UNDER the Resource Mangement Act 1991 ("RMA")

IN THE MATTER of a resource consent application to the Taranaki Regional Council for the application by Remediation (NZ) Limited

STATEMENT OF EVIDENCE OF HAYDEN RUSSELL EASTON ON BEHALF OF REMEDIATION NEW ZEALAND LIMITED

1. Introduction

1.1 My full name is Hayden Russell Easton. I am the Technical Director Surface Water at Pattle Delamore Partners Ltd (**PDP**). I have been employed at PDP since July 2011. I am a member of Water New Zealand, a member of the New Zealand Hydrological Society and a member of the New Zealand Coastal Society.

Experience

1.2 I have a Bachelors Degree in Earth Science from the University of Waikato, and a Masters Degree with Honours in Earth Science also from the University of Waikato. I am also a qualified trainer of Green Infrastructure operation and maintenance, a qualification I gained through the Water Environment Federation. The qualification is now gained from EnviroCert International Incorporated.

1.3 I have over 18 years of experience in the fields of stormwater management, hydrology, environmental monitoring, and technical research. My experience includes the presentation of evidence at Council level Resource Consent Hearings and Board of Inquiries.

1.4 My experience relating to stormwater management and the analysis of obtained water quality data comprises of the following:

(a) During the years 2007 to 2011, I was employed by the Auckland Regional Council in various stormwater technical roles including: Integrated Catchment Planning specialist, Stormwater Technical Project Leader, and Stormwater Technical Team Leader. In these various roles, I was responsible for providing technical guidance

for local district councils to develop and implement catchment management plans to address stormwater issues. I was also involved in the undertaking a range of technical research to inform persons how to correctly design, operate and maintain stormwater treatment devices. This work also entailed understanding of any residual environmental effects caused from stormwater discharges. A lot of this work undertaken, is presented to the general public as Auckland Regional Council Technical Publications, which are still used/referenced today, not just in the Auckland region, but nationally across New Zealand.

(b) Whilst employed at PDP I have continued to undertake stormwater management projects for a range of clients. Notably, I continue to still provide stormwater technical support to a range of regional councils. In this role, I provide stormwater quality expertise to improve public stormwater discharges within the environment, and undertake technical peer review of large scale infrastructure projects on behalf of the Auckland Council (as an example the Northern Corridor motorway upgrades).

(c) I also provide stormwater technical research on behalf of Z Energy New Zealand and BP Oil New Zealand. In this role, I have assessed the potential stormwater effects associated with new products that these oil companies were set to release to the market. One such product was ZDEC/AdBlue, a product used to reduce ozone depleting emissions from diesel vehicles. This new product has high potential for releasing elevated total ammoniacal nitrogen concentrations to the environment. I note that this contaminant of concern is also relevant to this evidence. Over the course of around six to seven years, I have investigated over 80 individual truck stop sites across New Zealand assessing the potential for total ammoniacal nitrogen effects within various receiving environments (groundwater and surface water bodies) on behalf of Z Energy and BP Oil New Zealand.

1.5 I therefore consider myself a competent person to review information regarding the stormwater management at the Remediation NZ Uruti site, and also understand the potential water quality effects that may be caused

by any residual stormwater discharge from stormwater treatment devices located at the site.

2. Involvement in the Proposal

2.1 I have had no involvement in the preparation of the Remediation (NZ) Limited (**Remediation NZ**) application to renew its consent for the Uruti composting and vermiculture facility (the **Site**) at 1460 Mokau Road. My involvement in this consent application has commenced late January 2021, when I was engaged by the applicant to provide a response to a letter addressed by Ms Kate McArthur (dated 9 December 2020) to Mr Paul Cummings of Te Rūnanga o Ngāti Mutunga.

2.2 On 4 February 2021, I visited the Uruti Composting Facility to inspect the composting operation, observe the onsite stormwater management system including treatment devices and various reaches of the Haehanga Stream.

2.3 I have also reviewed various documentation submitted by the applicant and their agents. This documentation included:

(a) Letter from Ms Kate McArthur (dated 9 December 2020) to Mr Paul Cummings of Te Rūnanga o Ngāti Mutunga.

(b) Surface water quality monitoring data.

(c) Uruti Wetland Management Plan.

(d) Haehanga Catchment Preliminary Groundwater Investigation – report prepared by BTW Company.

3. Scope of this Evidence

3.1 The scope of this evidence is limited to providing a response to the letter addressed by Ms Kate McArthur (dated 9 December 2020) to Mr Paul Cummings of Te Rūnanga o Ngāti Mutunga.

3.2 Within this letter Ms McArthur makes key claims about the Uruti Composting Facility, and/or the nature of the sites discharge, and the potential environmental effects resultant from the facilities discharge. To provide response to these key claims, I prepared a technical report for

Remediation NZ that outlined my observations of the facility, and the points of agreement and disagreement I have with Ms McArthur's letter.

3.3 The technical report I prepared for Remediation NZ is attached to this evidence. For ease of understanding in this evidence, I summarise the key points of this report into the following sections:

(a) Irrigation Ponds

(b) National Policy Statement for Freshwater Management 2020

(c) Proposed improvements to the management of the facilities discharge

3.4 In addition, I have been asked to respond to matters raised in the Officers report prepared by the Taranaki Regional Council (**TRC**).

4. Irrigation Ponds

4.1 In the letter (section titled 'Site Visit), Ms McArthur states '*I observed significant overland flow occurring throughout the RNZ site and stormwater across the entire site appeared to be almost completely uncontrolled in all areas. The composting, paunch waste, truck wash and drilling mud areas were either unlined or inadequately concreted (in the case of the truck wash pad) and were not bunded to capture and divert any contaminants from entering overland flow and ultimately surface waters (Photos 1a and b). The irrigation ponds were unlined and bunded only by permeable material (earth). As a result, the potential for contamination of surface and groundwaters is very high in my opinion*'.

4.2 To ascertain the accuracy of Ms McArthur's claim that the irrigation ponds were unlined and bunded with permeable material (thereby leading to potential contamination of surface waters and groundwater), I viewed the water levels of all ponds and the wetland on site. From my observations I noted that all ponds and wetlands were operating at or within 100-200 mm of invert levels of the devices outlet structures.

4.3 I reviewed rainfall records provided by the **TRC** for the automated rainfall monitoring station Uruti @ Kaka Road[1]. Figure 1 below presents the hourly rainfall totals two weeks prior to and on the day of my site visit.

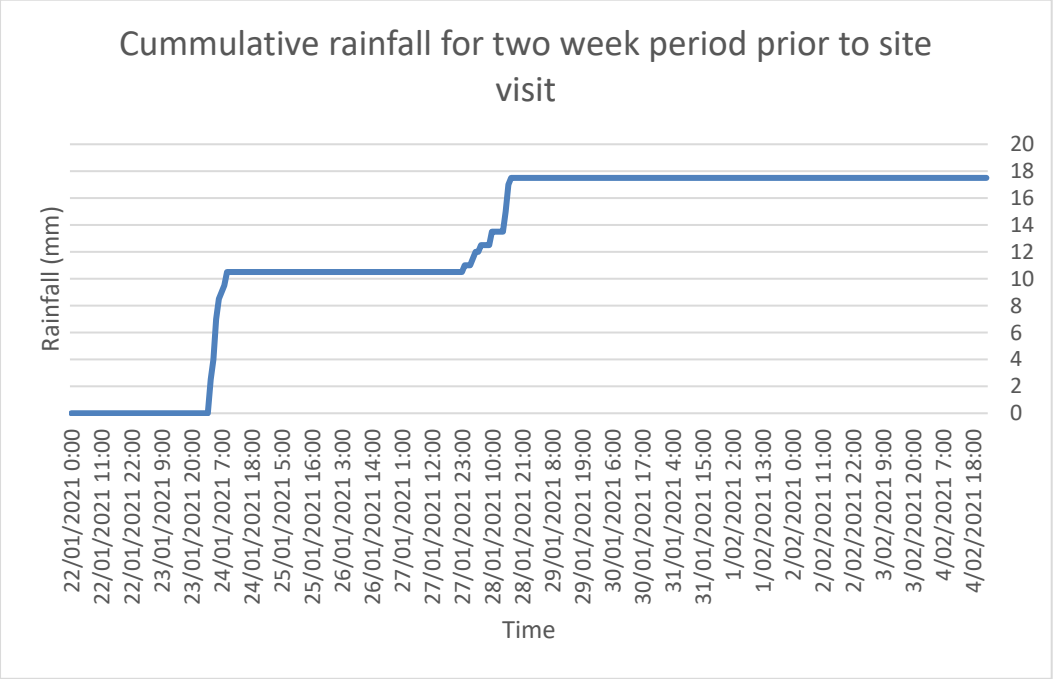

Figure 1: Cumulative rainfall recorded at the Taranaki Regional Council operated rainfall station (Uruti @ Kaka Road) two weeks prior to my site visit conducted on 4 February 2021.

4.4 As Figure 1 suggests, 17.5 mm of rainfall was measured at the Uruti @ Kaka Road rainfall monitoring site in the two weeks prior to my site visit. Specifically, no rainfall had occurred for six days prior to the site visit.

4.5 I have also reviewed the report 'Haehanga Catchment Preliminary Groundwater Investigation', a report prepared by BTW Company. This report suggests that groundwater levels are on average 0.81 m below ground level. The report also suggests that groundwater ingress to the ponds is possible.

[1] Data obtained from https://www.trc.govt.nz/environment/maps-and-data/site-details/?siteID=37&measureID=1&timePeriod=365days

4.6 Given that there is a potential that pond levels maintained by groundwater ingress, I recommend that a permeability test of the pond liners be conducted. This could be provided for as a condition of consent.

4.7 Should it be identified that the permeability of the pond liner is greater than 1 x 10^{-9} m/s, a new liner should be installed.

4.8 Ms McArthur also claims that the site had completely uncontrolled stormwater runoff during her site visit. She supports this claim with several photographs during her visit (photos 1 a and b).

4.9 Whilst I acknowledge that Ms McArthur's photo's do demonstrate the presence of surface water flow in the vicinity, based on my site visit, I would not have considered that this overland flow was directed towards any sensitive receptor, if anything, the sites overland flow was directed towards and into the onsite stormwater treatment devices.

4.10 I also consider that to implement diversion channels from the locations that Ms McArthur identifies, would actually limit Remediation NZ in its ability to undertake activities it at the site, i.e. movement of vehicles, including trucks and front-end loaders.

4.11 Based on the above observations, data obtained, and reports reviewed, I conclude:

(a) That the ponds and wetland located at the Uruti Composting Facility should undergo a permeability assessment. Should it be found that the permeability of a liner be greater than 1 x 10^{-9} m/s, a new liner should be installed.

(b) Stormwater sheet flow from key contaminant risk areas are controlled and directed to dedicated stormwater treatment devices (e.g. ponds or wetland). I therefore conclude that I do not agree with Ms McArthur's statement that the site's stormwater is uncontrolled.

5. National Policy Statement for Freshwater Management

5.1 Ms McArthur states that the water quality discharges, specifically total ammoniacal nitrogen (TAN), do not conform to the National Policy Statement for Freshwater Management 2020 (NPS:FM).

5.2 The extent these standards apply to the site and must be met immediately is a planning and legal matter but my understanding is that they do not apply immediately.

5.3 To qualify the accuracy of Ms McArthur's claim, I reviewed the TAN dataset obtained by the TRC at various monitoring locations throughout the Site.

5.4 I confirm that when conducting this assessment, the TRC field TAN data were recalculated to a common pH of 8.0. By doing so this allows for the direct comparison of data to the NPS:FM 2020 guidelines.

5.5 My technical report provides a tabulation of the TAN results for each monitoring location and how they compare to the NPS:FM 2020 guidelines.

5.6 Based on my review of the TAN dataset, I concur with the claims made by Ms McArthur. Based upon the TAN data reviewed, 8 of the 12 monitoring locations show data that either exceeds the annual median 'bottom line' concentration of 0.24 mg/L and/or the annual maximum acute toxicity concentration of 0.4 mg/L.

5.7 It is important to acknowledge that the NPS:FM 2020 guidelines for TAN have resulted in a significant reduction in concentration compared to previous versions (NPS:FM 2014 and the amendment made in 2017). As the treatment devices were built some time ago, the design and construction of the device was in order to comply with the earlier treatment performance requirements. As such, it is understandable why existing treatment devices do not conform to the NPS:FM 2020 TAN guidelines, and that previous consent compliance monitoring only had minor compliance issues.

6. Proposed improvements to the management of the facilities discharge

6.1 As a result of data for TAN demonstrating that facility discharges are not conforming to NPS:FM 2020 guidelines, the attached technical report provides recommendations to Remediation NZ on actions to optimise existing onsite treatment devices to improve the quality of discharges.

6.2 In providing recommendations to Remediation NZ, it is important to acknowledge that I do consider that the current management practices undertaken within the facility are appropriate for the contaminants of concern, i.e. stormwater ponds, land irrigation, cut and carry of vegetation and wetlands. Actions proposed therefore in my report are more targeted with the optimisation of the existing devices rather than installation of new technologies.

6.3 My report clearly acknowledges that there are maintenance and/or design issues present with the existing devices that need to be actioned. In summary, my report proposes the following actions to improve the discharge quality from the facility:

(a) Dredging of the stormwater treatment ponds.

(b) Installation of portable aeration systems within the stormwater treatment ponds.

(c) Removal of the unused above ground diesel storage tank and rehabilitation of soils surrounding the tank.

(d) Installation of an appropriate spill response kit at the used above ground diesel storage tank.

(e) Removal of accumulated hydrocarbon product within the stormwater treatment ponds.

(f) Removal of accumulated sediment within the paunch pond.

(g) Removal of oesophageal tube clips within the paunch pond, and implementation of a routine inspection programme to ensure that any further oesophageal tube clips are removed.

(h) Dredging of the wetland forebay.

(i) Raising of the bund to the north of the wetland, and then modifying the height of the wetland outlet structure to elevate the water level within the wetland.

6.4 In summary, the approach to improve the discharge water quality from the facility, is to undertake an adaptive management approach. Meaning, firstly Remediation NZ acknowledge that the existing discharge quality is

not in accordance with the NPS:FM 2020 and therefore will undertake the initial corrective actions proposed.

6.5 In addition to these initial actions, I have also recommended that a monitoring programme be developed and implemented. The actual water quality benefits achieved by the suggested actions is difficult to determine due to a number of variable parameters that occur onsite. The purpose of implementing a monitoring plan is therefore to understand the benefits achieved by these actions and if required, implement further actions should water quality still not meet NPS:FM guidelines.

6.6 I note however, that some design additions proposed will not see an immediate improvement in water quality. Some actions such as raising the water level in the wetland, will require a period of stabilisation to allow for the plants to respond to the greater water depths and biological process to become developed. As such, a sufficient dataset should be obtained before any additional actions are investigated.

6.7 Should it be found however, that the discharge is still not meeting the discharge requirements of the NPS:FM 2020, additional actions such as the implementation of floating wetlands within the treatment ponds and increasing the footprint of the wetland could be investigated.

7. Response to the Taranaki Regional Council Officers Report

7.1 Paragraphs 183 to 186 present a graph and discuss the TAN monitoring record that was obtained during the 2019 to 2020 monitoring year. Samples obtained during this period were on the following dates:

(a) 30 August 2019

(b) 6 November 2019

(c) 6 March 2020

(d) 8 May 2020

(e) 30 June 2020

7.2 Paragraph 185 states ‘The national bottom-line value for ammonia is 0.24 g/m^3 (annual median) and 0.40 g/m^3 (annual maximum), with the aim of

protecting 95% of species from toxic effects. These guideline triggers were derived from NPS: FM 2020, as stated in paragraph 185.

7.3 The reporting officer's comparison of obtained monitoring results with the NPS:FM 2020 is incorrect, as this document was only effective from 3 September 2020, i.e. the document was not operable at the time of sample collection. Instead, the reporting officer should have assessed against the NPS:FM 2017 guideline values.

7.4 As a consequence of the reporting officer incorrectly applying the 2020 version of the NPS:FM, the statement in paragraph 185 is misleading, as it is states that the obtained measurements are being compared to both the 'national bottom line standard' and the '95% protection guideline'.

7.5 Table 1 below presents a comparison between the 2017 and 2020 versions of the NPS:FM for ammonia at the 95% environmental protection and the 'national bottom line' criteria.

		NPS:FM 2017	NPS:FM 2020
95% environmental Protection	Annual Median	>0.03 and ≤ 0.24	>0.03 and ≤ 0.24
	Annual Maximum	>0.05 and ≤ 0.40	>0.05 and ≤ 0.40
National Bottom Line	Annual Median	1.3	0.24
	Annual Maximum	2.2	0.40

Table 1: Comparison between the 2017 and 2020 versions of the NPS:FM for ammonia at the 95% environmental protection and the 'national bottom line' criteria.

7.6 As the table suggests, if the reporting officer was intending to assess against the 'national bottom line' criteria, there is a significant difference in concentrations between the 2017 and 2020 versions of the NPS:FM.

7.7 To confirm, if the reporting officer were to correctly compare to the 2017 NPS:FM, and against the 'national bottom line" criteria, the conclusion

stated in paragraph 186 for the compliance location HHG190 (the most downstream monitoring site within the property boundary) would have been:

(a) Full compliance with the annual median criteria.

(b) Full compliance with the annual maximum criteria.

7.8 For confirmation, the only reasons why my technical report assesses the historic record of monitoring results and compares to the NPS:FM 2020 is because I was looking at whether the treatment devices would conform to the new NPS:FM 2020 guidelines in the future. As a result of this assessment, I concluded that the devices would not, and as such, recommendations to improve the device performance are suggested.

8. Proposed Consent Conditions

8.1 I have reviewed the conditions that have been proposed and have the following comments.

8.2 In condition 7a, the officer has stated that stormwater runoff be prevented entering Pad 1, Pad 2, Pad 3, the Paunch Maturation Pond, and any other area used for vermiculture activities at all times. Whilst I agree with the motive of the condition, I consider that this condition be only applied up to a given design rainfall condition i.e. the 10 year annual recurrence interval rainfall event.

8.3 Condition 12 requires ‘Under no circumstances shall there be any discharge of waste material to the ‘collection pond’. I consider that the condition be reworded to ‘Under no circumstances shall there be any direct discharge of waste material to the ‘collection pond’‘. This provides some flexibility to allow for any windblown or vehicular tracked material to enter into the collection pond.

8.4 Condition 18 c implies that even ‘presence’ of total hydrocarbons leads to an environmental effect within the Haehanga Stream. This condition should be altered to a measured total petroleum discharge concentration of 15 g/m^3. This discharge concentration would then be consistent with the standard prescribed within the Ministry of Environment standard provided in the report titled ‘Environmental Guidelines for Water Discharges from Petroleum Industry Sites in New Zealand’.

8.5 Condition 35 states that the 'Taranaki Regional Council assumes responsibility for the preparation and implementation of the Monitoring Plan for annual compliance purposes'. I recommend that whilst the TRC may take the lead in this document, RNZ representatives should also be involved in preparation of this document.

9. Conclusion

9.1 Based upon observations that I made on a visit to the Uruti Composting Facility, reports read, and a review of total ammoniacal nitrogen data obtained by TRC, I conclude the following:

(a) BTW Company (2015) reports potential groundwater ingress into the ponds. I therefore recommend that RNZ undertake permeability assessments of the liners. Should it be identified that a pond liner has a permeability rates greater than 1×10^{-9} m/s, this liner should be replaced.

(b) Stormwater sheetflow generated from within the facility is controlled and is directed to stormwater treatment devices.

(c) Total ammoniacal nitrogen monitoring results obtained at 8 of the 12 monitoring locations are greater than national bottom line guidelines stipulated by the NPS:FM 2020.

9.2 An adaptive management approach has therefore been proposed to Remediation NZ to optimise the existing stormwater treatment ponds and wetland to improve discharge concentrations from the facility. This adaptive management approach includes a range of corrective maintenance actions, inclusion of aeration systems, and modifications to the design of existing treatment devices.

9.3 In addition to the above actions, a monitoring plan is to be prepared and implemented to determine the water quality benefits achieved by the above actions. Should it be found that the discharge quality is still not in accordance with NPS:FM 2020 requirements, additional treatment actions are to be investigated and implemented.

9.4 Through the implementation of the above adaptive management approach, I consider that the discharge from the Site will improve and become consistent with NPS:FM 2020 requirements.

Hayden Russell Easton

9 March 2021

Auckland Hamilton Tauranga Wellington Christchurch Invercargill

PATTLE DELAMORE PARTNERS LTD

Uruti Composting Facility – Water Quality Management

Remediation New Zealand Limited

Uruti Composting Facility – Water Quality Management

Prepared for

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Limitations:

This report has been prepared by Pattle Delamore Partners Limited (PDP) on the basis of information provided by Remediation New Zealand and others (not directly contracted by PDP for the work), including the Taranaki Regional Council. PDP has not independently verified the provided information and has relied upon it being accurate and sufficient for use by PDP in preparing the report. PDP accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the provided information.

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1.0 Introduction

Pattle Delamore Partners Limited (PDP) has been engaged by Remediation New Zealand Limited (Remediation NZ) to provide technical advisory services to evaluate the Uruti Composting Facilities stormwater management and the existing treatment for the facilities discharges.

PDP undertook a visit on 4 February 2021 with Mr David Gibson (Remediation NZ General Manager, Special Projects and Resource Consents).

PDP understand that Remediation NZ has lodged resource consent for the continued operation of the facility. This includes the application for the discharge of water to land (via irrigation) and to water. PDP also understands that submissions to these resource consents have been received. One submitter has raised concerns that the water quality discharged from the facility is not in accordance with new discharge guidelines stipulated within the New Zealand Policy Statement: Freshwater Management 2020 (McArthur, 2020).

The purpose of this report is therefore to investigate the submitters concerns, and if required, provide technical advice and recommendations to Remediation NZ on opportunities that could be considered to improve the water quality of discharge water from the site.

2.0 Facility Overview

In regard to the site layout, the management of stormwater discharges can be categorised into three key aspects:

- Composting/drilling mud area.
- Hydrocarbon area.
- Paunch area.

Discussion for each of these areas is provided in the following sections.

2.1 Composting/drilling Mud Areas

The composting and drilling mud areas are to the north and central to the site. Land contours within the site are all to discrete collection points which allow water to be discharged into a series of four ponds. The composting areas allow discharge to enter into all four ponds (via migration of water through the system). Discharges from the drilling mud also enter into these four ponds. In addition, there is a cut off drain to the north of the drilling mud which diverts any discharge water to drain back to the northern most pond.

Conveyance of water from one pond to the next is via decanting outlet pipes. The arrangement is best described to be similar to oil-water separators that have been widely used in the past for management of hydrocarbons from service

stations (be it that this is considered to be an 'outdated' stormwater management approach, with the inception of new stormwater management technology).

From the northernmost pond, water is irrigated across multiple paddocks owned by Remediation NZ. Further to the north of the above mentioned ponds is a fifth pond (referred to as the Duck Pond). This pond is filled with abstracted water from the adjacent Haehanga Stream that is located to the north of Duck Pond. PDP understands that Remediation NZ use the water from Duck Pond to provide dilution on occasions to the northern-most pond should it be considered by onsite staff that pond water is too elevated in contaminant concentrations.

All ponds at the time of inspection were full of water. Antecedent rainfall conditions prior to the visit have been dry for many days. Based on data from the Uruti@Kaka Road rainfall monitoring station, operated by the Taranaki Regional Council (TRC), the last rainfall that occurred at the facility was on 28 January 2021 (a daily total of 7 mm). Only a total of 17.5 mm had fallen in the two weeks prior to the site visit.

BTW Company (2015) assessed the groundwater levels within the Haehanga catchment. The report in summary suggests that groundwater levels are approximately 0.81 metres below ground level. The report also comments that groundwater ingress into the ponds is a possibility. This groundwater ingress could be a possible explanation as to why pond levels were full when observed on site.

To ascertain the integrity of the liner, it is recommended that a permeability test be conducted. Engineering New Zealand guidelines (IPENZ, 2017) recommend that a clay liner should have a permeability no greater than 1×10^{-9} m/s. Should it be found that a liner has a permeability greater than 1×10^{-9} m/s, RNZ should install a new liner.

All four ponds were observed to have elevated algae populations on the date of inspection. The southernmost pond was also observed to have a large volume of sediment build up. Water in all ponds was very dark to black in colour and in areas was seen to be gassing. These observations are indicators that the ponds are likely to be in an anaerobic state.

The southernmost pond did have hydrocarbon product visible at the time of inspection (discussed further below). Ponds downgradient of this pond i.e. the ponds further to the north had no visual evidence of hydrocarbons being present.

2.2 Hydrocarbon Areas

During the visit, two above ground diesel tanks were observed. One tank was directly adjacent to the southernmost pond (described above). The second diesel tank was located centrally within the facility, to the west of the composting pads.

Based on discussions with Remediation NZ it is understood that the first diesel tank (adjacent to the pond) is no longer in use and will be removed from the facility.

Directly adjacent to the first diesel tank, a ponding area/ditch had been dug. The ditch is connected to the southernmost pond (discussed above) via a pipe. Water was present within pond/ditch, most likely because it was hydraulically connected to the southern pond. Soils surrounding the ditch and leading back to the diesel tank were visually observed to be contaminated with hydrocarbons. PDP understands that Remediation NZ will rehabilitate the above described soils once the diesel tank is removed from facility.

As discussed in section 2.1, hydrocarbons were observed within the southernmost pond at the time of inspection. Hydrocarbons were not seen in any downgradient pond. This is likely due to the configuration of the decanting outlet.

The second diesel tank (located west of the composing pads), is understood to be a double skinned tank, equipped with an emergency shut-off system (David Gibson, *pers comm.*).

From visual observation at the time of the visit, any discharges from around the second diesel tank discharge west. These discharges would enter into a drainage system which then discharges into the four pond system as described above.

It was noted that there was not a spill kit present in close proximity to the second diesel tank at the time of inspection.

2.3 Paunch Area

The paunch area is located to the east of the facility. Any sheetflow that discharges from the paunch pad is directed east to a very large storage pond. From the storage pond, water is pumped further east to a wetland system. The wetland drains east to west. From the wetland, water discharges directly to the Haehanga Stream.

The pond (which runoff from the paunch pad drains to) had visual sediment accumulation at the eastern banks. Oesophageal tube clips were also observed to be present within this pond.

The wetland (which receives water from the above pond) is comprised of raupo and Baumea species[1]. The wetland seemed to be densely planted, and all plant species looked to be healthy. The main wetland body did however have a large volume of sediment accumulation. Based upon visual observation, it is likely that the distribution of water flow through the wetland is potentially restricted. Islands of sediment could be seen within the wetland, so there is a high potential that there is sediment accumulation within the densely planted wetland species.

The water treatment performance provided by a wetland is best achieved if the biological processes associated with the wetland plant species is present. Due to potential bypassing of water flow around a large proportion of wetland plant species (due to the accumulated sediment), it is highly probable that the potential of the wetland treatment performance is not being achieved.

In addition to the above observation, PDP also observed the head of the wetland. Typically, the head of the wetland is commonly reserved for a forebay. Here the water is allowed to pool in an area with increased water depth. This pooling allows sedimentation processes to occur, principally due to the greater water depths, thereby reducing water velocities and consequently enhancing sediment processes to occur. Instead of the above, the head of the wetland at the Remediation NZ facility was designed as a meandering channel. The meandering channel will increase the flow length, however, it will cause increased velocities of water flow, thereby limiting the potential for sedimentation processes from occurring.

3.0 New Zealand Policy Statement: Freshwater Management 2020

As previously discussed, Remediation NZ has received submissions against its lodged resource consent applications for the continued discharge of water to land and water. One submission (McArthur, 2020) stated that water quality of the facilities discharges would not be in accordance with the New Zealand Policy Statement: Freshwater Management 2020 (NPS:FM). McArthur (2020) has identified that historical measured total ammoniacal nitrogen (TAN) concentrations within the Haehanga Stream are greater than the New Zealand 'bottom line' trigger value that is stipulated within the NPS-FM 2020.

For purposes of clarity, the NPS:FM 2020 states that the national bottom line trigger value for TAN in streams and rivers in New Zealand is an annual median of 0.24 g/m^3 (at a pH of 8.0 pH units) or an annual maximum of 0.40 g/m^3 (at a pH of 8.0 pH units).

[1] Whilst not confirmed, given the planting of the species within the emergent zone of the wetland, it is most likely to be a jointed baumea species.

It is important to note that the toxicity triggers for ammonia have been significantly reduced since the site stormwater management systems were constructed. Previous versions of the NPS:FM (2014 and 2017) required an annual median ammonia concentration of 1.3 g/m^3 (at a pH of 8.0 pH units) or an annual maximum ammonia concentration of 2.20 g/m^3 (at a pH of 8.0 pH units)

It is also important to note that the national bottom line may also not be the target water quality that has to be obtained within the Haehanga Stream under the NPS-FM 2020. The true water quality target may be of an even lower concentration and is dependent upon the water quality of the stream prior to the influence of the facilities discharge.

Once the unknown water quality is understood, this is then checked against various 'bands' presented within the NPS-FM (note not all parameters have water quality guidelines within the NPS-FM). Once the extents of the bands for the given parameter are understood (i.e. the upper and lower concentrations), the actual discharge quality from the facility must ensure that the resultant water quality within the stream (after reasonable mixing processes have been taken into account) must not be degraded such that the water quality is moving from one band to the next lower (i.e. more degraded) band.

If the resultant discharge quality is already at more elevated concentrations than the national bottom line, the discharge quality has to be improved such that the discharge is better than the bottom-line trigger.

3.1 Current State of Haehanga Stream

PDP obtained a timeseries of water quality monitoring results from Remediation NZ. This timeseries data has been obtained by TRC. For purposes of simplicity, and because TAN was specifically discussed in the submitter's response, median and maximum TAN concentrations (across the entire period of record[2]) were determined for each individual surface water monitoring location provided.

To allow for a direct comparison of the median data to the NPS:FM, the TRC median TAN data was recalculated to a pH of 8.0. The equation to undertake the recalculated is presented as Equation 1 below.

Due to the nature of the facilities operations, the maximum TAN datapoint is determined using the acute toxicity formulae (Equation 2) to allow conversion to 8.0 pH units and allow comparison to NPS:FM guidelines. Equations 1 and 2 are provided in the ANZECC (2000) and are reproduced again in the Guidelines for Freshwater and Marine Water Quality[3].

[2] Because the total length of record is less than 60 measurements, the entire record was used in the assessment

[3] https://www.waterquality.gov.au/anz-guidelines/guideline-values/default/water-quality-toxicants/toxicants/ammonia-2000

$$CV_{pH8} = \frac{CV}{\frac{0.0676}{1+10^{7.688-pH}} + \frac{2.91}{1+10^{pH-7.688}}}$$ Equation 1

$$AV_{pH8} = \frac{AV}{\frac{0.0489}{1+10^{7.204-pH}} + \frac{6.95}{1+10^{pH-7.204}}}$$ Equation 2

Where:

CV = Chronic toxicity value concentration measurement

AV = Acute toxicity value concentration measurement

pH = measured pH

Table 1 presents a summary of median and maximum TAN results for each surface water monitoring location, relevant obtained pH data equivalent to the TAN statistic, and the consequent TAN concentration once recalculated to a pH of 8.0.

A map of the monitoring locations presented in Table 1 is presented in Appendix B.

Table 1: Total Ammoniacal Nitrogen Concentrations

Monitoring Location [2]	Median TAN (g/m^3)	Maximum TAN (g/m^3)	Median pH (pH Units)	Associated pH of Maximum data point (pH Units)	Corrected Median TAN Concentration (g/m^3)[3]	Corrected Maximum TAN Concentration (g/m^3)[4]
HHG90	0.046	0.054	7.2	7.1	0.02	0.01
HHG93	0.053	0.35	7.2	7.3	0.02	0.11
HHG97	0.087	0.73	7.2	6.8	0.04	0.15
HHG103	1.29	8.28	7.3	7.5	0.62	3.50
HHG100	0.056	2.82	7.2	7.2	0.03	0.80
HHG109	0.407	24.8	7.3	7.4	0.20	9.07
HHG99	0.0515	1.41	7.3	7	0.02	0.33
HHG106	1.03	22	7.2	6.3	0.47	3.56
HHG98	0.078	4.08	7.2	7.3	0.04	1.31
HHG115	0.605	3.38	7.2	6.3	0.27	0.55
HHG150	0.482	15.9	7.1	7.3	0.21	5.10
HHG190	0.336	3.2	7.1	7.2	0.14	0.91

Notes:

1. *Measurement exceeds NPS:FM where the annual median exceeds 0.24 g/m^3 or the annual maximum exceeds 0.4 g/m^3.*
2. *All monitoring sites have less than 60 datapoints.*
3. *Uses the chronic toxicity formulae (equation 1).*
4. *Uses the acute toxicity formulae (equation 2).*
5. *Red cells indicate measurements that exceed NPS:FM 2020 bottom line guideline values.*

Based on the results presented in Table 1 there are a number of monitoring locations where TAN results (medians and maximums) do exceed the national bottom line. In reference to the monitoring location map, all non-exceedances to the NPS:FM 2020 are located upstream of Uruti Composting Facility. As such, the submission that concludes that the water quality discharges from the Uruti Composting Facility are contributing to Haehanga Stream TAN concentrations exceeding the NPS:FM 2020 bottom line is correct.

4.0 Improvement of Water Quality Discharges

PDP consider that Remediation NZ's use of stormwater treatment ponds, irrigation of water to land, cut and carry practices of vegetation and the treatment of water via the use of a wetland is appropriate for the contaminants of concern. However, based upon observations during our visit there are key issues with the current devices which is inhibiting the performance that can be achieved. Our thoughts to improve the facilities discharge water quality has therefore been focused on optimisation of the existing devices, rather than the introduction of new treatment devices.

Section 2 identifies a range of observations that are likely indicators that a current stormwater device is not operating effectively.

PDP has the opinion that the existing devices onsite are appropriate for the contaminants discharged from the facility. However, it is clear that some of the devices require immediate maintenance. In addition to maintenance, additional design considerations need to be added to these devices. These additions are discussed in further detail in the following sections.

The improvement to water quality provided by the following additions cannot be quantifiably determined at this point in time, as it will be dependent upon a range of other influences. As such, PDP strongly recommend that a parallel monitoring strategy be implemented to quantify the improvements made. We note however, that some design additions proposed will not see an immediate improvement, as such, there needs to be sufficient time and data collected to evaluate the changes before any additional actions are investigated.

4.1 Stormwater Treatment Ponds

Visual observations made of the four stormwater ponds identified a number of concerns. To summarise these were:

- High algal populations.
- Anaerobic conditions.
- High accumulated sediment volumes.
- Hydrocarbon presence in the southernmost pond.

- Odours.

To improve the performance of the four ponds, it is strongly suggested that each pond is dewatered and accumulated sediment removed. Sediment should be laboratory analysed to determine the appropriate facility which can receipt the material.

Once dredging has been completed, portable aerators should be deployed within the ponds. The purpose of the aerators is to improve the dissolved oxygen concentrations within the ponds. Elevated concentrations of oxygen within a waterbody are critical for the conversion of TAN to other forms of nitrogen (e.g. nitrite and nitrate). During this conversion process, a proportion of the nitrogen is also able to volatilise (i.e. lose nitrogen to the atmosphere).

Through the first initial implementation of the above measures, it is anticipated that some reduction in TAN should be achieved. As discussed earlier, a parallel monitoring strategy to quantify this achievement must be carried out. Should it be found that TAN concentrations are still elevated, options such as floating vegetated islands could be considered.

4.2 Hydrocarbons

As earlier discussed in section 2.2, it is understood that one of the existing above ground diesel storage tanks is to be removed from the facility. It is also understood that identified contaminated soils in the vicinity to this tank will be appropriately remediated by trained personnel who follow approved rehabilitation protocols. All contaminated soils during this rehabilitation are to be disposed of at the appropriate facility.

PDP understands from Remediation NZ that the direct area surrounding the second diesel tank (located west of the composting pad), is contoured to a drainage channel which then connects to the four ponds. Based on visual observation, the area is flat, but does have a slight gradient in a westerly directly, thereby confirming the comment made by Remediation NZ. In addition, it is understood that any mechanical repairs to vehicles/machinery is undertaken (where possible) adjacent to this diesel tank. As such, any spills that may occur during repairs, is contained within the ponds. It is strongly recommended however, that a spill response kit (with appropriate contents and size) is provided in the direct vicinity to this tank.

PDP understands that in the instance a hydrocarbon spill event does occur, the ponds (where the hydrocarbon product is contained) are pumped. Pumped water is held in intermediate bulk containers (IBC's) held onsite. The removed product is then disposed of offsite to an appropriate facility (*D. Gibson Pers comm*). PDP consider this management approach for hydrocarbons is acceptable practice.

4.3 Paunch Pad

The paunch pond is currently subjected to accumulated sediment and gross pollutants (oesophageal tube clips). PDP suggest that as part of Remediation NZ's routine monitoring programme, that observations be conducted of the paunch pond to identify the future presence of oesophageal tube clips. If found to be present, oesophageal tube clips are to be collected and disposed of appropriately.

PDP also recommend the dredging of the paunch pond to remove accumulated sediments.

As earlier discussed, the wetland vegetation is considered to be healthy, however, the wetland is subjected to an accumulation of sediment. This accumulation of sediment is likely to be causing a 'short-circuiting' of the wetland treatment, as such, the performance of the wetland is not efficient as it could be.

To rectify the wetland, PDP consider that the following actions should be undertaken:

- Formalise the head of the wetland as a forebay.
- Increase the height of the northern bund of the wetland.
- Modify the outlet structure of the wetland to allow a greater water depth to be created within the wetland.

4.3.1 Forebay

The existing wetland has a forebay that includes a meandering pattern. PDP proposes that the forebay is dredged such that all meandering patterns are removed. The forebay would be dredged such that it becomes a slow-moving waterbody. Slow water movement within the forebay will promote sedimentation processes, thereby reducing the potential sediment load being transported into the main wetland body.

Regular routine monitoring of sediment build-up within the forebay should be carried out. Dredging should occur when 50% of the storage capacity of the forebay has been lost.

4.3.2 Northern Bund

The purpose of increasing the height of the northern bund is to increase the storage capacity of the wetland once the water levels in the wetland are increased (refer to section 4.3.3). PDP suggests that a survey of the existing wetland be conducted to determine the optimal bund height.

Sediment dredged from the forebay could be tested, and if it is determined to be 'non contaminated', this sediment could be used to increase the bund height.

4.3.3 Wetland Outlet Structure

As earlier discussed, the wetland currently suffers from accumulated sediment. Consequently, water movement through the wetland is likely to be restricted thereby the potential treatment provided by the wetland is not optimal. Modifying the outlet structure will allow a greater water depth to be created. As earlier proposed, a survey of the wetland is strongly recommended to be conducted to determine the optimal water level within the wetland.

By increasing the water level within the wetland, diffuse flow through the entire wetland width will be created. This will provide improved biological processes within the wetland to improve the water quality of the discharge from the wetland.

The plants within the wetland are Baumea species and raupo. Raupo can withstand water depths of 1.5 m[4], whilst Baumea species typically do not like deep water depths greater than 1 m depth. As such, some of the Baumea species may die off. In this instance, the Raupo species may become the dominant species within the wetland consuming the spaces where the Baumea species may have been. Whilst this may reduce the ecological function of the wetland, the treatment performance provided by the wetland is not expected to be compromised.

As earlier discussed, PDP strongly recommend that water quality monitoring of the discharge from the wetland should be conducted to determine the quantifiable benefits achieved by the above wetland modifications. Should it be found that the discharge quality from the wetland is still not in accordance with the NPS:FM 2020 guidelines, options such as increasing the footprint area of the wetland could be considered. As earlier discussed, the paunch pond is considered a large pond, where its primary purpose is purely to act as a holding pond before the water is pumped to the head of the wetland[5]. The wetland footprint could therefore take up some of the paunch pond area. By increasing the wetland footprint, it increases the waters residence time and the treatment performance within the wetland.

[4] https://www.landcareresearch.co.nz/tools-and-resources/collections/new-zealand-flax-collections/weaving-plants/raupo/

[5] Granted, there is some benefits from this pond that allows for some sedimentation processes to occur.

5.0 Conclusion

Remediation NZ has lodged a resource consent application (discharge of water to land and water) for the continued operation of its Uruti Composting Facility.

A submission received for this application has identified a number of site related concerns (McArthur, 2020). Specifically, McArthur (2020) stated that:

- pond liners were leaking;
- stormwater runoff was not controlled; and,
- total ammoniacal nitrogen concentrations discharged from the facility do not meet the NPS:FM 2020 guidelines. As such, PDP was engaged by Remediation NZ to confirm this claim, and if required, provide guidance to Remediation NZ on how the discharged water quality may be improved.

Based on site observation and information reported in BTW Company (2015), there is a possibility that ponds may receive groundwater ingress. As such, it is recommended that RNZ undertake a permeability assessment of the liners. Should it be identified that a pond liner has a permeability rate greater than 1 x 10^{-9} m/s, this liner should be replaced.

From observations made during my site visit I concluded that stormwater sheetflow generated from within the facility is controlled and is directed to stormwater treatment devices. I therefore do not concur with Ms McArthur's statement that the site has uncontrolled stormwater runoff.

In regard to assessing the sites compliance with the NPS:FM it is firstly important to note that the NPS:FM 2020 guidelines were only operational from September 2020. Prior to this, the guidelines were considerably different (specifically, total ammoniacal nitrogen concentrations have had a significant reduction in guideline value from earlier versions of the NPS:FM to the 2020 version of the document). As such, when the site stormwater management systems were designed and constructed, the required discharge of the water quality was considerably different to what is now required.

PDP has reviewed the total ammoniacal nitrogen dataset that has been obtained by the Taranaki Regional Council at various monitoring locations throughout the Uruti Composting Facility and can confirm that most locations (8 of 12 monitoring locations) do exceed the NPS:FM 2020 total ammoniacal nitrogen guidelines (either as an exceedance to the annual median or the annual maximum discharge concentration).

PDP considers that Remediation NZ's use of stormwater treatment ponds, irrigation of water to land, cut and carry practices of vegetation and the treatment of water via the use of a wetland are appropriate for the contaminants of concern. Based upon observations during our visit however, there are issues

with the current devices. Our thoughts to improve the facilities discharge water quality is therefore more around optimising the existing devices, rather than introducing new treatment devices.

PDP have provided a range of recommendations that could be implemented to optimise the existing treatment system and improve the water quality of the discharge from the facility. Key recommendations are:

- Dredging of stormwater treatment ponds.
- Installation of portable aeration systems within the stormwater treatment ponds.
- Removal of the unused above ground diesel storage tank and rehabilitation of soils surrounding the tank.
- Installation of an appropriate spill response kit at the used above ground diesel storage tank.
- Removal of accumulated hydrocarbon product within the stormwater treatment ponds.
- Removal of accumulated sediment within the paunch pond.
- Removal of oesophageal tube clips within the paunch pond, and implementation of a routine inspection programme to ensure that any further oesophageal tube clips are removed.
- Dredging of the wetland forebay.
- Raising of the bund to the north of the wetland, and then modifying the height of the wetland outlet structure to elevate the water level within the wetland.

The actual quantifiable benefits obtainable from the above actions are difficult to determine. As such, PDP strongly recommend that a parallel monitoring programme be implemented. Should it be found through the monitoring programme that the discharge water quality is still not meeting the NPS:FM 2020 requirements, further assessment and improvement would be required.

PDP has identified that further improvements of the discharge water quality could be in the form of:

- Floating vegetated wetlands within the stormwater treatment ponds.
- Increased footprint of the existing wetland to increase the waters residence time (and treatment) within the wetland.

6.0 References

ANZECC, 2000. Australian and New Zealand guidelines for fresh and marine water quality. Volume 2, The guidelines / Australian and New Zealand Environment and Conservation Council, Agriculture and Resource Management Council of Australia and New Zealand.

BTW Company, 2015. Haehanga Catchment Preliminary Groundwater Investigation. Report prepared for Remediation New Zealand Limited, dated 1 July 2015.

IPENZ, 2017. Practice note 21: Farm Dairy Effluent Ponds. Engineering Practice Note ISSN 1176-0907, Version 3, August 2017.

McArthur, K. 2020. Remediation NZ Ltd water quality assessment. Memorandum from Kate McArthur to Paul Cummings – Te Rūnanga o Ngāti Mutunga, dated 9 December 2020.

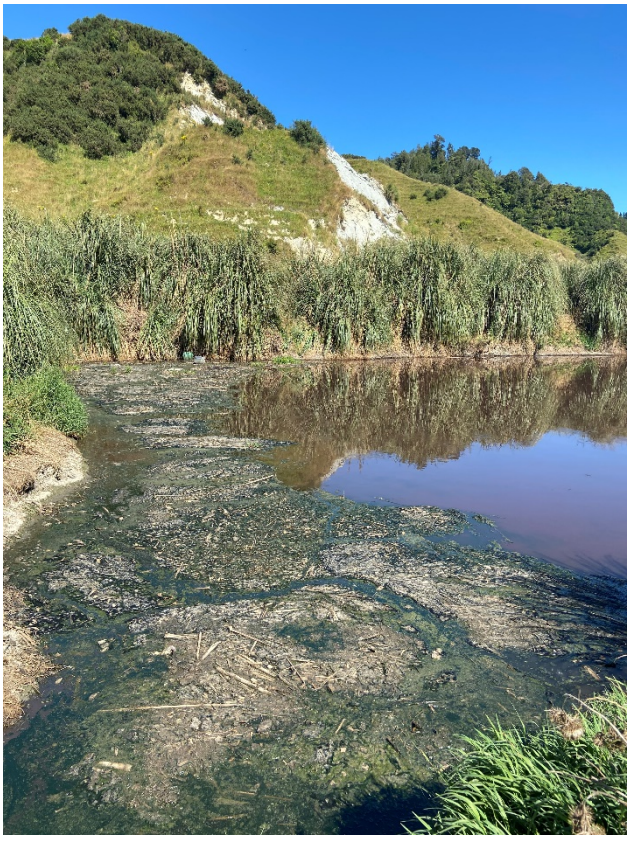
MfE, 2020. National Policy Statement for Freshwater Management 2020. Published by the Ministry for the Environment August 2020.

MfE, 2017. National Policy Statement for Freshwater Management 2014: Updated August 2017. Published by the Ministry for the Environment August 2017.

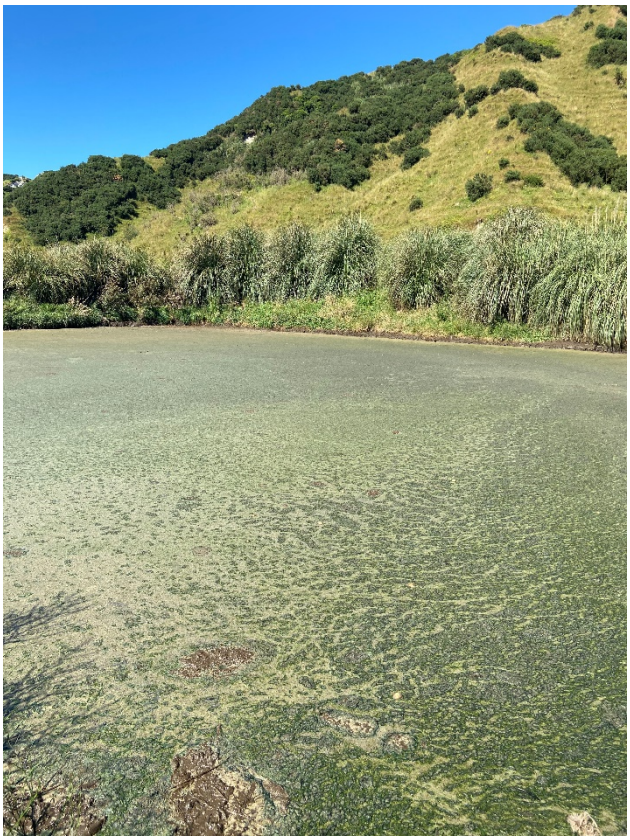
Appendix A

Photographs

Photograph 1: Irrigation Pond



Photograph 2: Stormwater Treatment Pond with accumulated sediment



Photograph 3: Stormwater Treatment pond with elevated algal population

Photograph 4: Above Ground Diesel Storage Tank which will be removed from site

Photograph 5: Stormwater Treatment Pond with accumulated hydrocarbon product

Photograph 6: Above Ground Diesel Storage Tank which will remain onsite

Photograph 7: Compost Pad area

Photograph 8: Paunch Pond

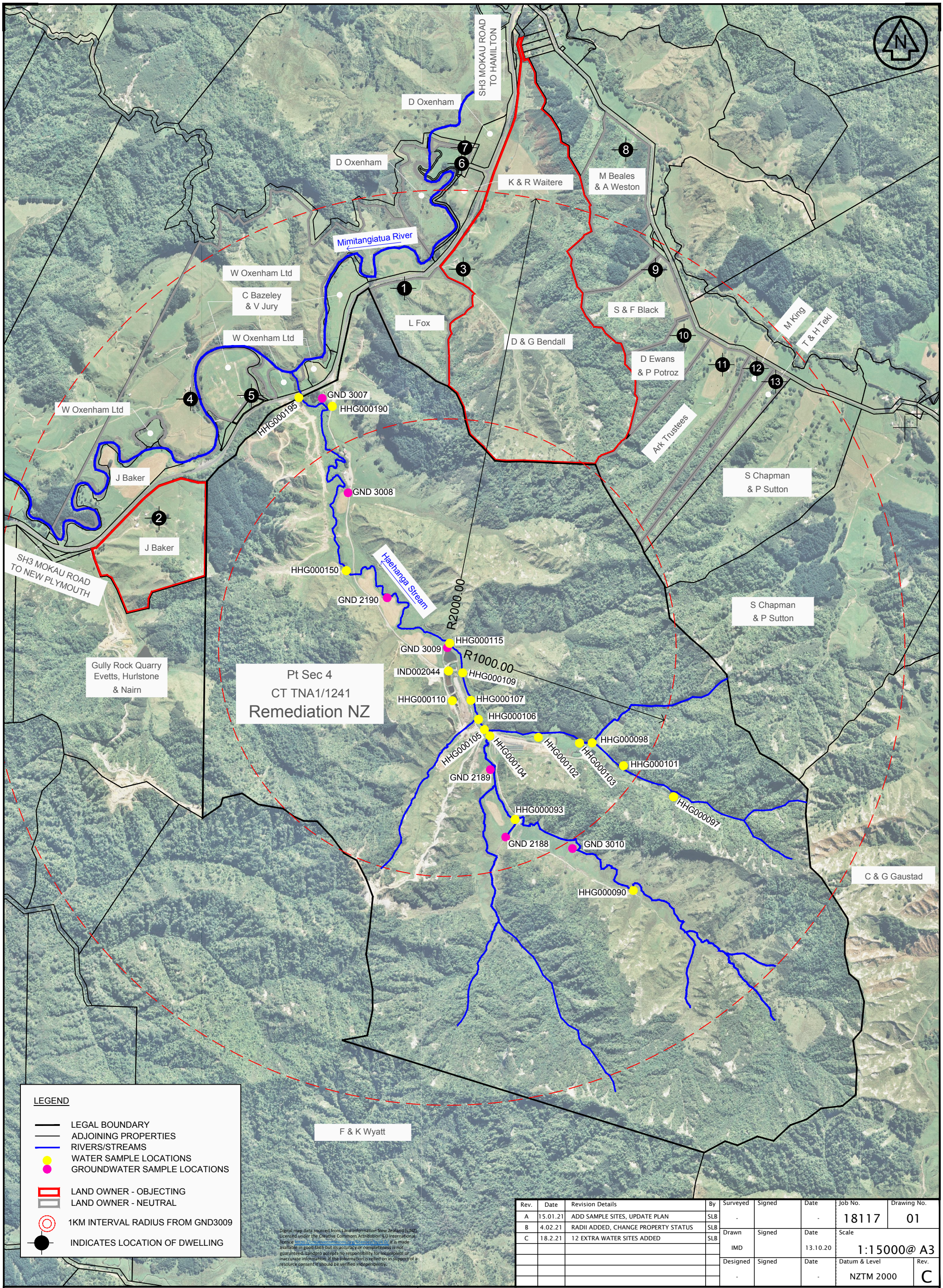
Photograph 9: Paunch Pond with accumulated sediment and oesophageal tubes

Photograph 10: Wetland looking west (Baumea species)

Photograph 11: Wetland looking east (Raupo)

Appendix B

Surface Water Monitoring Locations



Rev.	Date	Revision Details	By
A	15.01.21	ADD SAMPLE SITES, UPDATE PLAN	SLB
B	4.02.21	RADII ADDED, CHANGE PROPERTY STATUS	SLB
C	18.2.21	12 EXTRA WATER SITES ADDED	SLB

Surveyed	Signed	Date	Job No.	Drawing No.	
-		-	18117	01	
Drawn	Signed	Date	Scale		
IMD		13.10.20	1:15000@ A3		
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