory limit of detection at HGG000190. The concentration was within the consent condition.
- *E. coli* monitoring of receiving waters ranged from 600 to 4,000 cfu/100 ml. At all sites other than in the upper catchment, bacteriological counts indicated that waters were unsuitable for recreational or other contact usage.
- There were marked increases in a number of markers of pollution, between sites HHG000093 and HHG000100, consistent with the records of the use of area U1 for irrigation immediately prior to the survey. Likewise, a number of markers increased in concentration between site HHG000115, above the areas used for irrigation at this time, and the downstream sites HHG000150, HHG000165, and HHG000168, indicative of runoff or soakage from the recently irrigated areas.
- By every measure, the Mimitangiatua awa was compromised to some extent by the inflow from the Haehanga Stream although not to the extent of breaches of national standards or guidelines. The bacteriological quality of the Mimitangiatua awa did not meet the national bottom line either below or above its confluence with the Haehanga Stream.

Table 6 Surface water monitoring 25 January 2023

SW1 25/01/2023	NH_3	pH	*E. coli*	EC	EC	TSS	Temp
Site	g/m^3	pH Units	cfu/100 ml	mS/m	µS/cm	g/m^3	°C
Consent 5838-2.2 condition 11	>0.025		540[3]				
HHG000090	<0.00007	7.2	120	20.6	206	<3	21.1
HHG000093	0.0006	7.7	380	24.9	249	<3	20.8
HHG000099	0.00060	6.9	510	38.7	387	24	19.9
HHG000100	0.00123	6.9	4,000	34.1	341	11	19.8
HHG000097[2]	7.3	8.1	36,000	20.8	208	14,200	19.2
HHG000098	0.00126	7.2	600	29.7	297	29	17.7
IND003008[3]	51	8.8	58,000	79.2	792	1,080	22.6
HHG000103	0.00088	7.4	2,300	22.4	224	8	18.3
HHG000106	0.0074	7.3	1,100	40.4	404	-	20.4
HHG000109	0.0075	7.1	5,600	53.2	532	-	23.8
HHG000115	0.0045	7.4	1,900	52.5	525	-	23.8
HHG000150	0.0007	7.5	600	48.8	488	8	25.5
HHG000160	0.00142	7.2	380	47.7	477	9	25.3
HHG000165	0.00103	7.0	30	34.9	349	42	18.7
HHG000168	0.00087	7.4	350	43.3	433	11	22.6
HHG000190	0.00051	7.2	70	36.7	367	-	22.2
MMI000200	<0.00012	7.3	190	14.8	148	13	24.8
MMI000204	0.00042	7.4	130	15.4	154	12	24.7
MMI000210	<0.00012	7.3	120	15.0	150	<3	24.8
	Total Sodium	Chloride	Total ammoniacal nitrogen as N	Total ammoniacal nitrogen with equivalent toxicity at pH 8	NNN	DCBOD	CBOD
Site	g/m^3	g/m^3	g/m^3	g/m^3	g/m^3	$g\ O_2/m^3$	$g\ O_2/m^3$
Consent 5838-2.2 condition 11 max		>150		>0.4[1]		>2.0	
HHG000090	12.1	6.5	<0.010		0.002	1.2	-
HHG000093	13.9	10.9	0.032		0.034	<1.0	-
HHG000099	-	49	0.21		-	1.1	-
HHG000100	23	38	0.37		0.25	<1.0	-
HHG000097*	-	71	176		0.23	14.8	-
HHG000098	-	8.6	0.23		-	1.5	-
IND003008	-	70	230		0.04	-	-
HHG000103	-	8.8	0.108		-	1.4	-
HHG000106	-	40	1.01	0.51	-	1.5	-
HHG000109	-	87	1.20	0.47	-	1.2	-
HHG000115	41	90	0.36		0.41	<1.0	-
HHG000150	37	83	0.035		0.002	0.2	-
HHG000160	33	76	0.142		0.135	1.3	-
HHG000165	18.3	19.4	0.32		0.038	<1.0	-
HHG000168	29	58	0.077		0.120	<1.0	-
HHG000190	-	45	0.066		-	-	2.3
MMI000200	12.4	11.5	<0.010		0.027	<1.0	-
MMI000204	13.0	11.9	0.028		0.029	<1.0	-
MMI000210	12.4	11.8	<0.010		0.030	<1.0	-

1 Calculated as per MfE 2018. Not a consent condition.
2 Having reviewed field notes, Council staff consider this sample was collected from the wrong site. Data is shown as reported, but is not discussed further.
3 Sampled from WTS final pond, as no discharge to the tributary at the time

Rainfall for the few days prior to 25 January 2023 was dry (0 mm for the last 10 days). There was no report of any discharge from the WTS for the 10 days prior to the survey. There is no record of any irrigation activity in the weeks leading up to this survey.

Surface water monitoring on 25 January 2023 (Table 6) indicated the following:

- A notable finding from the freshwater survey undertaken on 25 January 2023 was the prospective breach of the consent limit on biochemical oxygen demand (highlighted in Red above) in the Haehanga Stream at the point it cross the downstream (northern) boundary, immediately prior to its confluence with the Mimitangiatua awa. The result of 2.3 g/m^3 can be assessed against the consented limit, which is that any discharges from the activities cannot cause the filtered BOD to rise by more than 2.0 g/m^3. It should be noted however that with the limit of detection for a BOD test being 1.0 g/m^3, it cannot be concluded that the increase from the upstream concentration (which can be stated only as being less than 1.0 g/m^3) exceeded the maximum permitted. Depending upon the duration and frequency of the discharge and the dissolved oxygen concentration of the stream, elevated BOD would pose a risk of environmental impacts upon invertebrates and fish. It is noted that in the Mimitangiatua awa the biochemical oxygen concentrations were at acceptable levels.
- More generally there was an increase in the concentration of a number of contaminants as the Haehanga Stream flows through the property. This can be shown most markedly by comparing the results for HHG000160 (main stem) and HHG 000165 (tributary from a new irrigation area). The main stem at the confluence has significantly greater concentrations of sodium, chloride, biochemical oxygen demand, and nitrate nitrogen, which are all products of decomposition and leaching from process materials and drilling wastes.
- Likewise, from the top of the catchment (HHG000090) to the bottom (HHG000116/HHG000190), every marker of pollution increased markedly, in some case by an order of magnitude or more.
- In-stream temperatures ranged 17.7-25.5 °C, a range of 7.8 °C, and were highest in the mid Haehanga sub-catchment.
- Un-ionised ammonia was not found above the consent limit (0.025 g/m^3) at any in-stream location. It ranged between <0.00007 and 0.0075 g/m^3, or about 1/3 of the consent limit. The most elevated was recorded at HGG000109 which is in the middle of the property and below Pads 1 and 3.
- Sites in the middle of the catchment showed very significant bacteriological pollution, although counts of faecal indicator bacteria had reduced to within national standards at the downstream boundary.
- There was no indication of a significant adverse effect upon the tributary receiving the intermittent discharge from the Wetland Treatment System near Pad 2.
- Of note, the results for site HHG000106 and HHG000109 were anomalous by comparison with other results during the year for these sites and by comparison with nearby sites in this survey, and show evidence of a break-out of contaminated groundwater. Site HHG000106 is on a tributary running adjacent to Pads 1 and 3 and the wastewater collection system. The anomalous results found in summer surveys are a recurring pattern at this site, and have been discussed more fully in the 2021-2022 annual compliance report[7]. In this survey, downstream sites in the main stem of the Haehanga Stream were not as affected as in previous years. This break-through and subsequent investigations and remedial intervention are discussed further below in Section 2.2.7.

[7] https://www.trc.govt.nz/assets/Documents/Environment/Monitoring-Industry/2022/22-24-Remediation-New-Zealand-Ltd-Uruti-Composting-Facility-Monitoring-Programme-Annual-Report-2021-2022-3091361.PDF Section 2.2.3

- The Mimitangiatua awa showed a negligible influence from the Haehanga Stream on this occasion in terms of environmental effects, although most contaminants were again at relatively higher concentrations below its confluence with the Haehanga Stream than above it. At the lowest site (MMI000210) most markers were the same as or displayed only a negligible change from the site above the confluence (MMI000200).
- Total ammoniacal nitrogen concentrations were found to remain below national standards at all sites on this occasion.
- On this occasion, the Haehanga Stream was also analysed for various hydrocarbon groups and species at the northern (downstream) boundary. No hydrocarbons were detected. Tests and limits of detection applied were for benzene, toluene, ethylbenzene, m&p-xylene, and o-xylene (0.0010g/m^3), C7-C9 (0.10 g/m^3), C10-C14 (0.2 g/m^3), C15-C36 (0.4 g/m^3) and total hydrocarbons (0.7 g/m^3).

Table 7 Surface water monitoring 23 March 2023

SW1 23/03/2023	NH_3	pH	*E. coli*	EC	EC	TSS	Temp
Site	g/m³	pH Units	cfu/100 ml	mS/m	µS/cm	g/m³	°C
Consent 5838-2.2 condition 11 max	>0.025		540[3]				
HHG000090	<0.00005	7.3	130	13.8	138	<3	12.5
HHG000093	0.00023	7.4	130	13.8	138	<3	12.9
HHG000099	0.00037	7.7	1,200	20.4	204	9	11.7
HHG000100	0.00033	7.5	1,100	16.3	163	6	12.5
HHG000097	0.00054	7.5	310	16.5	165	98	11.6
HHG000098	0.00053	7.4	210	16.4	164	10	11.6
IND003008[2]	3.4	8.0	27,000	187.4	1874	183	16.0
HHG000103	0.0032	7.5	380	16.4	164	72	11.9
HHG000106	0.0031	7.5	3,400	17.6	176	-	12.7
HHG000109	0.0041	7.5	5,000	18.3	183	-	13.6
HHG000115	0.0034	7.5	3,200	18.0	180	-	13.4
HHG000150	0.0138	7.4	11,000	21.2	212	9	14.1
HHG000160	0.0143	7.4	9,000	21.2	212	8	14.2
HHG000165	0.00047	7.0	110	19.8	198	4	14.4
HHG000168	0.0114	7.4	5,200	21.2	212	11	14.1
HHG000190	0.0115	7.5	2,100	20.4	204	-	14.8
MMI000200	0.00011	7.2	320	9.2	92	10	16.0
MMI000204	0.00038	7.3	310	9.8	98	12	15.6
MMI000210	0.00025	7.2	360	10.1	101	11	15.7
	Total Sodium	Chloride	Total ammoniacal nitrogen	Total ammoniacal nitrogen with equivalent toxicity at pH 8	NNN	DCBOD	CBOD
Site	g/m³	g/m³	g/m³	g/m³	g/m³	g O_2/m³	g O_2/m³
Consent 5838-2.2 condition 11 max		>150		>0.4[1]		>2.0	
HHG000090	9.8	5.5	<0.010		0.030	<1.0	-
HHG000093	9.2	6.2	0.035		0.030	<1.0	-
HHG000099	-	7.0	0.037		-	<1.0	-
HHG000100	10.2	7.2	0.046		0.040	<1.0	-
HHG000097	-	5.8	0.075		0.085	<1.0	-
HHG000098	-	6.0	0.090		-	<1.0	-
IND003008	-	-	122		0.11	-	-
HHG000103	-	6.9	0.51	0.24	-	<1.0	-
HHG000106	-	7.7	0.42	0.23	-	1.7	-
HHG000109	-	8.6	0.52	0.29	-	1.2	-
HHG000115	11.1	8.9	0.46	0.25	0.187	<1.0	-
HHG000150	12.6	12.6	2.3	1.19	0.24	9.8	-
HHG000160	12.9	13.4	2.1	1.08	0.26	7.9	-
HHG000165	12.6	9.8	0.181		0.137	<1.0	-
HHG000168	12.7	13.1	1.81	0.93	0.27	7.7	-
HHG000190	-	13.4	1.47	0.78	-	-	5.2
MMI000200	8.5	7.6	0.025		0.097	<1.0	-
MMI000204	8.7	8.0	0.066		0.117	<1.0	-
MMI000210	8.4	8.5	0.056		0.108	<1.0	-

[1] Calculated as per MfE 2018. Not a consent condition

[2] Sampled from final WTS pond, as no discharge from the pond to the tributary at time of sampling

Rainfall for the few days prior to 23 March was considerably heavier than usual (45 mm, or 11 mm/day, compared with an annual daily average of 6 mm/day). This would have meant more dilution of discharges than typical in the Haehanga stream. Flows from the WTS into the tributary above site HHG000103 had been moderate for each of 10 days up to the day of survey, but it appears that any effects were negated by the in-stream flows and consequent dilution, as there was minimal variation between sampling sites above (HHG000097 and HHG000098) and below (HHG000103) this discharge. RNZ advised the Council of irrigation on areas L1, L4, and U2 prior to this survey. Any effects upon water quality would be primarily observed at sites HHG000165 and HHG000100.

Surface water monitoring round five 23 March 2023 (Table 7) indicated the following:

- Temperature in the Haehanga Stream ranged 11.6–14.8 °C, a change of 3.2 °C, with the highest temperatures found in the lower catchment.
- Un-ionised ammonia was found to be below the consent limit (0.025 g/m^3) at all locations. At various sites in the lower catchment it was around half the limit.
- Total ammoniacal nitrogen (NH_4) results adjusted to pH 8 were calculated. Total NH_4 was found to range < 0.010 to 2.3 g/m^3 , with the highest results at the downstream four sites in the main Haehanga Stream. Adjusted to pH as per MfE 2018, the results in the lower catchment exceeded the maximum permitted by the NPS-FM (2020) by two to three times.
- pH ranged 7.3–7.7 within the Haehanga Stream, slightly higher than in the January survey.
- Electrical conductivity increased in concentration by more than 50% down the catchment.
- Chloride concentration likewise increased by more than 50% down the catchment, ranging 5.5–13.4 g/m^3 with the highest recording located at the downstream boundary (HGG000190).
- Dissolved carbonaceous biochemical oxygen demand (DCBOD) was recorded above laboratory limit of detection at the lower catchment sites with values of 7.7-9.8 g O_2/m^3, and at the northern site boundary total carbonaceous biochemical oxygen demand was still 260% higher than permitted. All these values represent non-compliance with the consent. Non-compliance had also been found in the previous survey.
- *E. coli* monitoring fluctuated greatly, with all sites in the mid and lower reaches of the Haehanga Stream showing values much greater than allowed by the national standard. Concentrations ranged from 130 cfu/100 ml upstream to 11,000 cfu/100 ml downstream, with the most elevated value recorded at HGG000150 (on the main stem of the Haehanga Stream, below the composting pad, wastewater system, and mid-site irrigation areas).
- The influence of the Haehanga Stream on the Mimitangiatua awa was again clear, although the changes in the Mimitangiatua awa were of no ecological significance and at the lowest sampling site parameters were close to or back to upstream values.
- In addition to the analyses reported above, sites HHG000090, and HHG000103, (ie above the site and the receiving waters for the WTS, respectively) were analysed for total metals. High concentrations of various metals been detected at a number of locations across the operational areas of the property, and have entered the surrounding environment. By comparison with the Haehanga Stream upstream of the operational area, the tributary below the WTS discharge showed similar concentrations of arsenic, cadmium, and nickel, and small and inconsequential increases in chromium, copper, lead, and zinc. Therefore any discharge from the WTS was not having an effect upon soluble metals downstream on this occasion. Metal concentrations were not at levels of ecological concern.
- There is an indication of some effect at site HHG000100 (below irrigation areas U1 and U2) by comparison with the upstream site HHG000093, especially but not only in *E. coli* colony counts. There is little evidence of any impact from the irrigation on areas L1 and L4. A significant impact on water quality detected at site HHG000150 remains unexplained.
- On this occasion, the Haehanga Stream was also analysed for various hydrocarbon groups and species at the northern (downstream) boundary. No hydrocarbons were detected. Tests and limits of

detection applied were for benzene, toluene, ethylbenzene, m&p-xylene, and o-xylene (0.0010g/m^3), C7-C9 (0.10 g/m^3), C10-C14 (0.2 g/m^3), C15-C36 (0.4 g/m^3) and total hydrocarbons (0.7 g/m^3).

The Council imposed an Infringement Notice (fine) because of the breach of the BOD consent limit discovered on 23 March 2023.

Table 8 Surface water monitoring 2 June 2023

02/06/2023	NH_3	pH	*E. coli*	EC	EC	TSS	Temp
Site	g/m^3	pH Units	cfu/100 ml	mS/m	µS/cm	g/m^3	°C
Consent 5838-2.2 condition 11 max	>0.025		540[3]				
HHG000090	0.00007	6.9	7000	11.8	118	540	14.1
HHG000093	0.0008	6.9	4000	12.6	126	590	14.1
HHG000099	-	-	-	-	-	-	-
HHG000100	0.00039	7.0	7000	14.6	146	570	14.2
HHG000097	0.00015	7.2	2300	15.5	155	1210	13.9
HHG000098	0.00010	7.1	3200	13.7	137	1660	15.0
IND003008	0.0085	7.2	2700	20.6	206	30	14.0
HHG000103	0.00039	7.1	2500	13.4	134	720	13.9
HHG000106	0.00122	7.1	4900	14.5	145	-	14.2
HHG000109	0.00122	7.2	3400	14.3	143	-	14.3
HHG000115	0.00127	7.1	11,000	14.8	148	-	14.3
HHG000150	0.0025	7.1	6000	14.4	144	480	14.4
HHG000160	0.0028	7.1	9000	15.0	150	490	14.4
HHG000165	0.00166	7.0	1400	16.5	165	146	14.1
HHG000168	0.0025	7.1	3500	15.4	154	440	14.4
HHG000190	0.0037	7.1	40,000	18.1	181	-	14.2
MMI000200	0.00012	7.0	11,000	9.6	96	810	14.4
MMI000204	0.00028	7.0	9000	10.3	103	1,010	14.4
MMI000210	0.00026	7.0	15,000	10.0	100	880	14.4

	Total Sodium	Chloride	Total ammoniacal nitrogen	Total ammoniacal nitrogen with equivalent toxicity at pH 8	NNN	DCBOD	CBOD
Site	g/m^3	g/m^3	g/m^3	g/m^3	g/m^3	$g\ O_2/m^3$	$g\ O_2/m^3$
Consent 5838-2.2 condition 11 max		>150		>0.4[1]		>2.0	
HHG000090	7.0	7.5	0.036		0.179	1.3	-
HHG000093	7.3	8.0	0.35		0.31	1.2	-
HHG000099	-	-	-	-	-	-	
HHG000100	7.5	8.6	0.60		0.33	<1.0	-
HHG000097	-	7.5	0.034		0.103	<1.0	-
HHG000098	-	7.7	0.031		-	<1.0	-
IND003008	-	11.2	1.93		2.1	-	-
HHG000103	-	8.2	0.129		-	<1.0	-
HHG000106	-	8.8	0.39		-	<1.0	-
HHG000109	-	8.8	0.33		-	<1.0	-
HHG000115	8.4	9.0	0.42	0.18	0.40	<1.0	-
HHG000150	8.6	9.5	0.71	0.31	0.49	<1.0	-
HHG000160	8.6	10.0	0.83	0.36	0.58	<1.0	-
HHG000165	9.8	10.0	0.63	0.26	0.42	<1.0	-
HHG000168	8.7	9.7	0.83	0.36	0.58	<1.0	-
HHG000190	-	12.0	1.13	0.49	-	-	7.1
MMI000200	7.6	8.3	0.051		0.151	<1.0	-
MMI000204	7.7	8.4	0.108		0.198	<1.0	-
MMI000210	7.8	8.3	0.102		0.191	<1.0	-

[1]Calculated as per MfE 2018. Not a consent condition

The weather in the few days prior to the survey of 2 June was slightly wetter than usual (27 mm, or 7 mm/day, compared with an annual average of 6 mm/day). However, the Haehanga Stream and its tributaries were running very turbid. There was negligible discharge from the WTS in the days prior to this survey. RNZ used irrigation areas L2, L3, L4, and L6 in the days immediately prior to this survey. Any impacts upon water quality would be primarily evident at sites HHG000150, HHG000165, HHG000168, and HHG000190.

Surface water monitoring round six 2 June 2023 (Table 8) indicated the following:

- Temperature ranged 13.9–15.0 °C.
- Un-ionised ammonia was not found above the consent limit (0.025 g/m^3) at any location. The highest results reached only 15% of the limit. ranging up to 0.037 g/m^3. The most elevated concentrations were recorded through the lower catchment sites.
- Total ammoniacal concentrations increased significantly down through the catchment, by more than 30 x from the upper sites (0.034 and 0.036 g/m^3) to the bottom sites (0.83 and 1.13 g/m^3).
- Total ammoniacal nitrogen (NH_4) results with adjustment to pH 8 calculated in order to generate equivalent toxicity values increased noticeably in the mid and lower catchment of the Haehanga, and at the boundary of the property the equivalent ammonia toxicity reached 0.49 g/m^3, which exceeds the national maximum total ammonium concentration permitted by the NPS-FM (2020).
- pH ranged 6.9-7.2, a narrower range than typical.
- Electrical conductivity increased in concentration down the catchment as is typical, with a significant jump at the lowest site (HHG000190), indicating a localized inflow in the reach above it.
- Chloride concentration also increased down the catchment ranging 7.5-12.0 g/m^3 with a significant increase located at HGG000190, as with conductivity. However, levels of conductivity and chloride were lower than on other occasions, consistent with the heavy rainfall preceding the survey increasing dilution of site discharges.
- Carbonaceous biochemical oxygen demand (DCBOD) was recorded above laboratory limit of detection only at the bottom catchment site (RNZ boundary) at 7.1 g O_2/m^3. This concentration is more than 3.5 times the consented limit of 2.0 g/m^3, but the latter applies to filtered rather than total CBOD and so could not be taken as the basis for enforcement. This survey was the third survey in a row that RNZ were found to cause elevated BOD in surface water quality at the boundary site.
- *E. coli* monitoring fluctuated greatly ranging 1,400–40,000 cfu/100 ml, and counts generally increased downstream with the most elevated recorded at the lowest monitoring site in the catchment. *E. coli* concentrations at this site were some ten times higher than at the uppermost catchment sites.
- Impacts potentially related to runoff or infiltration seepage from irrigation activities in the days immediately preceding the survey appear at the sites in the lower Haehanga catchment.
- Effects upon the quality of the Mimitangiatua awa downstream of the confluence could be detected for most parameters, but changes were not significant and did not adversely affect the quality of the Mimitangiatua in terms of recognised standards and guidelines for safeguarding water quality.

2.2.3 Comparison of surface water quality in 2021-2022 with 2022-2023

Un-ionised ammonia

2021-2022

In each of the surveys of September and October 2021, one in-stream site (the in-stream site below the mixing zone of the WTS discharge) had had a concentration of un-ionised ammonia that breached the consent, and in the survey of May 2022, there had been multiple non-complying in-stream sites.

2022-2023

While in the August 2022 survey there were no sites breaching this condition, the October 2022 survey saw the concentration of un-ionised ammonia below the WTS discharge was again in excess of the consented

limit. No breach of the consent's un-ionised limit occurred in any of the surveys in December 2022 or January, March, June of 2023.

NPS-FM equivalent ammonia toxicity

The National Policy Statement for freshwater management (NPS-FM) became law in September 2020. Whilst the Council is only evaluating RNZ's environmental performance against its current consents, it is considered appropriate to reference the sites performance against attributes such as equivalent ammonia toxicity which are included in this new and current legislation.

2021-2022

In each of the surveys of September and October 2021, the calculated equivalent ammoniacal toxicity below the WTS breached the NPS-FM limit, and in the survey of May 2022, when equivalent toxicity is calculated, multiple downstream sites were found to be up to more than 25 times higher than the maximum total ammonium concentration permitted by the NPS-FM.

2022-2023

Likewise, in the August 2022 and October 2022 surveys there were multiple non-complying in-stream sites within the mid and lower Haehanga Stream, although the highest concentrations were not as high as they had been in May 2022. Total ammoniacal concentrations in the catchment in August 2022 were much lower than those of September 2021, but had risen significantly in October 2022 and were somewhat above those in October 2021. Total ammoniacal nitrogen concentrations were lower in the December 2022 survey, but there was still one site exceeding the national bottom line. This number increased in January 2023 to 2 sites, and again increased in March to 4 sites that showed non-compliance with the NPS-FM. However, in June only the boundary monitoring site contained a concentration of ammonia above the national limit.

Biochemical oxygen demand

2021-2022 and 2022-2023

While dissolved carbonaceous BOD was significantly elevated (non-complying) in the lower Haehanga catchment in May 2022, the pattern by August 2022 onwards had reverted to that observed in September and October 2021, and results were compliant at all sites measured for this parameter. However, in the second part of 2022-2023 water quality in respect of biochemical oxygen demand again deteriorated. The Haehanga Stream was subject to elevated biochemical oxygen demand at the downstream boundary in January 2023, while by March there were four sites in the lower catchment that were non-compliant, with elevated total CBOD at the property boundary. In the June survey, it was again found that RNZ were still causing elevated biochemical oxygen demand in the Haehanga Stream as it left their property. The limit is imposed to protect ecological health and prevent the outbreak of undesirable biological growths in surface waters.

Bacteriological quality

2021-2022 and 2022-2023

Bacteriological quality was generally unacceptably compromised throughout the Haehanga Stream, other than at upstream sites, in all surveys. Counts in the August 2022 survey were similar to those found in October 2021 and were lower than those in September 2021 and May 2022. Counts in October 2022 were higher than in August 2022, although not at the level of September 2021 and May 2022. Counts in December 2022 were higher again. In January 2023 several sites within the catchment were far in excess of the national limit, although not at the boundary; but in March 2023 multiple monitoring sites in all locations other than those above RNZ's operational areas exceeded the national limits, in some cases by orders of magnitude. The same was found in the June 2023 survey.

However, other than in the October 2022 survey, effects upon the bacteriological quality of the Mimitangiatua awa were not found to be significant.

Conclusions of inter-year comparison

Overall, in the 2021-2022 year, RNZ breached the BOD limit at their downstream boundary once out of 6 surveys. On this latter occasion, non-complying concentrations of BOD stretched through the lower catchment. On one occasions RNZ were found to have breached the un-ionised ammonia limit below the WTS discharge, in a tributary of the Haehanga Stream. Therefore, on two of six surface freshwater surveys, RNZ were found to be in non-compliance with their consent 5838-2.

Further, on all six surveys, the concentrations of total ammonia (adjusted for equivalent toxicity as per the NPS-FM) were found to exceed the national criteria set out in the NPS-FM at one or more monitoring sites within the Haehanga Stream, although on only two of these surveys was the NPS-FM for ammonia toxicity breached in water quality at the downstream boundary of the RNZ property. The NPS-FM national limit for *E. coli* was found to have been breached by RNZ on 5 surveys out of six at sites within the lower catchment, and on four of six occasions at the downstream boundary. While on occasion *E. coli* concentrations at the upstream sites exceeded the NPS-FM limit even prior to flowing past the composting and vermiculture facilities and activities of RNZ, on these occasions the latter caused very significant increases in microbiological pollution loadings within the stream.

Overall, in the 2022-2023 year, RNZ caused elevated total BOD at concentrations well above the filtered CBOD limit at their downstream boundary on 3 of 6 surveys. On one of these occasions, non-complying concentrations of BOD stretched through the lower catchment. On another occasion RNZ were found to have breached the un-ionised ammonia limit below the WTS discharge, in a tributary of the Haehanga Stream. Therefore, on four of six surface freshwater surveys, RNZ were found to be in prospective or actual non-compliance with their consent 5838-2. Further, on five of six surveys, the concentrations of both total ammonia (adjusted for equivalent toxicity as per the NPS-FM) and *E. coli* were found to exceed the national criteria set out in the NPS-FM. While on occasion *E. coli* concentrations at the upstream sites exceeded the NPS-FM limit even prior to flowing past the composting and vermiculture facilities and activities of RNZ, on these occasions the latter caused very significant increases in microbiological pollution loadings within the stream.

Significant pollution of the Haehanga Stream due to the activities of RNZ had been found in May 2022. The results from the following surveys undertaken in August 2022 and October 2022 more closely resembled those of surveys undertaken a year previously, while still showing a number of non-compliant results. The situation had improved somewhat by the December 2022 survey, but then deteriorated again. All three surveys in calendar year 2023 found at least one prospective or actual breach of the Company's consent. As in 2021-2022, the water quality of the Haehanga Stream in 2022-2023 continued to be degraded as it progressed down the catchment, in some cases again to the extent of breaching various recognised criteria. The majority of surface water surveys in the 2022-2023 monitoring year coincided with wetter than usual weather and thus increased dilution of discharges into the stream, and thus of concentrations of pollutants.

The number of surface freshwater surveys in 2022-2023 on which RNZ was found to be breaching their consent or national standards for discharges to land and water has increased from that in 2021-2022.

2.2.4 Continuous monitoring of surface water quality

In August 2022 the Council installed a continuous water quality monitoring station in the Haehanga Stream adjacent to the site offices (between HHG000165 and HHG000190). The station provides continuous records of water level in the stream and its temperature and conductivity. As sensors improve in performance, it is intended that additional sensors capable of providing reliable measurements of other parameters such as dissolved oxygen, ammonia, and nitrate will be added.

From inspection of the records of conductivity in Table 3 to Table 8 above, it was generally around 140-150 µS/cm in the upper catchment of the Haehanga Stream. With runoff, infiltration, and/or discharge from the activities of RNZ affecting water quality, it increased generally to around 180-190 µS/cm downstream, reflecting an increase in dissolved minerals of around 30-50 µS/cm. The discharge from the WTS always had a much higher conductivity, generally ranging 400-800 µS/cm. Notably, under very dry conditions conductivities at all sites were found to be considerably higher: on 25 January 2023 conductivity was measured at approximately 200 µS/cm upstream, 400-500 µS/cm downstream, and 800 µS/cm in the WTS. However, this was not the highest conductivity recorded in the discharge from the WTS during the year. On 23 March this reached around 1900 µS/cm. On this occasion the downstream conductivities were unusually elevated (around 210 µS/cm instead of a more typical 180-190 µS/cm), indicating the adverse influence of the WTS discharge on downstream water quality under some circumstances. In very wet conditions, conductivities fell at all sites, from 120 µS/cm upstream to 160 µS/cm downstream, and 200 µS/cm in the WTS discharge.

There is not a direct correlation between conductivity and critical measures of water pollution such as ammonia, biochemical oxygen demand, bacteriological contamination, or toxic concentrations of metals. However, a review of episodes of high conductivity will at least indicate events where there has been less than optimal dilution of discharges from RNZ activities and facilities into the Haehanga Stream. Noting that the regular surveys discussed above indicate that a typical downstream conductivity is around 180-190 µS/cm, rising to 210 µS/cm on one occasion when the WTS had unusually high conductivity and downstream water quality was compromised in terms of the Company's consent limit (BOD) and the NPS-FM (ammonia toxicity), a somewhat arbitrary and very conservative threshold of 250 µS/cm at the continuous water quality monitoring station (near the boundary site HHG000190) can be used to assess the Company's continuous environmental performance in respect of water quality.

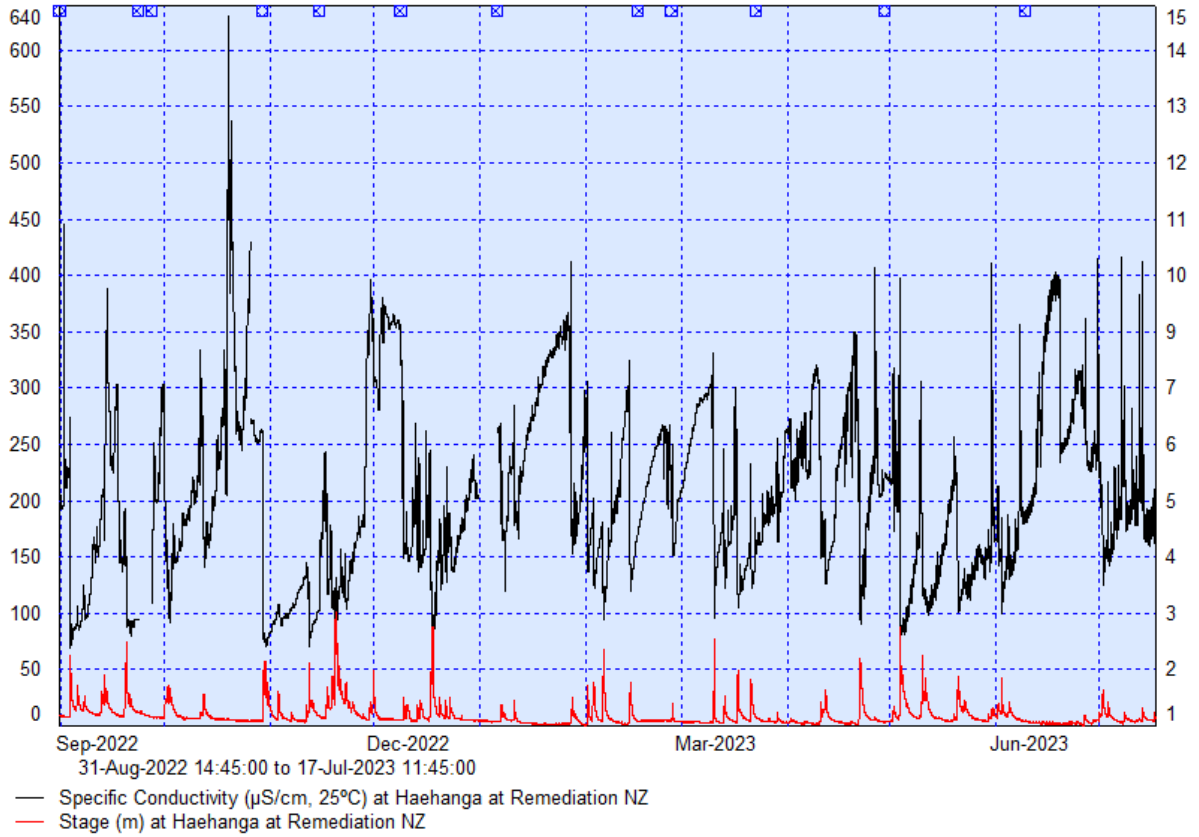


Figure 4 Continuous readings of conductivity in the lower Haehanga Stream 31 August 2022-17 July 2023

The graph above (Figure 4) presents the data from the conductivity sensor and flow height recorder since its installation and calibration. Hydrological officers have found that the probes are frequently fouled by debris within the stream, which would result in readings displaced from the actual conductivity in the main current of the stream. However, the overall patterns are clear. During dry periods (low stream flows), the conductivity gradually increases. This is a natural pattern, as deeper groundwaters have higher conductivity (due to concentrations of dissolved minerals following long exposure between minerals and groundwater) than rainfall runoff or shallow near-stream soil moisture. However, in the graph above, spikes of increasing conductivity can be observed superimposed on the natural pattern (eg the most obvious being around 19-20 October, but recurring throughout the year). These sharp peaks represent specific discharges of highly saline waters, which would be consistent with discharges from the wetland treatment system and/or irrigation direct deposition/runoff. In addition, the sustained trends of increasing conductivity above 250 µS/cm evident in early December and again in mid to late January and in early April suggest a significant compounding effect from irrigation runoff and/or infiltration throughout this period.

The Council conducted catchment water quality sampling surveys on 4 August (prior to continuous measurements of conductivity commencing); then 4 October and 14 December 2022; then 25 January, 23 March, and 2 June 2023. Of these dates, the survey on 23 March coincided with a period of increasing and highly fluctuating conductivity measurements, implying the discharges from the activities of RNZ were having some significant and immediate impact at this times. Likewise the survey of 25 January seems to have come towards the end of a period of increasing conductivity (and before a single spike that occurred a couple of days later), that was without particular individual spikes. This suggests a cumulative impact in January (eg from groundwater inflow into the Haehanga Stream) rather than a point source specific discharge event. It can be noted from Tables 6 and 7 above, that in-stream levels of ammonia, biochemical oxygen demand, and bacteriological contamination were worse in March than in January, which is consistent with direct wastewater discharges in March and indirect discharges in January being the respective primary sources of elevated conductivity on these two occasions,

The records of discharge events for the WTS that RNZ have supplied to the Council indicate minimal discharges from the WTS facility during dry periods during the year. This would indicate that the sharp spikes in the above graph relate rather to the effects of individual irrigation activities. There is some correlation between the periods of heavier application of irrigation wastewaters (total hours of pumping each day) in records provided by RNZ, and the spikes observed in the Haehanga Stream. For example examination of the pumping record indicates greater volumes discharged on 10-11 October, 17-19 October, 15 November, 4-5 and 9-10 December, and 25 April. This pattern would be confounded by factors such as the actual locations of placement of irrigation pods across irrigation paddocks, prevailing soil moisture deficit, evapotranspiration rates, and wind speed and direction. Nevertheless, the data suggest there is room for improved management of irrigation operations if direct and indirect impacts upon the water quality of the Haehanga Stream are to be avoided or minimised.

2.2.5 Metals in surface water

In addition to the analyses reported above, sites HHG000090, IND003008, and HHG000103, (ie above the site, the authorised WTS discharge, and the receiving waters) were analysed for total metals in each survey undertaken in 2022-2023. This is a result of the identification of contamination of the drilling waste stockpile through the use of treated sawdust in previous years. Arsenic, chromium, and copper are of particular concern.

Results are presented in Table 9 below.

Table 9 metals in surface water and WTS discharge

Site / Metal (total) g/m³		HHG000090 Upstream (baseline)	HHG000097 Tributary above WTS discharge	IND003008 WTS discharge	HHG000103 Tributary below WTS discharge	Reference criteria*
Arsenic	04/08/22	<0.0011	0.0013	0.0021	0.0013	0.024
	12/12/22	<0.0011	0.0016	0.0050	0.0018	
	25/01/23	<0.0011	0.019[1]	0.013	0.0026	
	23/03/23	<0.0011	0.0016	<0.011	0.0016	
	02/06/23	0.0031	0.0053	0.0023	0.0034	
Cadmium	04/08/22	<0.000053	<0.000053	<0.000053	<0.000053	0.0002
	12/12/22	<0.000053	<0.000053	<0.000053	<0.000053	
	25/01/23	<0.000053	<0.000053[1]	<0.000053	<0.000053	
	23/03/23	<0.000053	<0.000053	<0.000053	<0.000053	
	02/06/23	<0.000053	<0.000053	<0.000053	<0.000053	
Chromium	04/08/22	0.00098	0.0032	0.00060	0.0024	0.001 (CrVI)
	12/12/22	<0.00053	0.00095	0.00130	0.00093	
	25/01/23	0.00058	0.039[1]	0.0116	0.00105	
	23/03/23	0.00061	0.00069	<0.0053	0.00078	
	02/06/23	0.0086	0.0141	0.00131	0.0088	
Copper	04/08/22	0.0024	0.0045	0.0036	0.0038	0.0014
	12/12/22	0.0025	0.0029	0.0059	0.0033	
	25/01/23	0.00108	0.059[1]	0.043	0.0038	
	23/03/23	0.0020	0.0025	0.0122	0.0033	
	02/06/23	0.0108	0.0190	0.0031	0.0122	
Lead	04/08/22	0.00092	0.0027	0.00064	0.00191	0.0034
	12/12/22	0.00045	0.00081	0.00156	0.00087	
	25/01/23	<0.00011	0.034[1]	0.0104	0.00101	
	23/03/23	0.00028	0.00052	0.0022	0.00139	
	02/06/23	0.0096	0.0181	0.00114	0.0105	
Nickel	04/08/22	0.0032	0.0059	0.0036	0.0047	0.011
	12/12/22	0.0030	0.0041	0.0054	0.0041	
	25/01/23	0.0026	0.051[1]	0.023	0.0093	
	23/03/23	0.0026	0.0033	0.0119	0.0039	
	02/06/23	0.0129	0.021	0.0031	0.0134	
Zinc	04/08/22	0.0039	0.0115	0.0070	0.0078	0.008
	12/12/22	0.0016	0.0032	0.0133	0.0037	
	25/01/23	<0.0011	0.31[1]	0.22	0.0045	
	23/03/23	<0.0011	0.0016	0.059	0.0031	
	02/06/23	0.046	0.055	0.026	0.043	

*Australian and New Zealand Guidelines for Marine and Fresh Water Quality 2018, 95% protection of freshwater species

[1] All results for the sample designated HHG000097 and collected on 25 January 2023 are anomalous (see Table 6). Council staff consider this sample was collected from the wrong site. Data have been presented herein, but are not considered further.

Concentrations of total metals were relatively consistent between each sampling run through the year, except for the June 2023 survey.

Almost without exception, concentrations of metals below the WTS discharge were higher for each metal on every occasion than at the sampling site HHG000090 which is at the top of the catchment. However, there was no clear pattern of change between site HHG000097, which is the monitoring site above the WTS

discharge, and the next site downstream (below the WTS discharge). Given that the discharge from the WTS is intermittent, and that on at least two occasions Council officers noted there was no WTS discharge, this lack of pattern is not surprising.

The concentration of chromium in the tributary below the WTS mixing zone was frequently at or above the criterion for ecological protection. However, it should be noted that the criterion refers to Cr(VI), whereas the analysis reported above were for total chromium, and so results are not directly relatable to the criterion. The downstream concentrations of copper are more problematic. In every sampling run, copper was detected at above the recognised ecological threshold of adverse impact: usually at least double, and in June 2023 almost ten times higher than, the criterion.

The water quality on the last sampling occasion for the year was observed to be very turbid, with levels of suspended solids between 5 and 20 times higher than on any other freshwater survey in the 2022-2023 year. In this sampling run, the concentrations of various metals were the highest found in any of the surveys, and most metals exceeded their criteria (Australian and New Zealand Guidelines for Fresh and Marine Water Quality [ANZ WQ, 2018], using guideline for 95% protection of freshwater species). The sample from HHG000103, the downstream monitoring site for the WTS discharge, had a chromium concentration of 0.0088 g/m^3, almost 10 times higher than the criterion of 0.001 g/m^3; a copper concentration of 0.0122 g/m^3, almost 10 times the criterion of 0.0014 g/m^3; a lead concentration of 0.0105 g/m^3, three times the criterion of 0.0034 g/m^3; a nickel concentration of 0.0134 g/m^3, above the criterion of 0.011 g/m^3, and a zinc concentration of 0.043 g/m^3 , more than 5 times the criterion of 0.008 g/m^3.

Because analysis was for total rather than dissolved metals, the high turbidity (carrying metals adsorbed or chemically complexed onto particulate matter) would explain the comparatively elevated concentrations detected in June. It should be understood that both dissolved and total metals are of ecological concern, as the former can potentially have an immediate toxic effect while total metals (associated with particulate material) acts as a reservoir of metals that can be released into the aquatic environment on an ongoing basis, causing chronic toxic effects.

It is noted that dissolved copper is naturally high by comparison with recognised criteria for ecological protection within the catchment. This is a feature of the Taranaki landscape more broadly. However, the WTS is a source of copper and other metals in the catchment downstream of its discharge point.

2.2.6 Monitoring of surface water by PDP on behalf of the Company

As part of their Detailed Site Investigation into the extent of contamination across the Uruti property in February and July 2023[8], PDP undertook a comprehensive surface water survey across the property. Results and their implications were under Council review at the end of the year.

[8] Uruti Composting Facility Detailed Site Investigation prepared for Remediation New Zealand' August 2023, PDP (Draft)

2.2.7 Investigation and interception of Pad 3 seep into a tributary of the Haehanga Stream, by PDP on behalf of the Company

A routine monthly scheduled survey of the physico-chemical quality across the Haehanga catchment had been undertaken by the Council on 11 March 2022. Of particular significance were the anomalous results found in this survey at site HHG000106. HHG000106 is a sampling site in a small tributary that runs between, and is downslope of, Pad 1, the truckwash pond, the former Pad 3 raw wastes reception pit, and Pad 3 and the blended drilling wastes stockpile. By comparison with data for upstream sites in other tributaries or the main stem of the Haehanga Stream, markers such as total alkalinity, hardness, conductivity, chloride, and total ammoniacal nitrogen were elevated many times over. The Council considered the source(s) to likely to be from the stockpile, the holding pond previously used to receive wastes destined for Pad 3, and/or the truck-wash and irrigation ponds, as these have received run-off and leachate from Pad 3 and its dumping pond.

The point of seepage was to the east of the drilling wastes stockpile and several metres below it downslope. The point of seepage is shown below in Photo 1, by the white plastic standard.

Photo 1 Seepage into tributary of the Haehanga Stream

Remediation works have subsequently been implemented. A Council inspection on 28 April 2023 noted that an interception trench had been excavated across the southern area between the pad and the tributary, and was being backfilled with papa rock in order to create a barrier to further flow. Surface stormwater drains were being re-configured to abate overland flow in the same direction.

2.3 Results of receiving environment (surface water) biomonitoring

Macroinvertebrate monitoring survey

One biomonitoring survey was scheduled for the 2022-2023 year. The Council's standard 'kick-sampling' technique was used at eight established sites to collect streambed macroinvertebrates from an unnamed tributary and the main stem of the Haehanga Stream, and a reference site in the Waikekeho Stream, on 11 April 2023. Samples were processed to provide the number of taxa (richness), MCI and $SQMCI_S$ scores for each site. The sites used in the survey are described in Table 10 and shown in Figure 3.

Table 10 Current biomonitoring sites in the Haehanga Stream catchment and comparable reference site

Site	Site Code	GPS coordinates (Easting- Northing)	Location
1	HHG000090	1732685-5684577	Upstream of upper irrigation area
2	HHG000100	1732272-5684972	Downstream of upper irrigation area
T2	HHG000098	1732747-5685043	Tributary: upstream of wetland discharge point
T3	HHG000103	1732692-5685042	Tributary: downstream of wetland discharge point
5	HHG000115	1732124-5685478	Main stem, 25 m downstream of last pond and swale collection area (composting and wastewater facilities)
6	HHG000150	1731673-5685796	30 m downstream of lower irrigation area
7	HHG000190	1731611-5686514	50 m upstream of State Highway 3 bridge
RS*	WKE000800	1735152-5684987	Waikekeho Stream, 10 m upstream of old Ri Rd. bridge

* RS site had incorrect coordinates displayed from the previous report (KC031)

Significant changes or low scores in any of the number of taxa, the MCI, or the $SQMCI_S$ between sites indicate the degree of adverse effects (if any) of the discharges being monitored. Differences in habitat or in flow regimes will also affect the results and may mask the effects of a toxic discharge.

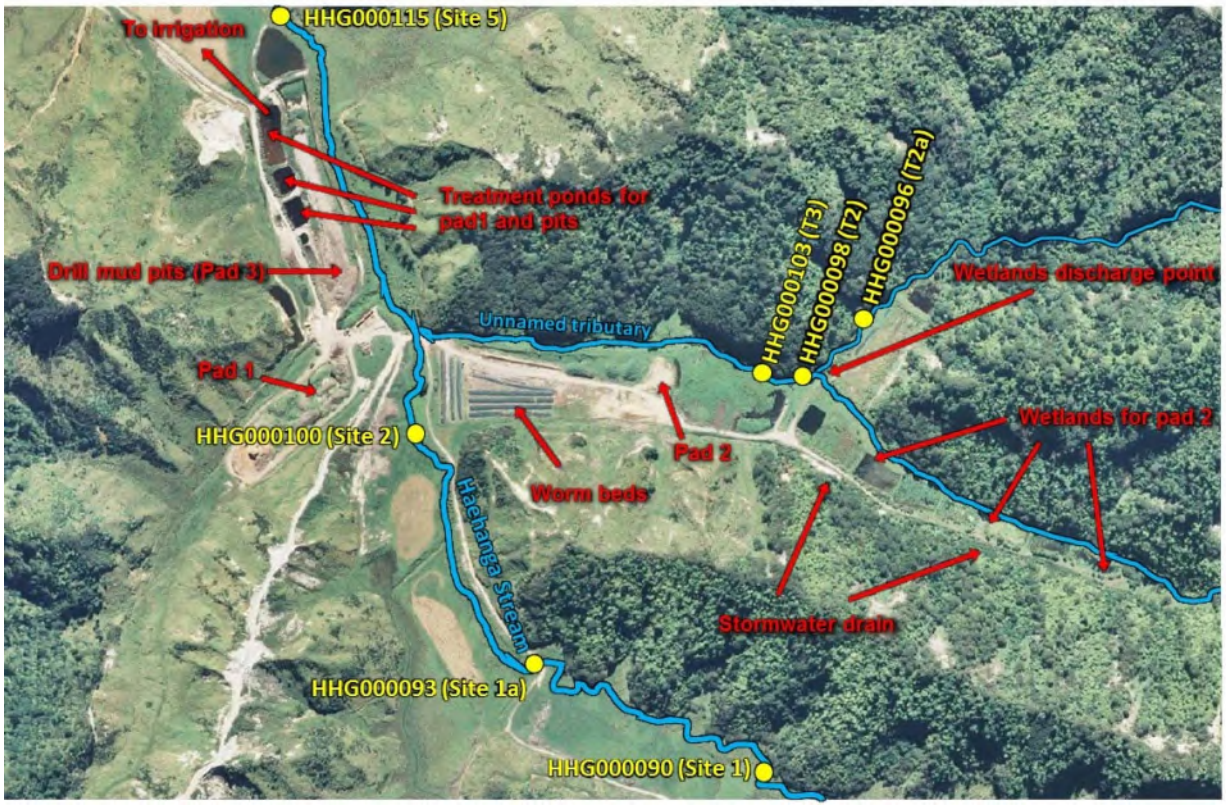


Figure 5 Map of upper Remediation NZ Ltd activities with former (designated with an 'a' after number) and current sampling sites

Figure 6 Map of the downstream sites in the Haehanga Stream

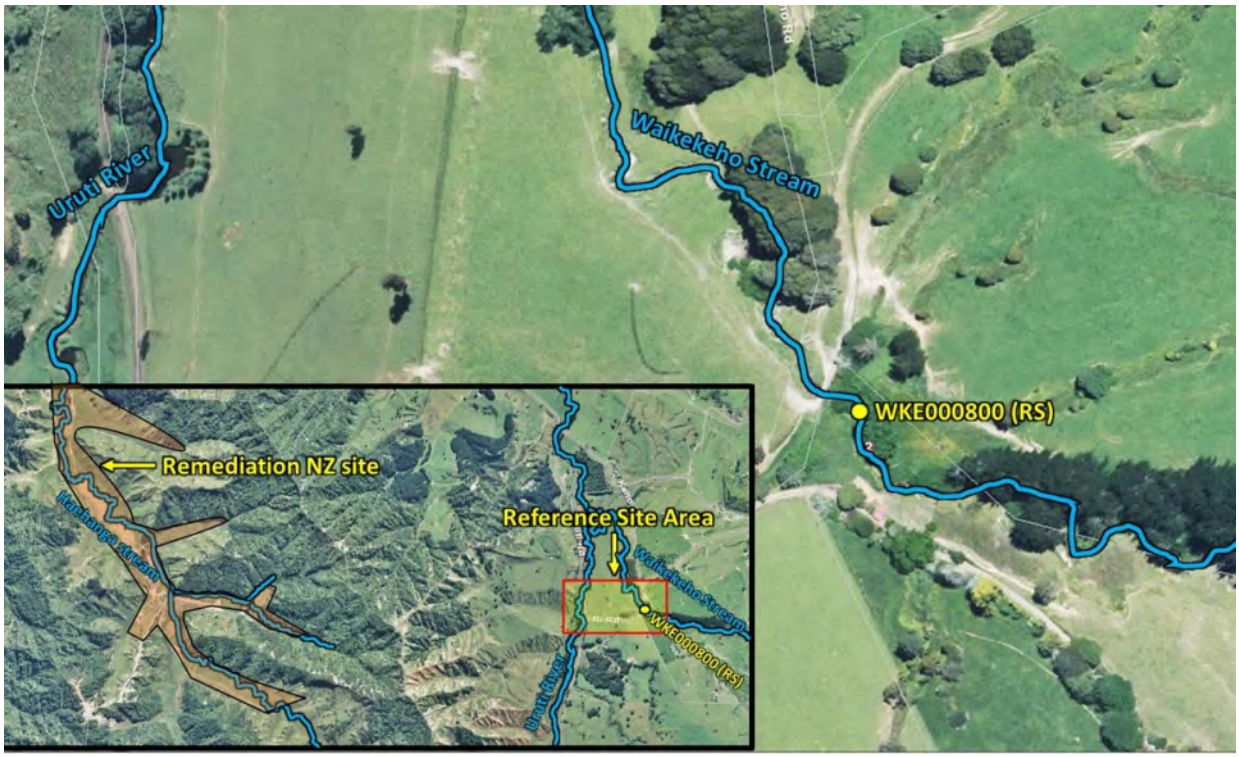


Figure 7 Small map of the reference site in relation to Remediation NZ Ltd. Small reference site box, outlined in red, is enlarged to show the Waikekeho Stream and Uruti River

The macroinvertebrate survey conducted on 11 April 2023, was performed 13 days after a fresh in excess of three times median flow and 14 days after a fresh in excess of seven times median flow as measured in a nearby catchment. Sites 1, 2, and 7 in the main stem, T2 and T3 in the tributary, and the reference site all had very high levels of siltation. Water quality at all sites was dirty, with moderate flows that at most sites had steady flow. Site 1 is a ponded rather than a riffle habitat. These conditions were quite different from those prevailing during the survey undertaken in the previous year (January 2022), which observed very low flows in the Haehanga catchment with either very slow or still water at all sites, after a prolonged period of dry weather. The results are presented in Table 11 below.

Table 11 Number of taxa, MCI and SQMCI values recorded in the Haehanga Stream catchment and reference stream in earlier, the last, and the current survey, together with a summary of results from control sites in comparable lowland hill country streams (LOWL) in Taranaki (TRC, 1999) (Updated to September 2021)

Site	N	Numbers of taxa				MCI values				SQMCI values				
		Range	Median	Previous Survey	Current Survey	Range	Median	Previous Survey	Current Survey	N	Range	Median	Previous Survey	Current Survey
LOWL	32	11-30	21	-	-	62-109	79	-	-	32	2.6-7.2	4.2	-	-
1a*	14	17-27	21	-	-	62-78	71	-	-	21	2.6-4.2	3.9	-	-
1	4	12-16	14	14	12	63-77	72	77	73	4	2.6-3.6	3.2	3.6	1.9
2	26	13-23	18	13	13	62-99	74	68	86	26	2.7-5.7	4.0	4.0	4.5
5	25	6-28	19	15	12	53-88	73	71	83	25	1.1-4.3	3.0	2.4	1.9
6	12	6-24	16	11	15	57-88	69	67	68	12	1-4	2.9	2.4	1.8
7	21	12-30	19	15	7	56-82	71	76	91	21	1.3-4.3	3.5	3.5	3.7
T2	12	12-30	22	12	13	79-104	87	88	92	12	3.8-7.2	5.2	5.3	5.2

Site	N	Numbers of taxa				MCI values				SQMCI values				
		Range	Median	Previous Survey	Current Survey	Range	Median	Previous Survey	Current Survey	N	Range	Median	Previous Survey	Current Survey
T2a**	1	-	19	-	-	-	-	105	-	1	-	-	5.6	-
T3	14	18-32	25	21	15	78-93	84	85	92	14	3.5-5.4	4.4	4.2	4.4
RS	2	17-20	19	17	11	73-97	85	73	87	2	3.3-4.2	3.8	3.3	5.8

* Former control site at HHG000093

** Site previously recorded as HHG000098 but now changed to HHG000096 (see TRC, 2022 for further details)

Macroinvertebrates were identified and the number of different types of taxa counted (taxa richness), and MCI and SQMCI scores were calculated for each site. The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of nutrient pollution in streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to pollution. The SQMCI takes into account taxa abundance as well as sensitivity to pollution, and may reveal more subtle changes in communities. Significant differences in either the MCI or the SQMCI between sites indicate the degree of adverse effects (if any) of the discharges being monitored and enable the overall health of the macroinvertebrate communities to be determined.

Macroinvertebrate taxa richness was moderate (12-15 taxa) throughout the Haehanga catchment, with the exception of site 7, which had a low richness of seven taxa. This is the lowest number of taxa ever found at this downstream site. Likewise, Site T3 (below the discharge from the WTS) had the lowest number of taxa ever found. However, it is noted that on this occasion the reference site also had the lowest number of taxa found (although from a much smaller database). All sites had fewer taxa present than the median of all counts recorded to date.

MCI scores indicated that sites in the main stem of the Haehanga Stream were of 'poor' to fair' health, while sites in the unnamed tributary were in 'fair' health. With the exception of site 6, all sites recorded MCI scores higher than the median, with significantly higher MCI scores recorded at both sites 2 and 7 (by 12 and 20 MCI units respectively). Site 1 recorded a slightly lower MCI score to that recorded previously, while the remaining scores recorded higher MCI scores. In comparison to the previous survey, significant increases in MCI score were recorded at sites 2, 5, 7 and RS.

SQMCI scores indicated that sites 1, 5 and 6 were in "very poor" health, site 7 was in "poor' health, site 2 and T3 were in "fair" health and sites T2 and RS were in "good" health. The SQMCI recorded at site 1 was significantly lower than both the median and previous survey score, while the SQMCI scores at sites 5 and 6 were lower than the previous survey scores and significantly lower than their respective medians. Site RS was the only site that recorded a SQMCI significantly higher than the site median and previous survey score.

Overall, macroinvertebrate community health in the main stem of the Haehanga Stream can be regarded as poor, being dominated by pollution tolerant taxa, which is likely a result of poor habitat quality. The unnamed tributary has better habitat quality and subsequently overall better macroinvertebrate health. In order to have strong confidence in the results, comparisons with sites with the same habitat features are necessary. Both the control (site 1) and reference (site RS) sites have habitat features that differ to the main Haehanga Stream stem and unnamed tributary and therefore caution is needed when making direct comparisons.

There was no evidence indicating that Remediation NZ activities were causing discharges that had direct toxic effects, as evidenced by taxa numbers and abundances. There was also no evidence based on MCI scores or SQMCI scores of any significant effects. Given the poor habitat at the time of sampling the results do not provide sufficient evidence to conclude that Remediation NZ was having any significant effect on macroinvertebrate communities in the Haehanga catchment.

It should be noted that poor established habitat conditions and flow conditions at the time of the survey could have masked any effects of direct or diffuse discharges from the activities of RNZ on the property, as sensitive taxa would be sparse or absent in any case (as was found to be the situation in this survey).

Copies of biomonitoring reports for this property are available from the Council upon request.

2.4 Groundwater

2.4.1 Introduction

The groundwater bores have been installed primarily to enable assessment of the direct effects upon groundwater beneath the irrigation areas, in order to (a) determine effects of wastewater discharges on groundwater quality and (b) to ascertain whether pasture is able to assimilate the wastewater nitrogen loadings, or alternatively is being overwhelmed leading to nitrogen leakage. The placement of the bores has not been designed specifically to determine the quality of groundwater at time and point of egress into the Haehanga Stream, although they are located on the downgradient side of the irrigation areas so as to capture cumulative effects of irrigation loadings. There will be continuing processes of attenuation and transformation within the system of shallow aquifers across the site.

Key measures within the groundwater analytical programme are any changes in ionic strength (measured by conductivity, total dissolved solids, sodium, and chloride), sodicity, which affects the integrity of the soil structure (measured by ratios between sodium, calcium, and magnesium), the nitrogen loading (measured by ammoniacal and nitrate nitrogen species), and any evidence of the leaching of potentially toxic substances (hydrocarbons, LOSP preservatives, and the metals arsenic, barium, copper, and chromium). Analytes are listed in full in Table 2, and the results are presented in section 2.4.2 below.

Seven bores were monitored in two surveys during the year under review, on 6 & 7 October 2022 and 1, 2, & 6 June 2023.

In the four days prior to the collection of groundwater samples on 6 October 2022, there had been considerable rainfall recorded by the Council at a site a few kilometres south of the Haehanga catchment. Fifty-five mm of rain had fallen on 2-3 October. The average daily rainfall at the meteorological station is 6.0 mm. Another 7 mm fell on 6 October. This precipitation would tend to raise groundwater levels and dilute the concentrations of contamination in groundwater sampled in the first survey.

In the four days prior to the survey conducted over the period 1-6 June 2023, there was considerable rainfall 26 mm on 30-31 May (13 mm daily average, or double the annual daily average), minimal rain on 1 June, and then another 22 mm on 2-3 June and 10 mm on 5 June. As with the earlier Council survey, the recent rainfall prior to sampling would tend to dilute pre-existing contamination in the groundwater.

Irrigation records provided to the Council by RNZ indicate that there was minimal discharge of spray irrigation in the days prior to the groundwater sampling in 6-7 October 2022: nothing recorded on 2 October; 21 m^3 to each of L1, L4, and U3 on 3 October; 21 m^3 to U3 alone on each of 4 and 5 October; and no irrigation anywhere on 6 October. Groundwater bore GND3010 is located within irrigation area U3, while GND3008 is downslope of both L1 and L6 and may intercept the effects of use of L1. There is no monitoring of groundwater beneath L4.

The irrigation records provided by RNZ indicate that prior to the PDP survey on 23 February 2023, there had been no irrigation to any disposal field for 20 days. Given the absence of both rainfall and irrigation activity, the concentrations of contaminants recorded by the PDP survey will provide a representation of baseline or long-term groundwater quality. Concentrations of contaminants under such circumstances will tend to be elevated due to the lack of dilution by rainfall and the evapotranspiration of shallow groundwater.

The irrigation records provided by RNZ indicate that prior to the second Council survey undertaken across the period 1-6 June 2023, irrigation areas L2, L3, L4, and L6 had received light to moderate loadings of irrigation wastewater. In particular, on 31 May, 48 m^3 had been applied to each of the four areas. Groundwater quality beneath L2 is monitored by GND2190; L3 by GND 3009; and L6 by GND3008.

Figure 8 Locations of groundwater monitoring wells RNZ Uruti

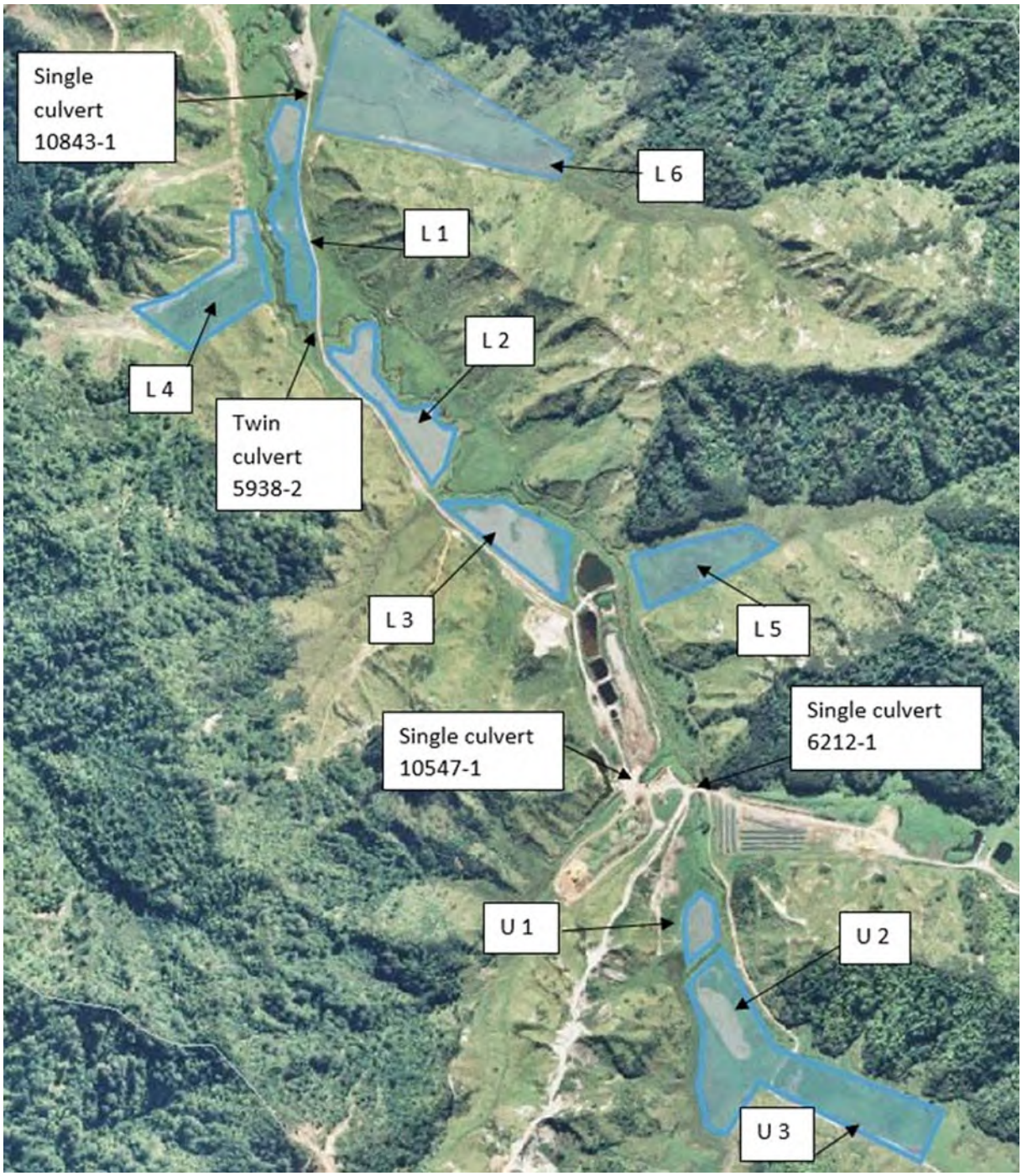


Figure 9 Irrigation areas and stream culverts RNZ Uruti

2.4.2 Results

The results from the two Council groundwater monitoring rounds, are displayed below in Table 12 to Table 13.

Table 12 GND2188 2022-2023 monitoring

GND2188	Date	6 Oct 2022	2 Jun 2023
Parameter	NZST	10:00	12:23
Level	M		
Sample Temperature	°C	13.4	15.6
pH	pH Units	6.7	6.4
Free Ammonia	g/m³	0.0042	0.000122
Total Ammoniacal-N	g/m³	2.8	0.156
Nitrate-N + Nitrite-N (NNN)	g/m³	1.14	0.140
Electrical Conductivity (EC)	mS/m	49.7	19.3
Electrical Conductivity (EC)	µS/cm	497	193
Total Dissolved Solids (TDS)	g/m³	260	140
Dissolved Barium	g/m³	0.060	0.037
Acid Soluble Barium	g/m³	<0.11	<0.11
Total Calcium	g/m³	47	14.2
Total Magnesium	g/m³	10.0	3.3
Total Sodium	g/m³	19.7	7.2
Chloride	g/m³	31	2.2
Organonitro & phosphorus Pesticides Screen in MR Water Liq/liq			
Tebuconazole	g/m³	0.00008	-
BTEX in Water by Headspace GC-MS			
Benzene	g/m³	< 0.0010	< 0.0010
Toluene	g/m³	< 0.0010	< 0.0010
Ethylbenzene	g/m³	< 0.0010	< 0.0010
m&p-Xylene	g/m³	< 0.002	< 0.002
o-Xylene	g/m³	< 0.0010	< 0.0010
Total Petroleum Hydrocarbons in Water			
C7 - C9	g/m³	< 0.10	-
C10 - C14	g/m³	< 0.20	-
C15 - C36	g/m³	< 0.40	-
Total hydrocarbons (C7 - C36)	g/m³	< 0.70	-

GND2188 is located to south west of the site, within irrigation area U2. This was previously the old control bore, prior to the expansion of the irrigation areas southwards (upslope). U2 was lightly loaded (kg N/ha) with effluent during the 2021-2022 period- it was used the least out of all zones that were available for that entire year. Likewise in the year under review, it received the second lightest loading rate, with minimal use particularly in April-June (i.e. prior to the second Council survey).

Several groundwater quality markers show that it was used for wastewater irrigation between June 2022 and the first survey in the year under review (October 2022). Total ammoniacal nitrogen, nitrate, calcium,

dissolved barium, sodium, chloride and conductivity all increased from June 2022 and by comparison with the survey 12 months previously (October 2021), generally by around 2-3 times.

Over the course of the 2022-2023 year:

- pH results maintained a weakly acidic concentration, ranging 6.4–6.7 pH throughout the year. These results were within the range for 2021-2022.
- By the end of the year, electrical conductivity (EC) was lower than at any time in the 2021-2022 year. Long term monitoring of this analyte had indicated a slow and steady increase over time (since 2011), but with a recent reduction (Figure 10).
- Total dissolved solids followed a similar trend to the EC, with a reduction from the peak observed in March 2022 and the June 2023 result being lower than in any result in the previous year.
- Dissolved barium remained measurable and fairly consistent across the monitoring period, ranging 0.037–0.060 g/m^3. These results were within the range found in 2021-2022. Barium is relatively immobile in soils, but there is a suggestion of a slight continuing decrease since a peak in March 2022.
- Acid soluble barium was below the LOD for the entire period, as in 2021-2022.
- Chloride results ranged 2.2–31.0 g/m^3, decreasing steadily during the year. The result on 2.2 g/m^3 in June 2023 was much lower than observed during the previous year.
- Total ammoniacal nitrogen (NH_4) ranged 0.156–2.8 g/m^3, and decreased during the year, while NNN ranged 0.053–1.14 g/m^3. The latter were higher than in the 2021-2022 year, and are consistent with the biologically driven processes of nitrification of ammonia to nitrate (decreasing the former, increasing the latter) followed by denitrification to nitrous oxide gas and elimination from the groundwater system.
- NH_4 has decreased drastically since the most elevated recorded level of 22 g/m^3 in February 2021.
- The pesticide tebuconazole previously detected in the treated sawdust (along with other LOSP chemicals) blended with drilling wastes on Pad 3 was detected in the irrigation field groundwater on the first sampling occasion only. Tebuconazole is known to have a relatively short half-life in soils and groundwater. It appears that the LOSPs have been spread across the site through the application of the irrigated wastewater (they are routinely detected in the wastewater storage pond surveys).
- However, no hydrocarbons were detected on any occasion.
- In summary, the results in 2022-2023 indicate that there was a greater application of wastewater to the area around GND2188 in the first part of 2022-2023, but reduced use of the uppermost irrigation fields for wastewater disposal by the Company in the second half of the year under review, with recovery of the groundwater in the vicinity of GND2188 from a peak in concentrations of contaminants that had been observed in March 2022.

Table 13 GND2189 2022-2023 monitoring

GND2189	Date	6 Oct 2022	2 Jun 2023
Parameter	NZST	11:00	13:45
Level	M	-	
Sample Temperature	°C	12.6	14.7
pH	pH Units	5.6	6.3
Free Ammonia	g/m³	0.000027	0.000064
Total Ammoniacal-N	g/m³	0.23	0.105
Nitrate-N + Nitrite-N	g/m³	0.040	0.026
Electrical Conductivity (EC)	mS/m	43.3	20.5
Electrical Conductivity (EC)	µS/cm	433	205
Total Dissolved Solids (TDS)	g/m³	240	124
Dissolved Barium	g/m³	0.179	0.138
Acid Soluble Barium	g/m³	0.17	0.14
Total Calcium	g/m³	20	13.5
Total Magnesium	g/m³	5.9	3.2
Total Sodium	g/m³	35	14.8
Chloride	g/m³	105	36
BTEX in Water by Headspace GC-MS			
Benzene	g/m³	< 0.0010	< 0.0010
Toluene	g/m³	< 0.0010	< 0.0010
Ethylbenzene	g/m³	< 0.0010	< 0.0010
m&p-Xylene	g/m³	< 0.002	< 0.002
o-Xylene	g/m³	< 0.0010	< 0.0010
Total Petroleum Hydrocarbons in Water			
C7 - C9	g/m³	< 0.10	< 0.10
C10 - C14	g/m³	< 0.20	< 0.20
C15 - C36	g/m³	< 0.40	< 0.40
Total hydrocarbons (C7 - C36)	g/m³	< 0.70	< 0.70

GND2189 is located on the northern end (ie on the down gradient) of irrigation area U1. U1 was heavily loaded with wastewater at some time or times during 2021-2022, and this was shown in a range of parameters up to the survey of March 2022. Since March 2022, markers such as conductivity, total dissolved solids, calcium, magnesium, chloride, and total ammoniacal nitrogen showed continuing decreases, including in the October 2022 survey.

Over the course of the 2022-2023 year:

- pH fluctuated by 0.7 units this monitoring period, between 5.6 and 6.3,, and remained weakly acidic, tending slightly less acidic throughout the monitoring period. These results were similar to those observed in the 2021-2022 year.
- EC dropped by about half during the year. Both results were lower than any recorded to 2021-2022, and show a short-term trend of continuing reduction since March 2022.
- TDS also demonstrated the same pattern and conductivity.
- Results for both dissolved and acid soluble barium suggested a slight reduction during the monitoring period, and both were lower than for any measurement of barium in 2021-2022.

- Chloride had dropped significantly by the end of the monitoring period.
- Total ammoniacal nitrogen remained below 1 g/m^3 across all three monitoring surveys, and in the last dropped significantly from what had been a plateau.
- Nitrate nitrite nitrogen (NNN) remained very low across the year, continuing the range of values observed in 2021-2022.
- BTEX and TPH were below the LOD across all three monitoring surveys.
- In summary, the results in 2022-2023 indicate that there was minimal application of wastewater to the area around GND2189 in the first part of 2022-2023, but there was increasing use of the upper irrigation fields for wastewater disposal by the Company in the second half of the year under review as shown by their irrigation records. Overall, the quality of the groundwater in the vicinity of GND2189 is recovering from a peak in concentrations of contaminants that had been observed in March 2022, and even higher concentrations in earlier years.

Table 14 GND2190 2022-2023 monitoring

GND2190	Date	6 Oct 2022	1 Jun 2023
Parameter	NZST	13:25	12:55
Level	M		
Sample Temperature	°C	14.5	
pH	pH Units	5.4	5.9
Free Ammonia	g/m³	0.000024	0.000123
Total Ammoniacal-N	g/m³	0.32	0.37
Nitrate-N + Nitrite-N	g/m³	0.26	0.32
Electrical Conductivity (EC)	mS/m	171.8	147.4
Electrical Conductivity (EC)	µS/cm	1718	1474
Total Dissolved Solids (TDS)	g/m³	980	810
Dissolved Barium	g/m³	0.94	0.74
Acid Soluble Barium	g/m³	0.90	0.74
Total Calcium	g/m³	69	57
Total Magnesium	g/m³	11.2	9.0
Total Sodium	g/m³	145	131
Chloride	g/m³	470	380
BTEX in Water by Headspace GC-MS			
Benzene	g/m³	< 0.0010	< 0.0010
Toluene	g/m³	< 0.0010	< 0.0010
Ethylbenzene	g/m³	< 0.0010	< 0.0010
m&p-Xylene	g/m³	< 0.002	< 0.002
o-Xylene	g/m³	< 0.0010	< 0.0010
Total Petroleum Hydrocarbons in Water			
C7 - C9	g/m³	< 0.10	< 0.10
C10 - C14	g/m³	< 0.20	< 0.20
C15 - C36	g/m³	< 0.40	< 0.40
Total hydrocarbons (C7 - C36)	g/m³	< 0.70	< 0.70

GND2190 is located within irrigation area L2. Area L2 had been subject to particularly high wastewater loading at some time or times during the 2021-2022 year. The consequences of this were particularly evident in markers such as conductivity and total dissolved solids, total ammoniacal nitrogen, and nitrate nitrogen during that year. Conductivity was decreasing in the last survey of 2021-2022, and this decrease continued in the first survey of 2022-2023 (October). Nitrate and total ammonia had also reduced in the October 2022 by comparison with peaks observed during 2021-2022. However, more persistent species such as conductivity, total dissolved solids, calcium, magnesium, sodium, chloride, and barium remained higher than they had been in the equivalent survey 12 months previously (October 2021), and were similar to the immediately previous survey of June 2022.

Irrigation records provided by RNZ show that area L2 had received a moderate loading of irrigation wastewater immediately prior to the 1 June 2023 survey. In particular, on 31 May, 48 m^3 had been applied to the area. More broadly, L2 received the second highest loading rate (kg N/ha) of any area in the 2022-2023 year. This area consistently has one of the highest concentrations of markers such as sodium and conductivity (Figures 7 and 10).

A by the Council on 1 June 2023 for organonitrogen and organophosphate pesticides found no detectable traces.

Over the course of the 2022-2023 year:

- Groundwater pH remained relatively stable this monitoring period. All results were in the moderately acidic range (<6.0 pH), although the result in June 2023 was higher (closer to neutral) than had been observed at any time in 2021-2022.
- EC results remained elevated and within the range of 2021-2022, during the monitoring period.
- TDS likewise remained elevated and within the range observed in 2021-2022.
- Dissolved and acid soluble barium had peaked in November in 2021. The results in the year under review were similar to those observed in June 2022, and were still well above those observed at the start of the 2021-2022 year.
- Sodium remained elevated throughout the monitoring period, and remained at the concentration observed at the end of the previous monitoring period, though it is noted that this analyte was lower than the levels that have been typical (250 g/m^3 +/-) since August 2019.
- Chloride showed a similar pattern to sodium within this monitoring period, although again has decreased overall since earlier periods, (900 g/m^3 +/-).
- Dissolved inorganic nitrogen (DIN, NNN+NH_4) remained low across all monitoring rounds, much reduced from the peak (1.66 g/m^3) seen at the end of the previous year. This latter result indicated stabilisation (oxidation) of ammonia nitrogen species under aerobic groundwater conditions, to nitrate, and the more recent denitrification of nitrate in the year under review.
- BTEX and TPH were not recorded above the LOD.
- In summary, the results for analysis of groundwater at bore GND 2190 suggest minimal use of the irrigation field L2 for the disposal of wastewater during the 2022-2023 year, and consequently some recovery of groundwater quality in the vicinity. Conductivity/salinity remain elevated and will only dissipate by non-usage of the area by the Company and natural attenuation by rainfall and migration.

Table 15 GND3007 2022-2023 monitoring

GND3007	Date	7 Oct 2022	6 Jun 2023
Parameter	NZST	10:37	12:50
Level	M		
Sample Temperature	°C	14.4	15.5
pH	pH Units	5.8	5.8
Free Ammonia	g/m³	<0.00001	0.000012
Total Ammoniacal-N	g/m³	0.041	0.058
Nitrate-N + Nitrite-N	g/m³	0.154	0.046
Electrical Conductivity (EC)	mS/m	13.2	12.2
Electrical Conductivity (EC)	µS/cm	132	122
Total Dissolved Solids (TDS)	g/m³	84	78
Dissolved Barium	g/m³	0.032	0.025
Acid Soluble Barium	g/m³	<0.11	<0.11
Total Calcium	g/m³	8.3	8.3
Total Magnesium	g/m³	2.4	2.5
Total Sodium	g/m³	8.0	8.0
Chloride	g/m³	10.2	6.4
BTEX in Water by Headspace GC-MS			
Benzene	g/m³	< 0.0010	< 0.0010
Toluene	g/m³	< 0.0010	< 0.0010
Ethylbenzene	g/m³	< 0.0010	< 0.0010
m&p-Xylene	g/m³	< 0.002	< 0.002
o-Xylene	g/m³	< 0.0010	<0.0010
Total Petroleum Hydrocarbons in Water			
C7 - C9	g/m³	< 0.10	< 0.10
C10 - C14	g/m³	< 0.20	< 0.20
C15 - C36	g/m³	< 0.40	< 0.40
Total hydrocarbons (C7 - C36)	g/m³	< 0.70	< 0.70

GND3007 is located at the entrance of the site, in close proximity to the State Highway. The bore therefore lies between the RNZ irrigation zones and downslope receptors offsite, while noting that much of the groundwater within the RNZ property in all likelihood flows more directly towards the Haehanga Stream rather than parallel to the stream and via any aquifer system in the proximity of GND3007. It is considered that groundwater in this locality is unlikely to show a significant influence from the activities of RNZ, but GND3007 has been installed to provide certainty around the potential for offsite effects. The bore consistently shows the lowest levels of markers of contamination, of any bore (Figures 7 to 10).

Analytical results in the first survey of the year under review (October 2022) for most parameters were very similar to those found in the equivalent survey 12 months previously, with slight reductions for parameters such as chloride, sodium, magnesium, and calcium. Likewise, the results in October 2022 were generally very similar to those in the immediate previous survey (June 2022).

Over the course of the 2022-2023 year:

- Un-ionised ammonia and total ammoniacal nitrogen concentrations remained at very low levels, having been considerably higher two years previously year (a peak of 1.56 g/m^3 in 2020-2021).
- pH remained lightly acidic across the two monitoring events, and within the range observed in 2021-2022.
- EC and dissolved solids results remained within the range observed in 2021-2022.
- Dissolved barium remained within the range observed in 2021-2022 in the two Council surveys.
- Both sodium and chloride remained stable and of low concentrations across all monitoring events. Chloride appeared lower than in 2021-2022 surveys.
- Nitrate-nitrite nitrogen remained at low concentrations across both monitoring events, although relatively higher than in 2021-2022; this may reflect nitrification of a slightly elevated ammonia observed in March 2022.
- BTEX and TPH remained below the LOD across all four monitoring events.
- The data indicates that minimal migration of contaminants due to irrigation practices is reaching the boundary of the property. RNZ commenced using a new irrigation area (L6) during the 2021-2022 year, which is in closer proximity to bore GND 3007 than other fields. The question will be whether the current lack of impact is maintained, or whether elevated concentrations of various parameters occasionally found in previous years will recur.

Table 16 GND3008 2022-2023 monitoring

GND3008	Date	7 Oct 2022	2 Jun 2023
Parameter	NZST	09:00	15:01
Level	M		
Sample Temperature	°C	13.9	15.6
pH	pH Units	6.3	6.5
Free Ammonia	g/m³	0.00082	0.00052
Total Ammoniacal-N	g/m³	1.29	0.42
Nitrate-N + Nitrite-N	g/m³	1.52	4.9
Electrical Conductivity (EC)	mS/m	77.3	74.0
Electrical Conductivity (EC)	µS/cm	773	740
Total Dissolved Solids (TDS)	g/m³	450	440
Dissolved Barium	g/m³	0.26	0.29
Acid Soluble Barium	g/m³	0.25	0.28
Total Calcium	g/m³	60	61
Total Magnesium	g/m³	14.3	15.4
Total Sodium	g/m³	46	40
Chloride	g/m³	149	122
BTEX in Water by Headspace GC-MS			
Benzene	g/m³	< 0.0010	< 0.0010
Toluene	g/m³	< 0.0010	< 0.0010
Ethylbenzene	g/m³	< 0.0010	< 0.0010
m&p-Xylene	g/m³	< 0.002	< 0.002
o-Xylene	g/m³	< 0.0010	< 0.0010
Total Petroleum Hydrocarbons in Water			
C7 - C9	g/m³	< 0.10	< 0.10
C10 - C14	g/m³	< 0.20	< 0.20
C15 - C36	g/m³	< 0.40	< 0.40
Total hydrocarbons (C7 - C36)	g/m³	< 0.70	< 0.70

GND3008 is located on the northern (downslope) end of irrigation area L1 and the western fringe of L6. L1 had received a relatively high loading of wastewater at some time or times during the previous (2021-2022) year, well in excess of the consented limit, while on the other hand L6 had received the lightest loading of all zones as it was used only since April 2022. Total ammonia concentration had peaked in March 2022, and nitrate nitrogen peaked 6 months later, in the first survey of the year under review (October 2022). A shift from peak ammonia to peak nitrate is the expected pattern of transformation of applied nitrogen over time.

Analytical results in October 2022 were generally the same as (un-ionised ammonia, dissolved and acid-soluble barium) or lower than (conductivity, TDS, calcium, magnesium, sodium, chloride) those found in October 2021. However, nitrate nitrogen and dissolved inorganic nitrogen (total ammoniacal nitrogen + nitrate-nitrite nitrogen) peaked in October 2022. Concentrations of most parameters were higher in October 2022 than they had been in the last survey of 2021-2022. There had been very light applications of irrigated wastewater to L1 and L6 on 3 and 1 (respectively) of the 15 days prior to the groundwater survey of 6 October 2022.

Irrigation records supplied by RNZ note that area L6 had received a moderate loading of irrigation wastewater. In particular, on 31 May 2023, 48 m^3 had been applied to the area. Over the whole year, L6 had been lightly loaded (kgN/ha), but L1 was amongst the most heavily loaded with irrigation wastewaters.

Over the longer term, concentrations of sodium in bore GND003008 have been steady since the start of calendar year 2021, and conductivity has been reducing from a peak at about the same time (Figures 7 and 10).

Over the course of the 2022-2023 year:

- pH remained weakly acidic and stable, ranging pH 6.3-6.5, generally reflecting the pattern of 2021-2022..
- EC and TDS results showed stability across both monitoring events, and are highly elevated by comparison with fields that do not experience the same usage. The readings were higher on both occasions than in the last survey of the previous year.
- Dissolved barium and acid soluble barium are higher in these results than most other bores, indicating the spreading of the metal from the drilling stockpile on Pad 2. The most elevated concentrations had been recorded in August 2020 (0.91 g/m^3 dissolved and 0.96 g/m^3 acid soluble), and had reduced since then. A pattern of ongoing slow reduction since August 2020 (which would be by continuing migration through the ground) had seemed apparent at the end of the 2021-2022 period, but measured concentrations were higher in the year under review than had been the case in the second half of the previous monitoring period..
- Chloride analysis had been indicating an overall reduction since August 2020, but were higher in the period under review than they had been in the last six months of 2021-2022.
- Ammoniacal nitrogen remained in the same elevated range during this period (0.42-2.5 g/m^3) as in 2020-2021 (1.01-3.3 g/m^3) and 2021-2022 (1.28-2.5 g/m^3).
- Nitrate/ nitrite nitrogen was extremely high (53 g/m^3) in August 2021), but has reduced since then. The concentrations measured during the year under review (1.52-4.9 g/m^3) were not of environmental concern. The change in peak nitrogen species from ammonia in October 2022 to nitrate in June 2023 is consistent with the biological process of nitrifying oxidation of ammonia.
- BTEX and TPH were not recorded above the LOD.
- Overall, the results observed at GND3008 indicate ongoing usage of L1 and/or L6 for the irrigation of wastewater by RNZ during the year. Concentrations of any contaminant measured did not reach levels of concern.

Table 17 GND3009 2022-2023 monitoring

GND3009	Date	6 Oct 2022	1 June 2023
Parameter	NZST	12:10	14:15
Level	M		
Sample Temperature	°C	14.0	15.3
pH	pH Units	6.7	6.8
Free Ammonia	g/m^3	0.0027	0.033
Total Ammoniacal-N	g/m^3	1.58	16.1
Nitrate-N + Nitrite-N	g/m^3	0.027	0.012
Electrical Conductivity (EC)	mS/m	201	178.9
Electrical Conductivity (EC)	µS/cm	2010	1789
Total Dissolved Solids (TDS)	g/m^3	1570	1050
Dissolved Barium	g/m^3	0.079	0.138
Acid Soluble Barium	g/m^3	<0.11	0.32
Total Calcium	g/m^3	310	65
Total Magnesium	g/m^3	54	14.6
Total Sodium	g/m^3	47	197
Chloride	g/m^3	85	370
BTEX in Water by Headspace GC-MS			
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
Total Petroleum Hydrocarbons in Water			
C7 - C9	g/m^3	< 0.10	< 0.10
C10 - C14	g/m^3	< 0.20	< 0.20
C15 - C36	g/m^3	< 0.40	< 0.40
Total hydrocarbons (C7 - C36)	g/m^3	< 0.70	< 0.70

GND3009 is located to the north (downslope) of the duck pond and to the east of irrigation area L3. The wastewater application loading on L3 during the 2021-2022 year had been relatively moderate by comparison with that on L1, L2 or U1. Likewise, in the 2022-2023 year area L3 received an average loading relative to the other areas. The irrigation data provided by RNZ recorded that area L3 had received a light to moderate loading of irrigation wastewater preceding the survey of 1 June 2023. In particular, on 31 May, 48 m^3 had been applied to the area. Nevertheless, GND3009 continues to show the greatest adverse impact upon groundwater for any area, as judged by markers such as sodium and conductivity (Figures 7 and 10).

In the first survey of the year under review, the concentrations of the various parameters measured were generally the same as (total dissolved solids, calcium, magnesium) or increased above (ammoniacal nitrogen, nitrate-nitrite nitrogen, conductivity, dissolved barium) those measured twelve months previously. By comparison with the results from the last survey of the previous year, there was general no change of any significance other than a slight increase in total ammoniacal nitrogen (although this was still well below the peak values seen earlier in the 2021-2022 year. However, the situation in the second half of the monitoring year under review was quite different.

Over the course of the 2022-2023 year:

- pH remained close to neutral across the two Council surveys, as it had in 2021-2022.
- EC monitoring results remained very high, as they had in 2021-2022 (1873-2320 µs/cm) and higher than the range observed in the 2020-2021 year (1252-2600 µs/cm), which was itself very elevated.. Taken together, and noting the high ammoniacal nitrogen concentrations in the second half of the year, these findings indicate the potential continuing over-application of wastewater to the surrounding area.
- TDS monitoring followed a similar long-term pattern to the EC.
- Concentrations of sodium and chloride increased sharply by four or more times over during the year, although not reaching the peaks seen in 2021-2022 (which were 240 g/m^3 for sodium, 500 g/m^3 for chloride).
- Ammoniacal nitrogen demonstrated a considerable deal of variation across all three monitoring events as it had in both of the previous two years, ranging 1.58-16.1 g/m^3 (cf 0.44-16.7 g/m^3 and 0.5-21 g/m^3). The concentrations of dissolved inorganic nitrogen (ammoniacal nitrogen + nitrate-nitrite nitrogen) in November 2021 and March 2022 had the highest found in any bore during the 2021-2022 monitoring year. In the year under review, GND 3009 again had the highest concentrations of nitrogen species
- Nitrate nitrite nitrogen remained at low concentrations across the four monitoring events, indicating soil conditions remain sour (anaerobic) with a high continuing concentration of ammoniacal nitrogen.
- BTEX and TPH were both below the LOD, across all four monitoring events.
- In summary, the groundwater in this location showed concentrations of some contaminants (particularly ammonia) that were of concern in respect of protecting surface water quality in the vicinity.

Table 18 GND3010 2022-2023 monitoring

GND3010	Date	6 Oct 2022	2 Jun 2023
Parameter	NZST		10:40
Level	M		
Sample Temperature	°C	12.2	15.3
pH	pH Units	6.0	6.2
Free Ammonia	g/m³	0.000082	0.00033
Total Ammoniacal-N	g/m³	0.31	0.58
Nitrate-N + Nitrite-N	g/m³	0.179	1.33
Electrical Conductivity (EC)	mS/m	21.6	21.8
Electrical Conductivity (EC)	µS/cm	216	218
Total Dissolved Solids (TDS)	g/m³	134	128
Dissolved Barium	g/m³	0.036	0.038
Acid Soluble Barium	g/m³	<0.11	<0.11
Total Calcium	g/m³	15.1	22
Total Magnesium	g/m³	6.4	6.3
Total Sodium	g/m³	11.8	9.8
Chloride	g/m³	14.3	8.3
BTEX in Water by Headspace GC-MS			
Benzene	g/m³	< 0.0010	< 0.0010
Toluene	g/m³	< 0.0010	< 0.0010
Ethylbenzene	g/m³	< 0.0010	< 0.0010
m&p-Xylene	g/m³	< 0.002	< 0.002
o-Xylene	g/m³	< 0.0010	< 0.0010
Total Petroleum Hydrocarbons in Water			
C7 - C9	g/m³	< 0.10	< 0.10
C10 - C14	g/m³	< 0.20	< 0.20
C15 - C36	g/m³	< 0.40	< 0.40
Total hydrocarbons (C7 - C36)	g/m³	< 0.70	< 0.70

GND3010 is located on the mid-south east fringe of irrigation area U3. While U3 had received a relatively low annual loading of wastewater during 2021-2022, the very high concentrations of ammoniacal nitrogen along with many other parameters peaking in March 2022, and the subsequent elevated nitrate-nitrite nitrogen concentrations in June and October 2022, are strongly indicative that there was nitrogen loading of some magnitude immediately prior to March 2022. Bore GND3010 has been considered a control site in the past, but is clearly being affected by activities on the property. RNZ irrigation data shows that area U3 received a relatively average loading (kg N/ha) n the 2022-2023 year. Long-term markers of groundwater quality have been steady for several years.

By October 2022, most parameters had reduced in concentration to below those in the equivalent surveys of either four months or twelve months previously. There had been very light applications of irrigated wastewater to U3 on 4 of the 15 days prior to the groundwater survey of 6 October 2022.

Over the course of the 2022-2023 year:

- pH remained relatively stable and weakly acidic, fluctuating around pH 6. This was the same pattern observed in the previous year.
- EC results also remained relatively stable across both monitoring events, and remaining somewhat below the values observed in the previous monitoring period and well below the peak value observed in the December 2020 event (487 µs/cm).
- Sodium results were relatively stable across the three monitoring events, and generally below those in previous years, especially by the end of the monitoring year (although there has been variability at this site).
- Likewise, chloride results remained low when compared to other wells on site and to previous results at this site.
- Ammoniacal nitrogen results ranged from 0.31-0.58 g/m^3, much lower than in 2021-2022 (0.75-7.5 g/m^3).
- Nitrate nitrite nitrogen results ranged 0.006-1.33 g/m^3. The highest result was observed at the end of the period, suggesting nitrifying oxidation of ammonia was well-established.
- No BTEX or other hydrocarbon compounds have been detected at this location since August 2020.
- In summary, these results suggest groundwater under irrigation area U3 (the uppermost area) has continues to show relatively moderate impacts from the disposal of wastewater during the year under review.

2.4.3 Calculation of dilution of groundwater upon entry into surface water

By comparing the relative concentrations of conservative water quality parameters (those constituents that do not undergo changes in concentration due to processes such as biotransformation or adsorption/desorption onto or from soil particles) it is possible to derive the degree of dilution of a discharge into receiving waters, such as from a tributary into the main stem of a river. Making some simplifications, the same approach can be applied where there is an inflow of groundwater into a surface water course.

The formula used is of the form (Concentration downstream – Concentration upstream)/ Concentration inflow- Concentration upstream). The product when this formula is used, gives the proportion of the downstream flow that has originated from the contributing source of interest. The reciprocal of the product is the ratio between the volume of inflow, and the volume of the combined downstream flow.

Using the surface water and groundwater data for conductivity, sodium, and chloride from sampling runs in October 2022 and February-March 2023, the calculated dilution ratios range between 1:9 and 1:26, with no significant differences between the two sampling periods. That is, the proportion of the flow downstream that is derived from inflow of groundwater from beneath the facilities and activities of the Company, is generally in the range of between 0.04 to 0.105.

It is acknowledged that the actual volumes of inflow at any particular locality within the property will vary from other stretches of the Haehanga catchment across the property, depending on preceding rates and volumes of applied irrigation by irrigation area, the lapsed time since last irrigated, rainfall rate and duration,, soil saturation, soil moisture deficit, and subsurface geology, amongst other factors. Nevertheless, these dilution ratios as derived give a first approximation towards providing for the determination of suitable criteria for groundwater quality that would afford protection of receiving surface waters as encapsulated by various recognised criteria. Currently in New Zealand there are no recognised criteria of protection of groundwater for the sake of groundwater ecosystem health itself.

Managing groundwater quality is one means for protecting surface waters. However, it does not take into account other pathways of contaminant entry into surface water, such as spillage, point source or diffuse seepages, irrigation overflow, and rainfall runoff.

2.4.4 Discussion of groundwater results

As noted above, the Council surveys of October 2022 and June 2023 were undertaken under wetter than usual conditions, which would tend to dilute the concentrations of contaminants in groundwater.

Changes in groundwater quality over the duration of monitoring are shown for all groundwater bores in Figure 10 to Figure 13 below for the parameters sodium, total ammonia, nitrate nitrogen, and conductivity, and discussed below.

While there is evidence of groundwater contamination by metals from the activities of RNZ, all concentrations of dissolved metals are below recognised thresholds of environmental concern in respect of pathways to adjacent surface water. New Zealand does not have established criteria for protection of ecological health within groundwater systems.

Sodium

The data in the graph show that sodium values across the majority of the bores have remained stable since 2018. Bores GND2190 and GND3009 (within the irrigation area L2, and within area L3 and immediately below the main composting and wastewater collection area, respectively) have shown the highest concentrations and greatest variation of ionic sodium over the duration of monitoring. This was again the situation found in 2022-2023. Levels in GND3009 during the 2022-2023 year showed an increasing trend.

The lowest values for sodium were observed in GND3007, the roadside bore.

Ammonia

Total ammoniacal nitrogen was recorded at reasonably stable low levels for sites GND2188, GND2189, GND2190, and GND3007 from 2011–2018. Site GND2188 had since displayed an overall increase in ammonia concentrations from 2018 onwards, but reduced during the year under review. Measurements of ammonia in both GND2189 and GND2190 remained stable and low in the year under review as did GND3010, and taken together these results are indicative of minimal impact upon groundwater ammonia in the upper irrigation areas during disposal of wastewater during the year under review.

Sites GND3008, GND3009, and GND3010 first began ammonia monitoring in 2018. GND3008 and GND3009 respectively have higher and much higher concentrations of ammonia when compared to other sites. In the year under review, GND3009 approached concentrations that could result in levels that are close to recognised thresholds of environmental concern in adjacent surface waters, depending upon dilution. GND3010 had stable and low levels of ammonia.

The lowest measurements of ammonia were in samples from GND 3007, the roadside bore.

Nitrate

Nitrate concentrations have been highest in bores GND 2188 and GND3008. New Zealand has a drinking water standard of a maximum concentration of nitrate-nitrogen of 11.3 g/m^3. The drinking water standard is not directly applicable to the RNZ site, as there is no abstraction for consumption, but the figure is often used as a working criterion to give perspective. The groundwater at the RNZ property did not exceed this value in the 2022-2023 year. The NPS-FM (2020) sets a median 95^{th} percentile attribute value for nitrate in surface water, of 2.4 g/m^3, and a 95^{th} percentile attribute value of 3.5 g/m^3. Contaminants migrating from groundwater into surface water are typically diluted by a number of times, Groundwater quality measured at GND3008 (irrigation area L6) exceeded the NPS-FM value, but the potential for subsequent dilution should be noted (see section 2.4.4). The concentration of nitrate in GND3008 more than trebled during the year.

Groundwater quality in other locations on the RNZ property was found to be below the NPS-FM values during 2022-2023.

Nitrate levels in groundwater beneath the upper irrigation fields remained stable, although GND2188 and GND3010 in these areas had the highest nitrate levels after GND3008. These patterns suggest that nitrifying oxidation is stabilising residual concentrations of ammonia in their vicinity. The roadside bore GND3007 has amongst the lowest concentrations of ammonia and nitrate observed across all bores during the year.

Conductivity

The conductivity graph is displaying an overall general decrease in concentration across all bores from 2011–2022. Bores GND3008 and GND3009 appeared to increase slightly during 2020 to late 2021, but appear to be reducing slowly since then.

For conductivity, the highest readings have been in bores GND2190 (irrigation area L2), GND3008, and GND3009. Readings in all these bores have been reducing over the past 4 years. In the 2022-2023 year, bore GND 3009 had by far the highest readings. Readings of conductivity in groundwater under the upper irrigation areas are relatively low, although still double or more the conductivity found in GND3007, the roadside bore.

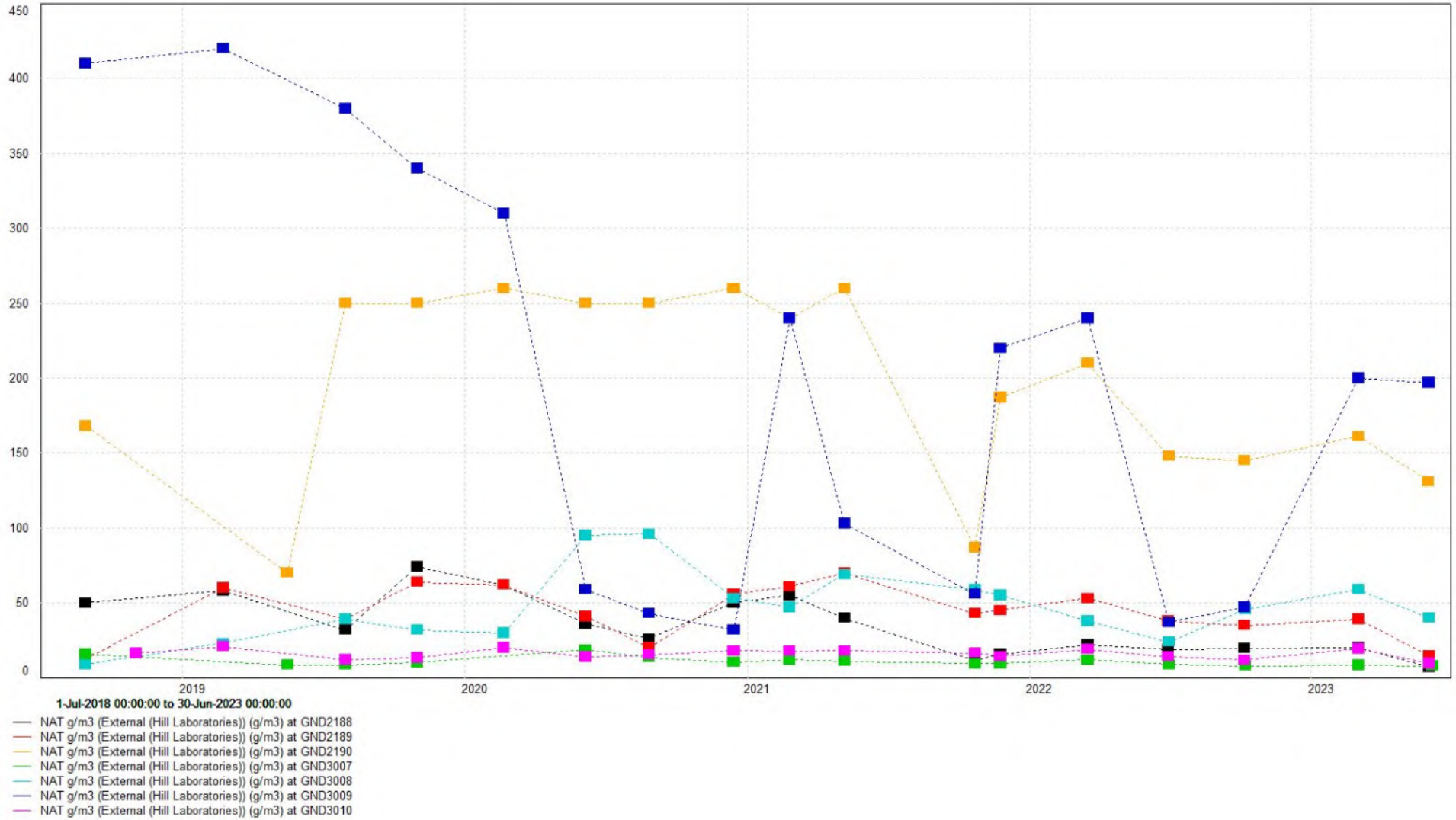


Figure 10 Total ionic sodium concentrations in groundwater 2018-2023

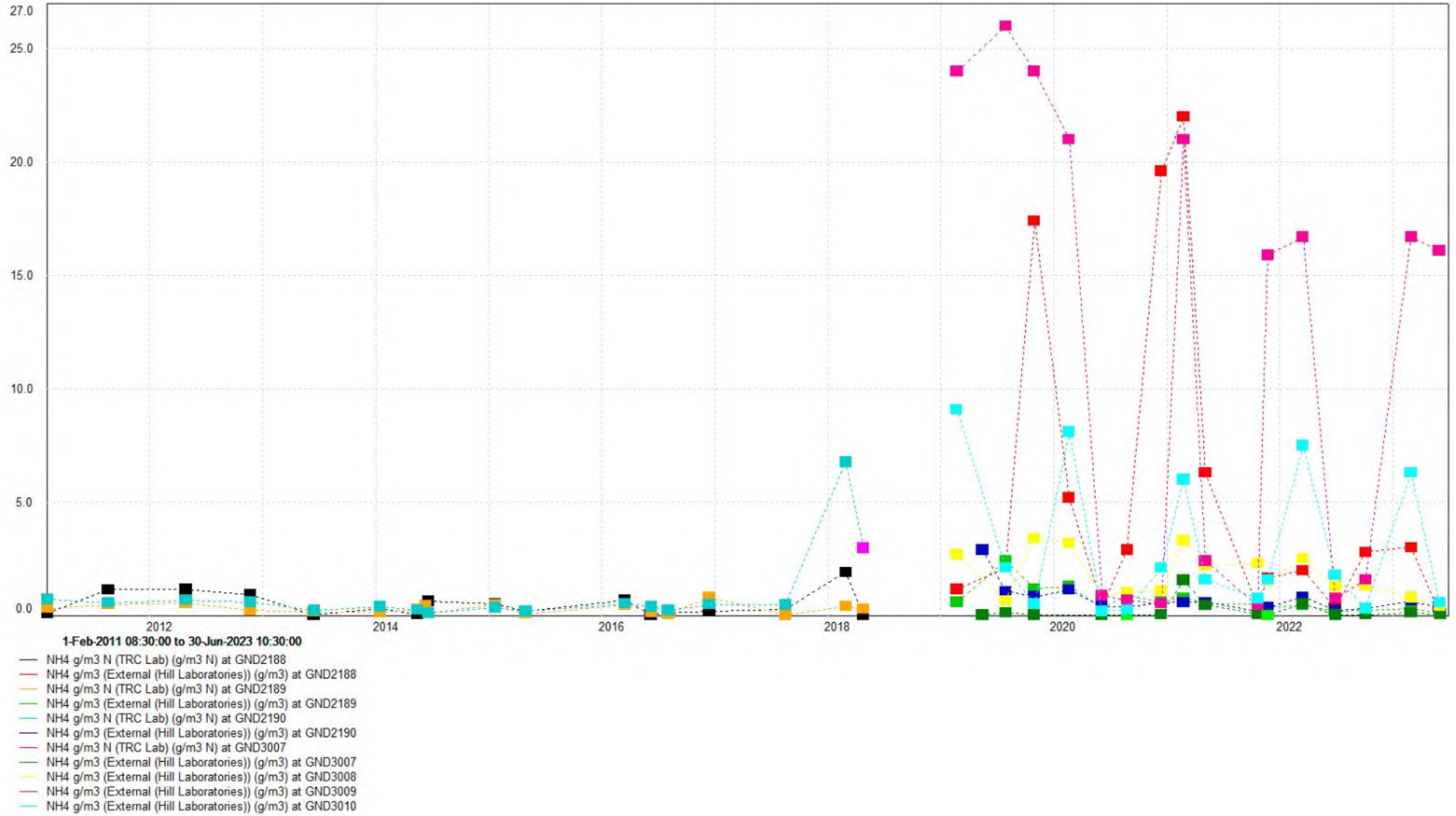


Figure 11 Total ammoniacal nitrogen concentrations in groundwater 2011–2023

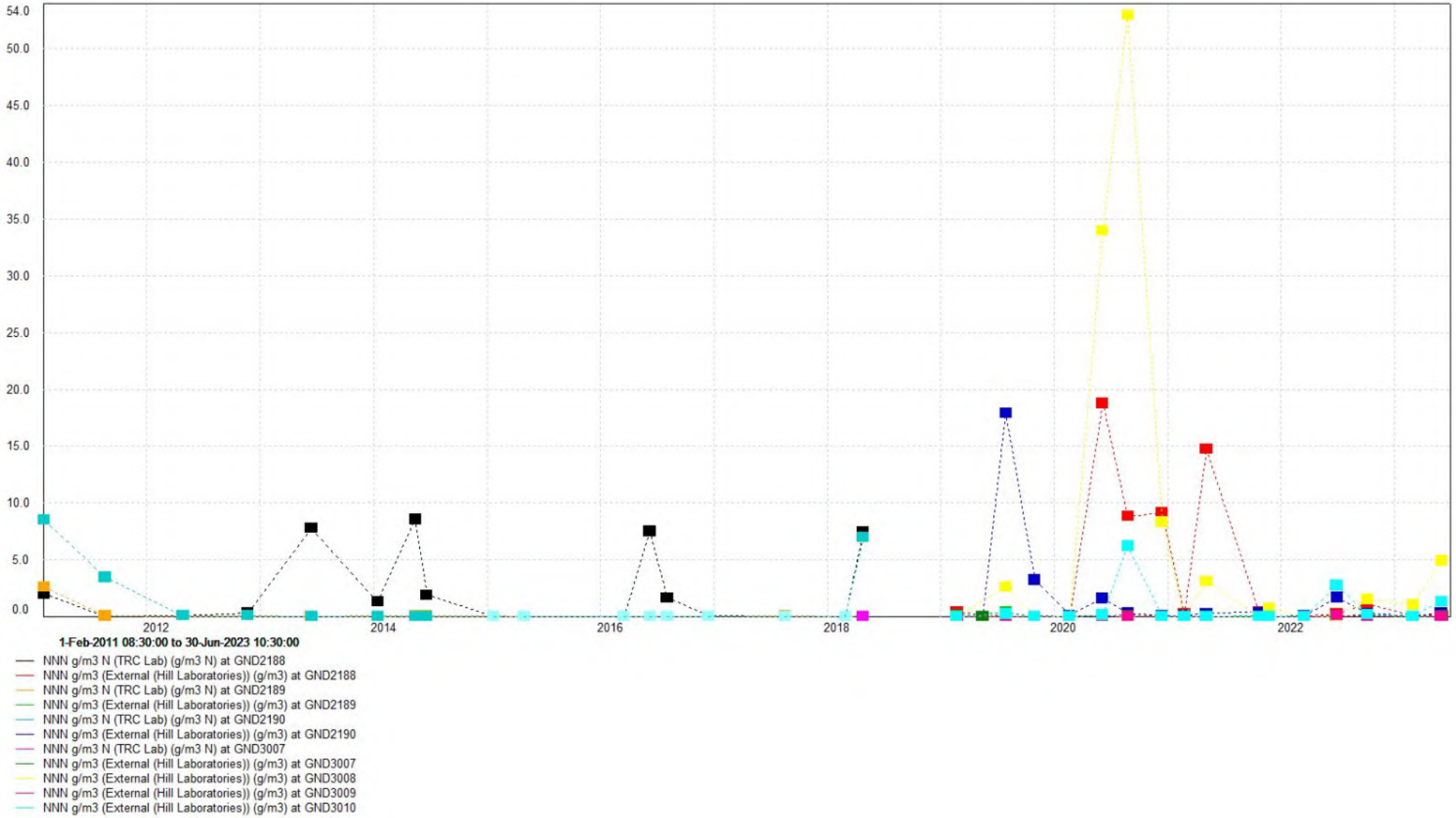


Figure 12 Total nitrate-nitrite concentrations in groundwater 2011–2023

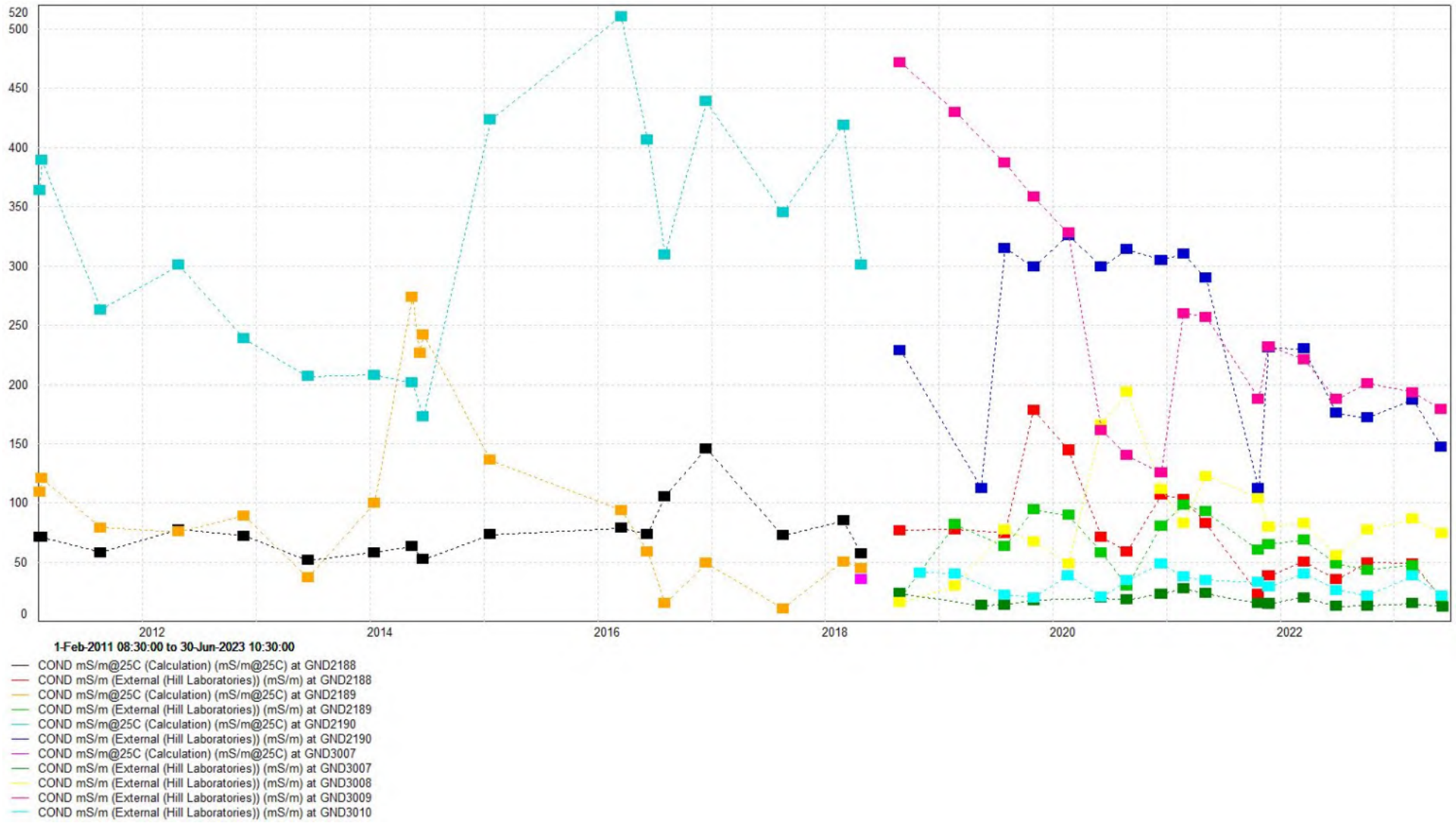


Figure 13 Total conductivity concentrations in groundwater 2011–2023

2.5 Air

2.5.1 Results of discharge monitoring

The Council had undertaken measurements of various air toxics on the site during the 2020-2021 period (BTEX aromatic hydrocarbons, ammonia, and hydrogen sulphide). Given the results were well below thresholds of concern, no further monitoring was implemented during the period under review. With the Company's proposal to increase the volume of wastewaters irrigated in the lower area (closer to the local community), it is intended that there should be further surveys for relevant chemical and microbiological contaminants of interest.

2.5.2 Results of receiving environment monitoring

It is acknowledged that odour events when taken in isolation may be below the threshold of being offensive and objectionable, but collectively over a longer term they may amount to being considered offensive and objectionable due to their frequency or continuation.

The Council holds assessments of 43 odour surveys undertaken by Council officers during the period reviewed. In the previous year, 32 odour surveys had been undertaken. The majority of surveys were taken outside normal working hours, focusing on early morning and evening periods when wind conditions were more likely to cause offsite odour episodes. Each survey included individual assessments at up to five separate locations beyond the boundary of the RNZ property. These surveys included both proactive and reactive (complaints-driven) surveys, and were undertaken both during and outside normal work hours. The Council has dealt with around 80 complaints over the past year (this number is down slightly from the previous year). However, for much of this period the Council was not responding to after-hours complaints if lodged by certain individuals, because of safety concerns, and so no on-site odour surveys were undertaken in such cases, and the complaints are neither upheld nor discounted.

Of the 43 proactive surveys by the Council, on 28 occasions (65%) no odour was detected at any off-site location that was visited. On another 13 survey occasions (30%), Council officers detected odour at least in one location during the survey, but at no location was odour considered to be immediately (acutely) or potentially (chronically) offensive or objectionable, over any duration or frequency.

On 2 occasions (5%) the investigating officer detected odour at least at one of the locations visited, and considered that it would be offensive and objectionable if it occurred frequently or continuously. That is, the officer found the odour might contribute to a finding that odour was chronically offensive in the receiving environment. In the previous period, a similar determination had been made during four surveys, or 10% of the surveys conducted in that year.

The Council recorded 81 odour complaints during the year under review. The Council declined to investigate 69 of these by a site visit. However, on 12 occasions site investigations were conducted, either because officers were already in the vicinity or because circumstances were suitable for a specific visit. On 7 of the 12 investigations, weak odour was detected beyond the boundary of the RNZ property. That is, on about half of all episodes when complaints could be followed up, the activities of RNZ were causing off-site odour. On no occasion did Council officers determine that the odour beyond the boundary was offensive or objectionable. Table 32 in Section 2.7 provides further details.

The record for the previous year showed that on the majority of their odour surveys, Council officers detected odour emitted from RNZ beyond the site boundary, with the evidence becoming clearer that even if on a single survey odours are not offensive or objectionable, when their cumulative impacts are taken into

account then the odours could well be considered chronically offensive[9]. In the year under review, the proportion of proactive surveys during which Council officers detected odour fell to one-third, but the proportion when responding to complaints was higher. Therefore the RNZ facility remains a source of odour in the neighbourhood and in need for improved performance, although with some relative gains in environmental performance.

2.5.2.1 Company odour monitoring survey

During conferencing for the Environment Court appeal hearing, the air quality experts for the parties noted that RNZ were to contract an independent odour scout to undertake intensive odour surveys during the period of April to June 2022. 60 surveys within two months were envisaged, followed by ongoing weekly surveys. It was further agreed that an integral element of these surveys was that the Council was to be contacted on a number of these observation occasions, to facilitate joint odour assessments.

RNZ did not undertake the surveys as specified. When queried, the Company noted that the original scout had failed to undertake any surveys, and when a replacement was found, RNZ were not able to book their calibration of sensitivity to odour. It is noted that it had been agreed the surveys were to be undertaken in any case (even if calibration was not immediately available), and further, that several Council staff had had their sensitivity calibrations undertaken during the time that RNZ were claiming they were not able to access calibration services. After the end of the 2021-2022 year, RNZ reiterated their intention to undertake surveys[10].

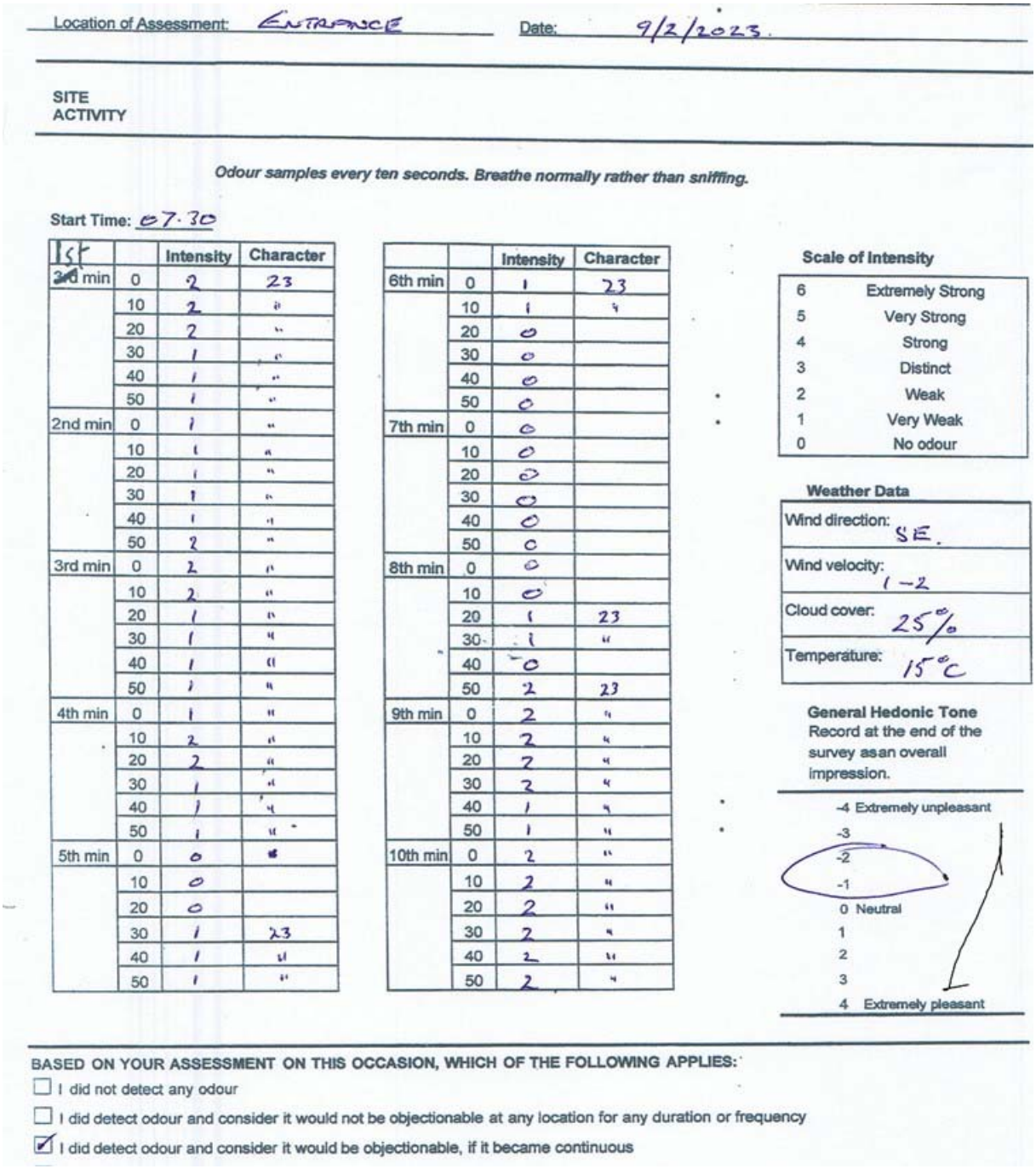
A RNZ survey was first undertaken on 25 July 2022, but then none until October (2 surveys, with another in November). It was not until December that the Council were offered an opportunity to conduct a joint survey, for cross-validation purposes. Given that the meteorological data for the property indicates that winds are from the south (ie towards the local community) approximately half the time, this frequency of surveying is considered inadequate. It was further identified that both the designated independent odour scout and a RNZ staff member had been calibrated for odour sensitivity and found to be less sensitive to odour than a normal recipient. In terms of assessing sub-acute odours that might cumulatively be considered chronically offensive, this is of concern. (The majority of Council monitoring staff, including those most frequently involved in monitoring the RNZ property, have been found to have the appropriate sensitivity). The Council received three further reports from the RNZ observer, two in December 2022 and one for 9 February 2023, but nothing since.

The odour scout's report for 9 February 2023 found that at the site boundary, the level of odour detected would be deemed offensive if recurring or prolonged (refer Figure 14). Odour was detected offsite on other surveys, but not at this level of intensity.

Overall, RNZ have failed to implement the intensive (60 surveys within two months) monitoring agreed, and subsequently have undertaken 7 surveys in 8 months to February 2023 (34 weeks) when weekly surveys had been recommended.

[9] The Ministry for the Environment's Good Practice Guide for Assessing and Managing Odour defines chronically offensive odour as: '*low-intensity and/or moderately unpleasant odours occurring frequently or continuously over a long period….. Cumulatively, these low-level odours can have an adverse effect even though no single odour event in isolation could reasonably be considered offensive or objectionable. A longer-term assessment of the frequency and nature of odour impacts is required for chronic odour effects*'

[10] eg Remediation New Zealand progress update 16 December 2022



Location of Assessment: ENTRANCE Date: 9/2/2023.

SITE ACTIVITY

Odour samples every ten seconds. Breathe normally rather than sniffing.

Start Time: 07:30

1st		Intensity	Character
~~3rd~~ min	0	2	23
	10	2	"
	20	2	"
	30	1	"
	40	1	"
	50	1	"
2nd min	0	1	"
	10	1	"
	20	1	"
	30	1	"
	40	1	"
	50	2	"
3rd min	0	2	"
	10	2	"
	20	1	"
	30	1	"
	40	1	"
	50	1	"
4th min	0	1	"
	10	2	"
	20	2	"
	30	1	"
	40	1	"
	50	1	"
5th min	0	0	"
	10	0	
	20	0	
	30	1	23
	40	1	"
	50	1	"

		Intensity	Character
6th min	0	1	23
	10	1	"
	20	0	
	30	0	
	40	0	
	50	0	
7th min	0	0	
	10	0	
	20	0	
	30	0	
	40	0	
	50	0	
8th min	0	0	
	10	0	
	20	1	23
	30	1	"
	40	0	
	50	2	23
9th min	0	2	"
	10	2	"
	20	2	"
	30	2	"
	40	1	"
	50	1	"
10th min	0	2	"
	10	2	"
	20	2	"
	30	2	"
	40	2	"
	50	2	"

Scale of Intensity

6	Extremely Strong
5	Very Strong
4	Strong
3	Distinct
2	Weak
1	Very Weak
0	No odour

Weather Data

Wind direction:	SE.
Wind velocity:	1-2
Cloud cover:	25%
Temperature:	15°C

General Hedonic Tone
Record at the end of the survey as an overall impression.

-4 Extremely unpleasant
-3
-2
-1
0 Neutral
1
2
3
4 Extremely pleasant

BASED ON YOUR ASSESSMENT ON THIS OCCASION, WHICH OF THE FOLLOWING APPLIES:

☐ I did not detect any odour

☐ I did detect odour and consider it would not be objectionable at any location for any duration or frequency

☑ I did detect odour and consider it would be objectionable, if it became continuous

Figure 14 Odour scout's report for 9 February 2023

2.5.3 Odour incidents

These are presented and discussed in Section 2.7 below.

2.6 Land and soil

2.6.1 Inspections

2.6.2 Irrigation wastewater storage IND002044

Leachates generated from both pad 1 (greenwaste pad) and pad 3 (drilling mud pad) flow through a series of sediment collection ponds prior to reaching the irrigation pond. From here, the leachate is irrigated across the irrigation areas (Figure 9). These had been extended during the 2021-2022 year from 13.18 ha to 15.96 ha, by incorporating the new L6 area. The fluid leachate was sampled on six occasions this monitoring period. Results are provided in the table below. The ranges since 2018 for each analyte are also provided.

It should be noted that the results for the sample taken on 25 January 2023 are anomalous in most parameters. Upon internal review, it was determined that the sample was sampled from the wrong location. While the results as received from the laboratory are presented in Table 19 below, no assessment of them is being provided.

Table 19 IND002044 irrigation pond monitoring 2022-2023

IND002044	Date	Range 2018-2022	4 Aug	4 Oct	12 Dec	*25 Jan**	23 Mar	2 June
Parameter	Time		09:52	10:18	8:50		10:15	11:25
Sample Temperature	°C	8.4-23.6	14.5	13.3	19.4	*26.1*	22.1	15.5
Acid Soluble Barium	g/m³	0.28-2.1	0.18	0.24	0.12	*0.14*	0.12	0.12
Acid Soluble Lead	g/m³	0.002-0.25	0.016	0.016	0.005	*<0.002*	0.012	0.006
Benzene	g/m³	0.002-0.139	<0.0010	<0.0010	<0.0010	*<0.0010*	<0.0010	<0.0010
Toluene	g/m³	0.007-0.78	<0.0010	<0.0010	0.023	*<0.0010*	<0.0010	<0.0010
Ethylbenzene	g/m³	0.0009-0.0179	<0.0010	<0.0010	<0.0010	*<0.0010*	<0.0010	<0.0010
o-Xylene	g/m³	0.0018-0.057	<0.0010	<0.0010	<0.0010	*<0.0010*	<0.0010	<0.0010
m&p-Xylene	g/m³	0.004-0.144	< 0.002	<0.002	<0.002	*<0.002*	<0.002	<0.002
C7 - C9	g/m³	0.07-1.17	<0.4	<0.10	<0.10	*<0.10*	<0.10	<0.5
C10 - C14	g/m³	0.3-1.5	<1.0	0.3	<0.2	*<0.2*	<0.2	<1.0
C15 - C36	g/m³	0.5-22	4	3.8	0.8	*<0.4*	2.0	<2
Total hydrocarbons (C7 - C36)	g/m³	1-23	4	4.1	0.8	*<0.7*	2.1	<4
Carbonaceous Biochemical Oxygen Demand ($cBOD^5$)	g O_2/m³	103-1,340	1660	610	250	*15*	193	360
Electrical Conductivity (EC)	µS/cm	4,620-18,360	7190	6450	5470	*766*	5590	6070
	mS/m	462-1,836	719	645	547	*76.6*	559	607
Chloride	g/m³	430-730	360	310	290	*96*	390	360
Dissolved Arsenic	g/m³	0.026-0.25	0.072	0.107	0.096	*<0.010*	0.112	0.076
Dissolved Barium	g/m³	0.127-0.77	0.116	0.115	0.077	*0.147*	0.058	0.069
Dissolved Cadmium	g/m³	<LOD	<0.0005	<0.0001	<0.0005	*<0.0005*	<0.0003	<0.0005
Dissolved Chromium	g/m³	0.008-0.069	0.020	0.019	0.012	*<0.005*	0.014	0.015

IND002044	Date	Range 2018-2022	4 Aug	4 Oct	12 Dec	*25 Jan**	23 Mar	2 June
Parameter	Time		09:52	10:18	8:50		10:15	11:25
Dissolved Copper	g/m³	0.004-0.016	<0.005	0.0029	<0.005	*0.009*	0.006	<0.005
Dissolved Lead	g/m³	0.0009-0.0154	0.0013	0.0009	0.0011	*0.0010*	0.0040	<0.0010
Dissolved Mercury	g/m³	<LOD	<0.00015	<0.00008	<0.00015	*<0.00008*	<0.00015	<0.00008
Dissolved Nickel	g/m³	0.026-0.136	0.016	0.019	0.018	*<0.005*	0.020	0.018
Dissolved Zinc	g/m³	0.005-2.7	0.011	0.008	0.013	*0.020*	0.025	0.012
Escherichia coli	cfu / 100 ml	<10-2,400,000	230,000	14,000	70,000	*170*	31,000	59,000
Free Ammonia as N	g/m³	1.84-47	29	36	56	*2.6*	44	33
Nitrate-N + Nitrite-N	g/m³	0.006-13.8	0.04	0.04	<0.02	*2.5*	0.05	0.05
Total Ammoniacal-N	g/m³	165-830	800	650	520	*12.0*	490	540
Total Kjeldahl Nitrogen (TKN)	g/m³	230-950	930	850	520	*17.2*	590	750
pH	pH Units	7.4-8.5	8.1	8.4	8.5	*8.6*	8.3	-
Sodium Absorption Ratio (Total)		2.5-11	3.5	3.7	3.1	*1.5*	4.2	3.5
Total Barium	g/m³	0.42-5.6	1.18	0.74	0.26	*0.142*	0.54	0.196
Total Calcium	g/m³	73-550	98	62	92	*41*	98	72
Total Magnesium	g/m³	18.1-62	35	30	30	*10.3*	43	34
Total Nitrogen	g/m³	230-950	930	850	520		590	750
Total Potassium	g/m³	290-2,700	350	320	330	*86*	520	370
Total Sodium	g/m³	124-950	160	140	135	*41*	199	143
Total Sulphide Trace	g/m³	<0.02-22	1.12		3.4	*<0.002*	0.44	1.64
Turbidity	NTU	87-490	1570	1430	420	*25*	870	690
Un-ionised hydrogen sulphide	g/m³	<0.002-2.7	0.084	0.118	0.108	*<0.002*	0.017	0.076
Methylene Blue Active Substances	g/m³	1-1.7	0.9	1.5	1.4	*0.3*	1.2	1.64
Permethrin	g/m³	LOD-0.0002	<0.0003	<0.00005	<0.0005	*<0.0005*	<0.00005	<0.00005
Propiconazole	g/m³	<0.004-0.019	0.0024	0.0024	0.0011	*<0.00015*	0.00195	0.00021
Tebuconazole	g/m³	<0.005-0.029	0.0040	<0.00017	0.0017	*0.0003*	0.0034	<0.0004
Terbuthylazine	g/m³	**	0.0040	<0.00004	0.0017	*<0.00010*	0.00095	0.001153

**Upon review, this sample is considered to have been collected from the wrong site, and is not discussed further as a legitimate sample.*

** This year is the first in which this chemical has been detected above LOD.

In terms of consent compliance, the sodium absorption ratio (SAR) is required to be below 18 SAR, while the concentration of TPH within the fluid must be below 5% (50,000 g/m³).

On the last survey of the previous year, the irrigation pond had held the highest concentrations measured in recent years, of carbonaceous biochemical oxygen demand, chloride, *E. coli*, total ammoniacal nitrogen, total Kjeldahl (organic) nitrogen, total nitrogen, and turbidity. Hydrogen sulphide was also elevated above usual concentrations. A significant water pollution event in the lower Haehanga Stream was detected by Council officers on the same day. This coincidence strongly suggests the pollution of the Haehanga was

caused by over-irrigation or other avenue of loss of collected wastewater, on or immediately preceding that day.

For most contaminants and parameters, results during the 2022-2023 year remained within the ranges found during previous periods. While the concentration of free ammonia in the 12 December 2022 survey was the highest that had been observed at any time in the preceding three years, and had been increasing in each survey since the May 2022 survey, it reduced in the following surveys. Notably, total ammoniacal nitrogen, Kjeldahl nitrogen, biochemical oxygen demand, unionised and total hydrogen sulphide were all reducing in the second half of the year. The concentrations of carbonaceous BOD returned to within the typical range, after the peak of May 2022 and subsequent elevated concentrations. Council officers had observed that aeration of the wastewater storage pond was maintained at a higher dissolved oxygen concentration, with continuous aeration over summer, and these reduction are consistent with better aeration practice.

Barium continued to be mobilised from drilling mud wastes into the wastewater. Barium is a marker for drilling wastes due to its use as a weighting mud. The concentrations of total, acid-soluble, and dissolved barium in the last two surveys of the year under review were at their lowest seen in the last three years, and there was a general tendency of reducing concentrations during the year. Likewise, chloride in the wastewater storage pond during the 2022-2023 year was lower than in the previous three years, although appearing to plateau rather than reduce further.

The average concentration of total ammoniacal nitrogen during the 2021-2022 year was 450 g/m^3, but in 2022-2023 was 600 g/m^3 (this calculation excludes an anomalous result of 12 g/m^3 for a sample collected on 25 January 2023). It is noted that RNZ have calculated the area of land needed for irrigation of wastewaters using a nitrogen concentration of only 250 g/m^3. This strongly suggests that RNZ have under-estimated the area of land they should be using, if excessive nitrogen loading (and hence risk of break-through into groundwater and eventually into the Haehanga Stream) is to be avoided.

Likewise, concentrations of Total Kjeldahl Nitrogen have remained very high during the year, and are 3-4 times higher than RNZ estimates for planning nitrogen loadings on irrigation areas. A major discrepancy between the analytical results for nitrogen in the irrigation wastewater obtained by the Council, through an accredited laboratory, and the results provided by RNZ to the Council (from another laboratory) is noted and discussed further below. The analytical services used by the Council are provided by a laboratory accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.

LOSP pesticides were routinely detected in the irrigation pond wastewaters on most occasions, indicating their ongoing leaching from the drilling wastes stockpile into the wider environment. There are indications the rate of leaching is reducing (based on concentrations, not on mass release over time). However, the LOSP terbuthylazine was detected for the first time, in August 2022 and was present in almost all subsequent samples. Terbuthylazine is a selective herbicide for grass and broadleaf weed control in forestry, non-cropland and selected crops. It is the active agent in a number of herbicides marketed for use in New Zealand. The question is whether it has been used on the RNZ property and spray drift or container washout has entered the wastewater system, or whether it is present in any greenwastes that RNZ are bringing onto their site. The chemical has an LC50 (lethal effects after 96 hr exposure period) to crustacean species of 0.1 g/m^3, and an EC50 (adverse effects during 5 day exposure period) for algae of 0.0032 g/m^3. The concentrations at which it has been found in the irrigation wastewater do not appear to pose an environmental risk, only as long as there is no direct and prolonged runoff of irrigation wastewaters to surface water.

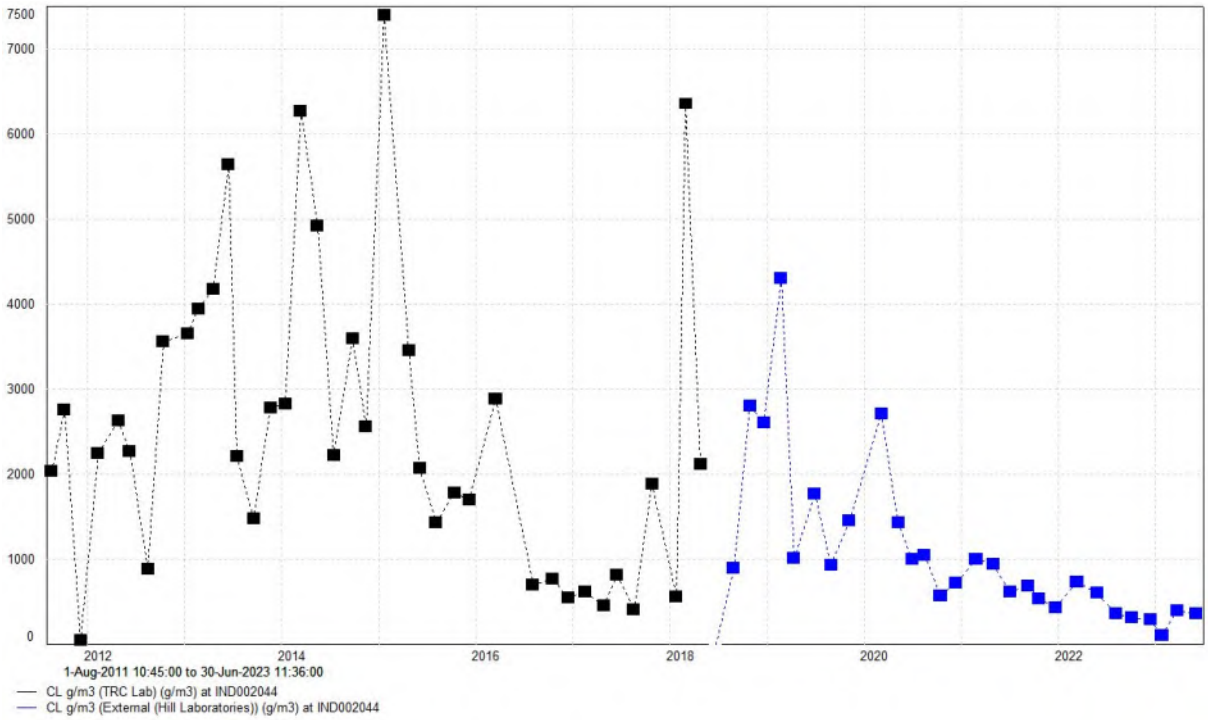


Figure 15 Chloride levels in the irrigation retention pond 2011-2023

Figure 15 above shows the trends in the concentration of chloride in the irrigation pond since 2011. RNZ committed to ending the acceptance of drilling wastes in or about December 2020. The data shows a substantial reduction in the concentration of chloride entering the irrigation holding pond since that date, while noting a pattern of overall reducing chloride leachate prior to that decision, particularly in 2017. The trend of declining transport of chloride from Pads 1 and 3 has continued into the 2022-2023 year.

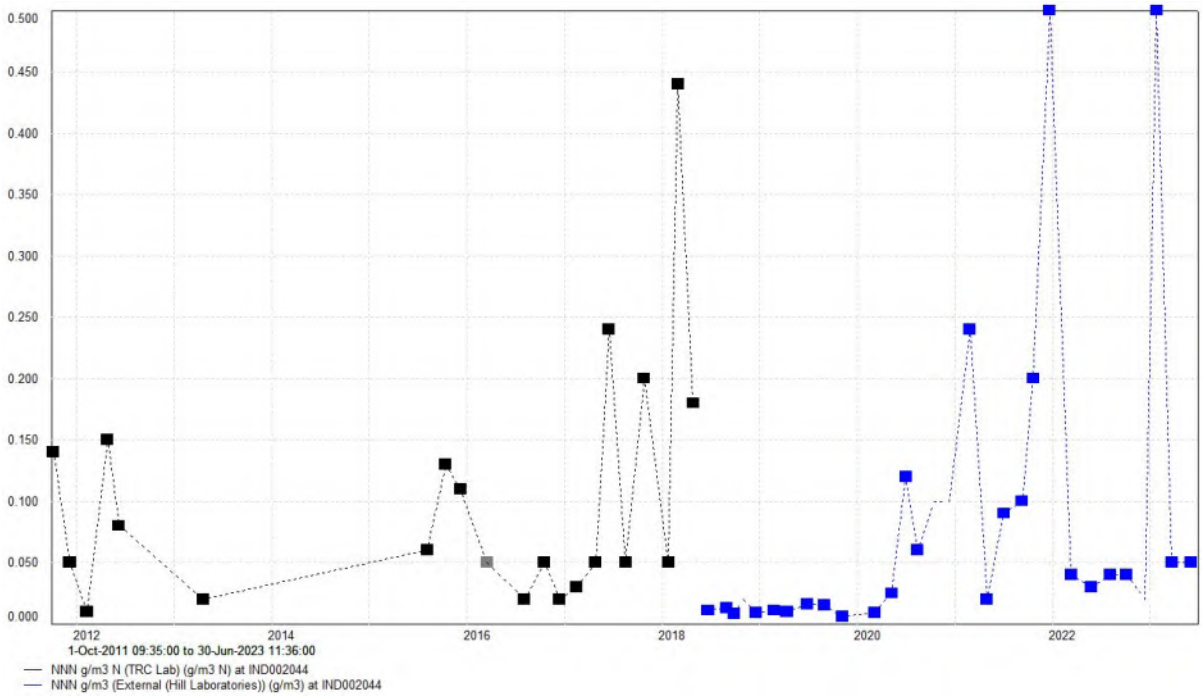


Figure 16 Oxidized nitrogen (nitrate+nitrite) concentrations in the irrigation retention pond 2011-2023 (excluding peak result in December 2022)

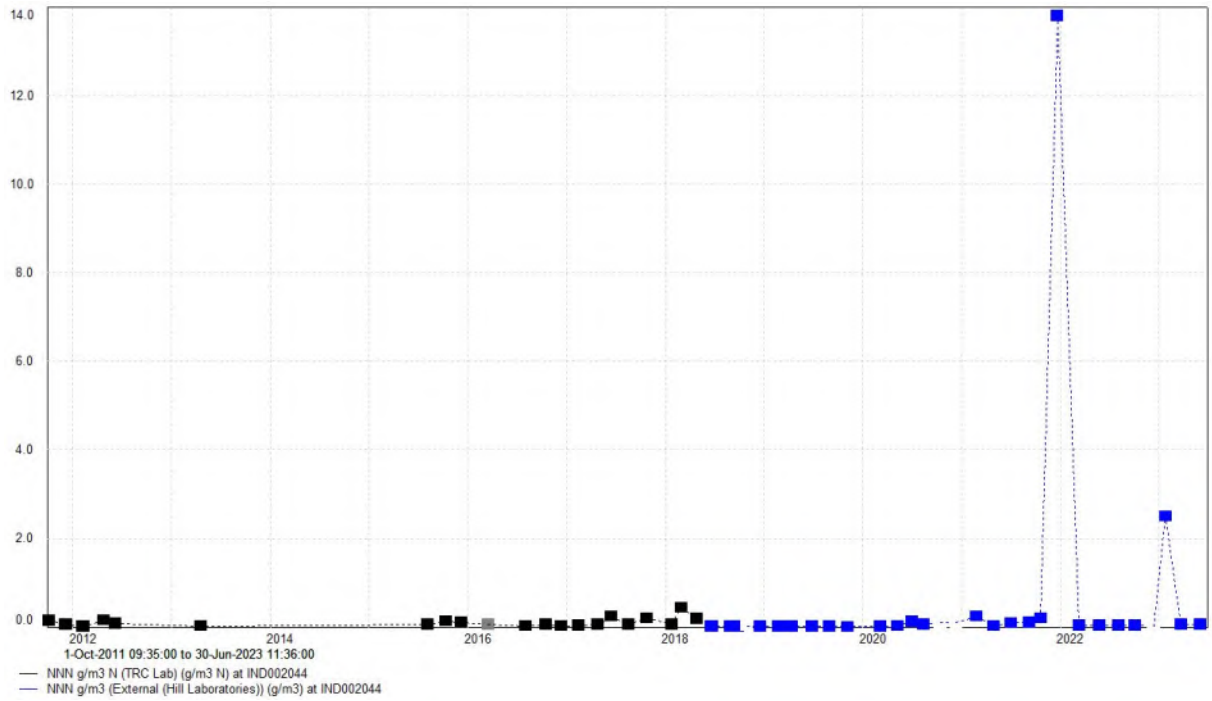


Figure 17 Oxidized nitrogen (nitrate+nitrite) concentrations in the irrigation retention pond 2011-2023 (including peak results in December 2021 and December 2022)

Figure 16 and Figure 17 above show the trends in the concentration of nitrate-nitrogen in the irrigation pond since 2011. The data show considerable variation in the concentration of nitrate within the irrigation holding pond over that period, with peaks in 2018, December 2021, and December 2022. The data suggests that at times, the composting process is creating highly stable compost (shown by increases and peaks in oxidised nitrogen), while at other times ammonia rather than nitrate is being leached from Pad 1 (see Figure 18 below). It should be noted that RNZ implemented greater aeration of the irrigation storage pond in late 2022, and the benefits in respect of the oxidation of ammonia to the oxidised forms of nitrogen (nitrate+nitrite) can be seen in the recent results in Figure 16 and corresponding dips in ammonia (see next figure).

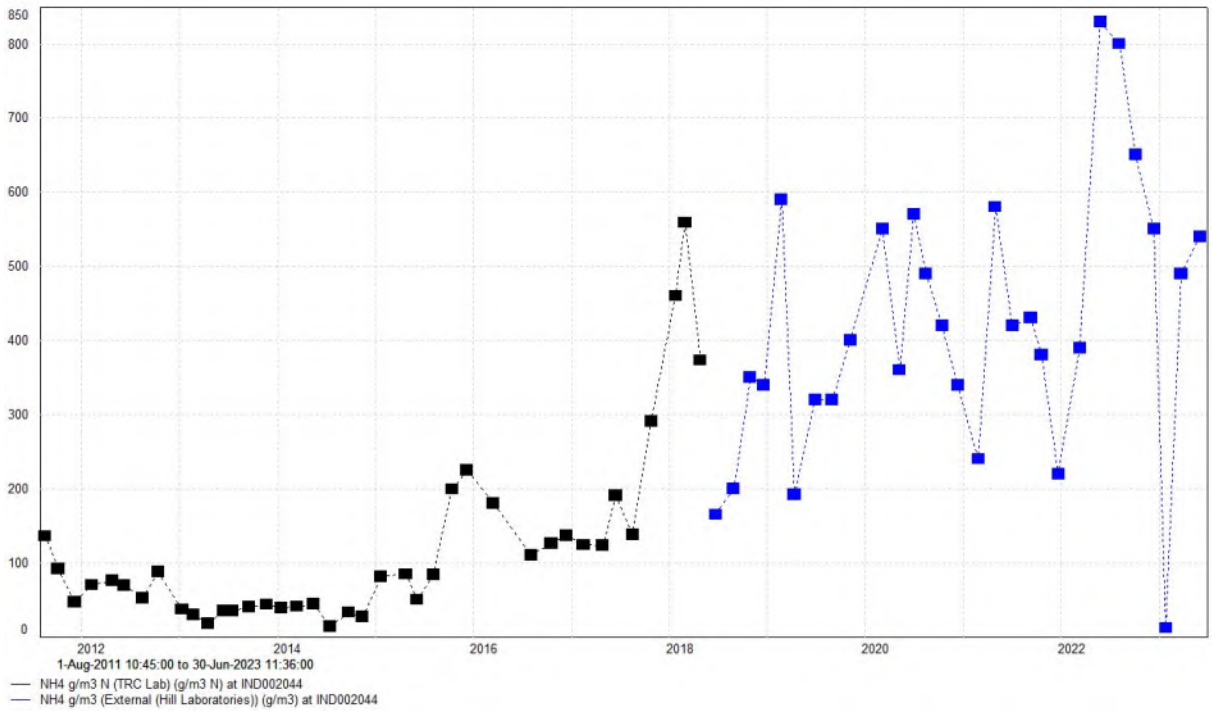


Figure 18 Total ammoniacal nitrogen concentrations in the irrigation retention pond 2011-2023

Figure 18 above shows the trends in the concentration of ammoniacal nitrogen in the irrigation pond since 2011. The data show a substantial overall increase in the concentration of ammonia entering the irrigation holding pond since around 2018, and a sharp and high peak in May 2022 that was more than a third higher than any previous result. In the year under review, concentrations of total ammoniacal nitrogen in the storage pond have remained very high (the anomalous result shown in Figure 12 for December 2022 is regarded as having been mistakenly sampled from the wrong location, and should be disregarded), The significance of increased ammoniacal or total nitrogen for the nitrogen loading on the pasture in the irrigation fields is discussed in Section 3.1.

The pattern of much higher leaching of ammonia in recent years is suggestive of much greater volumes of organic wastes being processed, and/or poorer covering of the materials during the composting process, leading to greater leaching and loss rates of soluble nutrients.

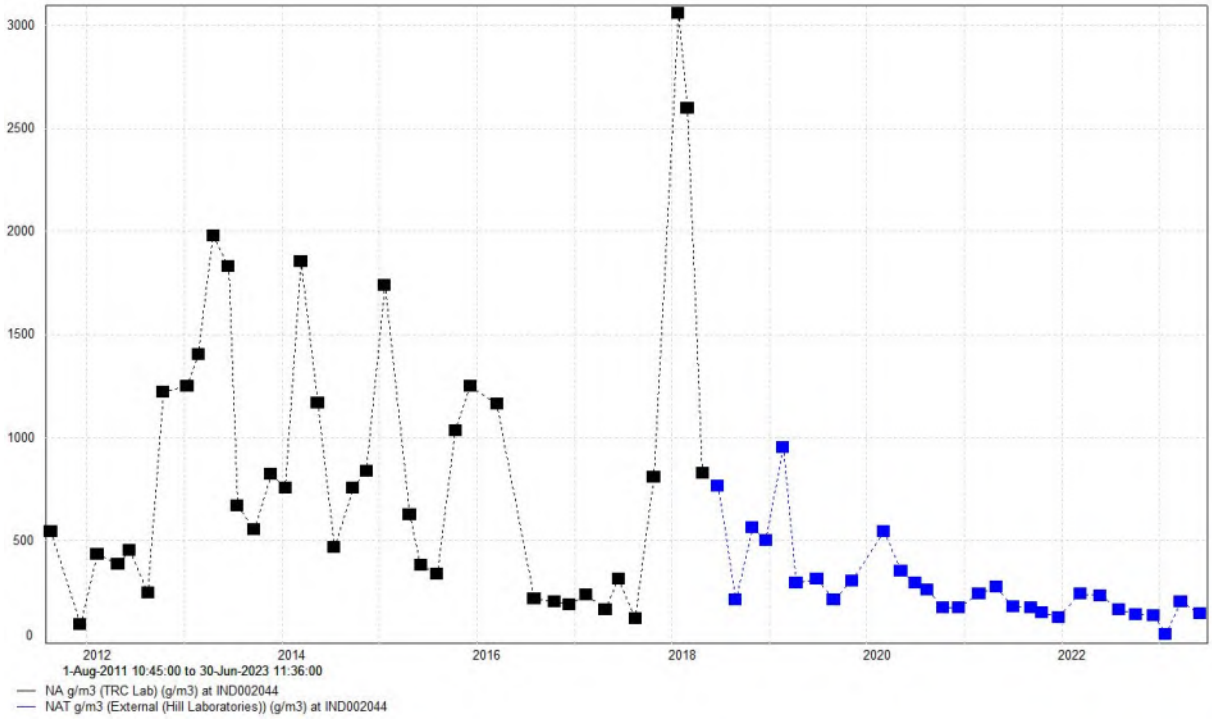


Figure 19 Ionised sodium concentrations in the irrigation retention pond 2011-2023

Figure 19 above presents the data for the concentration of sodium in the irrigation wastewaters since 2011. The application of excessive quantities of ionic sodium to soil causes degradation of soil structure, leading to loss of productivity and increased erosion. The pattern of reducing sodium concentrations is encouraging. It is noted that RNZ committed to eliminating the reception of drilling wastes from December 2020, and this appears to have had clear benefits, while noting that sodium concentrations were overall reducing prior to this time in any case (but with considerable variability and wide ranges in results). The reduction in sodium concentrations (and by implication, in total sodium loadings on irrigation soils) parallels the reduction in chloride noted above.

2.6.3 Results of soil monitoring (irrigation areas)

Nine irrigation areas are now in operation at the Uruti site (Figure 9). Two composite samples were collected from each irrigation area this monitoring period, on 16 May 2023. Shallow samples were collected every 2.5 m along a 50 m transect to a depth of 60 mm, and composited in the field. The deep samples were collected every 4 m along a 50 m transect, via a soil corer extracting to a depth of 300 mm below ground level, before compositing.

Included in the data set are the sample results from the previous monitoring periods, for comparison purposes.

In February 2023 the consulting company PDP[9] conducted a Detailed Site Investigation (DSI). The results and their implications were under Council review at the end of the year.

[9] Uruti Composting Facility Detailed Site Investigation prepared for Remediation New Zealand' August 2023, PDP (Draft)

Table 20 Irrigation area U1 soil results 2018-2023 (Columns presenting 'deep' samples are shaded for ease of comparison)

Soil results	Area	U1	U1	U1	U1 shallow	U1 shallow	U1 deep
Parameter	Unit/Date	24 Jan 18	26 Jun 20	3 Aug 21	3 Aug 21	16 May 23*	
Dry Matter	g/100 g as rcvd	69	69	68	54	56	66
Soluble Salts	g/100 g dry wt	-	< 0.05	< 0.05	< 0.05	<0.05	<0.05
Conductivity from soluble salts	mS/cm	-	< 0.2	< 0.2	< 0.2	<0.2	<0.2
Total Recoverable Barium	mg/kg dry wt	-	570	900	2,200	1,750	540
Total Recoverable Calcium	mg/kg dry wt	33.5	3,700	3,900	4,600	4,900	3,800
Total Recoverable Magnesium	mg/kg dry wt	4	6,000	6,400	5,700	6,300	6,900
Total Recoverable Potassium	mg/kg dry wt	23.7	1,300	1,340	1,580	1,610	1,290
Total Recoverable Sodium	mg/kg dry wt	46.8	199	165	177	152	125
Chloride	g/m^3	119.5	240	49	74	20	49
pH	pH Units	5.3	5.6	6	6	6.1	5.9
Total Recoverable Arsenic	mg/kg dry wt	5	4	5	4	4	5
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	0.12	0.1	0.13	0.12	<0.10
Total Recoverable Chromium	mg/kg dry wt	22	21	21	18	20	22
Total Recoverable Copper	mg/kg dry wt	13	11	12	14	14	12
Total Recoverable Lead	mg/kg dry wt	15.4	13	14.6	12.4	13.7	15.3
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	<0.10	<0.10
Total Recoverable Nickel	mg/kg dry wt	16	14	15	13	15	17
Total Recoverable Zinc	mg/kg dry wt	66	61	68	77	70	70
Permethrin	mg/kg dry wt	-	-	< 0.003	< 0.004	-	-
Propiconazole	mg/kg dry wt	-	-	< 0.006	< 0.008	-	-
Tebuconazole	mg/kg dry wt	-	-	< 0.009	< 0.011	-	-
Benzo[e]pyrene	mg/kg dry wt	0.015	< 0.014	< 0.014	< 0.014	-	<0.016
Perylene	mg/kg dry wt	0.019	< 0.014	< 0.015	< 0.018	-	<0.016

Soil results	Area	U1	U1	U1	U1 shallow	U1 shallow	U1 deep
Parameter	Unit/Date	24 Jan 18	26 Jun 20	3 Aug 21	3 Aug 21	16 May 23*	
Sodium Absorption Ratio (SAR)		2	2	1.6	1.2	0.7	

*A scan of the shallow and deep soil samples collected on 16 May 2023 for polycyclic aromatic hydrocarbons did not detect any above the various limits of detection.

Irrigation area U1

Area U1 (0.51 ha) is located up gradient from the drilling mud pad, towards the south east side of the Uruti composting site. The monitoring of shallow soils in this locality over the past four years indicated the following:

- Soluble salts and the conductivity from the soluble salts were all below the laboratory limit of detection (LOD).
- Total barium demonstrated a rapidly increasing concentration between 2020 and 2021, noting the concentration of barium was more elevated in the shallow soil samples from 2021 and 2023, as opposed to the deeper soils. Barium at both depths fell slightly in the 2023 survey, although still three times higher than three years previously.
- Total recoverable calcium results demonstrated a relatively stable concentration between 2020 and 2021, having substantially increased after the first sampling (January 2018). It is noted that in the most recent survey, the concentration of calcium in the shallow soils has increased further.
- It should be noted in the case of the calcium, potassium and sodium concentrations, results are significantly higher after the initial survey. This is at least in part due to change in laboratory analytical technique. The more recent samples have been analysed through a complete digestion, rather than measuring what was bioavailable.
- Chloride results continue to demonstrate a decrease in concentration over time, in both shallow and deeper soils.
- Total heavy metal concentrations have remained stable across the four surveys.
- In terms of polycyclic aromatic hydrocarbons, only compounds which were detected in the initial survey were tabulated. No detections of benzo[a]pyrene or perylene were recorded above the LOD in more recent monitoring periods.
- The sodium absorption ratio (SAR) remains low.
- Other than the increasing concentration of total barium in the soil (which appeared to plateau by the May 2023 survey), there are no results or trends of concern at this time for the area being monitored. The barium was presumably being re-distributed from the drilling wastes on Pad 3, via the irrigation wastewaters.

Table 21 Irrigation area U2 soil monitoring 2018-2023

Soil results	Area	U2	U2	U2	U2	U2	U2 shallow	U2 shallow	U2 deep
Parameter	Unit/Date	21 Jun 18	1 Nov 18	12 Apr 19	26 Jun 20	3 Aug 21	3 Aug 21	16 May 23*	
Dry Matter (Env)	g/100 g as rcvd	49	53	64	71	69	53	72	76
Soluble Salts	g/100 g dry wt	-	< 0.05	0.07	0.09	0.05	0.07	<0.05	0.09
Conductivity from soluble salts	mS/cm	-	< 0.2	0.2	0.2	< 0.2	0.2	<0.2	0.3
Total Recoverable Barium	mg/kg dry wt	-	-	780	186	450	550	250	156
Total Recoverable Calcium	mg/kg dry wt	5,000	5,600	3,900	3,700	5,100	9,200	7,000	4,500
Total Recoverable Magnesium	mg/kg dry wt	4,900	4,800	4,300	5,700	6,500	6,200	7,000	6,400
Total Recoverable Potassium	mg/kg dry wt	1,620	1,950	1,360	1,280	1,720	1,780	1,430	1,210
Total Recoverable Sodium	mg/kg dry wt	145	160	165	143	210	260	151	126
Chloride	g/m^3	33	54	200	125	153	130	8	39
pH	pH Units	6.3	6.8	5.5	5.5	6.4	7	7.2	6.1
Total Recoverable Arsenic	mg/kg dry wt	-	5	4	5	5	6	6	5
Total Recoverable Cadmium	mg/kg dry wt	-	0.19	< 0.10	< 0.10	< 0.10	< 0.10	<0.10	<0.10
Total Recoverable Chromium	mg/kg dry wt	-	18	19	19	20	20	21	21
Total Recoverable Copper	mg/kg dry wt	-	14	12	11	14	20	15	14
Total Recoverable Lead	mg/kg dry wt	-	13.2	13.4	13.2	14.6	20	18.5	53
Total Recoverable Mercury	mg/kg dry wt	-	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	<0.10	<0.10
Total Recoverable Nickel	mg/kg dry wt	-	12	14	16	16	17	20	20
Total Recoverable Zinc	mg/kg dry wt	--	63	56	57	70	93	78	67
Permethrin	mg/kg dry wt	-	-	-	-	< 0.003	< 0.004	-	-

Soil results	Area	U2	U2	U2	U2	U2	U2 shallow	U2 shallow	U2 deep
Parameter	Unit/Date	21 Jun 18	1 Nov 18	12 Apr 19	26 Jun 20	3 Aug 21	3 Aug 21	16 May 23*	
Propiconazole	mg/kg dry wt	-	-	-	-	< 0.006	< 0.008	-	-
Tebuconazole	mg/kg dry wt	-	-	-	-	< 0.009	< 0.011	-	-
TPH C15 - C36	g/m^3	55	< 50	< 40	< 40	< 40	67	-	-
Sodium Absorption Ratio (SAR)		0.8	1.2	1.5	1.6	1.9	1.1	0.9	-

*A scan of the shallow and deep soil samples collected on 16 May 2023 for polycyclic aromatic hydrocarbons did not detect any above the various limits of detection.

Irrigation area U2

Irrigation area U2 (2.53 ha) is also located in the upper reaches of the Uruti composting facility. Six soil surveys have been undertaken at this location since June 2018. In terms of the shallow and deep 2021 and 2023 soil samples, the shallower samples held a higher concentration than the deeper core, except for the linked parameters of soluble salts and conductivity in the most recent survey.

- Conductivity from the soluble salts remains near or below the LOD in shallow soils, although more pronounced in deeper soils.
- Total recoverable barium results ranged 186-780 mg/kg. There is no clear trend over time, although results at both depths are lower in May 2023 than was the case two years ago.
- Calcium ranged 3,700-9,200 g/m^3. The shallower soil samples show more elevated results than the deeper core. While the latest shallow soil result is lower than that of two years ago (which was the highest to date), there is no consistent pattern in the concentration of calcium.
- Magnesium results have demonstrated a slight increasing concentration since 2018.
- Potassium remained relatively stable across the six surveys, with little difference between the shallow or deeper core.
- Soil sodium results had demonstrated a slight but steady increase in concentration since 2018, with a recent reduction to levels seen in earlier years. The sodium absorption ratio remains very low, so the increase is not yet of concern.
- pH results remained weakly acidic, ranging 5.5-7.0 pH.
- Total recoverable (TR) arsenic results have remained relatively stable and low across all monitoring rounds.
- TR cadmium results, apart from a trace detection (0.19 g/m^3, 1 November 2018), early in the data set, remain below the LOD.
- TR chromium, copper, lead and nickel remained relatively stable across the soil samples, at both depths.
- TR mercury was below the LOD in all samples.
- TR zinc had demonstrated a slight increasing trend over time but may have reduced slightly, although still above all previous levels except those of 2021.
- In terms of PAH's, no compound has been detected above the LOD in any of the soil samples of this area, over time (since 2018). These results have not been tabulated.
- In terms of TPH, only carbon chain C15-C36 recorded trace concentrations in June 2018, but again more recently in the August 2021, U2 shallow sample.
- Sodium absorption ratios remained low across all soil samples.
- There are no results or trends that give rise to concern at this time for area U2. In the most recent survey, there are indications of an apparent reduction in some parameters. Future surveys will establish whether these are real changes or just random variability.

Table 22 Irrigation area U3 soil monitoring 2019-2023 (Columns presenting 'deep' samples are shaded for ease of comparison)

Soil results	Area	U3	U3	U3 shallow	U3	U3 shallow	U3 deep
Parameter	Unit/Date	12 Apr 19	26 Jun 20	3 Aug 21	3 Aug 21	16 May 23*	
Dry Matter (Env)	g/100 g as rcvd	77	74	78	62	72	80
Soluble Salts	g/100 g dry wt	< 0.05	0.17	0.08	0.08	<0.05	0.13
Conductivity from soluble salts	mS/cm	< 0.2	0.5	0.2	0.2	<0.3	0.4
Total Recoverable Barium	mg/kg dry wt	270	360	1,080	690	1,070	360
Total Recoverable Calcium	mg/kg dry wt	5,500	6,200	5,900	5,400	5,500	4,300
Total Recoverable Magnesium	mg/kg dry wt	6,300	6,800	7,000	6,300	7,500	6,400
Total Recoverable Potassium	mg/kg dry wt	1,410	1,660	1,520	1,580	1,700	1,290
Total Recoverable Sodium	mg/kg dry wt	156	230	240	188	165	146
Chloride	g/m^3	8	290	250	67	28	95
pH	pH Units	6.5	6.4	6.6	6.7	6.4	5.6
Total Recoverable Arsenic	mg/kg dry wt	5	5	5	6	6	5
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	<0.10	<0.10
Total Recoverable Chromium	mg/kg dry wt	20	21	21	19	23	21
Total Recoverable Copper	mg/kg dry wt	14	15	15	16	15	14
Total Recoverable Lead	mg/kg dry wt	16.2	16.4	16.8	22	17.0	16.0
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	<0.10	<0.10
Total Recoverable Nickel	mg/kg dry wt	20	19	19	18	21	21
Total Recoverable Zinc	mg/kg dry wt	67	68	72	74	76	64
Permethrin	mg/kg dry wt	-	-	< 0.003	< 0.003	-	-
Propiconazole	mg/kg dry wt	-	-	< 0.006	< 0.007	-	-
Tebuconazole	mg/kg dry wt	-	-	< 0.008	< 0.010	-	-
Perylene	mg/kg dry wt	< 0.013	0.084	< 0.013	0.029	-	<0.013
C15 - C36	mg/kg dry wt	< 40	42	< 40	47	-	-
Sodium Absorption Ratio (SAR)		0.7	1.7	1.3	1.2	1.3	-

*A scan of the shallow and deep soil samples collected on 16 May 2023 for polycyclic aromatic hydrocarbons did not detect any above the various limits of detection.

Irrigation area U3

Irrigation area U3 is the irrigation area furthest up catchment, spanning an area of 1.98 ha. Four soil surveys have been undertaken in this area since 2019.

- Soluble salts have ranged from below the LOD through to 0.17 g/100 g (1,700 mg/kg). Their concentrations have decreased in shallow soils but increased at depth, in the latest survey.
- Conductivity from the soluble salts ranged from below the LOD, through to 0.5 mS/cm.
- TR barium recorded an increase in concentration to 2021, ranging 270–1,080 mg/kg, but more recently appear to have plateaued. The shallow samples have much higher concentrations than the deeper core concentration, and 3-4 times higher than earlier samples.
- Calcium, magnesium, potassium and sodium remained relatively stable at both depths across the four surveys.
- Chloride results indicated an increase between the first and the subsequent monitoring rounds, with the shallow sample having a higher concentration than the deeper core in the 2021 monitoring period. However, this reversed in the latest survey, with the deeper soils showing the higher concentration of chloride. The concentration of chloride in the shallow soils fell substantially by comparison with the previous two surveys, almost back to the level found in the first survey.
- Soil pH remained stable across all four surveys, weakly acidic, with greater acidity now showing at depth.
- TR arsenic, copper, lead, nickel and zinc remained stable across all four samples.
- TR cadmium and mercury were below the LOD in all four samples.
- In terms of PAHs, only perylene has been recorded at low concentration, on two separate occasions. Having been detected at depth in the previous survey it was not detected in deeper soils in the latest survey.
- Sodium absorption ratio (SAR) remained low in all four samples.
- There was an increasing trend in barium, which seems to have stabilised. All results give rise to no environmental concerns at this time for the area being monitored.

Table 23 Irrigation area L1 soil monitoring 2018-2023. (Columns presenting 'deep' samples are shaded for ease of comparison)

Soil results	Area	L1	L1	L1	L1	L1	L1	L1 shallow	L1 shallow	L1 deep
Parameter	Unit/Date	24 Jan 18	21 Jun 18	1 Nov 18	12 Apr 19	26 Jun 20	5 Aug 21	5 Aug 21	16 May 23*	
Dry Matter (Env)	g/100 g as rcvd	70	61	63	61	71	71	53	66	73
Soluble Salts	g/100 g dry wt	-	-	0.15	0.1	0.08	< 0.05	0.09	0.07	0.13
Conductivity from soluble salts	mS/cm	-	-	0.4	0.3	0.2	< 0.2	0.3	0.2	0.4
Total Recoverable Barium	mg/kg dry wt	-	-	-	1660	1280	930	1,940	1,470	380
Total Recoverable Calcium	mg/kg dry wt	103.7	13,100	10,900	9,900	7,100	7,700	11,400	9,300	7,000
Total Recoverable Magnesium	mg/kg dry wt	13.5	4,500	5,500	3,800	5,500	5,900	5,100	6,400	7,000
Total Recoverable Potassium	mg/kg dry wt	40.4	1,470	1,470	1,990	1,500	1,590	1,880	1,720	1,350
Total Recoverable Sodium	mg/kg dry wt	59.2	270	340	300	320	290	310	270	210
Chloride	g/m^3	129	73	470	270	450	220	155	55	28
pH	pH Units	6.2	7.4	7	7	7.3	7	7.4	7.2	7.7
Total Recoverable Arsenic	mg/kg dry wt	4	-	6	5	5	5	7	6	4
Total Recoverable Cadmium	mg/kg dry wt	0.21	-	0.2	0.28	0.18	0.18	0.23	0.23	<0.10
Total Recoverable Chromium	mg/kg dry wt	20	-	20	16	19	22	21	21	21
Total Recoverable Copper	mg/kg dry wt	14	-	24	19	21	16	26	22	15
Total Recoverable Lead	mg/kg dry wt	16.3	-	22	19.8	18.8	16.5	24	25	17.0
Total Recoverable Mercury	mg/kg dry wt	< 0.10	-	< 0.10	< 0.10	< 0.10	0.18	< 0.10	<0.10	<0.10
Total Recoverable Nickel	mg/kg dry wt	15	-	15	10	13	16	14	16	21
Total Recoverable Zinc	mg/kg dry wt	73	-	98	95	76	80	105	95	72

Soil results	Area	L1	L1	L1	L1	L1	L1	L1 shallow	L1 shallow	L1 deep
Parameter	Unit/Date	24 Jan 18	21 Jun 18	1 Nov 18	12 Apr 19	26 Jun 20	5 Aug 21	5 Aug 21	16 May 23*	
Permethrin	mg/kg dry wt	-	-	-	-	-	< 0.003	< 0.004	-	-
Propiconazole	mg/kg dry wt	-	-	-	-	-	< 0.006	< 0.008	-	-
Tebuconazole	mg/kg dry wt	-	-	-	-	-	< 0.009	< 0.011	-	-
C15 - C36	mg/kg dry wt	69	96	**84**	**149**	**47**	< 40	100	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	69	105	**84**	**149**	< 70	< 70	101	-	-
Sodium Absorption Ratio (SAR)		1.4	1.3	1.6	1.8	1.9	1.7	1.5	0.9	-

*A scan of the shallow and deep soil samples collected on 16 May 2023 for polycyclic aromatic hydrocarbons did not detect any above the various limits of detection

Irrigation area L1

Irrigation area L1 (1.31 ha) is located at the northern end of the site, in close proximity to the main gate. It is one of the lower irrigation areas at the site as it is second furthest down catchment.

- Seven soil surveys have been undertaken in this area since 2018 (Table 23).
- Soluble salts has been analysed in five of the seven surveys. These ranged from below the LOD through to 0.15 g/100 g (1,500 mg/kg).
- TR barium results ranged 930–1,940 mg/kg, with the elevated result recorded in the 2021 survey in the shallow core (L1 shallow). The most recent results suggest a possible reduction in both shallow and deeper soils.
- TR calcium results, barring the initial round (24 January 2018), ranged 7,100–13,100 mg/kg. It should be noted that a change in laboratory analytical technique resulted in a more rigorous digestion of the soil samples, and as such the concentrations for cations are more elevated in the subsequent rounds than the initial. Concentrations continue to be variable.
- TR magnesium, barring the initial round, ranged 3,800–6,400 mg/kg (shallow soils). From the most recent results, magnesium might be increasing.
- TR potassium, bar the first round (24 January 2018) remains relatively stable, ranging 1,470–1,990 mg/kg.
- TR sodium also remained relatively stable, bar the initial round, ranging 270-340 mg/kg.
- Chloride concentrations ranged 55–470 mg/kg, and more recently have recorded a slight decrease in concentration over time, in both shallow and deeper soils.
- TR arsenic remained relatively stable, ranging 4–7 mg/kg across the six samples analysed.
- TR cadmium was measurable in all samples analysed, ranging 0.18–0.28 mg/kg.
- TR copper, lead, nickel and zinc remained relatively stable across all samples.
- TR mercury recorded a measurable trace concentration at depth (0.18 mg/kg, 05 August 2021), but all remaining samples have been below the LOD.
- No PAHs were recorded above the LOD across all samples collected.
- Sodium absorption ration (SAR), remained low, ranging 1.3–1.9.
- All results give rise to no environmental concerns at this time for the area being monitored. The hydrocarbon concentrations measured earlier were well below any recognised thresholds for environmental effects.

Table 24 Irrigation area L2 soil monitoring 2018-2023. (Columns presenting results for 'deep' samples have been highlighted for ease of comparison)

Soil results	Area	L2	L2	L2	L2	L2 shallow	L2	L2 shallow	L2 shallow	L2 deep
Parameter	Unit/Date	24 Jan 18	1 Nov 18	12 Apr 19	26 Jun 20	26 Jun 20	5 Aug 21	5 Aug 21	16 May 23*	
Dry Matter (Env)	g/100 g as rcvd	73	59	54	68	74	66	60	61	68
Soluble Salts	g/100 g dry wt	-	0.18	0.31	0.08	0.13	< 0.05	< 0.05	<0.05	<0.05
Conductivity from soluble salts	mS/cm	-	0.5	0.9	0.2	0.4	< 0.2	< 0.2	<0.2	<0.2
Total Recoverable Barium	mg/kg dry wt	-	-	1,380	490	2,300	410	650	520	250
Total Recoverable Calcium	mg/kg dry wt	279	13,800	17,200	8,500	9,800	7,300	6,900	5,900	4,500
Total Recoverable Magnesium	mg/kg dry wt	24.3	5,100	4,700	5,200	6,000	6,300	6,100	5,100	5,100
Total Recoverable Potassium	mg/kg dry wt	466.9	2,500	3,300	2,300	1,800	2,000	1,850	1,710	1,770
Total Recoverable Sodium	mg/kg dry wt	624.3	520	690	370	400	240	250	180	162
Chloride	g/m^3	1,254	580	1,060	440	680	68	53	7	21
pH	pH Units	7.2	7	7.2	7.2	7.1	7.2	7	6.1	6.8
Total Recoverable Arsenic	mg/kg dry wt	5	5	6	4	5	4	5	4	4
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	0.32	0.27	0.18	0.12	0.16	0.15	0.24	0.17
Total Recoverable Chromium	mg/kg dry wt	20	18	19	19	20	23	22	20	18
Total Recoverable Copper	mg/kg dry wt	21	32	24	13	18	14	16	11	11
Total Recoverable Lead	mg/kg dry wt	18.4	22	29	14.5	20	14.3	14.5	11.0	14.8
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	<0.10	<0.10
Total Recoverable Nickel	mg/kg dry wt	18	13	13	13	16	16	15	13	13
Total Recoverable Zinc	mg/kg dry wt	75	94	109	68	84	73	72	65	55
Permethrin	mg/kg dry wt	-	-	-	-	-	< 0.003	< 0.003	-	-
Propiconazole	mg/kg dry wt	-	-	-	-	-	< 0.007	< 0.007	-	-
Tebuconazole	mg/kg dry wt	-	-	-	-	-	< 0.009	< 0.010	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.014	< 0.017	0.019	< 0.015	< 0.013	<0.016	<0.017	-	<0.016

Soil results	Area	L2	L2	L2	L2	L2 shallow	L2	L2 shallow	L2 shallow	L2 deep
Parameter	Unit/Date	24 Jan 18	1 Nov 18	12 Apr 19	26 Jun 20	26 Jun 20	5 Aug 21	5 Aug 21	16 May 23*	
Fluoranthene	mg/kg dry wt	< 0.014	< 0.017	0.02	< 0.015	< 0.013	<0.016	<0.017	-	<0.015
Perylene	mg/kg dry wt	0.087	< 0.017	< 0.019	0.048	< 0.013	< 0.015	< 0.017	-	<0.015
C10 - C14	mg/kg dry wt	< 20	< 20	< 30	22	40	< 20	< 20	-	-
C15 - C36	mg/kg dry wt	157	82	125	167	260	< 40	55	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	157	82	125	189	300	< 70	< 70	-	-
Sodium Absorption Ratio (SAR)		9.6	4.3	4.3	3.5	2.1	2.3	1.7	0.9	-

*A scan of the shallow and deep soil samples collected on 16 May 2023 for polycyclic aromatic hydrocarbons did not detect any above the various limits of detection.

Irrigation area L2

Irrigation L2 (1.61 ha) is one of the oldest irrigation areas on site. Six soil surveys have been collected since 2018 (Table 24).

- Soluble salts have ranged from below the LOD through to 0.31 g/100 g (3,100 mg/kg). It was noted that the samples collected in the period under review were both below the LOD (shallow and deep cores). This suggests a reduction in salt concentrations when compared to the 2018 and 2019 sample rounds.
- TR barium ranged 250–2,300 mg/kg in May 2023, with the concentrations in the latest survey being amongst the lowest concentrations found to date.
- TR calcium ranged (barring the initial round as per the comment above for calcium in area L1) 5,900–17,200 mg/kg. The concentration appears to have reduced from earlier peak values.
- TR magnesium ranged relatively stable across the soil samples (bar the initial sample, see comment for L1 re cation digestion).
- TR potassium and sodium both demonstrated a slight reducing trend since 2018 and 2019 respectively.
- Chloride concentrations have reduced significantly in this area since 2018, in both shallow and deeper soils.
- Soil pH had remained stable, remaining neutral, 7–7.2 pH. However, both shallow and deeper soils have become more acidic.
- TR arsenic remained stable across all samples analysed.
- TR cadmium was measurable in all but one sample (24 January 2018), ranging 0.15–0.32 g/m^3.
- TR chromium, copper, nickel and zinc remained relatively stable across the monitoring rounds and are within or close to background soil concentrations for these elements.
- TR mercury was below the LOD in all samples analysed.
- Permethrin, propiconazole and tebuconazole were below the LOD in both samples collected this monitoring period.
- In terms of PAHs, benzo (a) pyrene has been recorded only on one occasion (12 April 2019, 0.19 mg/kg).
- Fluoranthene was also recorded on one occasion (12 April 2019, 0.02 mg/kg).
- Perylene was recorded on two occasions (24 January 2018, 0.087 mg/kg and 26 June 2020, 0.048 mg/kg).
- Sodium absorption ratio (SAR) ranged 0.9–9.6. It is noted the most recent results are the lowest results for this parameter, in this data set.
- The apparent reductions in sodium and chloride would be positive for soil quality and health if maintained. The recent absence of aromatic hydrocarbons at detectable concentrations is likewise encouraging. All results give rise to no environmental concerns at this time for the area being monitored. The hydrocarbon concentrations previously measured were well below any recognised thresholds for environmental effects.

Table 25 Irrigation area L3 soil monitoring 2018-2023 (Columns presenting results for 'deep' samples have been highlighted for ease of comparison)

Soil results	Area	L3	L3	L3	L3 shallow
Parameter	Unit/Date	21 Jun 18	26 Jun 20	3 Aug 21	3 Aug 21
Dry Matter (Env)	g/100 g as rcvd	56	74	78	68
Soluble Salts	g/100 g dry wt	-	0.13	0.05	< 0.05
Conductivity from soluble salts	mS/cm	-	0.4	< 0.2	< 0.2
Total Recoverable Barium	mg/kg dry wt	-	2,300	320	450
Total Recoverable Calcium	mg/kg dry wt	9,600	9,800	6,000	10,600
Total Recoverable Magnesium	mg/kg dry wt	4,700	6,000	7,100	6,900
Total Recoverable Potassium	mg/kg dry wt	2,200	1,800	1,480	1,480
Total Recoverable Sodium	mg/kg dry wt	570	400	230	230
Chloride	g/m^3	580	680	230	52
pH	pH Units	7.3	7.1	6.7	7.2
Total Recoverable Arsenic	mg/kg dry wt	-	5	5	5
Total Recoverable Cadmium	mg/kg dry wt	-	0.12	< 0.10	0.11
Total Recoverable Chromium	mg/kg dry wt	-	20	21	21
Total Recoverable Copper	mg/kg dry wt	-	18	14	17
Total Recoverable Lead	mg/kg dry wt	-	20	15.2	21
Total Recoverable Mercury	mg/kg dry wt	-	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	-	16	18	16
Total Recoverable Zinc	mg/kg dry wt	-	84	73	91
Permethrin	mg/kg dry wt	-	-	< 0.003	< 0.003
Propiconazole	mg/kg dry wt	-	-	< 0.006	< 0.007
Tebuconazole	mg/kg dry wt	-	-	< 0.008	< 0.009
Benzo[b]fluoranthene + Benzo[j]fluoranthene		<0.013	0.013	<0.013	<0.013
Pyrene	mg/kg dry wt				
C7 - C9	mg/kg dry wt	< 11	< 8	< 8	< 9
C10 - C14	mg/kg dry wt	< 30	40	< 20	< 20
C15 - C36	mg/kg dry wt	49	260	< 40	60
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 80	300	< 70	< 70
Sodium Absorption Ratio (SAR)		4.6	2.1	2.1	1.2

Irrigation area L3

Irrigation area L3 (1.47 ha) is also a long term irrigation area.

Four surveys have been collected from this area since 2018 by the Council.

- Conductivity from field salts ranged from below the LOD on two occasions (including the latest results) up to 0.4 mS/cm.
- Soluble salts ranged from below the LOD through to 0.13 g/100 g, with the latest results being at (deeper soils) and below (shallow soils) the LOD.
- TR barium ranged from 320-2,300 mg/kg.

- TR calcium ranged from 6,000-14,000 mg/kg, with the latest results being the highest observed to date.
- TR magnesium ranged 4,700-7,100 mg/kg, with no apparent pattern or trend.
- TR potassium ranged 1,480-3,000 mg/kg, with an apparent recent increase.
- TR sodium ranged 230-570 mg/kg, with an apparent recent increase.
- Chloride demonstrated an apparent reduction across the samples, over time, ranging 52-680 mg/kg.
- pH results remained relatively stable, fluctuating either side of pH 7.
- TR arsenic, cadmium, copper, lead, nickel and zinc remained stable across the three sampling rounds analysed.
- TR mercury was below the LOD on the three occasions analysed.
- In terms of PAHs, benzo[b]fluoranthene + benzo[j]fluoranthene has been recorded on one occasion (26 June 2020) at a low concentration. The rest of the PAHs were below the LOD.
- Sodium absorption ratio ranged 1.2-4.6.
- The apparent recent increases in sodium and potassium would be deleterious for soil quality and health if maintained. However, all results give rise to no environmental concerns at this time for the area being monitored.
- The results for lead and zinc, and for C15-C30 and total hydrocarbons in quadrat L3-D were above background soil concentrations. The result for barium in the same quadrat was above criteria applied for ecological protection.

Table 26 Irrigation area L4 soil monitoring 2019-2023 (Columns presenting results for 'deep' samples have been highlighted for ease of comparison)

Soil results	Area	L4 Baseline	L4 Baseline	L4	L4 shallow	L4 shallow	L4 deep
Parameter	Unit/Date	11 Nov 19	11 Nov 19	5 Aug 21	5 Aug 21	16 May 23*	
Dry Matter (Env)	g/100 g as rcvd	68	77	72	62	57	72
Soluble Salts	g/100 g dry wt	< 0.05	< 0.05	0.08	0.06	0.14	0.08
Conductivity from soluble salts	mS/cm	< 0.2	< 0.2	0.2	< 0.2	0.4	0.2
Total Recoverable Barium	mg/kg dry wt	36	39	230	1,030	3,300	1,480
Total Recoverable Calcium	mg/kg dry wt	2,800	3,000	5,800	6,800	24,000	13,100
Total Recoverable Magnesium	mg/kg dry wt	5,100	5,100	7,200	5,400	4,900	5,800
Total Recoverable Potassium	mg/kg dry wt	880	910	1,460	1,640	1,880	1,360
Total Recoverable Sodium	mg/kg dry wt	80	90	192	210	410	240
Chloride	g/m^3	10	6	66	121	65	66
pH	pH Units	5.6	5.8	7.2	6.9	7.3	7.3
Total Recoverable Arsenic	mg/kg dry wt	4	3	4	5	10	7
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	0.14	0.22	0.13
Total Recoverable Chromium	mg/kg dry wt	18	16	23	19	21	21
Total Recoverable Copper	mg/kg dry wt	9	9	14	17	41	24
Total Recoverable Lead	mg/kg dry wt	10.8	10.4	15.1	19.3	44	28
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	<0.10	<0.10
Total Recoverable Nickel	mg/kg dry wt	14	14	19	15	15	17
Total Recoverable Zinc	mg/kg dry wt	54	54	71	81	66	96
Permethrin	mg/kg dry wt	-	-	< 0.003	< 0.003	-	-
Propiconazole	mg/kg dry wt	-	-	< 0.006	< 0.007	-	-
Tebuconazole	mg/kg dry wt	-	-	< 0.009	< 0.010	-	-
C15 - C36	mg/kg dry wt	< 40	< 40	< 40	73	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	< 70	< 70	77	-	-
Sodium Absorption Ratio (SAR)		0.8	0.9	1	1.2	1.1	-

*A scan of the shallow soil sample collected on 16 May 2023 for polycyclic aromatic hydrocarbons did not detect any above the various limits of detection

Irrigation area L4

Irrigation area L4 (2.25 ha) is one of the newer irrigation area areas, constructed in the 2018-2019 monitoring period. Four soil surveys have been conducted in this locality since November 2019.

The two soil samples collected in November 2019 stand as baseline soil samples. These were collected before the area was utilised as an irrigation area.

The analysis of the 2023 results and long-term assessments indicated the following:

- Soluble salts ranged from below the LOD in the baseline samples, to 0.14 g/100g (1400 mg/kg) in the shallow core of the latest survey.
- Conductivity arising from soluble salts has reached its highest level to date, in the latest survey.
- TR barium results increased from the November 2019 monitoring round, with range of 36-39 mg/kg, through to 3,300 (shallow) and 1,480 (deeper soils) mg/kg in the latest survey, the highest results in L4 to date. The concentrations of barium in shallow soils across L4 are now 100 times higher than they were prior to the effects of irrigation activity being measured.
- TR calcium concentrations doubled in concentration between the November 2019 and the September 2021 monitoring rounds, increasing from 2,800-3,000 mg/kg to 5,800-6,800 mg/kg. They have now further increased four-fold (shallow) and double (deeper) soils. In shallow soils, calcium is now ten times higher than they were prior to the effects of irrigation activity being measured.
- TR magnesium concentrations have remained relatively stable, with higher concentrations in the deeper soils.
- TR potassium results increased across the monitoring rounds, and in shallow soils have reached their highest concentrations ever.
- Likewise, TR sodium results have increased five-fold in shallow soils across the monitoring rounds.
- Chloride concentrations increased from 6-10 mg/kg through to 66-121 mg/kg in August 2021, but have fallen back in shallow soils in the latest survey.
- Soil pH results have changed from a weakly acidic concentration (5.6-5.8 pH), to a more neutral concentration pH 6.9-7.2.
- TR arsenic may have recently increased..
- Likewise, TR cadmium results may have recently increased in both shallow and deeper soils.
- TR copper, lead, and zinc may have increased at depth.
- TR mercury remained below the LOD across all samples.
- In terms of TPH, carbon chain C15-C36 recorded a low concentration of 73 mg/kg in the August 2021 shallow sample.
- Sodium absorption ratio remained low across all samples analysed.
- The soil quality in this area is being significantly altered, with increases in a number of parameters that are markers of the application of irrigated wastewaters from RNZ's processes. Barium, associated with drilling wastes, has increased some 100 times over. Sodium has increased some five-fold; the concentrations of chloride have increased some 6-12 times over. On the other hand, the potentially toxic metals are not showing any evidence of increases to levels that are of concern.

Table 27 Irrigation area L5 soil monitoring 2020-2023 (Columns presenting results for 'deep' samples have been highlighted for ease of comparison)

Soil results	Area	L5	L5	L5 shallow	L5 shallow	L5 deep
Parameter	Unit/Date	26 Jun 20	3 Aug 21	3 Aug 21	16 May 23*	
Dry Matter (Env)	g/100 g as rcvd	68	67	57	60	64
Soluble Salts	g/100 g dry wt	< 0.05	< 0.05	< 0.05	0.08	0.07
Conductivity from soluble salts	mS/cm	< 0.2	< 0.2	< 0.2	0.2	<0.2
Total Recoverable Barium	mg/kg dry wt	67	71	72	93	78
Total Recoverable Calcium	mg/kg dry wt	4,400	4,000	3,400	4,100	3,700
Total Recoverable Magnesium	mg/kg dry wt	6,400	6,800	5,800	6,100	6,500
Total Recoverable Potassium	mg/kg dry wt	1320	1,320	1,340	2,000	1,330
Total Recoverable Sodium	mg/kg dry wt	137	140	116	280	230
Chloride	g/m^3	81	22	48	156	240
pH	pH Units	6.1	5.8	5.7	5.6	5.3
Total Recoverable Arsenic	mg/kg dry wt	5	5	4	5	6
Total Recoverable Cadmium	mg/kg dry wt	0.11	0.11	0.13	0.16	0.11
Total Recoverable Chromium	mg/kg dry wt	22	23	19	23	24
Total Recoverable Copper	mg/kg dry wt	11	12	11	10	11
Total Recoverable Lead	mg/kg dry wt	13.9	14.5	12	13.3	15.7
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	<0.10	<0.10
Total Recoverable Nickel	mg/kg dry wt	17	17	15	15	18
Total Recoverable Zinc	mg/kg dry wt	68	68	63	66	68
Permethrin	mg/kg dry wt	-	< 0.003	< 0.003	-	-
Propiconazole	mg/kg dry wt	-	< 0.007	< 0.008	-	-
Tebuconazole	mg/kg dry wt	-	< 0.009	< 0.011	-	-
Sodium Absorption Ratio (SAR)		0.9	1	0.8	2.9	-

*A scan of the shallow and deep soil samples collected on 16 May 2023 for polycyclic aromatic hydrocarbons did not detect any above the various limits of detection

Irrigation area L5

Irrigation area L5 (1.42 ha) is located to the east of the duck pond, in the centre of the site. This is also one of the newer irrigation areas.

Three surveys have been conducted within this area since 2020.

In terms of the analytical results:

- Soluble salts and conductivity results from the soluble salts were below the laboratory's LODs in the first two surveys, but both have now risen to measurable levels. That is, the soil is becoming more saline.
- TR barium has remained very low in this locality by comparison with other irrigation fields (e.g. L3 has barium concentrations 20 times higher).
- TR calcium results ranged 3,400-4,400 mg/kg, with no indications of any trend.
- TR magnesium ranged 5,800-6,800 mg/kg, with no indications of any trend.
- TR potassium ranged 1,320-2,000 mg/kg, with no indications of any trend.
- TR sodium ranged 116-280 mg/kg. These results are much lower than at sites L3 and L4.
- Chloride ranged 22-240 mg/kg, with an indication of recent increases in both shallow and deeper soils.
- pH results remain moderately acidic, in the range 5.3-6.1. pH may be decreasing. If so, this will tend to mobilise metals within the soil.
- TR arsenic ranged 4-6 mg/kg and remains stable.
- TR chromium ranged 19-24 mg/kg and remains stable.
- TR copper ranged 10-12 mg/kg and remains stable.
- TR lead ranged 12-15.7 mg/kg and remains stable.
- TR mercury was below the LOD in all samples.
- TR nickel ranged 15-18 mg/kg and remains stable.
- TR zinc ranged 63-68 mg/kg and remains stable.
- The sodium absorption ratio remained low, although relatively somewhat higher in the soil at L5 than at any other irrigation area in recent surveys. Much higher SAR levels had been found at some localities in early surveys.

Table 28 Irrigation area L6 soil monitoring 2021-23 (Columns presenting results for 'deep' samples have been highlighted for ease of comparison)

Soil results	Area	L6	L6 shallow	L6	L6 shallow
Parameter	Unit/Date	5 Aug 21	5 Aug 21	15 Oct 21	15 Oct 21
Dry Matter (Env)	g/100 g as rcvd	75	50	77	57
Soluble Salts	g/100 g dry wt	< 0.05	< 0.05	< 0.05	0.09
Conductivity from soluble salts	mS/cm	< 0.2	< 0.2	< 0.2	0.3
Total Recoverable Barium	mg/kg dry wt	390	2,500	430	2,500
Total Recoverable Calcium	mg/kg dry wt	6,700	19,300	8,400	18,200
Total Recoverable Magnesium	mg/kg dry wt	7,700	5,200	8,800	5,800
Total Recoverable Potassium	mg/kg dry wt	1,310	2,100	1,410	2,100
Total Recoverable Sodium	mg/kg dry wt	210	390	350	310
Chloride	g/m^3	14	46	19	75
pH	pH Units	7.6	7.8	7.0	7.3
Total Recoverable Arsenic	mg/kg dry wt	4	7	4	7
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	0.18	< 0.10	0.17
Total Recoverable Chromium	mg/kg dry wt	23	19	21	20
Total Recoverable Copper	mg/kg dry wt	18	32	22	32
Total Recoverable Lead	mg/kg dry wt	13.6	30	14.8	40
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	17	14	17	15
Total Recoverable Zinc	mg/kg dry wt	70	121	73	126
Permethrin	mg/kg dry wt	< 0.003	< 0.004	< 0.003	< 0.003
Propiconazole	mg/kg dry wt	< 0.006	< 0.009	< 0.006	< 0.008
Tebuconazole	mg/kg dry wt	< 0.008	< 0.012	< 0.008	< 0.011
Pyrene	mg/kg dry wt	< 0.013	0.02	< 0.013	< 0.018
C7 - C9	mg/kg dry wt	< 8	< 12	< 20	< 30
C10 - C14	mg/kg dry wt	< 20	< 30	< 20	28
C15 - C36	mg/kg dry wt	47	360	83	197
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	380	< 80	230
Sodium Absorption Ratio (SAR)		1	1.2	0.9	0.9

*A scan of the shallow soil sample collected on 16 May 2023 for polycyclic aromatic hydrocarbons did not detect any above the various limits of detection Irrigation area L6

Irrigation area L6 (2 ha) was constructed in the 2019-2020 monitoring period. It had not been utilised by the consent holder for irrigation prior to that time. Three Council surveys, together with a survey by PDP commissioned by RNZ, have been undertaken in this locality.

Analysis of the most recent and previous results indicated the following:

- Soluble salts and conductivity results from the soluble salts were both below the laboratory's LODs for two of the three Council surveys. In the shallow sample from October 2021 soluble salts were recorded at 0.09 g/100 g while corresponding conductivity was 0.3 mS/m.
- TR barium results in the Council surveys has ranged between 390-2,500 mg/kg. The first high shallow barium result had been collected prior to any use of the area for irrigation. This raises concern that drilling mud had been utilised for the construction of this irrigation area by the consent holder. If so, this would have been a breach of consent.
- TR calcium results ranged 6,000-19,300 mg/kg. This also suggests drilling mud origin. The concentration of calcium in shallow soils across L6 may be reducing, but any change is less marked in deeper soils.
- TR magnesium ranged 5,000-8,800 mg/kg, with no clear indication of any trends.
- TR potassium ranged 1,220-2,100 mg/kg, with a suggestion of a recent reduction.
- TR sodium ranged 184-390 mg/kg. These results are much higher than at similar sites L4 and L5, and similar to those at L2 and L3. This further suggests drilling wastes are present on the site. There is a suggestion of a recent reduction in sodium.
- Chloride ranged 14-75 mg/kg. In the most recent results, chloride in shallow soils were lower, but in deeper soils were higher than previously.
- pH results were previously weakly basic, ranging 7.0-7.8 pH, but were marginally acidic in the most recent survey.
- TR arsenic ranged 4-8 mg/kg, with no indication of any pattern or trend.
- TR chromium ranged 19-23 mg/kg, with no indication of any pattern or trend.
- TR copper ranged 16-32 mg/kg. It is noted that earlier copper results for L6 shallow were the most elevated in the soil samples collected from any irrigation area. This again suggests drilling wastes are present on the site.
- TR lead ranged 13.6-40 mg/kg with no indication of any pattern or trend.
- TR mercury was below the LOD in all samples.
- TR nickel ranged 14-17 mg/kg with no indication of any pattern or trend.
- TR zinc ranged 70-126 mg/kg with no indication of any pattern or trend. The concentration of 126 mg/kg in August 2021 was the most elevated in the data set of soil results for 2021-2022.
- In previous surveys for TPH, carbon chain C15-C36 was recorded in the range 47-360 mg/kg, while chain C10-14 was recorded in the shallow sample from October 2021 at 28 mg/kg. The concentrations of C15-C36 and total hydrocarbons in soil samples from this area were the highest of any measured for any of the irrigation areas in surveys at that time. The detection of such elevated hydrocarbons in the soil on area L6 prior to the use of the area for wastewater irrigation again raised concern that drilling mud has been utilised for the construction of this irrigation area by the consent holder. If so, this would have been a breach of consent.
- Sodium absorption ratio remains low or close to 1.

2.6.4 Discussion of metals concentrations within soils in the irrigation areas

Levels of parameters

Review of the 2022-2023 data in Tables 22-30 above indicates that the concentrations of barium, a marker for the presence of drilling wastes, in shallow samples range from 3,000 mg/kg in area L4 down to 93 mg/kg in area L5, a 30-fold difference. In deep samples, areas L3, L4, and L6 had the highest concentrations. It should be noted that area L6 has only recently been subject to irrigation, and high concentrations of barium had been detected in this area prior to any application of irrigation wastewaters. Area L5 had the lowest concentration of barium in its deep sample as well as in its shallow sample. There was approximately a 20-fold difference in barium concentrations in deeper soils, between lowest and highest concentrations.

For sodium, concentrations in shallow samples ranged from 410 mg/kg in L4 to 150-160 mg/kg variously in areas U1, U2, and U3, with a marginally higher concentration of sodium in area L5. The deep samples in areas L3, L4 + L6, and L1 had the highest concentrations, and the lowest level (half of that in L3) was found in the deeper soils in area U3.

Concentration of arsenic in shallow soils were highest in area L4 (10 mg/kg), with arsenic concentrations in most other areas generally in the range of 4-6 mg/kg. Copper concentrations ranged from 41 mg/kg in area L4, down to 10 mg/kg in area L5, or one-quarter of that in area L4. For lead, the maximum concentration was again found in area L4 (44 mg/kg), with concentrations in areas L5 and L2 a quarter of this concentration.

For deeper soils, for several metals there was no clear distinctions in concentration. However, for copper area L4 had the highest concentration and L5 the least; for lead L4 again had the highest concentration and L5 along with L2 the least; for zinc area L4 and L6 had the highest and L5 + L2 the least.

The highest concentration of total soluble salts in shallow soil was in area L4 (0.14%), with several areas containing less than 0.05% soluble salts (the limit of detection for this parameter). However, in deeper soils, areas L1 and U3 had more soluble salts than in area L4.

Ranking all sites from highest concentrations to lowest in shallow soils, for barium the order is L4 (highest), U1, L1, L6, U3, L3, L2, U2, and L5 (lowest). For copper, the order is L4 (highest), L1, L3, then U1+U2+U3+L6, and finally L2+L5. For sodium, the order is L4 (highest), L3, L1+L5, L2+L6, U3, and finally U1+U2. A

Shallow soils in areas L4, L1 and L3 consistently rank amongst the most contaminated for most parameters.

For deeper soils, areas L3 and L4 consistently had the highest concentrations of markers found and L2 + L5 generally the lowest (but noting that for the marker chloride, L5 and L6 had high concentrations by comparison with other sites).

Consent 5838-2.2 does not have specific (concentration-based) limits on metal levels in soil on the property. Condition 1 requires that:-

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.

There are a number of soil-related criteria provided by agencies, to address potential adverse effects such as the suitability of land for agricultural production, maintenance of soil ecological condition, consumption of produce, or human safety and health while present on the land in question.

For barium, an ecological protection criterion[11] is a limit of 750 mg/kg, and for agricultural production[12] 6,800 mg/kg.

For arsenic, the criteria are respectively 20 and 12 mg/kg. For copper, the criteria are 190 and 220 mg/kg. For sodium no criteria have been referenced.

Based on these criteria, several areas used by RNZ for the irrigation of wastewaters exceed the recognised barium criterion for protection of a healthy soil ecological condition. Areas U1, U3, L1, L4 (four times higher than the criterion) and L6 (twice the criterion) have excessive barium when assessed against the referenced criterion. Areas L2 and L3 have done so in the past, but now meet the criterion.

Trends in levels of parameters

Comparing 2022-2023 data with that from previous years, shallow samples collected within areas U1-U3 and L1, L2, and L6 show little change (sodium, arsenic, copper) or decreases (barium, chloride) in these key parameters. On the other hand, areas L3 (barium, sodium), L5 (barium, sodium, and chloride), and especially L4 (barium, sodium, arsenic, and copper) show very marked increases in most or all of these same parameters.

With a limited history of sampling deeper soils to date, it is premature to draw broad and strong conclusions from the data to date. With that proviso in mind, deeper soils in areas L2 and U2 give some indications of reductions in a few parameters. On the other hand, deeper soils in areas L3 (barium, calcium, potassium, and sodium), L4 (barium, calcium, and sodium), and L6 (barium, chloride) show substantial increases in some markers. Future sampling will help determine whether these apparent changes are ongoing and environmentally significant. It is noted that the apparent changes in deeper soils in areas L3 and L4 mirror the changes seen in the shallower soils in the same areas, suggesting these changes are real.

Examination of the irrigation records supplied by RNZ to the Council (see next section) did not find a clear correlation between increases in soil quality parameters and irrigation loading rates (volume per hectare). There are a number of factors that will affect the former, such as wastewater loading rates, varying concentrations of parameters in the wastewater, rainfall rates and duration, elapsed time since irrigation application, soil saturation and runoff rates, any soil disturbance, and pasture composition, growth, and harvesting.

There is also inherent variability in analytical results arising from representative ('systematically random') sampling. However, the shallow soil samples from L4 and L5 show the highest ever results for markers such as barium, sodium, copper and arsenic. Condition 12 of Consent 5838-2.2 requires that:-

Should the results of soil sampling, undertaken in accordance with condition 11 above, indicate an increasing trend in any of the measured parameters, the consent holder shall prepare a Soil Quality Management Plan which details how any significant adverse effects will be avoided, remedied or mitigated.

Given the increasing trend in some key parameters across areas L3, L4 and L5, it is appropriate to expect RNZ to review and if appropriate adjust cumulative loadings of wastewater to these three areas in order to ensure any trend of increases in soil contamination does not continue. It is noted that contamination of soil in area L4 already exceeds recognised guidelines for soil quality.

[11] Development of soil guideline values for the protection of ecological receptors, Manaaki Whenua 2019

[12] Canadian Soil Quality Guidelines: Soil Quality Guideline for the Protection of Environmental and Human Health-Agricultural, Canadian Council of Ministers for the Environment, 1997-2018

2.6.5 Irrigation loading rates

Condition 8 of consent 5838-2.2 requires that:

'The consent holder shall record the following information in association with irrigating wastewater to land:

a. The date, time and hours of irrigation;
b. The volume of wastewater irrigated to land;
c. The conductivity of the irrigation fluid (measured in mS/m)
d. The source of the wastewater (e.g. pond or wetland treatment system), and
e. The location and extent where the wastewater was irrigated.

The above records shall be made available to the Chief Executive, Taranaki Regional Council, on request.

The current (expired) consent does not impose a limit upon the annual mass loading of total nitrogen per area of irrigation field. Council officers recommended a limit of 400 kg N/ha/year at the Council hearing. This figure was consistent with other consents the Council has issued in recent years.

RNZ previously stated that the average annual N loading in irrigated areas is 345.6 kg/ha/year[13].

RNZ have offered a limit to be imposed via consent, of 400 kg N/ha/year[14].

RNZ provided a spreadsheet report for the 2022-2023 year in mid-June 2023. Upon review by the Council, an error was found in the analysis and presentation of data in the RNZ report, and correction was requested. At the time of finalisation of this compliance report, the corrected irrigation records from RNZ were still pending.

RNZ provided data on the average monthly concentration of nitrogen in the irrigated wastewater. RNZ had the wastewater analysed at frequent intervals. The range of individual sample results, and the monthly averages, for the 2022-2023 year are presented below in Table 29. For the 2022-2023 year, the mean of the monthly concentrations is 376 g/m^3, with a range of monthly means from 231 to 654 g/m^3. The data from the Council surveys (total Kjeldahl nitrogen) for corresponding months is also reproduced in the table.

For the 2021-2022 year, the mean of the monthly concentrations had been 324 g/m^3, and the range of monthly means had been 162 to 561 g/m^3. Therefore the concentrations measured in the irrigation pond in the year under review have been consistently higher than in the previous year, based on RNZ's own reporting.

[13] AEE revised in June 2020, Section 2.8.5.1 (pg 49), Table 7, At https://www.trc.govt.nz/assets/Documents/Environment/Consent-applications/Remediation2019/June2020Revisions/RevisedAEE-June2020.PDF

[14] Proposed consent limit of 400 kg N/ha/year. Email Colin Kay of Kay Consultants to Council counsel, 20 January 2023

Table 29 Concentrations of nitrogen in irrigation holding pond (RNZ data)

Month N g/m³	7/22	8/22	9/22	10/22	11/22[a]	12/22	01/23	02/23	03/23	04/23	05/23	06/23	Annual average
Min/ Max	478 680	498 660	240 560	240 620	31 890	350 495	222 242	155 300	133 612	208 612	108 368	175 362	
Average	654	555	404	414	316	378	235	231	347	420	246	310	376
Council		930		850		520			590			750	728[b]

[a] Both the minimum concentration of nitrogen, and the maximum, reported by RNZ as measured in November 2022, seem highly anomalous, especially given the large volume of liquid in the holding pond that would attenuate changes. Data has been taken at face value in this discussion.

[b] Average of Council results in 2021-2022 was 510 g/m³.

Of concern is the discrepancy in Table 29 above, between the analytical results for samples collected by the Council, and the analytical results provided by the Company. The Council results are generally double those of RNZ's own figures. The same discrepancy was noted in last year's annual report, although last year the difference was in the order of 50% rather than 100% as is now the case. As noted above, the Council uses the services of a laboratory that carries international accreditation for its analytical methodology and performance.

This discrepancy needs further investigation, as it materially affects whether RNZ are complying with the proposed N loading limit in the irrigation fields (see Table 30 below).

Table 30 Summary of nitrogen loadings per irrigation area (as supplied by RNZ and as determined by the Council). Prospective consent limit 400 kg/ha/yr

Area	L1	L2	L3	L4	L5	L6	U1	U2	U3
Nitrogen applied kg/yr	387	380	388	354	337	327	253	322	414
Area (ha)	1.2	0.99	1.55	2.02	1.42	3.17	0.3	2.27	1.43
N loading kg/ha/yr (RNZ)	322	384	250	175	237	106	843	142	289
N loading kg/ha/yr (Council)	624	745	485	339	460	206	1,635	277	561

RNZ's own data shows that RNZ did not meet the proposed consent limit (Table 30) in only one area, U1. In this area the loading of nitrogen applied per hectare was more than double the proposed limit. However, if the Council's measurements of the concentration of total nitrogen are used, then the proposed consent limit may also have been breached in 6 of the 9 areas used for the irrigation of wastewater- L1-L3, L5, U1, and U3, with U1 being over-loaded by more than 4 times the proposed limit.

Table 31 below sets out a summary of monthly pumping and loading data provided by RNZ. Based on these figures, the volume of wastewater irrigated by RNZ in the 2022-2023 year was 63% of that pumped in the previous year. The loading of nitrogen applied was higher, at 84% of that applied in 2021-2022, because of the increased concentration of nitrogen in the wastewater. Of significance, pumping was distributed more appropriately during the year than had been demonstrated in the 2021-2022 year, with below average volumes irrigated in cooler months such as July and August, and then in April and June, and above average application volumes most consistently in spring (September, October, November, and December). This can

be compared with the periods of highest (as measured by hours of pumping and volume pumped) in winter 2021 and autumn 2022, in the previous monitoring period. The last annual report expressed the Council's concern that the practice at that time was at variance to accepted farm irrigation management, which promotes wastewater storage during winter and targets spring and summer for maximum irrigation discharge volumes and nitrogen loadings, which is when pasture is most able to take up nitrogen during the phase of new growth. The change in the year under review represents a more thoughtful management of irrigation operations.

Table 31 Summary of irrigation data (as supplied by RNZ. See text)

Month 2022-2023	Pump hrs	Volume irrigated[1]	Nitrogen applied[2]
Jul	19.0	587	384
Aug	0.0	0	0
Sept	67.0	1,857	755
Oct	31.0	958	397
Nov	57.0	1,210	383
Dec	36.0	720	272
Jan	25.0	500.0	118
Feb	4.0	80.0	19
Mar	42.0	841.4	292
Apr	17.0	343.4	144
May	59.0	1250.4	308
Jun	14	287	89
Cumulative: 2022-2023	371.0	8,633.9	3,161.0
Cumulative: 2021-2022	616.5	13,664.2	3,780.0

Notes [1]: unit not stated. Presume m3 [2]: unit not stated. Presume kg nitrogen as total Kjeldahl Nitrogen. RNZ data as provided. See text for discussion of discrepancy between RNZ data and Council data.

2.7 Incidents, investigations, and interventions- summary

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

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

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

In January 2022, the Council had determined that because of concerns over the safety of compliance officers when deployed to investigate odour complaints in the vicinity, there would not be a field response at the time of complaint if received outside normal working hours.

Appendix III sets out the full record of proactive odour surveys, site inspections, and complaints received by the Council in respect of odour and air quality during the 2022-2023 year. The record encompasses 69 complaints which the Council did not investigate further; 12 incidents when the Council was either in a position to undertake an investigation in response, or had officers in the locality coincident with the time of the complaint being received, and 41 proactive odour surveys or on-site compliance inspections as discussed above in Section 2.5.

In respect of water quality, the Council issued an infringement notice to Remediation New Zealand on 28 September 2022 because of the seepage into the tributary of the Haehanga Stream that passes west to east above (south of) Pad 3. Council inspection data showed that the seepage was a regular occurrence each summer. An attempt by RNZ several years previously to address the seepage, as directed by the Council, had not proved successful subsequently. While the latest seepage had been detected in March 2022, the infringement notice was issued within the year under review. The Council issued Infringement Notice 24761 to RNZ, identifying the nature of infringement as the '*Discharge of contaminant, namely ammonia, onto or into land in circumstances which may have resulted in that contaminant (or any other contaminant emanating as a result of natural processes from that contaminant) entering water, namely the Haehanga Stream, when the discharge was not expressly allowed by a national environmental standard or other regulations, a rule in a regional plan, or a resource consent*'. The Infringement Notice incurred a penalty of $750.

The seepage is discussed further in Section 2.2.7.

After the end of the year under review, the Council issued another two Infringement Notices because of non-compliant environmental effects upon the surface water of the Haehanga Stream that were caused by the activities of RNZ. These two Notices related to impacts discovered by the sampling surveys undertaken by the Council on 4 October 2022 and 23 March 2023. Details are provided above in Section 2.2.2.

On 23 February 2023 a query was received by TRC regarding the use of the deodorising chemical at the composting facility and the nature of the authorisation for the discharge of the chemical into the air. On 14 March 2023 a decision was made by the Taranaki Regional Council's Consents Manager that the discharge of contaminants from the deodorisers was in contravention of Rule 55 of the Regional Air Quality Plan for Taranaki and a resource consent would be required for any continuation of the discharge. Abatement Notice 25044 was accordingly issued to the Company, requiring them to cease its use.

Table 32 below sets out details of additional investigations or interventions by the Council in relation to the Company's activities during the 2022-2023 period. This table presents a summary of events that required further investigation or intervention regardless of whether these were found to be compliant or not.

Table 32 Summary of significant Incidents, investigations, and interventions

Date	Details	Council findings; compliance (Y/N)	Outcome
28 Sep 22	Seepage discharge to tributary	Unauthorised contamination of water quality (N)	Infringement notice. Subsequent remedial action by RNZ consultants
4 Oct 22	Free (un-ionised) ammonia in tributary below WTS	Non-compliance with consented limit	Infringement Notice
8 Nov 22	Odour	Compliant at time of investigation, but RNZ acknowledged odour earlier in the day (Y)	No further action

Date	Details	Council findings; compliance (Y/N)	Outcome
17 Nov 22	Odour	No odour detected (Y)	No further action
13 Dec 22	Odour	No odour detected (Y)	No further action
20 Dec 22	Odour	Weak odour detected (Y)	No further action
10 Jan 23	Odour	Weak odour detected (Y)	No further action
24 Jan 23	Odour	No odour detected (Y)	No further action
8 Feb 23	Odour	Weak odour detected (Y)	No further action
16 Feb 23	Odour	No odour detected (Y)	No further action
23 Feb 23	Pre-existing use of deodorising chemical	Upon review, determined that the use was not covered by existing consent. (N)	Abatement notice. Company ceased use of chemical
8 Mar 23	Odour	No odour detected (Y)	No further action
16 Mar 23	Odour	Weak odour detected (Y)	No further action
23 Mar 23	Dissolved CBOD in Haehanga Stream below irrigation areas	Alleged non-compliance with consented limit	Infringement Notice
3 May 23	Odour-fire	RNZ were burning large pieces of timber. Non-complying activity and no consent (N)	RNZ were instructed to cease activity. A consent would be required prior to any resumption
5 May 23	Odour	Weak odour detected (Y)	No further action
2 Jun 23	Total CBOD in Haehanga Stream below irrigation areas	Excessive BOD, but analysed as total, not as filtered BOD (as specified in consent condition). Therefore non-compliance not established	Continued monitoring

In summary, during the 2022-2023 year RNZ were issued one Abatement Notice for a non-compliant discharge to air, and 3 Infringement Notices for non-compliant discharges to land/water. One of these Infringement Notices related to RNZ activities during the 2021-2022 monitoring year. A breach of the RAQP was addressed without formal enforcement.

Other incidences of non-compliance in the year under review, in respect of either deficient operational management or unauthorised environmental effects, did not lead to formal enforcement actions against the Company. They are discussed in the relevant sections of this report.

In the 2021-2022 year, RNZ had been issued 3 Infringement Notices, for over-irrigation of wastewaters to land, for the discharge of unauthorised solid wastes to land, and for offensive odour, respectively.

3 Discussion

3.1 Discussion of site performance

Site performance for discharge to land and water consent 5838-2

At the start of the 2021-2022 year, 13.2 ha of the site was being used for wastewater irrigation (9.1 ha located to the northwest of the site- nearer the road; and 4.5 ha to the south-east, beyond the composting area). During the year, RNZ increased this to 15.96 ha. No further expansion occurred in 2022-2023. However, it should be noted that the adequacy of this area to comply with nitrogen loadings per hectare (for optimal assimilation of nitrogen into pasture growth) and the hydraulic loadings to avoid surface runoff or odorous ponding remains a concern. The Council's monitoring data during the year under review indicates that the nitrogen loading on the irrigation areas is well above recognised maxima.

On the other hand, the timing of irrigation episodes during 2022-2023 was much improved over that of 2021-2022, when irrigation activities were most pronounced during wetter and cooler months. Greater irrigation during spring and early summer serves to reduce the comparative risk of runoff and would serve to increase nitrogen capture during the period of highest pasture growth.

The raw materials drop-off pond together with various elements of the wastewater collection and treatment system have been rehabilitated during 2022-2023, with sludges and potentially contaminated soils placed onto the stockpile on Pad 3. The observations of Council officers on inspections was that initially this additional material generally remained uncovered, which meant it continued to be a source of potential sediment and leachate runoff (as well as odour) for the remainder of the 2022-2023 period. However, grass cover was established during the year under review, easing concern over possible erosion of the Pad 3 stockpile.

The areal extent of Pad 1 was reduced during the year under review, which will serve in due course to reduce the hydraulic and contaminant loading on the wastewater collection and storage system. Vegetative cover was being established on the cleared section formerly used, and meantime stormwater runoff was still being collected within the wastewater system for treatment. The perimeter drainage system round Pad 3 was improved during the year, to expedite flow into the settlement and storage ponds. Formerly wastewaters were ponding within the open drains, leading to increased soakage to groundwater and odour generation.

Prior to July 2022, RNZ gave an undertaking to substantially reduce the size of the Pad 2 paunch dewatering pond, and in the future to accept only dewatered paunch and store it under shelter until such time as it is placed on the vermiculture beds. The works to reduce the pond size were undertaken on an intermittent basis, before being completed early in the 2022-2023 year. Paunch deliveries continue to be stored in the open. A smaller catchment for the paunch pond will serve to reduce hydraulic and contaminant loadings on the WTS, and consequently the possibility of a higher degree of treatment and removal of sediment and nitrogen species such as ammonia, within the WTS.

Likewise, RNZ has indicated the intention to eliminate the discharge from the Wetland Treatment System on Pad 2 into the tributary of the Haehanga Stream, should they receive consent to continue composting activities on the site. Termination of this direct discharge would mean there is no intentional direct discharge into surface waters on the property of RNZ's wastewaters. Analysis of the discharge from the WTS into the Haehanga Stream shows that it is a point source of pollution, with a mean annual concentration during the year for total ammoniacal nitrogen in the discharge of 77 g/m^3, with a range of 1.9 to 230 g/m^3 (in 2021-2022 the mean was 53 g/m^3, so the mean has increased by almost 50%), and for *E. coli* of 17,900 cfu/100 mls, with a range of 500 to 58,000 cfu/100 mls (in 2021-2022 the mean was 3,800 cfu/100 mls, so the mean has increased by more than 4 times over). Discharge from the WTS is on an intermittent basis.

Bunding around the north-eastern vermiculture beds was constructed during the year, to intercept runoff into the upper tributary that flows past them. The intercepted stormwater is soaking to ground.

However, assessment of the data from the surface water quality surveys shows that diffuse pollution of the Haehanga Stream is occurring throughout its length from the upper irrigation fields downstream, irrespective of any discharge from the WTS. A repetitive breakout of contaminated groundwater into a tributary had been confirmed through routine Council monitoring in March 2022. Remedial intervention was undertaken in March 2023.

The fact that surface water quality continued to be degraded throughout the year, with breaches of the consent limits for biochemical oxygen demand and ammonia toxicity, indicates that there has not yet been any clear sustained progress by RNZ towards an improvement in site management and environmental performance in relation to water quality.

The average concentration of ammoniacal nitrogen in the irrigation wastewater retention pond during the 2021-2022 year was shown to be 450 g/m^3. For the year under review, the average concentration of TAN was 600 g/m^3 (this calculation excludes an anomalous result of 12 g/m^3 for a sample collected on 25 January 2023), and an average concentration of total nitrogen of 728 g/m^3. It is noted that RNZ have presented to the Environment Court calculations on the area of land needed for irrigation of wastewaters using a nitrogen concentration of only 225 g/m^3 or thereabouts.[15] While the nitrogen concentration in irrigated wastewater, and the consequent nitrogen loading on irrigation fields, is not limited within the current (expired) consent, the discrepancy in these figures strongly suggests that RNZ have under-estimated the area of land they should be using, if excessive nitrogen loading (and hence risk of break-through into groundwater and eventually into the Haehanga Stream) is to be avoided. Figure 15 shows that ammoniacal nitrogen concentrations in the irrigation storage pond have been steadily increasing for the past five years, with the average in 2022-2023 the highest ever recorded.

This means that there is real risk that irrigation areas will be overloaded, both hydraulically and with respect to the ability of the pasture and soil to retain nitrogen.

Sampling of the drilling wastes stockpile on Pad 3 by RNZ's consultant established in particular that the concentrations of arsenic in the pile are above levels that are suitable for application to land without compromising future land uses. The future of the stockpile (and noting that other stockpiles elsewhere on the property also contain contamination above land application guidelines) remains a matter for resolution during the consent appeal proceedings.

RNZ have offered through the consent appeal proceedings to prepare a comprehensive suite of operational management, contingency, and environmental audit plans. These largely remain dependent upon the outcome of the consent appeal.

Site performance for discharge to air consent 5839-2

In the second half of the previous year (2021-2022), RNZ increased the number and size of windrows significantly, which raised concern that aerobic composting processes might not be effective and therefore there would be increased odour release when windrows were turned or screened; and stagnant drainage water was left ponded around the bases of the windrows on Pad 1 instead of being emptied to the wastewater system for aeration and stabilisation. Immediately prior to the start of the 2022-2023 monitoring period, the air quality experts for various parties involved in the consents' appeal (including an expert for RNZ) recorded that RNZ had failed to implement a range of air quality enhancement measures[16]. These measures were to include:-

[15] Uruti Composting Facility Irrigation Block Nitrogen Balance Analysis, Kay Consulting, May 2020. Section 4.6

[16] Expert Witness Caucusing Conference And Joint Witness Statement – Air Quality 11 May 2022

(a) Procurement of a permanent dissolved oxygen (DO) meter for the irrigation pond, and its installation at an appropriate location in the pond for representative measurements.
(b) Use of the DO probe to drive automatic switching of the aerator in the irrigation pond, to prevent anaerobic conditions developing and to optimise energy usage.
(c) Works to reduce the size of the dewatering pond for the reception and storage of raw paunch material, to a target of 0.1 ha.
(d) No testing of odour release during irrigation had yet been undertaken. Several observations (e.g. 5) were considered necessary and sufficient to determine whether additional odour management is required during irrigation episodes..
(e) The truck wash pond was to be completely removed.
(f) The issue of stagnant ponded water (leachate and stormwater) in the drains around Pad 1 remained unresolved. The culvert intended to drain this area was perched higher than the ponded water, which therefore could not escape. The area around Pad 1 needed to be re-contoured. No timeframe had been offered by RNZ for undertaking this work.
(g) The wetland treatment system (WTS) was to be retired from use for treating wastewater from the paunch and vermiculture pads. The air experts noted that this related more to water quality than to air quality, but agreed in any case it will reduce or remove any odour from the WTS.

Aeration of the irrigation pond was implemented in 2021-2022, but was found by the Council to be intermittent and inadequate to avoid very significant odour generation and release. During the year under review, operation of the aerator was found to have changed to be continuous, with a dissolved oxygen sensor recording the DO concentrations continuously placed in close proximity on the surface of the pond. While dissolved oxygen depletion occurs quickly elsewhere in the pond, or if aeration is lost, the flow of aerated water across the surface is considered to provide effective minimisation of odours. Council observation is that the wastewater pond odours can be detected only a short distance from the pond under normal operation. Of concern, in the last inspection of the year the aerator was switched off and RNZ advised that it was now being operated on a timer. This would again create the potential for the generation of odorous gases during the anaerobic phase of pond operation, and release of these odours when agitation resumed.

The air quality experts jointly inspected the RNZ facility seven months later, on 25 January 2023. They recorded their observations of odour and of odour abatement activities[17]. RNZ advised that the aerator in the wastewater storage pond was being operated fulltime. If the aerator was turned off, dissolved oxygen levels dropped below the recognised minimum concentration in 2-3 hours. The sizes and coverage of the composting heaps on Pad 1 had been reduced in size; Pad 2 (paunch had been reduced in size to approximately 2,000 m^2; and the stockpile on Pad 3 was now fully grassed.

One of the deodorisers had been moved back to beside the office (they had previously both been beside the wastewater pond, close to the point of odour release as recommended by the air experts). RNZ advised that it was being used in evenings as necessary. It was observed that the other deodoriser, while still situated beside the pond, was disconnected from power and the neutraliser additive supply. The dissolved oxygen concentration in the wastewater pond was observed to be 6.44 g/m^3. A RNZ staff member advised that he had measured DO at the far end of the pond to be in the range 2-2.8 g/m^3. These data indicated good control of DO levels in the pond. It was observed on this occasion that downwind odour from the pond was minimal other than in its close proximity.

The truckwash facility was noticeably less odorous than had been observed on previous visits. There was a strong composting odour associated with Pad 1, but RNZ advised that they were taking steps to remove stored mature compost from the property and thus reduce the volume of composted material being held

[17] Odour Monitoring and Site Visit - Joint Witness Statement, 30 January 2023

on the pad. RNZ have also given an undertaking that the composting windrows will not be turned when light or calm winds are from the south (i.e. towards the main road and the local community).

It was noted that there were large amounts of wood shavings on site for use as a biofiltering material to cover the first two composting windrows immediately they were constructed. Composting odours are more intense from the initial stages of the composting process. The covering of the first two windrows is, therefore, expected to assist in reducing the odour emissions from the site. While in 2021-2022 Council staff had observed that this practice was not being consistently followed, the practice of covering fresh windrows with wood chip or shavings seems to have been more consistently applied in the year under review.

The perimeter drainage system around Pad 1 had also been regraded, with leachate and runoff flowing to a central point, before entering a culvert to travel to the settling pond. There was still a small amount of residual leachate adjacent to the culvert mouth, but no odour associated with it.

Pad 2 was considerably smaller than seen on previous visits, and there was no associated odour. The reduction in the surface area of the paunch pond should mean a corresponding reduction in total odour release from the pond. The worm beds have not been found to be odorous on any inspection. Unless fresh paunch is being applied or vermiculture beds being removed, the worm beds are almost always covered (unless disturbed by high winds) for the protection of the worm communities.

However, while inspecting the southern-most irrigation area, a strong composting odour was detected by the experts, even though they were standing several hundred metres from the active raw materials processing and composting facilities.

The experts concurred that generally, the site was tidier than on previous inspections, with fewer sources of odour and less odour observed.

As noted above, during the period under review RNZ have made a number of changes to site infrastructure and installed equipment that could have the outcome of reducing incidents of offensive and objectionable odour beyond the property if given full effect on a systematic basis. These include the removal and rehabilitation of a number of ponds within the wastewater system for Pads 1 and 3, that have meant the elimination of these sources of anaerobic wastewater and attendant unpleasant smells; more regular monitoring of composting processes; the installation of aeration and dissolved oxygen metering in the irrigation wastewater lagoon; the establishment of grass cover on the Pad 3 drilling wastes stockpile; and provision of a misting spray for use when wind conditions are adverse in terms of odours migrating towards the local community.

As noted above in Section 2.5.2.1, air quality experts for the parties to the Environment Court appeal noted that RNZ were to contract an independent odour scout to undertake intensive odour surveys during the period of April to June 2022. 60 surveys within two months were envisaged, before weekly surveys on a continuing basis. It was further agreed that an integral element of these surveys was that the Council was to be contacted on a number of these observation occasions, to facilitate joint odour assessments.

However, RNZ failed to implement the intensive (60 surveys within two months) monitoring agreed, and subsequently undertook only 7 surveys in 8 months to February 2023 (a period covering 34 weeks) when weekly surveys had been recommended.

Offensive and objectionable odours offsite during the 2022-2023 year are discussed in Section 3.2 below.

Use of the deodoriser spray mister and neutralising additive

In 2009-2010 RNZ were using a spray mister to project a fog of water mist across the northern entrance to the valley, in an attempt to reduce odours. In February 2011 RNZ requested the permission of the Council to undertake a trial of injecting a neutralising compound into the mister, to enhance the mist's effectiveness at odour mitigation. The Council considered that this was permitted within the conditions of the consent, as an application of 'best practicable option'.

Two misters with injection of the neutralising agent were in regular use in the 2021-2022 year. They were located adjacent to the site office, with the discharges of the mists in opposing directions, the intention being to create a fog across the width of the valley at this location. Sprays were generally used overnight, or in the early morning or late afternoon periods, on various days per month. Usage was at times proactive, based on wind direction, or in other cases was in response to RNZ staff detecting odour or the Council investigating complaints.

In late calendar year 2021, the air quality experts for the various parties involved in RNZ's appeal re renewal of its consents specifically reviewed the safety sheets and the records of operational use of the neutraliser elsewhere, and confirmed that in their view there was no risk to parties offsite such as neighbours. The experts considered that the use of the additive would potentially provide some degree of abatement, along with giving directions to RNZ as to the relocation of deployment of the misters to the active composting area and the wastewater pond, instead of down at the exit to the alley, to improve the completeness of any reactions between odorous compounds and the additive.

However, during the year under review, neighbours raised concerns over possible toxic effects, and alleged their health was being affected. A complaint was lodged with the Council on 23 February 2023. The Council reviewed its position on whether the use of the neutralising agent was covered by the existing (expired) consent. Having considered the provisions of the RAQP, the Council determined that any discharge to air of the additive should be explicitly consented. The additive had not been considered when the current consent was granted in 2010. The Council subsequently issued an abatement notice on 27 March 2023, to confirm that use of the neutralising additive was to cease in the interim. RNZ initially advised the Council that they would apply for a resource consent to provide for the resumption of its use. However, at the time of preparation of this report, no application has been lodged. RNZ have continued to use the mister located beside the office, injecting only water.

During the year the Council found that RNZ were burning oversized timber and stumps, in contravention of the Regional Air Quality Plan. RNZ were instructed not to continue this activity.

Site performance for twin culverts consent 5938-2

The management of the twin culverts included remedial works as instructed by the Council during this monitoring period. During the year, the culverts had become perched and the downstream riffle had been scoured away, meaning fish passage was impeded. The Company undertook remedial works as instructed, and by the end of the period the performance of the culverts was considered compliant with the consent.

Site performance for single culvert in the Haehanga Stream consent 6212-1

The management of the culvert was satisfactory for most of this monitoring period. However. Council officers found in January that the riffle below the culvert underneath the vermiculture bed access track needed improvement to lift the downstream water level. Initial remedial work by RNZ was only partially compliance, and the rock placement undertaken to that time had to be re-graded. By the end of the period under review the stream flows were much improved. The Council also directed that silt traps be installed to prevent eroded soils entering the stream and clogging the stream bed.

Site performance of the large culvert situated in the unnamed tributary of the Haehanga Stream consent 10547-1

The RNZ management of the culvert was satisfactory during this monitoring period. The Council did not require any works or find any issues with culvert maintenance or stability.

Site performance to discharge treated stormwater from a quarry site, into an unnamed tributary of the Haehanga Stream consent 10063-1

In 2021-2022, the quarry remained non-operational, but RNZ staff were anticipating it re-opening. In preparation, they had undertaken various sediment control works, including re-contouring the access track, installing cut-off drains and sediment and stormwater capture works, and the diversion of runoff to swale for treatment.

During 2022-2023, the quarry was utilised by the Company for a short period and on a small scale. The Council directed RNZ to provide further stormwater controls on the lower section of the access track. Silt controls were put in place. The area was naturally revegetating throughout the monitoring period. The Council directed RNZ to not simply push overburden down banks.

Site performance of the realignment of two unnamed tributaries of the Haehanga Stream for land improvement purposes consent 10825-1

The Company had developed an additional land disposal area (area L6) in close locality to the main gate. In doing so, two ephemeral tributaries of the Haehanga Stream were to be realigned along the southern edge of the new irrigation area. The batters of the realigned tributaries were found to have stabilised, with natural re-vegetation emerging.

Riparian planting has been established on the true right bank, but the true left bank requires further planting (which will improve the stream as a habitat through canopy cover and shading) in order to meet the consent conditions re density and extent. The property has been de-stocked, and so requirements re streambank fencing can be waived.

The consent also provides for a second section of stream to be realigned. This had not yet been implemented. Although riparian planting had been undertaken along the length of the realignment, infill plantings were still required to provide consent compliance and a better canopy and shading effect for the stream.

Performance of the modification of an existing culvert to provide for fish passage into an unnamed tributary of the Haehanga Stream consent 10843-1

The previous culvert was significantly perched. As such, with the development of the lower irrigation area, the pre-existing culvert required replacement to enable fish passage.

The new culvert was installed in the 2020-2021 monitoring period, and has performed well since. Some headwall erosion including displacement of a concrete block occurred in the previous year because of a rainfall event. Repair of this headwall remained an outstanding matter at the end of the period under review, despite continued reminders being given to the Company. This matter has now been outstanding for more than a year. Maintenance of the culvert's headwall and associated earthworks will continue to be pursued in the future.

3.2 Environmental effects of exercise of consents

Environmental effects are discussed by consent.

Environmental effects associated with the discharge to land and water consent 5838-2.2

The primary potential environmental effects on water quality and stream health that might arise during the exercise of consent 5838 include:

- effects upon a tributary of the Haehanga Stream due to direct discharges from the wetland treatment system (WTS) (primarily elevated ammonia, biochemical oxygen demand, and bacteriological contamination), introducing toxicity into the freshwater aquatic environment;
- diffuse runoff and/or groundwater percolation from all operational areas (primarily elevated ammonia, biochemical oxygen demand, chloride/salinity, dissolved oxygen depletion, suspended solids/turbidity, and bacteriological contamination), which potentially impacts stream habitat and community richness and diversity;
- increases in nitrogen species percolating into groundwater due to any excessive wastewater irrigation to land, adversely impacting groundwater quality;
- contaminant migration into soil and groundwater beneath the pads, wastewater collection and containment systems, and/or any storage areas for raw or processed materials, including but not limited to the drilling wastes stockpile on Pad 3 and other areas where these materials have been distributed around the property; and
- any point-source seepage or break-out of contaminated stormwater or leachate into freshwater.
- In terms of potential environmental effects on soil quality and health that might arise during the exercise of consent 5838, these include:-
    - potential for discharge to land of unauthorised materials that might cause soil or product pollution;
    - the inadvertent or intentional re-distribution of contaminated materials around the property, as stockpiles or as material spread across land or as soluble contaminants in the irrigation waters; and
    - the ongoing issues around the characterisation and management of the drilling wastes stockpile.

The above list relating to the current discharge consent does not extend to the matters that will have to be considered upon termination of current site activities and any rehabilitation of the property upon site exit or change of land use.

Over the last three monitoring periods, the identification and determination of the migration of unauthorised contaminants discovered in the sawdust stockpiles and sawdust-blended materials on site has been a particular issue. These toxic contaminants include metals (arsenic, copper, and chromium) and light organic solvent preservatives (LOSPs). The contaminants as identified in their present locations pose a limited risk to soil health and communities in the vicinity, as well as to current and future land uses.

Compliance is assessed against the current conditions in consent 5838. However, the requirements of the NPS-FM are also discussed below, as the Council is obliged to give effect to the attribute limits specified in the NPS-FM through its next freshwater plan. In particular, the NPS-FM imposes a maximum allowable concentration of total ammonium nitrogen, to be calculated in terms of the equivalent toxicity of ammonium nitrogen at pH 8, and limits upon the concentration of *E. coli* as a measure of bacteriological contamination versus suitability for immersive and contact activities. The NPS-FM requires 95% of bacteriological samples to contain less than 540 cfu/100 ml. At a sampling rate of 6 per year, this is equivalent to allowing less than one exceedance every 3 years. It is recommended that the Company gives

consideration to any actions that it can take to contribute toward improving freshwater outcomes, including achieving freshwater targets and national bottom lines.

Surface water in the Haehanga catchment

In 2021-2022, surface water monitoring of the Haehanga Stream found that nitrogen impacts, in the form of un-ionised ammoniacal nitrogen, were the primary concern for the ecological health of the water course. There was regular non-compliance with the consent for this parameter at the site below the discharge from the WTS into a tributary of the Haehanga Stream, but there was also a break-out of contaminated groundwater into another tributary in March, and then widespread pollution of the lower Haehanga Stream in May 2022.

This trend has continued unabated in the year under review. On two of six sampling surveys, a breach of the un-ionised ammonia limit in the consent was found in the tributary below the WTS discharge. In addition, every one of the six surface water monitoring rounds found ammoniacal nitrogen at concentrations in excess of the NPS-FM national bottom line annual maximum at one site at least.

In addition to continuing concern over toxic levels of ammonia in the stream, in the second part of 2022-2023 water quality in respect of biochemical oxygen demand deteriorated, with non-compliance particularly poor in the March 2023 survey. A limit on BOD is imposed to protect ecological health and prevent the outbreak of undesirable biological growths in surface waters.

On every occasion, contamination increased downstream for most pollutants surveyed. As an example, when data from the upstream (baseline) site HHG000090 are compared with the bottom site (HHG000190) located near the boundary of Remediation NZ for the dry weather survey of 25 January 2023, the concentration of:

- chloride increased by more than 7 times over (6.5 g/m^3 at HHG000090, to 45 g/m^3 at HHG000190);
- total ammoniacal nitrogen was increased by around 6 times (<0.010 g/m^3 at HHG000090 to 0.066 g/m^3 at HHG000190);
- conductivity was increased by more than 1.5 times (206 µS/cm at HHG000090 to 367 µS/cm at HHG000190).

The Mimitangiatua awa also showed evidence of deterioration in every survey, although the environmental significance of this was less than minor.

Biological monitoring of the Haehanga Stream and associated unnamed tributaries was undertaken on two occasions. A survey of macroinvertebrate communities was undertaken on 11 April 2023.

The lack of any significant changes in taxa richness or of taxa abundances by comparison with previous surveys or between sites indicates that no significant toxic discharges have recently occurred from the WTS that have been affecting the macroinvertebrate communities in the receiving tributary of the Haehanga catchment.

Overall, macroinvertebrate community health in the main stem of the Haehanga Stream can be regarded as poor, being dominated by pollution tolerant taxa, which would be a direct result of poor habitat quality and conditions at the time of sampling. The unnamed tributary that receives the WTS discharge has better habitat quality and subsequently better macroinvertebrate health.

It should be noted that poor habitat conditions at the time of the survey could have masked any effects of direct or diffuse discharges from the activities of RNZ on the property, as sensitive taxa would be sparse or absent in any case (as was found to be the situation in this survey).

Groundwater monitoring

No petroleum hydrocarbons, including BTEX compounds, were detected in any of the wells this monitoring period. There had last been a detection in the 2020-2021 year.

RNZ were using an expanded total area of land for irrigation purposes during the year under review, Groundwater bores 3009 (down gradient of the composting area and adjacent to area L3) and 2190 (irrigation area L2) continue to show the greatest impact by RNZ on the quality of groundwater in their vicinity, with some measures more than 10 times higher than those found at other bores. Concentrations of ammonia and nitrate in a couple of the bores remain elevated despite the expanded irrigation areas, and if not for dilution upon seepage into surface water could be of ecological concern. Management of the day to day and annual loadings of wastewater to each area remains a concern, if groundwater quality (and consequently the quality of the Haehanga Stream) is to be conserved.

GND3007 is located at the site entrance. All analytes remained of low concentrations. The increased use of the adjacent new irrigation area, L6, and future patterns in this bore (which marks groundwater quality as it passes across the property boundary) will be closely watched.

New bores were installed at various key locations around the irrigation and duckpond water storage ponds by PDP[10], the consultants to RNZ. They also undertook a survey at all existing bores across the property.

Soil monitoring

The concentration of sodium in the wastewater irrigated to land is a particular focus of the Council's monitoring programme. Excessive soil sodicity can lead to:

- reduced flow of water through soil, which limits leaching and can cause salt to accumulate over time and the development of saline subsoils
- dispersion in the soil surface, causing crusting and sealing, which then impedes water infiltration
- dispersion in the subsoil, accelerating erosion, which can cause the appearance of gullies and tunnels
- dense, cloddy and structureless soils, as sodicity destroys aggregation.

Measurements of the concentrations of ionic sodium over the past decade show that concentrations have been steadily reducing, and have been consistently low since December 2020. Drilling wastes were no longer accepted since about this time.

Shallow and deep composite core samples were collected from all irrigation areas this monitoring period.

Soil chloride concentrations in irrigation areas were found to have been decreasing in area U1, L1, L2, L3, and L5, but increasing in area L4. Soil barium concentrations (a marker of the distribution of leachate from the drilling wastes stockpile on Pad 3) were found to have been increasing on areas U1, U3, L1, and L4. LOSP pesticides were not detected in any area. Hydrocarbons were widespread- they were found to be present in areas U2, U3, L1, L2, L3, L4, and L6.

Of concern was the detection of a number of markers of drilling wastes (barium, calcium, sodium, copper, and hydrocarbon groups) across area L6, prior to any known application of irrigation wastewaters. This strongly suggest drilling wastes have been transported from the stockpile on Pad 3 and distributed across this area, in contravention of the consent.

Environment effects associated with the discharge to air consent 5839-2

Emissions to air from the site continued to draw a number of complaints throughout the year. The Council could not investigate each complaint fully at the time of complaint because of concerns for the safety of Council officers. It is also acknowledged that between the time of complaint and the arrival of an officer on site, wind conditions and/or the source of odour release may change.

A total of 63 complaints had been recorded by the Council during the 2021-2022 year, following on from 83 in 2020-2021. One investigation in the 2021-2022 monitoring year, on 27 April 2022, led to the issue of an infringement notice to RNZ for causing offensive and objectionable odours beyond the boundary. In the 2020-2021 year, the Council had found cause to issue 5 infringement notices for the same reason.

During the year under review, the Council recorded 81 complaints concerning odour. The Council declined to investigate 69 of these by a site visit. However, on 12 occasions investigations were undertaken, either because officers were already in the vicinity or because circumstances were suitable for a specific visit. On 7 of the 12 investigations, weak odour was detected beyond the boundary of the RNZ property. That is, on about half of all episodes when complaints could be followed up, the activities of RNZ were causing off-site odour. On no occasion did Council officers determine that the odour beyond the boundary was offensive or objectionable.

Throughout the year under review, the Council undertook a series of proactive odour surveys. On a number of these, composting and similar odours emitted from RNZ were detected beyond the boundary, although not of a strength and nature that meant they could be considered acutely offensive and objectionable. However, that raised the issue of whether odours from the site should be recognised as constituting a chronically offensive effect. In air quality it is recognised that odours may be offensive on either an acute (immediate and single event) or a chronic (ongoing and cumulative) basis.

As detailed in Section 2.5.2, of the 43 proactive surveys by the Council in the year under review, on 26 occasions (63%) no odour was detected at any off-site location that was visited. On another 13 survey occasions (32%), Council officers detected odour at least in one location during the survey, but at no location on these occasions was odour considered to be immediately (acutely) or potentially (chronically) offensive or objectionable, over any duration or frequency. On the remaining 2 occasions (5%), the investigating officer did detect odour at least at one of the locations visited, and considered that it would be offensive and objectionable if it occurred more frequently or continuously. Thus, no infringement notices were issued by the Council in the year under review due to acutely offensive or objectionable odours from the RNZ property. However, odours (albeit weak) continue to be detected beyond the boundary of the property, which is some 1.5 km more or less from the composting and wastewater facilities, on between one-third and one half of all Council surveys. The number of complaints from the local community continue unabated.

Environmental effects for the use of twin culverts 5938-2

The primary concerns with culverts are if improperly installed or maintained, they may become a barrier to fish passage or promote bank erosion and collapse. During the year, it was found that the stream bed and riffles below the culverts had scoured out, meaning fish passage could be impeded. RNZ undertook works to reinstate the stream bed and riffles, and it is considered fish passage was again adequately provided for by the end of the monitoring period.

Environmental effects of instream culvert on the Haehanga Stream consent 6212-1

The primary concerns with culverts are if improperly installed or maintained, they may become a barrier to fish passage or promote bank erosion and collapse, affecting in-stream habitat. During the year, the Council found the downstream streambed had scoured out. The Council directed RNZ to undertake remedial works. The initial work by RNZ was only partially acceptable, and further work was required to more appropriately form the reinstated stream bed, in order to re-establish fish passage and to protect in-stream habitat.

Environmental effects in relation to the discharge of treated stormwater from a quarry site, into an unnamed tributary of the Haehanga Stream consent 10063-1

Minimal environmental effects were noted for this consent in this monitoring period. This is likely attributed to the non-operational nature of this consent during the monitoring period under review. Natural regrowth of vegetation was promoting site stability. RNZ staff constructed additional cut-off drains, silt controls, and a system for discharge to swale in anticipation of site activities recommencing. The Council considers these measures should serve to minimise potential environmental effects from sediment transport.

Environmental effects of the large culvert situated in the unnamed tributary of the Haehanga Stream consent 10547-1

The primary concerns with culverts are if improperly installed or maintained, they may become a barrier to fish passage or promote bank erosion and collapse. No environmental effects were noted in relation to this culvert, with stream flow through the culvert observed to be unobstructed and no evidence of effects on stream habitat from any bed or bank erosion.

Environmental effects associated with the realignment of two unnamed tributaries of the Haehanga Stream for land improvement purposes consent 10825-1

The potential was for excessive sedimentation transport into the stream during and following realignment works, with consequent effects on stream health and habitat. In the event, the land disturbed by the earthworks has been stabilised, with the batters beginning to grow grass on the exposed areas. No obstructions to stream flow and fish passage were noted. Establishment of riparian shading is a continuing requirement, in order to optimise habitat for streambed and stream bank communities

Environmental effects associated with the modification of an existing culvert to provide for fish passage into an unnamed tributary of the Haehanga Stream consent 10843-1

The primary concerns with culverts are if improperly installed or maintained, they may become a barrier to fish passage or promote bank erosion and collapse.. As noted in previous annual reports, the former culvert was considerably perched, which negated fish passage from achieving upstream movement. It was replaced in 2020-2021 with a fit for purpose culvert which allows for fish passage. Rock rip rap had been installed on either side and through the culvert, to enable climbing species access. In the previous monitoring period, some slumping of the upper head wall was found, which potentially could result in stream blockage. The matter was brought to the attention of RNZ staff for repair. While these works were still outstanding at the time of the last inspection for the year under review, and could be an issue in the case of flood events, the slumping was not observed to adversely affect the stream. It is considered there is good fish passage through the new culvert.

3.3 Evaluation of performance

A tabular summary of the consent holder's compliance record for the year under review is set out in Table 33 to Table 40.

Table 33 Summary of performance for consent 5838-2.2

Purpose 5838-2.2: ***To discharge of waste material to land for composting; and treated stormwater and leachate from composting operations; onto and into land in circumstances where contaminants may enter water in the Haehanga Stream catchment and directly into an unnamed tributary of the Haehanga Stream***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Adopt best practical option	Programme management/site inspections	- No - Soil analysis established drilling mud or drilling mud-blended compost is present in the new irrigation area L6 and stockpiled or spread elsewhere as well - Elevated contaminants within the surface water of the lower catchment - NPS-FM annual maximum exceedances for ammonia and *E. coli* in surface water at multiple sites. Note: this exceedance is not a compliance monitoring criteria. - Breakthrough of contaminated groundwater into tributary, breaching consent and previous abatement notice (remedied in latter part of period) - But noting remedial works to abate seepage from Pad 3 area
2. Only acceptable waste accepted onto site	Site inspections/review of supplied records	- Yes
3. Representative sample of each type of drilling waste analysed for: a. Total petroleum hydrocarbons b. Benzene, toluene, ethylbenzene and xylenes c. Polycyclic aromatic hydrocarbons d. Heavy metals e. Chloride, nitrogen, pH, potassium and sodium	Records to be provided	- Yes - Drilling wastes ceased acceptance 31 December 2020 or shortly thereafter
4. DAF residue not to be accepted	Site inspections/review of supplied records not listed as accepted	- Yes - Records checked

Purpose 5838-2.2: *To discharge of waste material to land for composting; and treated stormwater and leachate from composting operations; onto and into land in circumstances where contaminants may enter water in the Haehanga Stream catchment and directly into an unnamed tributary of the Haehanga Stream*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
5. Maintenance of stormwater systems	Inspections	- No, but remedied during year by re-configuring perimeter drains on Pad 1 and the stormwater settlement ponds, and bunding installed around some vermiculture beds
6. Maintenance of treatment systems	Inspections	- No - Variable degree of aeration of irrigation pond - Concern over potential seepage from ponds. New monitoring bores adjacent to irrigation storage pond show high degree of groundwater contamination
7. Adequate pond construction to prevent any leak to surface water or groundwater from any leachate or stormwater holding pond	Inspections and monitoring	- Uncertain. Potential leakage and groundwater contamination from ponds is to be investigated further. - Seepage into tributary investigated and remedied during year (source not identified) - Former dropoff pond rehabilitated
8. Keep and supply irrigation records	Supply of records	- Yes - Annual RNZ records supplied. Error found. (Revised records pending at time of preparation of this Annual Report)
9. No direct discharges to water to occur as a result of irrigation to land	Site inspections /sampling	- Not established. Lower catchment sampling shows unidentified contamination sources
10. Irrigated fluids not to exceed 5% hydrocarbon content or SAR of 18	Site inspections and sampling	- Yes - Previous sampling indicated the SAR was below the value of 18 on all monitored occasions - Previous sampling indicated TPH in fluid has been below 5%
11. Discharges not to cause adverse effects downstream of irrigation areas	Surface water sampling and inspections	- No - Water quality repeatedly impacted at one or more sampling sites adjacent to and below irrigation areas. Infringement Notice issued - Noting the biological monitoring of the Haehanga Stream did not find clear evidence of adverse effects below the irrigation areas due to RNZ activities.

Purpose 5838-2.2: *To discharge of waste material to land for composting; and treated stormwater and leachate from composting operations; onto and into land in circumstances where contaminants may enter water in the Haehanga Stream catchment and directly into an unnamed tributary of the Haehanga Stream*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
12. Soil sampling to be undertaken for TPH and BTEX	Soil sampling undertaken by the Council	- Yes
13. Soil sampling to be undertaken for chloride, sodium, magnesium, calcium, potassium, soluble salts and conductivity	Soil sampling undertaken by the Council	- Yes
14. Adhere to composting facility management plan	Inspections	- Pest animal culling undertaken - Irrigation areas extended significantly - Stormwater and leachate system improvements
15. Establish groundwater monitoring bores	Site inspections	- Yes - Additional monitoring wells have been installed
16. Groundwater monitoring wells installed as per standard	Undertaken	- Yes
17. Consent holder monitoring and record groundwater in each monitoring well monthly for level, temperature, and conductivity	Not undertaken by consent holder	- No reports provided to Council
18. Groundwater sampled per six month interval: a. Total petroleum hydrocarbons b. BTEX	Undertaken by Council	- Yes
19. Groundwater samples shall be collected from all wells for chloride, sodium, magnesium, calcium, TDS and conductivity	Undertaken by Council	- Yes
20. Prepare Pond Treatment System Management Plan	Plan provided	- Yes - Draft leachate and stormwater management plan currently included in consent renewal

Purpose 5838-2.2: *To discharge of waste material to land for composting; and treated stormwater and leachate from composting operations; onto and into land in circumstances where contaminants may enter water in the Haehanga Stream catchment and directly into an unnamed tributary of the Haehanga Stream*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
21. Adhere to Pond Treatment System Management Plan	Inspections	- Storage pits and ponds cleaned out during the year, and pad 2 paunch pond has been reduced in size
22. Prepare Wetland Treatment System Management Plan	Management plan (Wetland Treatment Management Plan) submitted for consent renewal	- Yes
23. Adhere to Wetland Treatment System Management Plan	Inspections	- Yes
24. Wetland discharge not to exceed certain parameters	Sampling	- Yes. Some exceedances of limits, but WTS was not discharging at the time these samples were collected
25. Wetland discharge not to cause certain effects at site HHG000103	Sampling	- No - Un-ionised ammonia non-compliance. Infringement Notice issued - Failed to achieve the NPS-FM national bottom line for ammonia on 3 occasions (Not a consent matter) - Biological monitoring provides no clear evidence of any ecological effects that might be caused by this discharge
26. Maintain riparian plantings	Inspection identified that riparian planting is developing. This will be on-going	- Partial - Additional riparian planting undertaken - A significant portion still requires planting or re-planting
27. Notify the Council of significant incidents on site	No notifications received	- Council is not aware of any significant on-site incidents other than those found during Council's own monitoring
28. Prepare a Site Exit Plan prior to site closure	Not supplied	- Not applicable - RNZ have promised to provide a Site Exit Plan as part of proceedings in the Environment Court
29. Adhere to Site Exit Plan	N/A	- N/A
30. Optional Review	Consent renewal occurring. No review option	- N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**Poor**
Overall assessment of administrative performance in respect of this consent		**Poor**

Table 34 Summary of performance for consent 5839-2

Purpose 5839-2.0: *To discharge emissions to air at Mokau Road, Uruti*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Adopt best practical option	Programme management/site inspections	- No - A number of recommendations from the RNZs expert were only partially implemented, or after a delay, or not at all as yet
2. Composting area not to exceed certain limits	Programme management and site inspections	- Yes - Pad 1 (composting) has now been reduced in size to be compliant with the consent. Mature compost stockpiles have been removed
3. Only acceptable waste brought onto site	Site inspections and a review of records	- Yes - No incidents of unacceptable material this period
4. DAF residue not to be accepted	Site inspections/review of supplied records	- Yes
5. Maintain and supply an inwards good register	Inwards goods records supplied	- Yes - Data received and reviewed
6. Prepare a Site Practices Plan	Plan submitted with AEE	- Yes
7. Adhere to Site Practices Plan	Inspections	- Yes
8. Arrange professional assessment of Site Practices Plan	Supplied in 2010-2011 year.	- Yes
9. Submit Proposed Implementation Plan	Plans submitted to Court for appeal hearing	- Yes
10. Adhere to Proposed Implementation Plan		- Not assessed
11. Dust deposition not to exceed certain limits	Not measured	- Yes - Dust not observed to be an issue during inspections
12. PM10 and suspended particulate not to exceed certain limits	Not measured	- Yes - Dust not observed to be an issue during inspections
13. No offensive or objectionable odour beyond the boundary	Inspections	- Yes (as determined by Council investigations). No proven offsite offensive or objectionable odours - 69 complaints not investigated - Unresolved issue of determining chronic offensive odour
14. Install a weather station and provide data	Inspection and weather updates.	- Yes

Purpose 5839-2.0: *To discharge emissions to air at Mokau Road, Uruti*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
15. Conduct odour surveys	Undertaken by the Council during inspections and during complaints	- No-RNZ failed to implement an intensive survey programme or ongoing surveys as required by this consent
16. Hold community meeting	Meeting held with iwi	- Yes
17. Notify the Council of onsite incidents	No notification received	- N/A
18. Prepare a Site Exit Plan prior to site closure	Included in Environment Court documentation	- Yes
19. Adhere to Site Exit Plan upon site closure	N/A	- N/A
20. Optional review	A review was not required	- N/A
Overall assessment of consent compliance and environmental performance in respect of this consent Overall assessment of administrative performance in respect of this consent		**Improvement required** **Poor**

Table 35 Summary of performance for consent 5938-2

Purpose 5938-2.0: *To use a twin culvert in the Haehanga Stream for vehicle access purposes*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Ensure stream bed downstream is adequately constructed and does not prevent fish passage	Site inspections	- Non-compliance during year when the downstream riffles were scoured out - RNZ undertook reinstatement works to the satisfaction of the Council
2. Maintains the structure so: a. It does not become blocked and is free flowing b. Any erosion or instability of the stream bank is remedied by the consent holder	Site inspections	- Yes - Site inspections indicated the culvert is being maintained as required
3. Review condition	No review pursued	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent Overall administrative performance with respect to this consent		**Good** **High**

Table 36 Summary of performance for consent 6212-1

Purpose 6212-1.0: *To establish and maintain a culvert at Mokau Road, Uruti*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Notification prior to commencement of works	Inspections	- Yes
2. Replacement of temporary culvert	N/A	- Yes
3. Construction in accordance with application	Site inspections	- Yes
4. Best practicable option	Inspections	- Yes
5. Minimisation of riverbed disturbance	Site inspections	- Yes
6. Provision of fish passage	Inspections	- No. During the year, inspections found the downstream streambed had scoured out. Initial works by RNZ to reinstate the riffles and re-establish stream levels were only partially acceptable, and further works were undertaken to re-from the channel - The Council directed silt traps be installed to intercept and treat surface runoff
7. Reinstatement of site	N/A	- N/A
8. Optional review of consent	No review due this period	- N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**Good**
Overall administrative performance with respect to this consent		**High**

Table 37 Summary of performance for consent 10063-1.0

Purpose 10063-1.0: *To discharge treated stormwater from a quarry site, into an unnamed tributary of the Haehanga Stream*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Authorises the discharge of treated stormwater into unnamed tributary of Haehanga Stream in line with the original application	Inspection	- Yes - Quarry was operated for a short time within this monitoring period. All stormwater directed to grassland off access track via cut-off drain. Further stormwater controls were put in place as directed by the Council

Purpose 10063-1.0: *To discharge treated stormwater from a quarry site, into an unnamed tributary of the Haehanga Stream*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
2. Notification of quarry works	Communication during inspections	- No. Council were aware of general intention to re-open, but no specific notification received
3. Adopt best practicable option	Inspection the quarry was not operated this monitoring period	- Yes - Cut-off drains inspected and found to be working well. Council directed further improvements to stormwater controls on lower track
4. Shall operate and progressively reinstate the quarry site in a manner which ensures exposed areas are kept to a minimum at all times	Not assessed as quarry not operational	- NA
5. Ensure no area greater than 1 ha is exposed at any one time	Online assessment	- Yes - Inspection and online review indicated the current quarry area is 6,000 m^2 - The access track is 4,000 m^2
6. The stormwater discharged shall not exceed 4 ha	Not assessed this period	- NA
7. Stormwater treatment system shall be installed before any site works commence	Inspections	- Yes - Inspection indicated the stormwater cut-off drains and sediment traps had been upgraded (2021-2022) - Further controls required upon discovery by Council that quarry had re-opened
8. Stormwater treatment system shall be maintained for the life of the quarry operation	Inspection indicated that this is on-going	- Yes
9. All stormwater to be directed to stormwater treatment system prior to discharge to Haehanga Stream tributary	Inspection	- Yes - Discharge to be to grassed swales

Purpose 10063-1.0: ***To discharge treated stormwater from a quarry site, into an unnamed tributary of the Haehanga Stream***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
10. Constituents of the discharge shall meet the following standards: a. pH: 6.0-9.0 b. suspended solids: <100g/m^3 c. total hydrocarbons: <15 g/m^3	Sampling	- Surface water monitoring at HHG000100 indicated compliance with this condition.
11. The pH may exceed 9.0 if the exceedance is the result of photosynthetic activity, however the discharge shall not alter the receiving waters by more than 0.5 pH after a mixing zone of 25 m	Sampling	- NA
12. After mixing the discharge shall not give rise to any of the following effects: a. Production of scums, films or foams b. Any conspicuous change in the colour or visual clarity c. Any emission of objectionable odour d. Rendering of fresh water unsuitable for farm animal e. Any significant adverse effects on aquatic life	Inspection and sampling	- Yes - Inspections and sampling did not indicate any of the prohibited effects as process of the quarry operations
13. The discharge shall not give rise to any of the following effects: a. A change in turbidity measurements upstream of the discharge point and below the discharge point of more than 5NTU b. A change in turbidity measurements of greater than 5 NTU as a result of the discharge	No turbidity monitoring undertaken this period	- NA

Purpose 10063-1.0: *To discharge treated stormwater from a quarry site, into an unnamed tributary of the Haehanga Stream*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
14. Maintain and update Contingency plan	Notification and supply of records	- Yes - December 2021. RNZ advised intention to review once quarry re-opened, but no review received
15. Site shall be operated in a management plan which will contain the following: a. The loading and unloading of materials b. Maintenance of conveyance systems c. General housekeeping d. Management of the interceptor system	Supply of management plan-Not received	- Yes - December 2021. RNZ advised intention to review once quarry re-opened, but no review received
16. Notification pertaining to the change of nature of discharge	Notification	- Nature of activities discussed at each inspection
17. Consent lapse	Consent in effect	- NA
18. Review condition	No review required.	- NA
Overall assessment of consent compliance and environmental performance in respect of this consent		**Good**
Overall administrative performance with respect to this consent		**Good**

Table 38 Summary of performance for consent 10547-1.0

Purpose 10547-1.0: *To replace an existing culvert in an unnamed tributary of the Haehanga Stream, including the associated disturbance of the stream bed*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. The culvert pipe shall be a smooth bore plastic pipe and have an internal diameter of no less than 1 metre and be no longer than 40 m	Inspections	- Yes
2. The fill over the top of the culvert pipe shall be comprised of suitable soils free of wood, humus and other organic matter. The embankment shall be well compacted in uniform layers not exceeding 300 mm loose depth to achieve	Inspections	- Yes

Purpose 10547-1.0: *To replace an existing culvert in an unnamed tributary of the Haehanga Stream, including the associated disturbance of the stream bed*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
a compaction of at least 95 % of maximum dry density		
3. The fill over the top of the culvert pipe shall be 2.3 m above the invert of the culvert	Inspections	- Yes
4. The consent holder shall notify the Chief Executive, Taranaki Regional Council, in writing at least 2 working days prior to the commencement of work	Notification is to be received via inspectorate	- NA
5. Between 1 May and 31 October no work shall be undertaken on any part of the stream bed that is covered by water		- NA
The consent holder shall take all practicable steps to minimise stream bed disturbance, sedimentation and increased turbidity during installation of the culvert, including by: a. completing all works in the minimum time practicable; b. avoiding placement of excavated material in the flowing channel; c. keeping machinery out of the actively flowing channel, as far as practicable; and d. reinstating any disturbed areas as far as practicable	Inspections	- Yes
6. A reinforced concrete headwall shall be installed at the inlet to the culvert	Inspections	- Yes
7. A layer of rock riprap 1000 mm thick shall be installed in the stream bed. The riprap shall extend 5 m downstream of the culvert outlet and 1 metre up the banks on both sides of the	Inspections	- Yes

Purpose 10547-1.0: *To replace an existing culvert in an unnamed tributary of the Haehanga Stream, including the associated disturbance of the stream bed*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
stream. The rock shall have the following grading: - 100% less than 800 mm diameter; - 50% greater than 600 mm diameter; - 90% greater than 350 mm diameter		
8. The culvert shall not restrict fish passage	Inspections and a fish survey if scheduled	- Yes - Not assessed by the Council biologist, but considered not to restrict passage
9. The invert of the culvert shall be set below the existing stream bed by 200 mm so that it fills with bed material and simulates the natural bed	Inspections	- NA
10. The gradient of the culvert shall be no steeper than the natural gradient of the stream bed at the site	Inspections	- Yes - On observation this appears to be in line with the gradient
11. On completion of works, the banks of the channel upstream and downstream of the culvert shall be no steeper than the existing natural banks. Where the bank consists of fill, the fill must be well compacted with batter slopes no steeper than 2 horizontal to 1 vertical	Inspections	- Yes
12. The culvert shall remain the responsibility of the consent holder and be maintained so that: a. it does not become blocked, and at all times allows the free flow of water through it; and b. the consent holder repairs any erosion, scour or instability of	Inspections	- Yes - Maintenance undertaken when required - Regularly inspected

Purpose 10547-1.0: *To replace an existing culvert in an unnamed tributary of the Haehanga Stream, including the associated disturbance of the stream bed*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
the stream bed or banks that the culvert causes		
13. In the event that any archaeological remains are discovered as a result of works authorised by this consent, the works shall cease immediately at the affected site and tangata whenua and the Chief Executive, Taranaki Regional Council, shall be notified within one working day. Works may recommence at the affected area when advised to do so by the Chief Executive, Taranaki Regional Council		- None reported. - Note this was a replacement culvert
14. This consent shall lapse on 31 March 2023, 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		- Exercised
15. Review condition	Not required currently.	- NA
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**
Overall administrative performance with respect to this consent		**High**

Table 39 Summary of performance for consent 10843-1

Purpose 10843-1.0: *To modify a culvert to provide for fish passage, in an unnamed tributary of the Haehanga Stream, including associated disturbance of the stream bed*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. The culvert pipe shall have a diameter no less than 900 mm and be no longer than 10 m	Inspections	- Yes
2. The fill over the top of the culvert pipe shall be comprised of suitable soils	Inspections	- Yes

Purpose 10843-1.0: *To modify a culvert to provide for fish passage, in an unnamed tributary of the Haehanga Stream, including associated disturbance of the stream bed*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
free of wood, humus and other organic matter. The embankment shall be well compacted in uniform layers not exceeding 300 mm loose depth to achieve a compaction of at least 95% of maximum dry density		
3. The fill over the top of the culvert pipe shall be no less than 4 m		- Yes
4. No less than 2 and no more than 20 working days before commencing work the consent holder shall notify the Chief Executive, Taranaki Regional Council ('the Chief Executive')	Inspections	- Yes
5. Between 1 May and 31 October no work shall be undertaken on any part of the stream bed that is covered by water	Notification received via inspectorate	- Yes
6. The consent holder shall take all practicable steps to minimise stream bed disturbance, sedimentation and increased turbidity during installation of the culvert, including by: a. completing all works in the minimum time practicable; b. avoiding placement of excavated material in the flowing channel; c. keeping machinery out of the actively flowing channel, as far as practicable; and d. reinstating any disturbed areas as far as practicable		- NA
7. A layer of rock riprap 900 mm thick shall be installed in the stream bed.	Inspections	- Yes

Purpose 10843-1.0: *To modify a culvert to provide for fish passage, in an unnamed tributary of the Haehanga Stream, including associated disturbance of the stream bed*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
The riprap shall extend 3 m upstream of the culvert inlet and 5 m downstream of the culvert outlet and up the banks on both sides of the stream. The rock shall have the following grading: a. 100% less than 600 mm diameter; b. 50% greater than 450 mm diameter; c. 90% greater than 20 mm diameter		
8. At all times after 1 May 2021 the culvert shall provide for fish passage	Not assessed	- Not assessed by the Council biologist
9. The invert of the culvert shall be set below the existing stream bed by 225 mm that it fills with bed material and simulates the natural bed	To be assessed	- NA
10. The gradient of the culvert shall be no steeper than the natural gradient of the stream bed at the site		- Yes - On observation this appears to be in line with the gradient
11. On completion of works, the banks of the channel upstream and downstream of the culvert shall be no steeper than the existing natural banks. Where the bank consists of fill, the fill must be well compacted with batter slopes no steeper than 2 horizontal to 1 vertical	Inspections	- Yes
12. The culvert shall remain the responsibility of the consent holder and be maintained so that: a. it does not become blocked, and at all times allows the free flow of water through it; and b. the consent holder repairs any erosion, scour or instability of	Inspections	- No. RNZ have failed to comply with Council directions re reinstatement of the upper headwall, throughout the year

Purpose 10843-1.0: *To modify a culvert to provide for fish passage, in an unnamed tributary of the Haehanga Stream, including associated disturbance of the stream bed*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
the stream bed or banks that the culvert causes		
13. This consent lapses 5 years after its commencement date (shown on the front of this document), unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period in accordance with section 125(1)(b) of the Resource Management Act 1991		- Exercised
14. Review condition	Not required currently.	- NA
Overall assessment of consent compliance and environmental performance in respect of this consent		**Good**
Overall administrative performance with respect to this consent		**High**

Table 40 Summary of performance for consent 10825-1.0

Purpose 10825-1: *To realign a section of two unnamed tributaries of the Haehanga Stream for land improvement purposes*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. This consent authorises the permanent diversion of the full stream flow through two sections of reconstructed channel on two unnamed tributaries, between grid references as set out in consent	Inspections	- Yes
2. The new stream channels shall have a flow capacity no less than that of the existing stream channels	Inspections	- Yes
3. No less than 2 and no more than 20 working days before commencing work the consent holder shall notify the Chief Executive, Taranaki Regional Council ('the Chief Executive')	Inspections	- Yes
4. The consent holder shall take all practicable steps to	Inspections	- Yes

Purpose 10825-1: *To realign a section of two unnamed tributaries of the Haehanga Stream for land improvement purposes*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
minimise stream bed disturbance, sedimentation and increased turbidity during installation of the culvert, including by: a. completing all works in the minimum time practicable; b. avoiding placement of excavated material in the flowing channel; c. keeping machinery out of the actively flowing channel, as far as practicable; and reinstating any disturbed areas as far as practicable		- Council informed during the development
5. The channels shall be constructed to include sequences of runs and riffles that simulate the natural bed where the original stream bed is no longer present or stable	Inspections	- Yes
6. Between 1 May and 31 October no work shall be undertaken on any part of the stream bed that is covered by water.	Notification received via inspectorate	- Yes
7. The consent holder shall prepare and implement a fish recovery plan that has been certified by the Chief Executive of the Taranaki Regional Council. The plan shall detail how the impacts on fish during culvert installation are avoided as far as practical, and shall include as a minimum how fish will be salvaged, how often fish will be salvaged, and recording the number and types of fish salvaged	Provided to the Council	- Yes
8. The new channel shall not restrict fish passage	Inspections	- Yes
9. At all times during the works the consent holder	Inspections	- Yes

Purpose 10825-1: *To realign a section of two unnamed tributaries of the Haehanga Stream for land improvement purposes*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
shall ensure that the stream flow downstream of the affected reach is not significantly diminished		
10. On completion of the realignment work: a. the banks of the reconstructed channel shall have a slope no steeper than 1.5 horizontal to 1 vertical; and b. the bed of the reconstructed channel shall be at an appropriate grade so as to provide for upstream fish passage	Inspections	- Yes
11. The consent holder shall ensure that rock riprap in placed in the stream bed at all bends in the new channels. The riprap shall be placed within the entire bed width and up the banks of the new stream channel	Inspections	- Yes
12. The rock riprap shall be no less than 0.9 metres thick, and of the following grading: a. 100% less than 600 mm diameter; b. 50% greater than 450 mm diameter; c. 90% greater than 200 mm diameter	Inspections	- Yes
13. The consent holder shall maintain the realigned channel by repairing any erosion, scour or instability of the stream bed or banks	Inspections	- Yes
14. The consent holder shall undertake and maintain riparian fencing and planting on the tributaries affected by the realignment, in accordance with the Riparian Management Plan for the property. An area of	Inspections	- No. Further infill riparian development is required, and is planned by the consent holder - Fencing requirement has been waived given the destocking of the property

Purpose 10825-1: *To realign a section of two unnamed tributaries of the Haehanga Stream for land improvement purposes*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
not less than 5 m shall be planted between the stream bed and fence		
15. The fencing and riparian planting required in condition 14 shall be completed before August 2021	Inspections	- No. Further riparian management is planned for winter 2023
16. To remedy and mitigate the adverse environmental effects of this consent, the consent holder shall establish and maintain riparian planting and a wetland as detailed in the 'Wetland Restoration Management Plan' provided with the application and attached as Appendix 1 of the consent. The works shall be undertaken within the timeframes specified in that plan	Inspections	- This is planned to be achieved over a three year period
17. All earthwork areas shall be stabilised as soon as is practicable immediately following completion of soil disturbance activities	Inspections	- Yes
18. This consent lapses 5 years after its commencement date (shown on the front of this document), unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period in accordance with section 125(1)(b) of the Resource Management Act 1991		- Exercised
19. Review condition	Not required currently.	- NA
Overall assessment of consent compliance and environmental performance in respect of this consent		**Good**
Overall administrative performance with respect to this consent		**High**

Table 41 Summary of performance for all consents

Consent	Environmental Performance	Administrative performance
5838-2.2 Discharge waste to land and water	Poor	Poor
5839-2 Discharge emissions to air	Good*	Poor
5938-2.0 Twin culvert	Good	High
6212-1 Culvert	Good	High
10063-1.0 Quarry discharge	Good	Good
10547-1.0 Culvert unnamed tributary	High	High
10843-1.0 To modify a culvert to provide for fish passage	Good	High
10825-1.0 To realign a section of two unnamed tributaries	Good	High

*Based on environmental performance as found in Council investigations

The overall gradings that the Council has assigned to RNZ over the last ten years are set out below in Table 42.

Table 42 Evaluation of environmental performance over the last ten years

Monitoring period	Compliance status
July 2021- June 2022	Poor
July 2020 – July 2021	Poor
July 2019 – July 2020	Poor
July 2018 – July 2019	Improvement required
July 2017 – July 2018	Improvement required
July 2016 – July 2017	Good
July 2015 – July 2016	Improvement required
July 2014 – July 2015	Improvement required
July 2013 – July 2014	Poor
July 2012 – July 2013	Good

During the year, the Company demonstrated a poor level of environmental and a poor level of administrative performance with the resource consents, as defined in Appendix II. During the year under review one infringement notice and one abatement notice were issued for matters related to unauthorised discharges to land, surface water, and air. A further alleged non-compliant event remained under Council review at the end of the year. Abatement notices issued in previous years continue in force.

3.4 Recommendations from the 2021-2022 Annual Report

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

1. THAT in the first instance, monitoring of consented activities at the Uruti facility of Remediation New Zealand in the 2022-2023 year be amended from that undertaken in 2021-2022, by commissioning of

a multi-parameter continuous water quality monitoring device at the bottom of the Haehanga Stream.

2. THAT should there be issues with environmental or administrative performance in 2022-2023, monitoring may be adjusted to reflect any additional investigation or intervention as found necessary.

The Council installed a multi-parameter continuous water quality measuring device at the bottom of the catchment as recommended, in August 2022. The installation had been delayed due to Covid-related supply issues.

An additional water quality site, within the Mimitangiatua awa, was incorporated into the surface freshwater monitoring programmes.

A number of additional surveys and investigations were necessitated because of environmental or site management issues. These were undertaken by the Council and by a consultant for RNZ.

3.5 Alterations to monitoring programmes for 2023-2024

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

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

The Council also takes into account the scope of assessments required at the time of renewal of permits, and the need to maintain a sound understanding of industrial processes within Taranaki exercising resource consents.

Site investigation and remediation planning by RNZ's consultants have recommended a number of activities and further investigations, and the Council will review those as they are developed.

As noted in the discussion of the irrigation records that RNZ provides to the Council (Section 2.6.5), there is a very significant discrepancy between the measurements of the concentration of nitrogen found in the irrigation wastewater made through the Council's monitoring, and the data provided by RNZ, with the latter being much lower than determined by the Council. The Council uses a laboratory that has international accreditation for the relevant analyses. It is critical for the maintenance of soil structure, optimal nitrogen capture by pasture, and protection of groundwater and surface water, that reliable data on nitrogen concentrations is known. This needs to be a matter for investigation and resolution in the 2023-2024 year. A recommendation to this effect is set out in the next section.

It should be noted that the proposed programme represents a reasonable and risk-based level of monitoring for the site in question. The Council reserves the right to subsequently adjust the programme from that initially prepared, should the need arise if potential or actual non-compliance is determined at any time during 2023-2024. Further changes may arise, contingent upon any decision of the Court. A decision from the Court as regards any renewal or otherwise of the Company's consents is expected sometime in calendar 2024.

3.6 Renewal of consents

The application by RNZ to the Environment Court for renewal of consents 5838 and 5839 remains in the hands of the Court at the time of this report's preparation. A further hearing is scheduled for November-December 2023. It is expected it will be in calendar year 2024 before any decision is released.

4 Recommendations

1. THAT in the first instance, monitoring of consented activities at the Uruti facility of Remediation New Zealand in the 2023-2024 year be as implemented during 2022-2023 and reported herein.
2. THAT should there be issues with environmental or administrative performance in 2023-2024, monitoring may be adjusted to reflect any additional investigation or intervention as found necessary.
3. THAT the Council liaise with RNZ and respective analytical laboratories to resolve discrepancies in measurements of ammoniacal and total nitrogen in irrigated wastewaters.

Glossary of common terms and abbreviations

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

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.
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.
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^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, a measure of conductivity.
NH_4	Ammoniacal nitrogen, also referred to as 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).
NPS-FM	National Policy Statement for Freshwater Management 2020.
NTU	Nephelometric Turbidity Unit, a measure of the turbidity of water.
O&G	Oil and grease, defined as anything that will dissolve into a particular organic solvent (e.g. hexane). May include both animal material (fats) and mineral matter (hydrocarbons).
Pb*	Lead.
pH	A numerical system for measuring acidity in solutions, with 7 as neutral. Numbers lower than 7 are increasingly acidic and higher than 7 are increasingly alkaline. The scale is logarithmic i.e. a change of 1 represents a ten-fold change in strength. For example, a pH of 4 is ten times more acidic than a pH of 5.
Physicochemical	Measurement of both physical properties (e.g. temperature, clarity, density) and chemical determinants (e.g. metals and nutrients) to characterise the state of an environment.
PM_{10}, $PM_{2.5}$, $PM_{1.0}$	Relatively fine airborne particles (less than 10 or 2.5 or 1.0 micrometre diameter, respectively).
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 (and readily available) rather than in particulate or solid form.

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

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Appendix I

Resource consents held by Remediation New Zealand Ltd

(Uruti composting, vermiculture, and quarrying site)

(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:	Remediation (NZ) Limited PO Box 8045 New Plymouth 4342
Decision Date (Change):	20 August 2015
Commencement Date (Change):	20 August 2015 (Granted Date: 27 May 2010)

Conditions of Consent

Consent Granted:	To discharge: a) waste material to land for composting; and b) treated stormwater and leachate from composting operations; onto and into land in circumstances where contaminants may enter water in the Haehanga Stream catchment and directly into an unnamed tributary of the Haehanga Stream
Expiry Date:	1 June 2018
Review Date(s):	June 2016, June 2017
Site Location:	1450 Mokau Road, Uruti
Legal Description:	Sec 34 Pt Sec 4 Blk II Upper Waitara SD (Discharge site)
Grid Reference (NZTM)	Between 1731656E-5686190N, 1733127E-5684809N, 1732277E-5685101N, 1732658E-5684545N & 1732056E-5684927N
Catchment:	Mimi
Tributary:	Haehanga

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.

Acceptable wastes

2. The raw materials accepted onsite shall be limited to the following:
    - Paunch grass;
    - Animal manure from meat processing plant stock yards and dairy farm oxidation pond solids;
    - Green vegetative wastes;
    - Biosolids wastes including, but not limited to, pellets from wastewater treatment plants;
    - Mechanical pulping pulp and paper residue (excluding any pulping wastes that have been subject to chemical pulping or treated or mixed with any substance or material containing chlorine or chlorinated compounds);
    - Solid drilling cuttings from hydrocarbon exploration provided they are blended down to a maximum hydrocarbon content of 5.0% total petroleum hydrocarbon within 3 days of being received onsite;
    - Water based and synthetic based drilling fluids from hydrocarbon exploration provided they are blended down to a maximum hydrocarbon content of 5.0% total petroleum hydrocarbon content within 3 days of being brought onto the site;
    - Produced water from hydrocarbon exploration;
    - Vegetable waste solids (being processing by-products);
    - Grease trap waste (from food service industries);
    - Fish skeletal and muscle residue post filleting (free from offal); and
    - Poultry industry waste (eggshells, yolks, macerated chicks and chicken mortalities).

    The acceptance of any other materials shall only occur if the Chief Executive, Taranaki Regional Council advises in writing that he is satisfied on reasonable grounds that the other materials will have minimal effects beyond those materials listed above.

3. Before bringing waste to the site the consent holder shall take a representative sample of each type of drilling waste permitted under condition two from each individual source, and have it analysed for the following:

   a. total petroleum hydrocarbons (C_6-C_9, C_{10}-C_{14}, C_{15}-C_{36});
   b. benzene, toluene, ethylbenzene, and xylenes;
   c. polycyclic aromatic hydrocarbons screening;
   d. heavy metals screening; and
   e. chloride, nitrogen, pH, potassium, and sodium.

   The results of the analysis require by this condition shall be forwarded to the Chief Executive, Taranaki Regional Council every three months or upon request.

4. Material produced as a result of a dissolved air flotation process shall not be accepted on site.

Maintenance of measures

5. All sediment ponds and silt traps on site, that are located upstream of the pond treatment system or wetland treatment system, shall be managed so that they are no more than 20% full of solids at any one time.

   Note: For the purposes of this condition, the location of the pond treatment system and wetland treatment system are shown on Figure 1, attached as Appendix 1 of this consent.

6. All treatment measures on site shall be implemented and maintained so that:
   - clearwater runoff is prevented from entering Pad 1, Pad 2 and the Drill Mud Pad; and
   - all stormwater and/or leachate from Pad 1, Pad 2, the Drill Mud Pad and any other exposed areas within the composting site is directed for treatment through the Pond or Wetland Treatment System.

   Note: For the purposes of this condition, the location and extent of Pad 1, Pad 2 and the Drill Mud Pad are shown on Figure 1, attached as Appendix 1 of this consent.

7. Any pond(s) used on site for the purposes of stormwater and leachate treatment shall be constructed and maintained in a manner which prevents the seepage of wastewater through the pond liners entering surface water or groundwater.

Irrigation

8. The consent holder shall record the following information in association with irrigating wastewater to land:

   a) the date, time and hours of irrigation;
   b) the volume of wastewater irrigated to land;
   c) the conductivity of the irrigation fluid (measured in mS/m);
   d) the source of the wastewater (e.g. Pond or Wetland Treatment System); and
   e) the location and extent where the wastewater was irrigated.

   The above records shall be made available to the Chief Executive, Taranaki Regional Council, on request.

9. There shall be no direct discharge to water as a result of irrigating wastewater to land. This includes, but is not necessarily limited to, ensuring the following:
    - No irrigation shall occur closer than 25 metres to any surface water body;
    - The discharge does not result in surface ponding;
    - No spray drift enters surface water;
    - The discharge does not occur at a rate at which it cannot be assimilated by the soil/pasture system; and
    - The pasture cover within irrigation areas is maintained at all times.

10. Treated wastewater discharged by irrigation to land shall not have a hydrocarbon content exceeding 5% total petroleum hydrocarbon or a sodium adsorption ratio exceeding 18.

11. Discharges irrigated to land shall not give rise to any of the following adverse effects in the Haehanga Stream, after a mixing zone extending 30 metres from the downstream extent of the irrigation areas;

    a) a rise in filtered carbonaceous biochemical oxygen demand of more than 2.00 gm^{-3};
    b) a level of unionised ammonia greater than 0.025 gm^{-3};
    c) an increase in total recoverable hydrocarbons;
    d) chloride levels greater than 150 g/m^3;
    e) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
    f) any conspicuous change in the colour or visual clarity;
    g) any emission of objectionable odour;
    h) the rendering of fresh water unsuitable for consumption by farm animals; and
    i) any significant adverse effects on aquatic life.

Soil quality

12. Representative soil samples shall, be taken from each irrigation area at intervals not exceeding 6 months and analysed for total petroleum hydrocarbons, benzene, toluene, ethylbenzene, and xylene.

13. Representative soil samples shall be taken from each irrigation area at intervals not exceeding 3 months and analysed for chloride, sodium, magnesium, calcium, potassium, total, soluble salts, and conductivity.

14. Before 30 November 2015 the holder shall review and update the Uruti Composting Facility Management Plan supplied in support of application 5838-2.2 and any changes shall be submitted for approval to the Chief Executive, Taranaki Regional Council, acting in a certification capacity The plan shall be adhered to and reviewed on an annual basis (or as required) and any changes shall be submitted for approval to the Chief Executive, Taranaki Regional Council, acting in a certification capacity. The shall plan include but not limited to:

    a) Trigger limits for the three tier management system tiers set out in section 3.1 of the Uruti Composting Facility Management Plan;
    b) Monitoring frequencies of soil and groundwater in Tiers one, two, and three;
    c) Remediation options for Tier three irrigation areas;
    d) Riparian planting of irrigation areas;
    e) Stormwater improvements at the site ;
    f) Water storage for dilution and remediation; and
    g) Soil and groundwater data analysis.

Groundwater quality

15. The consent holder shall establish and maintain at least one groundwater monitoring well at each of the following locations for the purpose of monitoring the effect of the wastewater discharges on groundwater quality:

    a. up gradient of the irrigation areas in an un-impacted area;
    b. down gradient of the extent of the irrigation of each area;
    c. down gradient of the duck pond and drill mud pits and up gradient of irrigation area H for the purpose of assessing integrity clay liners of drilling waste treatment ponds, and
    d. at NZTM 1731518N-5686536E (approximately 40 metres south of SH3) for the purpose of assess groundwater near the northern boundary.

    For the purposes of clarification this condition requires four new bores to be installed for the purposes of establishing irrigation areas F & E and in accordance with the Uruti Composting Facility Management Plan 2015 supplied with application 5838-2.2.

16. Any new groundwater monitoring wells required by condition 15 shall be installed to the following standards;

    a) Prior to installation of any new wells, confirmed NZTM GPS locations shall be provided to the Taranaki Regional Council for approval;
    b) All new wells shall be at least 25 metres from any water way (unless otherwise authorised by a separate consent) and be accessible by vehicle;
    c) All new wells shall be installed by a qualified driller and designed to encounter groundwater and accommodate expected annual fluctuations in water level -i.e. screened sections and filter packs to be located next to the water bearing horizons;
    d) Soils encountered during installation shall be logged by a suitably qualified and graphic logs of the soils and well construction are to be supplied to the Taranaki Regional Council;
    e) All new wells shall be surveyed for topographical elevation by a suitably qualified person;
    f) All wells shall completed with an appropriate riser, riser cap, toby and be fenced to prevent stock access;
    g) Prior to any irrigation occurring in any new irrigation area, a groundwater sample shall be collected from the down gradient well by a suitably qualified person, using a method approved by the Chief Executive of the Taranaki Regional Council and analysed and analysed for sodium, calcium, magnesium, nitrate, ammoniacal nitrogen, pH, chloride, and conductivity.

    Adherence to New Zealand Standard 4477:2001 will ensure compliance with this condition.

17. The consent holder shall undertake weekly groundwater level, temperature, and conductivity readings from each well within a single eight hour period using a method approved by the Chief Executive, Taranaki Regional Council. Results shall be recorded in a cumulative spread sheet, a copy of which shall be forwarded to the Taranaki Regional Council every three months, or upon request.

18. Groundwater samples shall be collected from all monitoring wells required under condition 15 at intervals not exceeding 6 months by a suitably qualified person using a method approved by the Chief Executive, Taranaki Regional Council and analysed for; total petroleum hydrocarbons, benzene, toluene, ethylbenzene, xylene, lead and arsenic.

19. Groundwater samples shall be collected from all monitoring wells required under condition 15 at intervals not exceeding 3 months by a suitably qualified person using a method approved by the Chief Executive, Taranaki Regional Council and analysed for; chloride, sodium, magnesium, calcium, total soluble salts, and conductivity.

Pond Treatment System

20. The consent holder shall prepare a Pond Treatment System Management Plan which details management practices undertaken to maximise treatment capabilities of the system. The plan shall be submitted for approval to the Chief Executive, Taranaki Regional Council, acting in a certification capacity, within one month of the commencement date of this consent.

    The Management Plan shall address, but not necessarily be limited to, the following matters:

    a) how the build up of sediment and/or sludge will be managed within the entire system, how the level of build-up will be monitored including factors that will trigger management, and the frequency of undertaking the identified measures or procedures;
    b) how overloading of the system will be prevented; and
    c) how any offensive or objectionable odours at or beyond the site boundary will be avoided in accordance with condition 13 of consent 5839-2.

21. Operations on site shall be undertaken in accordance with the Pond Treatment System Management Plan, approved under condition 20 above, except in circumstances when the Proposed Implementation Plan, approved under condition 9 of consent 5839-2, specifies otherwise.

Wetland Treatment System

22. The consent holder shall prepare a Wetland Treatment System Management Plan that details management practices undertaken to maximise treatment capabilities of the system. The plan shall be submitted for approval to the Chief Executive, Taranaki Regional Council, acting in a certification capacity, within one month of the commencement date of this consent.

    The Management Plan shall address, but not necessarily be limited to, the following matters:

    a) how the build up of sediment and/or sludge will be managed within the entire system, how the level of build-up will be monitored including factors which will trigger management, and the frequency of undertaking the identified measures or procedures; and
    b) how plant die-off within the system will be managed, and the frequency and/or timing of undertaking the identified measures or procedures.

23. Operations on site shall be undertaken in accordance with the Wetland Treatment System Management Plan, approved under condition 22 above.

24. The discharge from the Wetland Treatment System shall meet the following standards (at monitoring site IND003008):

    a) the suspended solids concentration shall not exceed 100 g/m^3; and
    b) the pH shall be between 6.0 and 9.0.

25. Discharges from the Wetland Treatment System shall not give rise to any of the following effects in the unnamed tributary of the Haehanga Stream, after a mixing zone of 40 metres, at established monitoring site HHG000103 (at or about grid reference 1732695E-5685050N):

    a) a rise in filtered carbonaceous biochemical oxygen demand of more than 2.00 gm^{-3};
    b) a level of unionised ammonia greater than 0.025 gm^{-3};
    c) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
    d) any conspicuous change in the colour or visual clarity;
    e) any emission of objectionable odour;
    f) the rendering of fresh water unsuitable for consumption by farm animals; and
    g) any significant adverse effects on aquatic life.

Riparian planting

26. The consent holder shall maintain the areas of riparian planting, undertaken in accordance with option 1 of riparian management plan RMP383, by ensuring the ongoing replacement of plants which do not survive, the eradication of weeds until the plants are well established, and the exclusion of stock from the planted areas.

Incident notification

27. The consent holder shall keep a permanent record of any incident related to this consent that results, or could result, in an adverse effect on the environment. The consent holder shall make the incident register available to the Taranaki Regional Council on request.

    Details of any incident shall be forwarded to the Taranaki Regional Council immediately. At the grant date of this consent, the Taranaki Regional Council's phone number is 0800 736 222 (24 hour service).

Site reinstatement

28. The consent holder shall prepare a Site Exit Plan which details how the site is going to be reinstated prior to the consent expiring or being surrendered. The Plan shall be submitted for approval to the Chief Executive, Taranaki Regional Council, acting in a certification capacity, at least 6 months prior to this consent expiring or being surrendered.

    The Site Exit Plan shall address, but not necessarily be limited to, the following matters:

    a) How the site will be reinstated so that no raw materials listed or approved under condition 2 of this consent remain on site;

    b) How the site will be reinstated so that no partially decomposed material remains on site;

c) How any remaining leachate or sludge, resulting from the operation, will be either removed from the site, buried, treated or otherwise to avoid any adverse effects on groundwater or surface water;

d) The remediation of irrigated soils and groundwater; and

e) Timeframes for undertaking the activities identified in association with a) to c) above.

Note: The requirement of this condition shall not apply if the consent holder applies for a new consent to replace this consent when it expires.

29. The consent holder shall reinstate the site in accordance with the plan approved under condition 28 above prior to this consent expiring or being surrendered.

Review

30. 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 within one month of approving the plan required under condition 9 of consent 5839-2 and/or during the month of June in any year for any of the following purposes:

a) Ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, and in particular to address any more than minor adverse effects relating to odour discharges from the site and/or water quality issues;

b) To incorporate into the consent any modification to the operation and maintenance procedures or monitoring that may be necessary to deal with any adverse effects on the environment arising from changes in association with condition 9 of consent 5839-2; and

c) To determine any measures that may be appropriate to comply with condition 1 of this consent, and which are necessary to address any adverse effects relating to the wastewater discharges and/or odour from the site.

Signed at Stratford on 20 August 2015

For and on behalf of
Taranaki Regional Council

_____

A D McLay
Director - Resource Management

Appendix 1 of consent 5838

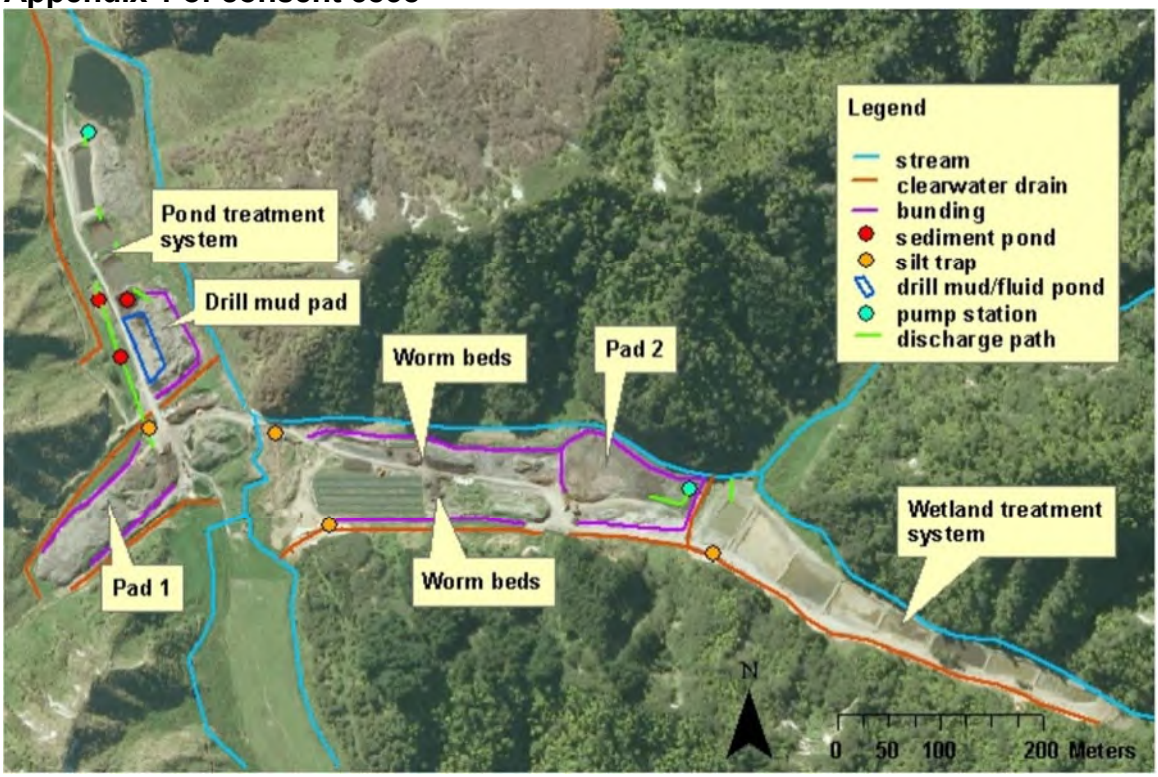

Figure 1 The location and extent of the Pond Treatment System, Wetland Treatment System, Pads 1 and 2, and the Drill Mud Pad.

Discharge Permit

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

Name of Consent Holder:	Remediation (NZ) Limited P O Box 8045 NEW PLYMOUTH 4342
Decision Date:	27 May 2010
Commencement Date:	18 June 2010

Conditions of Consent

Consent Granted:	To discharge emissions into the air, namely odour and dust, from composting operations between (NZTM) 1731704E-5685796N, 1733127E-5684809N, 1732277E-5685101N, 1732451E-5684624N and 1732056E-5684927N
Expiry Date:	1 June 2018
Review Date(s):	June 2011, June 2012, June 2013, June 2014, June 2015, June 2016, June 2017
Site Location:	1450 Mokau Road, Uruti
Legal Description:	Sec 34 Pt Sec 4 Blk II Upper Waitara SD

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 [the Council] all the administration, monitoring and supervision costs of this consent, fixed in accordance to section 36 of the Resource Management Act.

General

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 surface areas of Pad 1 and Pad 2 shall not exceed 3,500 m² and 4,000 m², respectively.

   Note: For the purposes of this condition, the location and extent of Pad 1 and Pad 2 are shown on Figure 1, attached as Appendix 1 of this consent.

Incoming material

3. The raw materials accepted onsite shall be limited to the following:

   - Paunch grass;
   - Animal manure from meat processing plant stock yards and dairy farm oxidation pond solids;
   - Green vegetative wastes;
   - Biosolids wastes including, but not limited to, pellets from wastewater treatment plants;
   - Mechanical pulping pulp and paper residue [excluding any pulping wastes that have been subject to chemical pulping or treated or mixed with any substance or material containing chlorine or chlorinated compounds];
   - Solid drilling cuttings from hydrocarbon exploration provided they are blended down to a maximum hydrocarbon content of 5.0 % total petroleum hydrocarbon within 3 days of being received onsite;
   - Water based and synthetic based drilling fluids from hydrocarbon exploration provided they are blended down to a maximum hydrocarbon content of 5.0 % total petroleum hydrocarbon content within 3 days of being brought onto the site;
   - Produced water from hydrocarbon exploration;
   - Vegetable waste solids [being processing by-products];
   - Grease trap waste [from food service industries];
   - Fish skeletal and muscle residue post filleting [free from offal]; and
   - Poultry industry waste [eggshells, yolks, macerated chicks and chicken mortalities].

   The acceptance of any other materials shall only occur if the Chief Executive, Taranaki Regional Council advises in writing that he is satisfied on reasonable grounds that the other materials will have minimal effects beyond those materials listed above.

4. Material produced as a result of a dissolved air flotation process shall not be accepted on site.

5. The consent holder shall record the following information in association with accepting all incoming material on site:

   a) the date and time that the material is accepted;
   b) description of the material; and
   c) the approximate volumes of material.

   The above records shall be made available to the Chief Executive, Taranaki Regional Council, on request.

Management practices

6. The consent holder shall prepare a Site Practices Management Plan which details management practices undertaken to ensure that offensive or objectionable odours at or beyond the site boundary will be avoided in accordance with condition 13 of this consent. The plan shall be submitted for approval to the Chief Executive, Taranaki Regional Council, acting in a certification capacity, within one month of the commencement date of this consent.

   The Management Plan shall address, but not necessarily be limited to, the following matters:

   a) identification of all activities on site which have the potential to generate odour [e.g. turning compost piles, removing sludge from ponds];
   b) the conditions and/or time of day when activities identified under a) above should be undertaken [e.g. during favourable weather conditions and the identification of those conditions] and/or measures that shall be implemented to avoid odours arising [e.g. containment measures];
   c) measures undertaken to minimise odours during receiving and storing material on Pad 1 and Pad 2 and throughout the composting and vermiculture processes [e.g. method[s] used to cover material once received, how anaerobic conditions are maintained];
   d) measures undertaken to minimise odours arising in the Wetland Treatment System, and identification of the time of year and/or frequency when undertaken;
   e) measures undertaken to minimise odours arising in the Pond Treatment System and associated treatment measures [e.g. silt traps located upstream], and identification of the time of year and/or frequency when undertaken; and
   f) details of how a complaint investigation procedure shall operate, including what data shall be collected and what feedback is to be provided to the complaint.

7. Operations on site shall be undertaken in accordance with the Site Practices Management Plan, approved under condition 6 above, except in circumstances when the Proposed Implementation Plan, approved under condition 9 of this consent, specifies otherwise.

Site audit and implementation

8. The consent holder shall engage a suitably qualified and experienced professional to prepare and submit an Odour Assessment Report for approval to the Chief Executive, Taranaki Regional Council, acting in a certification capacity, within three months of the commencement date of this consent. The professional that the consent holder engages shall be to the reasonable approval of the Chief Executive, Taranaki Regional Council.

   The report shall include, but not necessarily be limited to, the following:

   a) The appropriateness of the management practices and control measures undertaken in avoiding offensive and/or objectionable odours arising beyond the property boundary in association with the composting processes on Pad 1;
   b) Recommendations in association with a) above;
   c) The appropriateness of the design and management of the Pond Treatment System and associated pre-treatment devices (e.g. silt ponds) in effectively managing odours arising from treating leachate derived from Pad 1 and avoiding offensive and/or objectionable odours arising beyond the property boundary; and
   d) Recommendations in association with c) above.

   For assisting with the above assessment, the consent holder shall provide a copy of the documents listed below to the engaged and approved professional:

   - The Taranaki Regional Council final officers report and hearing decision report for applications 5276 and 5277;
   - Consent certificates [including conditions] for consents 5838-2 and 5839-2;
   - The Pond Treatment System Management Plan approved under condition 18 of consent 5838-2; and
   - The Site Practices Management Plan approved under condition 6 of this consent.

9. The consent holder shall prepare and submit a Proposed Implementation Plan for approval to the Chief Executive, Taranaki Regional Council, acting in a certification capacity, within one month of the Odour Assessment Report being approved under condition 8 above.

   The Plan shall include, but not necessarily be limited to, the following:

   a) Management practices and/or control measures proposed to be implemented in association with the composting processes on Pad 1, of which are from the recommendations of the Odour Assessment Report, approved in accordance with condition 8;
   b) Management practices and/or control measures proposed to be implemented in association with the Pond Treatment System, of which are from the recommendations of the Odour Assessment Report, approved in accordance with condition 8;
   c) The reasons for the chosen practices and/or measures identified in accordance with a) and b) above
   d) A timeframe by when each of the practices and/or measures identified in accordance with a) and b) above will be implemented

e) Identification of appropriate management practices to ensure the on-going functionality of any chosen control measures identified in accordance with a) and b) above

10. Operations and activities on site shall be undertaken in accordance with the Proposed Implementation Plan, approved under condition 9 above.

Dust

11. The dust deposition rate beyond the boundary of the consent holder's site arising from the discharge shall be less than 4.0 $g/m^2/30$ days.

Note: For the purposes of this condition, the consent holder's site is defined as Sec 34 Pt Sec 4 Blk II Upper Waitara SD.

12. Any discharge to air from the site shall not give rise to any offensive, objectionable, noxious or toxic levels of dust at or beyond the boundary of the consent holder's site, and in any case, total suspended particulate matter shall not exceed 120 $\mu g/m^3$ as a 24 hour average [measured under ambient conditions] beyond the boundary of the consent holder's site.

Note: For the purposes of this condition, the consent holder's site is defined as Sec 34 Pt Sec 4 Blk II Upper Waitara SD.

Odour

13. The discharges authorised by this consent shall not give rise to an odour at or beyond the boundary of the consent holder's site that is offensive or objectionable.

Note: For the purposes of this condition:

- The consent holder's site is defined as Sec 34 Pt Sec 4 Blk II Upper Waitara SD; and
- Assessment under this condition shall be in accordance with the *Good Practice Guide for Assessing and Managing Odour in New Zealand, Air Quality Report 36, Ministry for the Environment, 2003.*

Monitoring

14. The consent holder shall install a monitoring device that continuously records wind speed and direction in the area of the composting activity. The device shall be capable of logging collected data for at least six months and shall be installed and be operational within three months of the commencement date of this consent.

The data shall be provided telemetrically to the Taranaki Regional Council. If this method is not technically feasible, the data shall be provided to the Taranaki Regional Council at a frequency and a form advised by the Chief Executive, Taranaki Regional Council until such a time it is technically feasible to telemetric the data.

Odour surveys

15. The consent holder shall undertake an odour survey within six months of the Plan approved under condition 9 of this consent being implemented and thereafter at yearly intervals during periods when metrological conditions are most likely to result in offsite odour. The methodology for the survey shall be consistent with German Standard VDI 3940 "Determination of Odorants in Ambient Air by Field Inspection", or similar. Prior to the survey being carried out, the methodology shall be approved by the Chief Executive, Taranaki Regional Council, acting in a certification capacity.

    The results of the survey shall be provided to the Chief Executive, Taranaki Regional Council, within three months of the survey being completed.

Community liaison

16. The consent holder and the Director – Resource Management, Taranaki Regional Council, or his delegate, shall meet locally as appropriate, six monthly or at such other frequency as the parties may agree, with submitters to the application of this consent and any other interested party at the discretion of the Chief Executive, Taranaki Regional Council, to discuss any matter relating to the exercise of this consent, in order to facilitate ongoing community consultation.

Incident notification

17. The consent holder shall keep a permanent record of any incident related to this consent that results, or could result, in an adverse effect on the environment. The consent holder shall make the incident register available to the Taranaki Regional Council on request.

    Details of any incident shall be forwarded to the Taranaki Regional Council immediately. At the grant date of this consent, the Council's phone number is 0800 736 222 [24 hour service].

Site reinstatement

18. The consent holder shall prepare a Site Exit Plan which details how the site is going to be reinstated prior to the consent expiring or being surrendered. The Plan shall be submitted for approval to the Chief Executive, Taranaki Regional Council, acting in a certification capacity, at least 3 months prior to this consent expiring or being surrendered.

    The Site Exit Plan shall address, but not necessarily be limited to, the following matters:

    a) How the site will be reinstated so that no raw materials listed or approved under condition 3 of this consent remain on site;

    b) How the site will be reinstated so that no partially decomposed material remains on site;

    c) How any remaining leachate or sludge, resulting from the operation, will be either removed from the site, buried, treated or otherwise to avoid any adverse effects on groundwater or surface water; and

d) Timeframes for undertaking the activities identified in association with a) to c) above.

Note: The requirement of this condition shall not apply if the consent holder applies for a new consent to replace this consent when it expires.

19. The consent holder shall reinstate the site in accordance with the Plan approved under condition 18 above prior to this consent expiring or being surrendered.

Review

20. 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 within one month of approving the plan required under condition 9 of this consent and/or during the month of June in any year for any of the following purposes:

a) Ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, and in particular to address any more than minor adverse effects relating to odour discharges from the site;

b) To incorporate into the consent any modification to the operation and maintenance procedures or monitoring that may be necessary to deal with any adverse effects on the environment arising from changes in association with condition 9 of this consent; and

c) To determine any measures that may be appropriate to comply with condition 1 of this consent, and which are necessary to address any adverse effects of odour from the site.

Signed at Stratford on 27 May 2010

For and on behalf of
Taranaki Regional Council

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Director-Resource Management

Appendix 1 of consent 5839-2

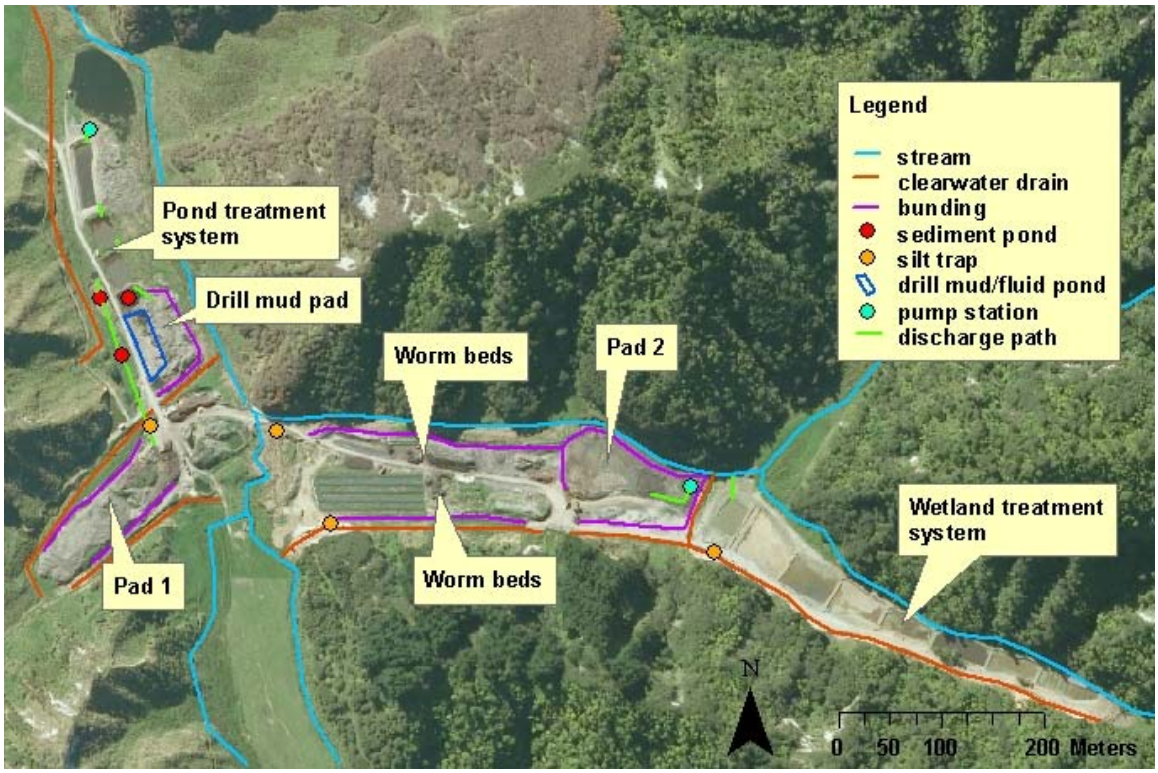

Figure 1 The location and extent of the composting operation including Pads 1 and 2.

Land Use Consent

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

Name of Consent Holder:	Remediation (NZ) Limited PO Box 8045 New Plymouth 4342
Decision Date:	01 September 2015
Commencement Date:	01 September 2015

Conditions of Consent

Consent Granted:	To use a twin culvert in the Haehanga Stream for vehicle access purposes
Expiry Date:	01 June 2033
Review Date(s):	June 2021 and June 2027
Site Location:	1460 Mokau Road, Uruti
Legal Description:	Sec 34 Pt Sec 4 Blk II Upper Waitara (site of structure)
Grid Reference (NZTM)	1731706E - 5685779N
Catchment:	Mimi
Tributary:	Haehanga

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 ensure that the stream bed downstream from the structure is built up with appropriate material before 31 March 2016 to allow for fish passage and from this date forward the structure shall not prevent the passage of fish.

2. The consent holder shall maintain the structure so that:

   (a) it does not become blocked and at all times allows the free flow of water through it;
   (b) any erosion, scour or instability of the stream bed or banks is remedied by the consent holder.

3. 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 2021 and/or June 2027, 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 01 September 2015

For and on behalf of
Taranaki Regional Council

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A D McLay
Director - Resource Management

Land Use Consent

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

Name of Consent Holder:	Remediation (NZ) Limited P O Box 8045 NEW PLYMOUTH 4342
Consent Granted Date:	26 September 2003

Conditions of Consent

Consent Granted:	To realign and divert the Haehanga Stream in the Mimi catchment for land improvement purposes at or about (NZTM) 1732402E-5684777N
Expiry Date:	1 June 2021
Review Date(s):	June 2009, June 2015
Site Location:	1460 Mokau Road, Uruti
Legal Description:	Pt Sec 4 Blk II Upper Waitara SD
Catchment:	Mimi
Tributary:	Haehanga

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 notify the Taranaki Regional Council at least 48 hours prior to and upon completion of any subsequent maintenance works that would involve disturbance of or deposition to the riverbed or discharges to water.

2. The realignment authorised by this consent shall be undertaken generally in accordance with the documentation submitted in support of the application and shall be maintained to ensure the conditions of this consent are met.

3. The consent holder shall adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to avoid or minimise erosion and scouring as a result of channel realignment.

4. The consent holder shall adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to avoid or minimise the discharge of silt or other contaminants into water or onto the riverbed and to avoid or minimise the disturbance of the riverbed and any adverse effects on water quality.

5. The consent holder shall ensure that the area and volume of riverbed disturbance shall, so far as is practicable, be minimised and any areas which are disturbed shall, so far as is practicable, be reinstated.

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

Transferred at Stratford on 22 September 2008

For and on behalf of
Taranaki Regional Council

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Director-Resource Management

Land Use Consent

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

Name of Consent Holder:	Remediation (NZ) Limited P O Box 8045 NEW PLYMOUTH 4342
Consent Granted Date:	26 September 2003

Conditions of Consent

Consent Granted:	To erect, place, use and maintain a culvert and associated structure[s] in the bed of the Haehanga Stream in the Mimi catchment for access purposes at or about (NZTM) 1732402E-5684777N
Expiry Date:	1 June 2021
Review Date(s):	June 2009, June 2015
Site Location:	1460 Mokau Road, Uruti
Legal Description:	Pt Sec 4 Blk II Upper Waitara SD
Catchment:	Mimi
Tributary:	Haehanga

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 notify the Taranaki Regional Council in writing at least 48 hours prior to the commencement and upon completion of removal of the temporary culvert [being the 800mm diameter culvert] and installation of the permanent culvert and associated structures, and again at least 48 hours prior to and upon completion of any subsequent maintenance works which would involve disturbance of or deposition to the riverbed or discharges to water.

2. The consent holder shall replace the existing temporary culvert with a permanent culvert and associated structure[s] by 1 April 2004. Prior to the installation of the permanent culvert and associated structure[s] the consent holder shall forward designs of the proposed culvert and associated structure[s] for the written approval of the Chief Executive.

3. The structures authorised by this consent shall be constructed generally in accordance with the documentation submitted in support of the application and shall be maintained to ensure the conditions of this consent are met.

4. The consent holder shall adopt the best practicable option to avoid or minimise the discharge of silt or other contaminants into water or onto the riverbed and to avoid or minimise the disturbance of the riverbed and any adverse effects on water quality.

5. The consent holder shall ensure that the area and volume of riverbed disturbance shall, so far as is practicable, be minimised and any areas which are disturbed shall, so far as is practicable, be reinstated.

6. The structures, which are the subject of this consent, shall not obstruct fish passage.

7. The structures authorised by this consent shall be removed and the area reinstated if and when the structures are no longer required. The consent holder shall notify the Taranaki Regional Council at least 48 hours prior to structures removal and reinstatement.

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

Transferred at Stratford on 22 September 2008

For and on behalf of
Taranaki Regional Council

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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:	Remediation New Zealand 107 Corbett Road Bell Block 4373
Decision Date:	09 March 2015
Commencement Date:	09 March 2015

Conditions of Consent

Consent Granted:	To discharge treated stormwater from a quarry site, into an unnamed tributary of the Haehanga Stream
Expiry Date:	01 June 2033
Review Date(s):	June 2021 and/or June 2027
Site Location:	1460 Mokau Road, Uruti
Legal Description:	Sec 34 Pt Sec 4 Blk II Upper Waitara SD (Discharge source & site)
Grid Reference (NZTM)	1732059E-5684796N
Catchment:	Mimi
Tributary:	Haehanga

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. This consent authorises the discharge of treated stormwater into an unnamed tributary of the Haehanga Stream, as described in the information provided with the application, and specifically:

   a) The Assessment of Environmental Effects prepared by BTW Company Limited dated 9 January 2015; and
   b) Additional Information prepared by BTW Company Limited dated 16 February 2015.

   In the case of any contradiction between the details of information provided and the conditions of this consent, the conditions of this consent shall prevail.

2. The consent holder shall notify the Chief Executive, Taranaki Regional Council, in writing, at least 48 hours prior to the exercise of this consent (including vegetation removal). Notification shall include:

   a) the consent number;
   b) a brief description of the activity consented; and
   c) the extent or stage of the activity to be commenced.

   Notification shall be emailed to worknotification@trc.govt.nz.

3. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects on the environment from the exercise of this consent.

4. The consent holder shall operate and progressively reinstate the quarry site in a manner which ensures that the area of exposed, un-vegetated earth, within the quarry's stormwater catchment is kept to a minimum at all times.

5. The consent holder shall ensure that no area greater than 1 ha is exposed at any one time.

6. The stormwater discharged shall be from a catchment area not exceeding 4 ha.

7. This stormwater treatment system shall be installed before any site works commences.

8. The stormwater treatment system shall be maintained for the life of the quarry operation.

9. All stormwater shall be directed for treatment through the stormwater treatment system prior to discharge into the Haehanga Stream tributary.

10. Constituents of the discharge shall meet the standards shown in the following table.

Constituent	Standard
pH	Within the range 6.0 to 9.0
suspended solids	Concentration not greater than 100 gm^{-3}
total hydrocarbons	Concentration not greater than 15 gm^{-3}

This condition shall apply before entry of the treated stormwater into the receiving waters at a designated sampling point approved by the Chief Executive, Taranaki Regional Council.

11. The pH may exceed 9.0 if the exceedance is a result photosynthetic activity within the detention ponds, but in any case the discharge shall not result in the pH of the receiving water increasing by more than 0.5 pH units after allowing for a mixing zone of 25 metres.

12. After allowing for reasonable mixing, within a mixing zone extending 500 metres downstream of any discharge point, the discharge shall not give rise to any of the following effects in the receiving waters:

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

13. After allowing for reasonable mixing, within a mixing zone extending 500 metres downstream of any discharge point, the discharge shall not give rise to any of the following effects in the receiving waters:

    a) an increase in the suspended solids concentration within the unnamed tributary of the Haehanga Stream in excess of 10 grams per cubic metres when the turbidity as measured immediately upstream of the discharge point is equal to or less than 5 NTU (nephelometric turbidity units); or

    b) an increase in the turbidity within the unnamed tributary of the Haehanga Stream of more than 50%, where the stream turbidity measured upstream if the discharge is greater than 5 NTU, as determined using NTU (nephelometric turbidity units).

14. The consent holder shall maintain and regularly update a 'Contingency Plan' that details measures and procedures that will be undertaken to prevent, and to avoid environmental effects from, a spillage or any discharge of contaminants not authorised by this consent. The plan shall be approved by the Chief Executive, Taranaki Regional Council, acting in a certification capacity.

15. The site shall be operated in accordance with a 'Management Plan' prepared by the consent holder and approved by the Chief Executive, Taranaki Regional Council, acting in a certification capacity. The plan shall detail how the site is to be managed to minimise the contaminants that become entrained in the stormwater and shall include as minimum:

    a) the loading and unloading of materials;
    b) maintenance of conveyance systems;
    c) general housekeeping; and
    d) management of the interceptor system.

    A Stormwater Management Plan template is available in the Environment section of the Taranaki Regional Council's web site www.trc.govt.nz.

16. The consent holder shall notify the Chief Executive, Taranaki Regional Council, prior to making any changes to the processes or operations undertaken at the site, or the chemicals used or stored on site that could alter the nature of the discharge. Any such change shall then only occur following receipt of any necessary approval under the Resource Management Act. Notification shall include the consent number, a brief description of the activity consented and an assessment of the environmental effects of any changes, and be emailed to consents@trc.govt.nz.

17. This consent shall lapse on 31 March 2020, 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.

18. 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 2021 and/or June 2027, 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 09 March 2015

For and on behalf of
Taranaki Regional Council

A D McLay
Director - Resource Management

Land Use Consent

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

Name of Consent Holder:	Remediation (NZ) Limited PO Box 8045 New Plymouth 4342
Decision Date:	02 March 2018
Commencement Date:	02 March 2018

Conditions of Consent

Consent Granted:	To replace an existing culvert in an unnamed tributary of the Haehanga Stream, including the associated disturbance of the stream bed
Expiry Date:	01 June 2033
Review Date(s):	June 2021 and or June 2027
Site Location:	1460 Mokau Road, Uruti
Grid Reference (NZTM)	1732180E-5685096N
Catchment:	Mimi
Tributary	Haehanga

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 culvert pipe shall be a smooth bore plastic pipe and have an internal diameter of no less than 1 metre and be no longer than 40 metres.

2. The fill over the top of the culvert pipe shall be comprised of suitable soils free of wood, humus and other organic matter. The embankment shall be well compacted in uniform layers not exceeding 300 mm loose depth to achieve a compaction of at least 95 % of maximum dry density.

3. The fill over the top of the culvert pipe shall be 2.3 m above the invert of the culvert.

4. The consent holder shall notify the Chief Executive, Taranaki Regional Council, in writing at least 2 working days prior to the commencement of work. Notification shall include the consent number and a brief description of the activity consented and be emailed to worknotification@trc.govt.nz.

5. Between 1 May and 31 October no work shall be undertaken on any part of the stream bed that is covered by water.

6. The consent holder shall take all practicable steps to minimise stream bed disturbance, sedimentation and increased turbidity during installation of the culvert, including by:
   a) completing all works in the minimum time practicable;
   b) avoiding placement of excavated material in the flowing channel;
   c) keeping machinery out of the actively flowing channel, as far as practicable; and
   d) reinstating any disturbed areas as far as practicable.

7. A reinforced concrete headwall shall be installed at the inlet to the culvert.

8. A layer of rock riprap 1000 mm thick shall be installed in the stream bed. The riprap shall extend 5 metres downstream of the culvert outlet and 1 metre up the banks on both sides of the stream. The rock shall have the following grading:
   - 100% less than 800 mm diameter;
   - 50% greater than 600 mm diameter;
   - 90% greater than 350 mm diameter.

9. The culvert shall not restrict fish passage.

10. The invert of the culvert shall be set below the existing stream bed by 200 mm so that it fills with bed material and simulates the natural bed.

11. The gradient of the culvert shall be no steeper than the natural gradient of the stream bed at the site.

12. On completion of works, the banks of the channel upstream and downstream of the culvert shall be no steeper than the existing natural banks. Where the bank consists of fill, the fill must be well compacted with batter slopes no steeper than 2 horizontal to 1 vertical.

13. The culvert shall remain the responsibility of the consent holder and be maintained so that:
    a) it does not become blocked, and at all times allows the free flow of water through it; and
    b) the consent holder repairs any erosion, scour or instability of the stream bed or banks that the culvert causes.

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

15. This consent shall lapse on 31 March 2023, 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.

16. 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 2021 and/or June 2027, 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 02 March 2018

For and on behalf of
Taranaki Regional Council

Director – Resource Management

Land Use Consent

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

Name of Consent Holder:	Remediation (NZ) Limited PO Box 8045 New Plymouth 4342
Decision Date	24 June 2020
Commencement Date	24 June 2020

Conditions of Consent

Consent Granted:	To realign a section of two unnamed tributaries of the Haehanga Stream for land improvement purposes
Expiry Date:	1 June 2039
Review Date(s):	June 2027, June 2033
Site Location:	1460 Mokau Road, Urenui
Grid Reference (NZTM)	Between: 1731695E-5686147N & 1731840E-5686084N; and 1732341E-5685496N & 1732422E-5685525N
Catchment:	Mimi
Tributary:	Haehanga

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. This consent authorises the permanent diversion of the full stream flow through two sections of reconstructed channel on two unnamed tributaries, between grid references:
   - (NZTM) 1731695E-5686147N and 1731840E-5686084N; and
   - (NZTM) 1732341E-5685496N and 1732422E-5685525N.

2. The new stream channels shall have a flow capacity no less than that of the existing stream channels.

3. No less than 2 and no more than 20 working days before commencing work the consent holder shall notify the Chief Executive, Taranaki Regional Council ('the Chief Executive'). Notification shall include the consent number, a brief description of the work, and the intended commencement date. Unless the Chief Executive advises that an alternative method is required this notice shall be served by completing and submitting the 'Notification of work' form on the Council's website (http://bit.ly/TRCWorkNotificationForm).

4. The consent holder shall take all practicable steps to minimise sedimentation and increased turbidity of the stream during the construction, implementation and maintenance of the works, including:

   (a) completing all works in the minimum time practicable;
   (b) avoiding placement of excavated material in the flowing channel; and
   (c) keeping machinery out of the actively flowing channel, as far as practicable.

5. The channels shall be constructed to include sequences of runs and riffles that simulate the natural bed where the original stream bed is no longer present or stable.

6. Between 1 May and 31 October no work shall be undertaken on any part of the stream bed that is covered by water.

7. The consent holder shall prepare and implement a fish recovery plan that has been certified by the Chief Executive of the Taranaki Regional Council. The plan shall detail how the impacts on fish during culvert installation are avoided as far as practical, and shall include as a minimum how fish will be salvaged, how often fish will be salvaged, and recording the number and types of fish salvaged.

8. The new channel shall not restrict fish passage.

9. At all times during the works the consent holder shall ensure that the stream flow downstream of the affected reach is not significantly diminished.

10. On completion of the realignment work:

    (a) the banks of the reconstructed channel shall have a slope no steeper than 1.5 horizontal to 1 vertical; and
    (b) the bed of the reconstructed channel shall be at an appropriate grade so as to provide for upstream fish passage.

11. The consent holder shall ensure that rock riprap in placed in the stream bed at all bends in the new channels. The riprap shall be placed within the entire bed width and up the banks of the new stream channel.

12. The rock riprap shall be no less than 0.9 metres thick, and of the following grading:

    (a) 100% less than 600 mm diameter;
    (b) 50% greater than 450 mm diameter;
    (c) 90% greater than 200 mm diameter.

13. The consent holder shall maintain the realigned channel by repairing any erosion, scour or instability of the stream bed or banks.

14. The consent holder shall undertake and maintain riparian fencing and planting on the tributaries affected by the realignment, in accordance with the Riparian Management Plan for the property. An area of not less than 5 metres shall be planted between the stream bed and fence.

15. The fencing and riparian planting required in condition 14 shall be completed before August 2021.

16. To remedy and mitigate the adverse environmental effects of this consent, the consent holder shall establish and maintain riparian planting and a wetland as detailed in the 'Wetland Restoration Management Plan' provided with the application and attached as Appendix 1. The works shall be undertaken within the timeframes specified in that plan.

17. All earthwork areas shall be stabilised as soon as is practicable immediately following completion of soil disturbance activities.

    Note: For the purpose of this condition "stabilised" in relation to any site or area means inherently resistant to erosion or rendered resistant, such as by using indurated rock or by the application of basecourse, colluvium, grassing, mulch, or another method to the reasonable satisfaction of the Chief Executive, Taranaki Regional Council and as specified in Guidelines for Soil Disturbing Activities- Waikato Regional Council. Where seeding or grassing is used on a surface that is not otherwise resistant to erosion, the surface is considered stabilised once, on reasonable visual inspection by an Investigating Officer, Taranaki Regional Council, an 80% vegetative cover has been established.

18. This consent lapses 5 years after its date of commencement, 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.

19. 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 2027 and/or June 2033, 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 24 June 2020

For and on behalf of
Taranaki Regional Council

_____

A D McLay
Director - Resource Management

Appendix 1

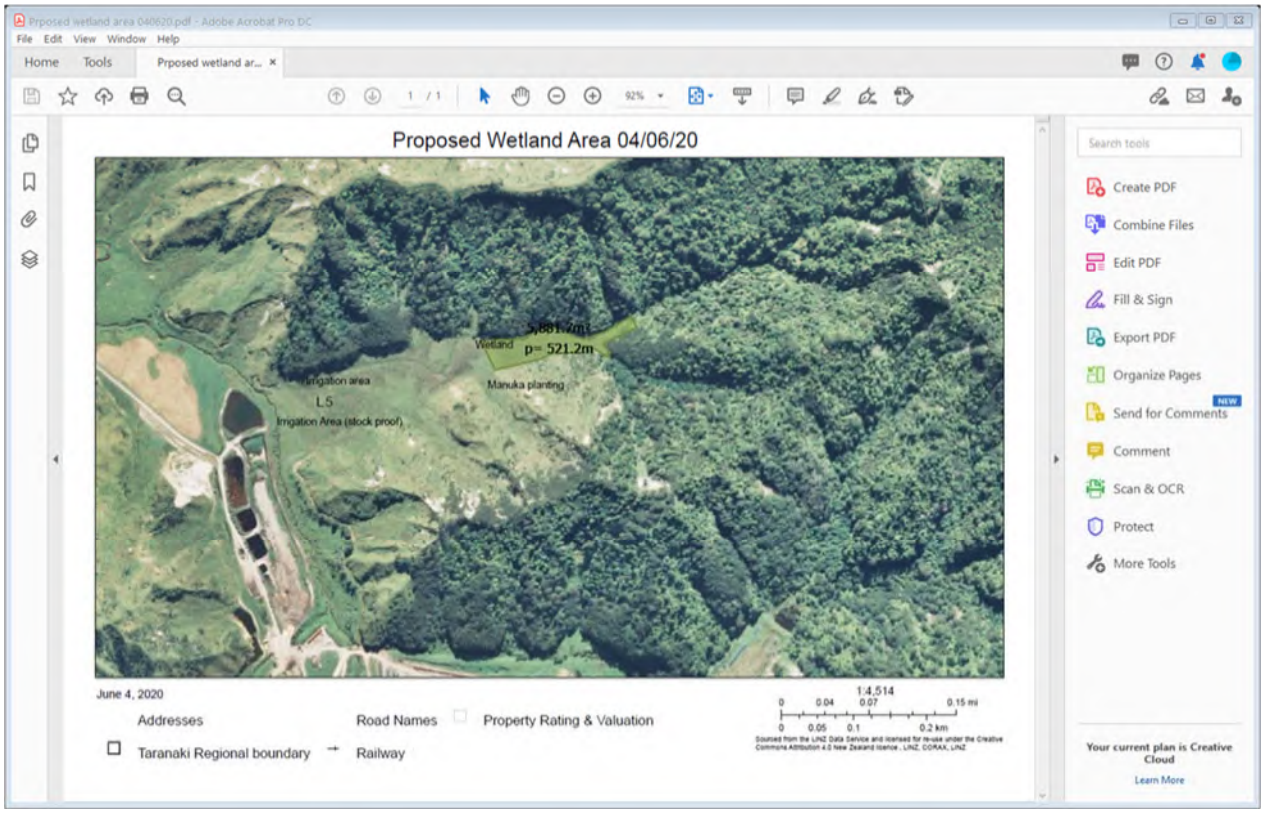
Wetland Restoration/Management Plan-Remediation (NZ) Ltd Uruti Site

13.1 Location

It is proposed to carry out a wetland restoration project on Remediation (NZ) Ltd land situated at 1460 Mokau Road.

The location of the proposed wetland is upstream of the L5 irrigation area. The wetland will have an approximate area of 0.588ha.

Diagram 1-Site of proposed wetland



Regenerative native bush is to the north and east of the proposed wetland. It is proposed to plant manuka on the southern hillside. To the western side of the proposed wetland is irrigation area L5.

The proposed wetland area has been grazed in the past and has little or no swamp vegetation. There is Juncus sp. growing in the wetland area.

It has been suggested by Sophie Arnoux (TRC Land Management Officer) that the proposed wetland area was likely to have been kahikatea/pukatea swamp forest (email dated 13/5/2020).

13.2 Description of water flow and drainage

There is a defined tributary of the Haehanga Stream to the west of the wetland. There is no defined stream through the wetland, with water flow either overland in periods of heavy rain, and underground during periods of no rain. Water seeps from the downstream bank that the wetlands have created which then forms the over ground tributary that runs between the irrigation area and bush margin.

13.3 Enhancement Proposal

It is proposed to replant the wetland area so as to re-create a kahikatea/pukatea swamp forest that would have been found in this area. Flax, cabbage tree, manuka and carex will also be planted. On the hill sides to the south of the wetland it is planned to plant manuka. The wetland and lower irrigation area will be fenced off summer 2020/21.

13.4 Plant numbers and plant spacing

The planting area is 5,880 m2. Distance between plants will be 2 m. 5,880 divided by 2, divided by 2 again is 1,470 plants required to fill the area. There will be spacing of 1 m between sedges on the wetland margin.

Table 1: Planting

Location	Species	Spacing	Number
Centre area	Kahikatea	3 m	30 (year 3-4)
Centre area	Pukatea	3 m	30 (year 3-4)
Outer areas	Cabbage Tree	2 m	100
Outer areas	Flax	2 m	300
Outer areas	Manuka	2 m	500
Dispersed	Carex secta	1 m	150
Dispersed	Carex virgate	1 m	150

Plants will be sourced from local native plant nurseries, with planting out being carried out by Remediation staff. Weeding around plants will be carried out on an annual basis. Any regenerating native plants will be encouraged with these filling up the area.

13.5 Animal Pest Control

Goats and possums are the two pests that will need to be kept under control.
Remediation has a contract with a goat culler to ensure the population of goats is kept under control. Possum traps will be set around the wetland area.

13.6 Timing

Ideally we would like to start planting this year. This may be flax and carex around the perimeter of the area. Planting of trees will occur in year 3 and remainder of planting in year 4.

Year 1	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pest Control									x			
Pre planting herbicide							x					
Planting								x				
Post planting release											x	

Year 2	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pest Control			x					x				
Pre planting herbicide				X								
Planting						X						
Post planting release											x	

Year 3	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pest Control			x					x				
Pre planting herbicide				X								
Planting						X						
Post planting release											x	

Land Use Consent

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

Name of Consent Holder:	Remediation (NZ) Limited PO Box 8045 New Plymouth 4342
Decision Date	24 June 2020
Commencement Date	24 June 2020

Conditions of Consent

Consent Granted:	To modify a culvert to provide for fish passage, in an unnamed tributary of the Haehanga Stream, including associated disturbance of the stream bed
Expiry Date:	1 June 2039
Review Date(s):	June 2027, June 2033
Site Location:	1460 Mokau Road, Uruti
Grid Reference (NZTM)	1731692E-5686143N
Catchment:	Mimi
Tributary:	Haehanga

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 culvert pipe shall have a diameter no less than 900 mm and be no longer than 10 metres.

2. The fill over the top of the culvert pipe shall be comprised of suitable soils free of wood, humus and other organic matter. The embankment shall be well compacted in uniform layers not exceeding 300 mm loose depth to achieve a compaction of at least 95% of maximum dry density.

3. The fill over the top of the culvert pipe shall be no less than 4 metres.

4. No less than 2 and no more than 20 working days before commencing work the consent holder shall notify the Chief Executive, Taranaki Regional Council ('the Chief Executive'). Notification shall include the consent number, a brief description of the work, and the intended commencement date. Unless the Chief Executive advises that an alternative method is required this notice shall be served by completing and submitting the 'Notification of work' form on the Council's website (http://bit.ly/TRCWorkNotificationForm).

5. Between 1 May and 31 October no work shall be undertaken on any part of the stream bed that is covered by water.

6. The consent holder shall take all practicable steps to minimise stream bed disturbance, sedimentation and increased turbidity during installation of the culvert, including by:

   (a) completing all works in the minimum time practicable;
   (b) avoiding placement of excavated material in the flowing channel;
   (c) keeping machinery out of the actively flowing channel, as far as practicable; and
   (d) reinstating any disturbed areas as far as practicable.

7. A layer of rock riprap 900 mm thick shall be installed in the stream bed. The riprap shall extend 3 metres upstream of the culvert inlet and 5 metres downstream of the culvert outlet and - up the banks on both sides of the stream. The rock shall have the following grading:

   (a) 100% less than 600 mm diameter;
   (b) 50% greater than 450 mm diameter;
   (c) 90% greater than 20 mm diameter.

   Note: The rock riprap shall be installed so that smaller grade rocks and gravels are placed within the larger rock to create a lasting stream bed appropriate for fish passage.

8. At all times after 1 May 2021 the culvert shall provide for fish passage.

9. The invert of the culvert shall be set below the existing stream bed by 225 mm that it fills with bed material and simulates the natural bed.

10. The gradient of the culvert shall be no steeper than the natural gradient of the stream bed at the site.

11. On completion of works, the banks of the channel upstream and downstream of the culvert shall be no steeper than the existing natural banks. Where the bank consists of fill, the fill must be well compacted with batter slopes no steeper than 2 horizontal to 1 vertical.

12. The culvert shall remain the responsibility of the consent holder and be maintained so that:

    (a) it does not become blocked, and at all times allows the free flow of water through it; and
    (b) the consent holder repairs any erosion, scour or instability of the stream bed or banks that the culvert causes.

13. This consent lapses 5 years after its commencement date (shown on the front of this document), unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period in accordance with 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 2027 and/or June 2033, 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 24 June 2020

For and on behalf of
Taranaki Regional Council

_____

A D McLay
Director - Resource Management

Appendix II

Categories used to evaluate environmental and administrative performance

Categories used to evaluate environmental and administrative performance

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

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

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

Environmental Performance

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

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

For example:

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

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

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

Administrative performance

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

Good: Perhaps some administrative requirements of the resource consents were not met at a particular time, however this was addressed without repeated interventions from the Council staff. Alternatively

adequate reason was provided for matters such as the no or late provision of information, interpretation of 'best practical option' for avoiding potential effects, etc.

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

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

Appendix III

Record of odour-related complaints, investigations, and monitoring inspections

Table Qdour-related complaints, investigations, and monitoring inspections

Date	Complaint	Inspections and investigations
01/07/2022	A complaint was received concerning odour coming from the Remediation Site, Mokau Road, Uruti. Caller advised she could smell the odour whilst driving past the site and the odour smelt like rotten cabbage and faecal odour	Incident not attended/assessed
02/07/2022	A complaint was received concerning odour discharging from the composting site at Mokau Road, Uruti. Caller advised that there was a really strong chemical smell today and lots of evidence of truck activity. Able to smell it from home and concerned it might get worse as mist rolls in	Incident not attended/assessed
04/07/2022	A complaint was received concerning odour discharging from the composting site art Mokau Road, Uruti. Caller advised that she travelled through to pick up her son from Uruti and the smell coming from the Remediation was noticeable at 18:45 and when she returned the odour was terrible/offensive from the JQ Jones Quarry at 1358 Mokau Road to her property at 1540 Mokau Road. Caller advised with the mist and cold air drainage at nights that the odour will be pretty offensive by 21:00 this evening	Incident not attended/assessed
06/07/2022		An inspection was undertaken within the Mimi Valley to assess compliance with resource consent conditions with regards to the discharge of odours off site from the RNZ-Uruti composting facility See Section 2.5.2
29/07/2022	Several complaints were received concerning odour discharging from the composting site at Uruti	Incident not attended/assessed
01/08/2022	Two complaints were received concerning odour discharging from the composting site art Mokau Road, Uruti	Incident not attended/assessed
01/08/2022	A complaint was received concerning odour discharging from the composting site art Mokau Road, Uruti. Caller advised that two other family members smelt this from 1358 Mokau Road and past Redemption through to 1540 Mokau Road. Approx 2kms on the road way they could smell this smell	Incident not attended/assessed

Date	Complaint	Inspections and investigations
04/08/2022		Inspection undertaken to assess odour discharges from the RNZ - Uruti composting facility. See Section 2.5.2
04/08/2022	A complaint was received concerning odour discharging from the composting site art Mokau Road, Uruti. Has smelt Remediation tonight on his way home. He says it is a lot of different smells causing a stench	Incident not attended/assessed
06/08/2022	A complaint was received concerning odour discharging from the composting site art Mokau Road, Uruti. Caller reports the smell from Remediation 1460 Mokau Road. It is noticeable at their property but at the time of the call the smell at 1358 Mokau Road was extremely bad already. The smell this morning is a very strong chemically pig manure-y smell	Incident not attended/assessed
10/08/2022		A pro-active inspection was undertaken to assess compliance with resource consent conditions See Section 2.5.2
14/08/2022	A complaint was received concerning odour discharging from the composting site art Mokau Road, Uruti. Caller has advised that the smell this morning is so putrid at her mother's place that you can almost 'cut the air with a knife'	Incident not attended/assessed
15/08/2022	A complaint was received concerning odour discharging from the composting site art Mokau Road, Uruti. Caller advised that she woke up to a definite offensive smell in the valley this morning at around 6:25am from her home on her way out of the Valley, on her way back at around 6:35am the smell became overbearing wafting through the valley to her mothers property at 1358 Mokau Rd as well	Incident not attended/assessed
25/08/2022		An odour assessment was undertaken to assess compliance with resource consent conditions in relation to the discharge of odour beyond the boundary of the property at the RNZ composting facility at Uruti. See Section 2.5.2
30/08/2022	A complaint was received concerning odour discharging from the composting site art Mokau Road, Uruti	Incident not attended/assessed

Date	Complaint	Inspections and investigations
31/08/022	Several complaints were received concerning odour discharging from the composting site art Mokau Road, Uruti	Incident not attended/assessed
01/09/2022	A complaint was received concerning odour discharging from the composting site art Mokau Road, Uruti	Incident not attended/assessed
01/09/2022		An odour assessment was undertaken to assess compliance with resource consent conditions in relation to the discharge of odour beyond the boundary of the property at the RNZ composting facility at Uruti. See Section 2.5.2
09/09/2022	A complaint was received concerning odour discharging from the composting site art Mokau Road, Uruti. Caller has phoned in this morning to complain about the objectionable stench coming from Remediation Ltd. this morning. Apparently it is especially foul today, with it being a 10 on a scale from 1-10, and this can also be strongly smelt at 1358 Mokau Road. The caller's son, was put on the phone to explain that yesterday when the school bus drove past as it normally does around 0745-0800, the smell was bad and gave him a bad headache which he had the rest of the way in to Waitara. He said the other kids on the bus are disgusted by the smell and try to block their noses each time they go along there	Incident not attended/assessed
14/09/2022		Inspection undertaken at the RNZ- Uruti composting facility to assess compliance with the odour parameters of the resource consent. See Section 2.5.2
04/10/2022	A complaint was received concerning odour discharging from the composting site art Mokau Road, Uruti. Caller has advised that the smell from remediation this morning is really bad - cuts your breathe off, and can't breathe when you go outside. She noted that she has people staying in their farm stay at 1358 Mokau Road and its bad there too. She noted that her husband woke up at 0300am and vomited phlegm - so the smell came through the house	Incident not attended/assessed

Date	Complaint	Inspections and investigations
09/10/2022	A complaint was received concerning an odour discharging from a composting site at Mokau Road, Uruti Caller advised of an awful odour coming from Remediation LTD. Its smells of a dead goat that has been left for 2 days. She stated its so awful and wants to vomit, she will be going to other neighbours and get them to call in	Incident not attended/assessed
10/10/2022	A complaint was received concerning odour discharging from the composting site art Mokau Road, Uruti. Caller advised there is an offensive smell coming from the dump down, Remediation NZ limited	Incident not attended/assessed
13/10/2022	A complaint was received concerning an odour discharging from the composting site at Mokau Road, Uruti. Caller has phoned in to report that this morning the foul odour from Remediation NZ is "stenching out the valley", a continuation of last night's smell. She is trying to move cattle on her farm but everyone is being disturbed by the odour, including those caught up in the stop/go at the bottom of her driveway	Incident not attended/assessed
15/10/2022	A complaint was received concerning an odour discharging from the composting site at Mokau Road, Uruti. Caller has expressed frustration over her odour complaint for 1416 referring to it as the remediation and how tonight it is impacting on her and her family enjoying a bbq. Odour Location: 1416 Mokau Road, Uruti Odour Duration: Ongoing. Odour Description: Not happy with the odour as an ongoing issue for the caller and her family	Incident not attended/assessed
22/10/2022	A complaint was received concerning an odour discharging from the composting site at Mokau Road, Uruti. Caller said there is a rotten, sewerage smell coming from Remediation since 17:00. He said its more intense right now. Odour Location: 1460 Mokau Road, Urenui Odour Duration: Since 17:00 Odour Description: Rotten, sewerage odour	Incident not attended/assessed
23/10/2022	A complaint was received concerning an odour discharging from the composting site at Mokau Road, Uruti. Caller said they have seen sucker trucks heading up to Remediation. Smell is at a 10 and is obnoxious and objectionable. She reports it feels like it is burning the inside of her nose. Odour Location: Smelt from 1358 Mokau Rd and their home at 1540 Odour Duration: Could smell it as they were heading home a short time ago and smell is ongoing Odour Description: Chemical Element	Incident not attended/assessed

Date	Complaint	Inspections and investigations
24/10/2022	A complaint was received concerning an odour discharging from the composting site at Mokau Road, Uruti. Caller has reported odour tonight is foul and an 8 on a scale of 1-10. The last two nights have been a 10. Odour Location: Remediation 1460 Mokau Road, Urenui Odour Duration: For the past couple of days Odour Description: Rotten, sewerage odour	Incident not attended/assessed
25/10/2022		Evening inspection undertaken as part of proactive monitoring of potential odour emissions from the Remediation (NZ) Limited, Mokau Road - Uruti composting facility. See Section 2.5.2
05/11/2022	A complaint was received concerning an odour discharging from the composting site at Mokau Road, Uruti. Caller reports faecal odour from worm farm. Odour Location: Mokau Road - Worm Farm Odour Duration: When caller drove past it. Odour Description: Faecal odour	Incident not attended/assessed
08/11/2022	A complaint was received concerning an odour discharging from the composting site at Mokau Road, Uruti. Caller said Yesterday a sucker truck left Remediation NZ and was stinking out the valley, all night. She will be following up this morning to ensure investigation of the smell. 1358, 1460, 1540 Mokau Road, All night, Rotten and putrid smell, with a chemical element	Multiple odour surveys were completed and failed to detect any odour. However, Remediation NZ acknowledged that odour had been present at the site boundary earlier in the morning and were undertaking steps to mitigate further discharges of odour that included using odour demisters and covering the compost. No further action
13/11/2022	A complaint was received concerning an odour discharging from the composting site at Mokau Road, Uruti. Callers said they have just returned home from a fishing comp to horrid chemical smells wafting throughout the valley. Noticed that when trucks go up there the smell is most present. Remediation have a Odour Scout and is wondering if Pollution DO can advise the scout.1460 Mokau Road, 9pm till now, Chemicals	Incident not attended/assessed

Date	Complaint	Inspections and investigations
15/11/2022	A complaint was received concerning an odour discharging from the composting site at Mokau Road, Uruti. Caller has advised this stench is so strong her husband has had an asthma attack due to the strong stench. The caller has advised that an odour scout is needed to get a correct smell verified. The duty officer has advised they will be discussing this in the meeting today. From 160 - 1358 Mokau Road, this morning, Strong stench	Incident not attended/assessed
17/11/2022	A complaint was received concerning an odour discharging from the composting site at Mokau Road, Uruti. Caller has called to report that the Remediation Farm aka the worm farm on Mokau Road is smelling horrible. She just got home and can smell it in her house. She stated the smell is making her dry retch. Mokau Road, Uruti, 17:30 , Faecal smell	Inspection undertaken as part of proactive monitoring of potential odour emissions from the Remediation (NZ) Limited, Mokau Road - Uruti composting facility. See Section 2.5.2
07/12/2022	A complaint was received concerning an odour discharging from the composting site at Mokau Road, Uruti. Strong smell of sickly toxic chemicals, it appears someone is sprinkling a product on the ground up there. She is currently seeing a doctor and thinks her condition is caused by the chemical smell coming from remediation. At home, The last hour, Strong chemical smell	Incident not attended/assessed
08/12/2022	A complaint was received concerning an odour discharging from the composting site at Mokau Road, Uruti. Caller has phoned back in to advise she has woken up this morning nd the smell is very strong so she has got in her car and driven down to 1460 and stood at the remedial site and the smell is offensive and horrible. Caller has advised she and her kids are experiencing health isues as a result. Harab trucks that are going up there are taking liquid and chemicals and dumping them in ponds on site and filling the ponds with sawdust to bypass RDC. These trucks are Coming from the Mangahewag Site	Incident not attended/assessed
08/12/2022		Inspection undertaken as a proactive odour survey. See Section 2.5.2
13/12/2022	A complaint was received concerning odour discharging from the composting site at Mokau Road, Uruti. The caller said there was a horrific, offensive and objectionable smell from the site	Investigation undertaken after a complaint was received concerning odour from the Remediation New Zealand composting facility on Mokau road, Uruti. Investigation found that there was no odour

Date	Complaint	Inspections and investigations
20/12/2022	A call was received regarding odour at 1415 Mokau Road, Uruti, which the complainant believes to be coming from the Remediation composting site. The complainant mentioned that is had been smelling like sewage since last night, and today it was very strong 8/10. It was a still and cloudy day	Inspection undertaken due to an odour complaint from Remediation (NZ) Limited, Mokau Road - Uruti composting facility. 3 x odour surveys were conducted between 1135hrs and 1221hrs. At the time of conducting the associated surveys the air was still to a south west wind direction. Air temperature was between 16 - 17 degrees Celsius. There was full cloud cover. Odour surveys were undertaken around the gravel pit Mokau Road. The investigation today found that there was weak odour detected towards the end of the first survey. Then went down to the Haehanga stream bridge and did a survey very weak for the first minute. No odour was detected at the final survey 1589 Mokau Road. No site inspection was undertaken at RNZ as there was no breach of consent
20/12/2022	A complaint was received concerning odour discharging from a composting site at Mokau Road Uruti	Incident not attended/assessed
21/12/2022		A proactive inspection was carried out at Mimi Valley to detect off site odours regarding RNZ-Uruti composting facility See Section 2.5.2
22/12/2022	A call was received regarding odour at 1415 Mokau Road, Uruti, which the complainant believes to be coming from the Remediation composting site. Complainant mentioned Bad smell coming from hydro carbon smell	Incident not attended/assessed
25/12/2022	A call was received regarding odour at 1415 Mokau Road, Uruti, which the complainant believes to be coming from the Remediation composting site. Customer has advised that there is a very heavy chemical smell coming over their property from Remediation NZ as they have put deodoriser through the air which has some sort of chlorine acid in it and is bleaching her grass and car roof	Incident not attended/assessed

Date	Complaint	Inspections and investigations
26/12/2022	A call was received regarding odour at 1415 Mokau Road, Uruti, which the complainant believes to be coming from the Remediation composting site. Complainant mentioned there is an accident and there is an Envirowaste truck stuck on the road because of it. Complainant's husband asked them what was on their truck as it smelled so bad. They were told it was offal for Remediation Worm Farm. Complainant says they are not allowed offal and would like something done about this	Incident not attended/assessed
03/01/2023		A proactive odour assessment was undertaken to assess compliance with resource consent conditions in relation to the discharge of odour beyond the boundary of the property at the RNZ composting facility at Uruti. See Section 2.5.2
09/01/2023	A complaint was received concerning odour discharging from the composting site art Mokau Road, Uruti. Caller advised that there is many truck moving in and out of the Remediation and the smell of hydro carbon is so strong. She said she has itchy nose and Remediation need to stop operations. She said several houses have the same issue with the odour. She stated the moving trucks are making the smell worse. Odour Location: 1460 Mokau Road. Odour Duration: Since 20:30. Odour Description: Hydro carbon	Incident not attended/assessed
10/01/2023	A complaint was received concerning odour discharging from the composting site art Mokau Road, Uruti. Caller advised that there is a Hydro Carbons smell coming from down the road from 1460. Has been going for the last half an hour. Odour Location: 1460 Mokau Road Odour Duration: 2030 until now at 2100 Odour Description: Hydrocarbons smell	Inspection undertaken as part of proactive monitoring of potential odour emissions from the Remediation (NZ) Limited, Mokau Road - Uruti composting facility.. Air temperature was between 18 - 21 degrees Celsius. There was full cloud cover and air was still to a south easterly wind direction, Three surveys were completed at 1589 Mokau Road, at the boundary of RNZ at 1460 Mokau Road and Jones Quarry. No objectionable odour was detected on the three surveys completed between 20:04 to 20:54 After receiving a complaint, a further two more odour surveys were completed. One at the gravel pit on Mokau Road and a second odour survey at the boundary of RNZ at 1460 Mokau Road between 20:59 and 21:28. A weak odour was detected initially at 1460 Mokau Road within the first three minutes, however this was not considered to be offensive or objectionable. No site inspection was undertaken at RNZ as there was no breach of consent

Date	Complaint	Inspections and investigations
16/01/2023	A complaint was received concerning odour discharging from the composting site art Mokau Road, Uruti. Caller advised that she has smelt this since 9.15pm and has got a lot worse, has shut the windows up. Odour Location: 1540 Mokau Road, Urenui Odour Duration: First smelt at 9.15pm but has got a lot worse since Odour Description: Hydrocarbons - compost -dead animal smell	Incident not attended/assessed
17/01/2023	A complaint was received concerning odour discharging from the composting site art Mokau Road, Uruti. Caller advised that stench over the valley is harming their valley, community and her family since Christmas Day. Caller has also expressed it smells like a 100 dead cows. Odour Location: 1460 Mokau Road Odour Duration: Since 8pm Odour Description: Smells like an Offal pit bbq stench	Incident not attended/assessed
18/01/2023		A proactive odour assessment was undertaken to assess compliance with resource consent conditions in relation to the discharge of odour beyond the boundary of the property at the RNZ composting facility at Uruti. See Section 2.5.2

Date	Complaint	Inspections and investigations
18/01/2023	A complaint was received concerning odour discharging from the composting site art Mokau Road, Uruti. Caller advised that there has been a strong stench coming from the remediation plant for the last four days and it's been going through the day and night. There has been a huge increase in truck movements over the past few days and they appear to be dumping a lot of stuff which is causing the smell. They've had to close all the windows in their house and her nose is burnt and her uncle has been coughing because of it. Her mother's property down the road is also affected by the stench. She also wanted to note there is Ragwort weeds growing along the border of her mother's property and the remediation plant and she wants the council to come out and remove them as they are starting to seed and are going to pollinate onto her mother's property soon. She also advised there is still no boundary fence between her property and the plant and some of her livestock are starting to make their way onto the remediation plant's property. She believes they need to put up a new fence as soon as possible as she said they were the ones who damaged the original fence. Odour Location: At 1540 Mokau Road Odour Duration: Since the morning until night Odour Description: Strong mulchy stench	Incident not attended/assessed
19/01/2023	A complaint was received concerning odour discharging from the composting site art Mokau Road, Uruti. Caller advised that it is wafting tonight with the wind in the area from Remediation on Mokau Road. Odour Location: 1540 Mokau Road Odour Duration: 8.30pm wafting in and out Odour Description: Hydro carbon - nor easterly breeze tonight waftling	Incident not attended/assessed
20/01/2023		Proactive odour survey was completed, at various locations along Mokau road, North and west of the site entrance. See Section 2.5.2
23/01/2023	A complaint was received concerning odour discharging from the composting site art Mokau Road, Uruti. Caller advised that there has been a strong stench coming from the remediation plant and it's been going through the day and night. Odour Location: 1460 Mokau Road Odour Duration: All night Odour Description: Offal dead smell	Incident not attended/assessed

Date	Complaint	Inspections and investigations
23/01/2023	A complaint was received concerning odour discharging from the composting site art Mokau Road, Uruti. Caller advised that the smell has been really bad this evening Odour Location: 1460 Mokau road Odour Duration: Around 8.30/9pm Odour Description: Offal pit/Chemical smell	Incident not attended/assessed
24/01/2023	A complaint was received concerning odour discharging from the composting site art Mokau Road, Uruti. Caller advised there has been a very strong pungent smell on the scale of 1 to 6 it's a 6. She said the deodorizers that are being used are causing her to have a burnt nose and throat and not good for the upper airways as it's hydrochloric acid going into the atmosphere. She said it's causing her calves and dogs to be sick and that there is a dead hawk. Odour Location: 1540 Mokau Road Odour Duration: Since 20:30 tonight Odour Description: Pungent carbon smell	Investigation of request undertaken, no odour detected. No further Council involvement at this stage
29/01/2023	A complaint was received concerning odour discharging from the composting site art Mokau Road, Uruti. Caller advised 10/10 Smell. Coming from Remediation Thinks the dehumidifiers are running. Complaining of eyes stinging, not wanting to eat. Says her farm stay guests are complaining too. Odour Location: 1540 Maukau Rd Odour Duration: From 1950 till now Odour Description: Hydrocarbon	Incident not attended/assessed
01/02/2023		Proactive odour survey was completed See Section 2.5.2
02/02/2023	A complaint was received concerning odour discharging from the composting site at Mokau Road, Uruti. Caller advised all night there has been a strong smell that has made it hard to breathe and sleep through the night. xxxxx has gone for a drive and noticed a very strong pig effluent smell coming from this address, which can be associated with hydrogen sulphite	Incident not attended/assessed
05/02/2023	A complaint was received concerning odour discharging form the composting site at Mokau Road, Uruti. Caller's staying at 1540 and is experiencing a '10/10', must, sweet smell. Caller asked if we can get someone out at 0500, tomorrow. I said I cannot put in requests, in advance, but i'll note it down	Incident not attended/assessed

Date	Complaint	Inspections and investigations
07/02/2023	A complaint was received concerning odour discharging from the composting site at Mokau Road, Uruti. Caller advised that the smell is back and has gotten worse. She has described it as a 10/10	Incident not attended/assessed
08/02/2023	A complaint was received, concerning an 'offensive odour' from the composting facility at Mokau Road Uruti	Odour survey was undertaken at various locations, along Mokau road Uruti. A very weak, intermittent odour was detected at one location, However, overall the odour was not considered to be objectionable or offensive at any location for any duration of frequency. The composting facility was compliant with resource consent conditions, at the time the odour survey was undertaken
09/02/2022	A complaint was received concerning odour discharging from the composting site at Mokau Road, Uruti. Caller advised that there was an 'odour scout' there just before 8am when there was no odour, however as soon as the 'odour scout' left there was odour. I asked if it was a Council Officer and she said she didn't know, our records show no Council officer was doing odour surveys at the time. She said the odour smelt like sewage and came and went on the wind. Gave them headaches. Also sid her sons were on the bus that drove past the remediation gate about 8.05am and it stunk and gave them headaches	Incident not attended/assessed
10/02/2023	Several complaints were received concerning odour discharging from a composting facility on Mokau Road, Uruti. Caller has reported that there has been a really foul smell all night and into the morning. She would rate it at a 10/10 and is concerned about feeding her animals - she needs to wait until the sun comes up for the odour to dissipate. The caller has asthma, and Remediation is making it worse	Incident not attended/assessed
11/02/2023	Request Details: A complaint was received concerning odour discharging from a composting site at Mokau Road, Uruti. XXXXX advised of a hydro carbon stench coming from Remediation, he said his uncle had a heart attack and one of the causes was the smell. He said he is concerned for his kids and will take it to Fair Go	Incident not attended/assessed

Date	Complaint	Inspections and investigations
23/02/2023	A complaint was received regarding the use of deodorisers and the associated chemicals discharged to air as an odour mitigation measure at Remediation (NZ) Limited's composting facility at Mokau Road, Uruti	TRC was aware that RNZ had been using deodorisers at their Uruti composting facility for some months as an odour mitigation device, however a recent thorough assessment against the Regional Air Quality Plan for Taranaki found that a resource consent is required to authorise the discharge of odour mitigation chemicals via this method. RNZ were advised of the decision and have ceased the operation of the devices which contravened the RAQP
16/02/2023	Complaints were received concerning odour discharging from the composting siter at Mokau Road, Uruti	Odour surveys were undertaken in the vicinity of the site and no odour was found to be discharging beyond the boundary of the site
20/02/2023	A complaint was received concerning odour discharging from a composting site at Mokau Road, Uruti. Complainant has advised the air is not fresh outside, it is like there is no oxygen in the air. There is mist all around the house and a heavy type of air. Her uncle has fluid around his lungs and had a heart attack and the doctor has confirmed the heart attack is due to the lack of oxygen and what he is breathing in. Odour Location: 1540 Odour Duration: Since they woke up it has been like this. Odour Description: No oxygen and heavy air	Incident not attended/assessed
21/02/2023	A complaint was received concerning odour discharging from a composting site at Mokau Road, Uruti. Complainant advised that she feels like there's no oxygen in the air. There's no strong odour, but it's definitely there as her and her family aren't feeling well. With the way the mist is, she's wondering if deodorisers have been used, which they've asked remediation NZ not to use	Incident not attended/assessed
21/02/2023		Inspection undertaken for proactive compliance monitoring. See Section 2.5.2
23/02/2023	A complaint was received concerning odour discharging from a composting site at Mokau Road, Uruti. Complainant advised the smell has been so bad they had to call the ambulance last night for her husband as he thought he was having a heart attack due to the spray they are letting off at the back of the property. Odour Location: Remediation 1460 Mokau Road Odour Duration: from 9pm and all night Odour Description: Offal, dead animal	Incident not attended/assessed

Date	Complaint	Inspections and investigations
25/02/2023	A complaint was received concerning odour discharging from a composting site at Mokau Road, Uruti. Complainant advised that this time it is not a smell that is coming from Remediation NZ it is more of an effect as though you are losing oxygen when you step outside. Odour Location: Remediation NZ Odour Duration: Started overnight until present Odour Description: Not a smell more of an effect	Incident not attended/assessed
27/02/2023	A complaint was received concerning odour discharging from a composting site at Mokau Road, Uruti. Complainant advised of a deodorizer that is being used in the valley, making it extra misty. It was fine for the previous days but today, due to stillness, the place is reeking of the deodorizer of some sort. The smell itself isn't as bad but the air feels like it has had the oxygen sucked out of it. Note: husband has had to pull over on the way to work, use his inhaler, and he threw up with phlegm and he felt like his lungs were drowning. Odour Location: Remediation NZ Odour Duration: 0600-present Odour Description: Deodorizer, blanketing the valley, stinking out the valley	Incident not attended/assessed
01/03/2023	complaint was received concerning odour discharging from a composting site at Mokau Road, Uruti. Complainant mentioned there was a manure type smell at her house mainly in the mornings for the past few days	Incident not attended/assessed
02/03/2023	A complaint was received concerning odour discharging from a composting site at Mokau Road, Uruti. Complainant Caller has phoned in to report that since she walked out of her house this morning she was confronted with a foul offal stench and has found it more difficult to breathe when traveling to her mother's house at 1358 Mokau Road. Apparently it is "like the oxygen has been taken out of the air". She believes they may be using the deodorisers which is prohibited due to her family's health. There is a lot of mist in the air and she would like TRC to check on whether the deodorisers have been used and their contents	Incident not attended/assessed
02/03/2023		Inspection undertaken for proactive compliance monitoring. See Section 2.5.2

Date	Complaint	Inspections and investigations
03/03/2023	A complaint was received concerning odour discharging from a composting site at Mokau Road, Uruti. Complainant advised that this morning there is an objectionable odour coming from Remediation Ltd. which is a 6/6 at both her address and her mother's. It is a still calm morning but mist can be seen coming down their valley so they seem to be using deodorisers again. Odour Location: 1358 and 1540 Mokau Road Odour Duration: All night Odour Description: Objectionable offal stench	Incident not attended/assessed
08/03/2023	A complaint was received concerning odour from the composting site at Mokau Road, Uruti. Caller stated that the air had been good the past few days but was not good today. An odour which smelt like an offal pit had been there all night and was now present at 1540 Mokau Road. She also stated that the odour was now present at 1415 and 1358 Mokau Road. She had spoken with another resident, who could not call himself because 'his voice is bad'. There was a thick mist overnight but it had lifted now. She said they had seen trucks going to and from the site all night and that when the demisters were on it gave them itchy skin. She has photos of them going. She said the demisters should be turned off.	Odour surveys were undertaken in the vicinity of the site. No odours were found to be occurring beyond the boundary of the site.
08/03/2023		Proactive odour surveys carried out to detect off site odours regarding RNZ-Uruti composting facility. See Section 2.5.2
15/03/2023	A complaint was received concerning odour discharging from the composting site at Mokau Road, Uruti. At the moment not noticeable but the smell is offensive at 1460 Mokau Road & 1358 Mokau Road, from last night as trucks went up there and put down chicken mortalities. Customer also advised not to use the deodorize as sodium chlorite exists and this causes skin irritant. It can cause heart attack, asthma, bronchioles and heaps of health issues.	Incident not attended/assessed

Date	Complaint	Inspections and investigations
16/03/2023	A complaint was received concerning odour from the composting site at Mokau Road, Uruti. The complainant advised the foul stench coming from Remediation Ltd and going over the boundary. It is smelt strongly at 1540 Mokau Road and is also blowing across to number 1348. She rated this a 6/6 and said it is horrific. This complaint was received during a poractive monitoring survey.	While conducting a pro-active compliance inspection at Remediation, Uruti, received a call from the after-hours call centre in relation to a complaint which has just come in from a member of the public. "Caller has phoned this morning to log a complaint regarding the foul stench coming from Remediation Ltd and going over the boundary. It is smelt strongly at 1540 Mokau Road and is also blowing across to number 1348. She rated this a 6/6 and said it is horrific. Odour Location: See details - 1540 and 1538 Mokau Road Odour Duration: All night Odour Description: Offal; horrendous stench. In total there were seven odour surveys conducted between 0602hrs and 0730hrs, the first of which was conducted 30 mins prior to the odour complaint being received. The odour surveys are as follows: 0602 hrs West of Haehanga Bridge 0619 hrs Remediation Site Entrance 0620 hrs 1589 Mokau Rd 0640 hrs Remediation Site Entrance 0644 hrs 1358 Mokau Rd 0725 hrs Remediation Site Entrance 0730 hrs West of Haehanga Bridge Wind direction during all surveys N/W and was either calm or very light, cloud cover was foggy/misty, temperature between 9 and 10 degrees. 3 of the 7 surveys noted no odour at all, the other four surveys while noticing some odour it was never for any length of time and was not found to be offensive or objectionable.
18/03/2023	A complaint was received concerning odour from the composting site at Mokau Road, Uruti. Caller advised she was driving home and at her mother's house and her own she states it reeks of Hydrogen sulphide. She said her lawyers advised there was not to be any deodoriser used. She said she will call the fire brigade as it is a toxic gas. Odour Location: at home and at 1358 Mokau Road Odour Duration: For past 10 minutes Odour Description: Smells like Hydrogen sulphide	Incident not attended/assessed
20/03/2023	A complaint was received concerning odour from the composting site at Mokau Road, Uruti. Complainant called to report a smell coming from the location and also felt in her house. Her husband hasn't been able to breath because of this and has vomited Odour Location: At home and at 1358 Mokau Road Odour Duration: All Night Odour Description: Smells like Offal Pit	Incident not attended/assessed

Date	Complaint	Inspections and investigations
22/03/2023		Proactive compliance monitoring undertaken to assess compliance with Resource Consent 5839-2 - to discharge emissions into the air, namely odour and dust, from composting operations. See Section 2.5.2
23/03/2023	A complaint was received concerning odour discharging from a composting site at Mokau Road, Uruti. XXXXX reports putrid offal smell from Remediation works. She also she had spoken with her neighbour XXXXX at 1415 Mokau Road who 'has no voice and cant speak' but told her that it was a 9/10 smell at his property.	Incident not attended/assessed
24/03/2023	A complaint was received concerning odour from the composting site at Mokau Road, Uruti. Caller said odour was noticeable at 0620 but increased in strength through to 10/10 by 0800, between 1540 and 1358 Mokau Road. Caller believes the deodoriser was on as she could smell the chemical in the air and noted the change in the mist. Caller also sent two photos	Incident not attended/assessed
27/03/2023	A complaint was received concerning odour from the composting site at Uruti. Caller advised she was calling on behalf of XXXXX who could not talk and is very sick. Advised that the odour had been intermittent and offensive overnight. Further matters were discussed in relation to the site.	Incident not attended/assessed
28/03/2023		A proactive odour survey was carried out on the morning of 28 March 2023. See Section 2.5.2
30/03/2023	A complaint was received concerning odour from the composting site at Mokau Road, Uruti. Caller said she feels the reason the smell is only slight at her place and worse at 1415 and 1358 is due to her being north of Remediation and the other areas are south where the cold air drainage is blowing and increasing this smell. Odour Location: 1540 - slight smell and 1415 and 1358 is really bad Odour Duration: Since they woke up Odour Description: Rotten offal smell	Incident not attended/assessed

Date	Complaint	Inspections and investigations
31/03/2023	A complaint was received concerning odour discharging beyond the boundary of the composting site at Mokau Road, Uruti. Caller advised that the odour was from 0630 to 0845 and was objectionable at the site boundary, odour was a chemical type odour	Incident not attended/assessed
05/04/2023	A complaint was received concerning odour discharging form a composting site at Mokau Road.	Proactive Odour assessments and odour surveys, had been completed at various location along Mokau Road, Uruti, in the morning, between the hours 0550 to 0717. While an composting type odour was detected, the overall outcome of the monitoring, considered it would not be objectionable at any location for any duration or frequency. At the time when the complaint of the alleging an offensive odour, west of the composting facility, was received, the Council officer was still in the area. They completed odour assessments at the locations given by the complainant. No composting type odour was detected. They spoke with a potentially affected party, downwind of the composting facility, regarding the alleged offensive odour. They have not detected any odour, from the composting facility that morning or days prior. No further action was taken.
13/04/2023	Complaints were received concerning odour discharging form a composting site at Mokau Road, Uruti. Callers advised that past two weeks had been really good and woke up to odour.	Incident not attended/assessed
14/04/2023		Inspection of RNZ composting location undertaken to assess compliance with resource consent conditions. See Section 2.5.2
19/04/2023		Proactive survey carried out See Section 2.5.2
27/04/2022		Proactive monitoring was undertaken to check compliance with resource consent conditions. See Section 2.5.2

Date	Complaint	Inspections and investigations
29/04/2023	A complaint was received concerning odour discharging beyond the boundary of the composting site at Mokau Road, Uruti. Caller advised that the odour was noted from 6:00pm and was described as a sulphur type odour. Trucks were observed operating in the area at the time the odour was detected.	Incident not attended/assessed
02/05/2023		Proactive survey carried out See Section 2.5.2
03/05/2023	A complaint was received concerning a burning rubber type odour outside the Remediation (NZ) Limited's composting facility on Mokau Road, Uruti. The odour was noted extending from the RNZ site to approximately 1358 Mokau Road.	An inspection was carried out following a complaint alleging that smoke smelling of rubber was detected along SH3. Council officer noticed and approached an RNZ manager at a roadside layby, and advised him of the complaint. The RNZ manager informed TRC that a fire had been lit to burn waste timber and wood onsite. An inspection on the Remediation site found that wood that was too large to add to the compost piles was being burned. According to staff onsite this process occurs every six weeks approximately. This waste product must be burned in an industrial incinerator for it to be a permitted activity. The activity occurring today was not permitted as a purpose built incinerator was not in use (Rule 30 of the Regional Air Quality Plan for Taranaki). The activity of discharging contaminants to air from the disposal by combustion of waste materials requires resource consent. RNZ were instructed to cease this activity unless resource consent has been granted for this activity
04/05/2023	A complaint was received regarding a sulphur type odour along Mokau Road from 1358 to the Metal park over area adjacent to the Haehanga Stream.	Not attended/assessed
05/05/2023	A complaint was received regarding emanating from the RNZ facility and noted at the site gate and at 1358 Mokau Road	Not attended/assessed
08/05/2023		Monitoring was undertaken to check compliance with resource consent conditions. See Section 2.5.2
13/05/2023	A complaint was received regarding an offal and sulphur type odour along Mokau Road about 1358 Mokau Road. Has been noticed for the last week	Not attended/assessed

Date	Complaint	Inspections and investigations
23/05/2023	A complaint was received regarding foul rubbish/sulphur type odour effecting 1415, 1420 & 1358 Mokau Road	Not attended/assessed
25/05/2023		Proactive odour assessment was carried out to determine whether odours from Remediation NZ's Uruti Valley site were discharging beyond the boundary of the property, and to assess whether these odours were considered objectionable/offensive in nature. See Section 2.5.2
31/05/2023	A complaint was received regarding a smoke and general stench odour being discharged from the Remediation (NZ) Limited composting facility, Mokau Road, Uruti	Not attended/assessed
02/06/2023		Proactive survey carried out to assess compliance with Resource Consent 5839-2 - to discharge emissions into the air, namely odour and dust, from composting operations. See Section 2.5.2
08/06/2023		Monitoring was undertaken to check compliance with resource consent conditions. See Section 2.5.2
10/06/2023	A complaint was received regarding a strong sewage odour from the Remediation (NZ) Limited's composting facility, Mokau Road, Uruti	Not attended/assessed
12/06/2023	A complaint was received regarding odour discharging from the RNZ facility to the complainant's house. Concern that the deodorisers are being operated and the residents (including the dogs) at the address are itchy	Not attended/assessed
13/06/2023		Compliance Monitoring Inspection undertaken to assess compliance with resource consent conditions to discharge emissions into the air, namely odour and dust from composting operations. See Section 2.5.2