5.1 ECONOMIC AND PRACTICABILITY ASSESSMENT FOR DISCHARGE OF TREATED WASTEWATER TO LAND FROM KAEO WASTEWATER TREATMENT PLANT

File Number: **A3572769**

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TAKE PŪRONGO / PURPOSE OF THE REPORT

To seek a decision from Council, via the Infrastructure Committee, regarding the economic viability of discharging treated wastewater from the Kaeo Wastewater Treatment Plant (WWTP) to land.

To seek a decision from the Infrastructure Committee, regarding continued investigations into discharge to land for the Kaeo Wastewater Treatment Plant.

WHAKARĀPOPOTO MATUA / EXECUTIVE SUMMARY

- The resource consent that authorises discharge of treated wastewater (to water) from the Kaeo Wastewater Treatment Plant (WWTP) expires 31 October 2022. In accordance with section 124(1) of the Resource Management Act (RMA) replacement resource consent applications must be lodged with Northland Regional Council (NRC) prior to 31 July 2022. This will enable the WWTP to continue to operate under the current consents while a decision is made on the replacement applications.
- The Proposed Regional Plan for Northland (PRP) sets out that an application for resource consent to discharge municipal wastewater to water will not generally be granted unless a discharge to land has been considered and found not to be environmentally, economically, or practicably viable.
- This report seeks a decision from Council, via the Infrastructure Committee, regarding the economic viability of discharging treated wastewater to land to support the renewal of the Kaeo discharge consent. This report:
  - Demonstrates, based on a desktop assessment, that discharge of treated wastewater from the Kaeo WWTP to land is considered practicably viable.
  - Discusses the cost estimate of $6.2M (-30% to +50%) to establish a treated wastewater to land discharge in Kaeo. The cost estimate excludes costs for land purchase or any potentially required upgrade to the Kaeo WWTP.
  - Estimates a targeted rating increase of $845 - $1800 for the first year (Y5) which will reduce to a range of $765 - $1640 after 5 financial years (Y10).
  - Assesses the affordability of the rating impact using the *Rates affordability in the Far North* report (attachment 4) prepared by Business and Economic Research Ltd (BERL) and determines that discharge to land is not currently considered to be economically viable due to Council's targeted rates funding mechanism.
  - Recommends that Council does not pursue discharge to land as part of the current resource consent application as it is not considered economically viable within the context of Council's purpose under the Local Government Act 2002.
  - This report considers continuation of investigations into discharge to land in Kaeo (separate to the resource consent application process) including feedback from the community in Kaeo and acknowledges that with the transition to Water Entity A implementing a discharge to land scheme may become economically viable.

TŪTOHUNGA / RECOMMENDATION

That the Infrastructure Committee recommends to Council that:

1. the option of discharging treated wastewater from the Kaeo Wastewater Treatment Plant to land is not pursued at this time as part of the application to replace the resource consents authorising discharge of contaminants from the Kaeo Wastewater

Treatment Plant, on the basis that the costs associated with that activity, are assessed as not economically viable.

That the Infrastructure Committee notes that:

1. **staff will undertake initial engagement with mana whenua and affected landowners to determine the selection of a possible site based on the options presented in the desktop study; and**
2. **should a possible site(s) be identified, staff prepare a budget request for this Committee to consider making funding available for the site assessment and concept design for the discharging to land from the Kaeo wastewater treatment plant that includes site specific technical, design and cost investigation of this option, in which mana whenua are included.**

1) TĀHUHU KŌRERO / BACKGROUND

Discharge to Land Investigations

The resource consent held by Far North District Council (FNDC) authorising the discharge of treated wastewater to the Kaeo River from the Kaeo WWTP will expire on 31 October 2022.

Operative policy D.4.3 of the PRP sets out that an application for resource consent to discharge municipal wastewater to water will not be generally granted unless a discharge to land has been considered and found not to be environmentally, economically, or practicably viable.

Staff have undertaken a desktop assessment to determine the practicable viability of discharging treated wastewater to land in Kaeo. Results found numerous sites to be practicably viable. A high-level cost estimate to establish a discharge to land scheme was prepared by consultants and found to be $6.2M with -30% to +50% accuracy. The estimate is indicative only and does not include the cost of purchasing land or any upgrade costs that may be needed to safely discharge treated wastewater to land.

Based on the cost estimate to establish a discharge to land scheme, the targeted rate increase per connection in the Kaeo wastewater scheme has been estimated as $845 - $1800 in the first financial year. This will reduce to an increase of $765 - $1640 after 5 financial years. The rating impact is assessed as high in part due to the small service area of the scheme with only ~240 connections. The BERL report issued in July 2020 titled *Rates Affordability in the Far North* has been used to frame considerations of affordability.

In line with policy D.4.3 of the PRP, for staff to proceed with an application for resource consent to discharge treated wastewater to water the application must demonstrate that the option of discharging treated wastewater to land is not environmentally, economically, or practicably viable. For this determination, “economic viability” should be read within the context of Council’s purpose under the Local Government Act 2002, that is: to promote the social, economic, environmental, and cultural well-being of communities in the present and for the future.

The recommendation is being sought to support the resource consent applications for the Kaeo WWTP, aimed to be lodged in April 2022. It should be noted that this recommendation does not rule out consideration of wastewater disposal to land options as part of future Long-Term Plans (LTP) or through a new Three Waters governing Entity.

To advance investigations and reduce the margin of error associated with the high-level estimate of costs, wastewater discharge to land options will need to be progressed to concept design stage.

The concept design will include irrigation and pipe networking alongside potential treatment plant upgrade options if required. Costing can then be completed at an accuracy of +/- 25%. The estimated cost for this work to be completed is $285k and the timeframe can vary widely depending on how quickly decision making can occur with stakeholders regarding key aspects such as which site(s) will be discharged to, methods of discharge and end use of the land being discharged to. The estimated timeframe to complete the concept design project (should it be

funded) is in the order of 2 to 3 years; however this will be dependent on external engagement factors.

Engagement

A stakeholder and partners analysis was conducted in late 2021 to determine key groups within the community that may have an interest in the discharge from the Kaeo wastewater treatment plant. This identified a variety of community groups as set out in attachment 2.

Follow up engagement with mana whenua representatives from Whanau Kaitiaki and Te Runanga o Whaingaroa has been conducted through online meetings where the project was discussed in detail and further meetings are planned. In both cases, participants expressed their interest in further investigating a wastewater discharge to land option. The Whaingaroa Resource Management Plan echoes this in a policy stating, *'No direct discharges to water including the discharge of treated effluent to water*'.

The 2011 – 2036 Whangaroa community development plan also has the goal of *'No raw or treated effluent to waterways or sea'* which indicates the communities desire to pursue discharge to land as an option. Engagement with the wider community of Kaeo, including the groups identified in the stakeholder & partners analysis, is planned to take place over March 2022.

A webpage has been set up on the FNDC website which provides an overview of the treatment process and the ongoing consent renewal project. There is a form on the webpage where feedback on the option of wastewater discharge to land can be provided.

2) MATAPAKI ME NGĀ KŌWHIRINGA / DISCUSSION AND OPTIONSPractical viability of wastewater discharge to land for Kaeo

A desktop assessment of land within 5km radius of the Kaeo WWTP identified several potentially suitable sites. These sites were ranked in terms of practicality using a range of criteria, the full details of which can be found in the attachment 1.

This assessment was peer-reviewed by Beca engineering staff to ensure credibility and confirms that discharge to land is practicably viable in Kaeo at a desktop level. The top ranked site from this assessment was then used by Beca to develop the cost estimate for establishing a discharge to land scheme in Kaeo.

If further investigations are funded, then the sites can be investigated, in order from highest ranking down, to identify a preferred site that is acceptable from technical, cultural and landowner perspectives.

Economic viability of wastewater discharge to land for Kaeo

A high-level cost estimate for establishing a wastewater discharge to land scheme is assessed at $6.2M, with -30% to +50% accuracy. The total range of cost is $4.4M to $9.3M and does not include cost estimates associated with land purchase or potential upgrades that may be required at the Kaeo WWTP. A copy of the cost estimate has been included as attachment 5.

It is possible that the land purchase costs can be avoided if a lease or similar arrangement is entered into between FNDC and the landowner; however such arrangements cannot be relied upon until further engagement is carried out with specific landowners.

The Kaeo WWTP may need to be upgraded to facilitate a wastewater discharge to land option, to address potential issues such as algae or total suspended solids (TSS) blocking the disposal network. Costs associated with upgrading the WWTP would be additional to the above discussed estimate and cannot be determined at this time.

The investigations to develop a concept design for wastewater disposal at Kaeo will include determining whether land purchase and/or WWTP upgrade costs will also need to be funded to achieve wastewater discharge to land for Kaeo.

Staff used the high-level cost estimate to determine the rating impact for establishing a discharge to land scheme for Kaeo. Separate rating impact options were developed to reflect the range set out in the cost estimate, using the estimated value, lower and upper margin of error values.

Table 1 sets out the estimated rating impact of establishing a discharge to land scheme in Kaeo. A copy of the rating impact assessment has been included as attachment 3.

Table 1: Estimated targeted rating impact of wastewater discharge to land for Kaeo

Additional Capital Rate Per Connection	2025 (Y5)	2026 (Y6)	2027 (Y7)	2028 (Y8)	2029 (Y9)	2030 (Y10)
At $6.2M	$1205.6	$1183.3	$1160.9	$1138.6	$1116.2	$1093.9
At $4.4M	$843.9	$828.3	$812.6	$797	$781.35	$765.7
At $9.3M	$1808.4	$1774.9	$1741.4	$1707.9	$1674.3	$1640.8

To assess affordability of establishing a discharge to land scheme in Kaeo, the 2020 BERL report is used. The report does not assess the Kaeo community individually but does look at the Bay of Islands-Whangaroa Ward as a whole.

The BERL report establishes that affordability, in the context of rates has two aspects:

I. The cost relative to income (and wealth);
II. The ability of ratepayers to earn greater income in the future from the spending of rates, e.g. investment in infrastructure. It also sets out an approximate benchmark for affordability, whereby affordability concerns will arise where rates exceed 5% of gross household income.

The BERL report assesses rates affordability at three levels: district wide level, ward level (Te Hiku, Bay of Islands-Whangaroa and Kaikohe-Hokianga), and at several specified smaller areas which do not include Kaeo. Within the BERL report, rates affordability is assessed by:

I. Establishing an average lower quartile, average median, and average upper quartile total rates payable value at district level, ward level, and smaller area level (the total includes both NRC and FNDC rates)
II. Determining an average gross household income for eight typical household types also defined at district, ward, and smaller area level, and calculating the cost of total rates as a percentage of the gross income for each household type for the lower quartile, median and upper quartile average total rates values.

The results of the affordability assessments for the Bay of Islands-Whangaroa Ward are depicted in table 10 and 11 of the BERL report. Table 2 shows the total rates as they were depicted in 2020.

Table 2: Rates payable – Bay of Islands-Whangaroa Ward.

	FNDC rates ($)	NRC rates ($)	Total rates ($)
Lower Quartile	1,898	276	2,174
Median	2,437	236	2,673
Upper Quartile	2,937	267	3,205

In 2020, 6 out of 8 typical household types in the upper quartile have rates greater than 5% of their gross income which is deemed unaffordable by the BERL report. A maximum of 15.8% of gross income being exhibited in households with a single adult with two children on the benefit. 3 of the 8 typical household types have rates greater than 5% of gross income at all levels indicated in Table 2 above.

If discharge to land is pursued, the estimated lowest cost increase scenario will result in total rates of $3018, $3517, and $4048 for lower quartile, median, and upper quartile households respectively. At these values the rates would be unaffordable for 6 out of 8 typical household types

across all 3 levels indicated in Table 2. The two household types where rates remain affordable are 'Couple, two children, both employed' and 'Two working adults, based in Auckland'.

Using the BERL report to frame considerations of affordability, staff have deemed discharge of treated wastewater to land from the Kaeo wastewater treatment plant is not economically viable under the current rating mechanism. Should land acquisition and/or WWTP upgrades be required to establish a wastewater discharge to land scheme, the impact on rates for Kaeo would be greater than those discussed above.

It is acknowledged however, with the incoming Three Waters reform, that the funding mechanisms are likely to change which may make it economically viable in the future. Therefore, staff consider that this likely change combined with the expressed community direction warrants the continuation of discharge to land investigations (separately to the Resource Consent application).

Options for consideration by the Infrastructure Committee

Decision 1a (preferred decision) – Determining that discharge of treated wastewater to land from the Kaeo wastewater treatment plant is not pursued as part of the replacement consent application process.

Council supports the staff recommendation that disposal of treated wastewater from the Kaeo WWTP to land is practicably viable but not economically viable within the context and timing of the required resource consent applications. It is anticipated that this will result in a resource consent authorising discharge to water being approved for the Kaeo WWTP.

This outcome does not prevent FNDC from continuing to investigate the option of wastewater discharge to land.

Decision 1b - Deferring a decision on the economic viability of wastewater discharge to land for Kaeo

Council defers a decision on the economic viability of land disposal. Staff will still be required to lodge the application for replacement resource consents authorising discharge of treated wastewater to water prior to 31 July 2021. These applications would include the assessment carried out to date on wastewater discharge to land feasibility and costs but will be absent a Council decision in respect of the economic viability of establishing such a scheme. The consequence of not including a Council decision on the matter is that staff will be required to decide on the matter and present this in the application. A determination by staff may not carry sufficient weight to be accepted either by the community or NRC.

Decision 1c - Deciding that wastewater discharge to land for Kaeo is economically viable

A decision that wastewater discharge to land is economically viable will require a staged consenting process. Staff will be required to lodge a consent application for discharge to water to cover the ongoing discharge whilst the site selection, land purchase, consenting, design, delivery and LTP requirements are covered.

It is anticipated that a short-term consent would not be inconsistent with Policy D.4.3 because it can be demonstrated that it is not practicably viable to deliver a wastewater discharge to land scheme within the time constraints associated with the above. Additional costs associated with land purchase and potential upgrade options for the Kaeo wastewater treatment plant will need to be assessed and included in the proposal.

The Infrastructure Committee is also being requested to note that allocating funds in future for continued investigation into wastewater discharge to land for Kaeo may be needed.

Staff will engage with mana whenua, landowners and other stakeholders, to determine a preferred site based on practicality, cost, cultural considerations, landowner participation and the potential for wastewater to become a resource (i.e., irrigation) on the preferred site.

Funding will then be required to progress on-site investigations to assess if the land is suitable to receive treated wastewater as predicted at a desktop level. Providing that a preferred site is successfully identified and verified through site investigations, a concept design and cost estimate will be developed for a wastewater discharge to land scheme including potential upgrades that may be required at the treatment plant.

The concept design can then be progressed into a detailed design to be implemented should the activity of discharging treated wastewater to land become economically viable in future for Kaeo.

Take Tūtohunga / Reason for the recommendation

Due to the estimated rating impact on households that are connected to the Kaeo wastewater scheme, it has been determined that a wastewater discharge to land scheme is currently unaffordable for the community of Kaeo.

As such, it is recommended that a wastewater discharge to land scheme is determined as economically non-viable, and that the replacement consent application seeking to continue discharging to the Kaeo river is supported.

However, staff acknowledge that discharge of treated wastewater to land is a long-term goal for Council because it generally results in better environmental and cultural outcomes. There is also potential to establish end-use practices (i.e., wastewater as irrigation) to help supplement costs.

3) PĀNGA PŪTEA ME NGĀ WĀHANGA TAHUA / FINANCIAL IMPLICATIONS AND BUDGETARY PROVISION

This report identifies that discharge to land options are uneconomic for the Kaeo wastewater treatment plant:

Staff have undertaken a desktop assessment to determine the practicable viability of discharging treated wastewater to land in Kaeo. Results found numerous sites to be practicably viable. A high-level cost estimate to establish a discharge to land scheme was prepared by consultants and found to be $6.2M with -30% to +50% accuracy. The estimate is indicative only and does not include the cost of purchasing land or any upgrade costs that may be needed to safely discharge treated wastewater to land.

Based on the cost estimate to establish a discharge to land scheme, the targeted rate increase per connection in the Kaeo wastewater scheme has been estimated as $845 - $1800 in the first financial year. This will reduce to an increase of $765 - $1640 after 5 financial years. The rating impact is assessed as high in part due to the small service area of the scheme with only ~240 connections.

If further investigation is approved in future once a preferred disposal to land site has been identified, additional operational funding of $285k over two years would be required. This would fall to be met from the operational charge for wastewater and impact on the overall rate calculations for the 2022/23 or future Annual Plans. The current projected rate increase is sitting at 6.25% against a limit of 6.4%. This request would see the rates moved to the limit without any other amendments being suggested for the coming plan.

The Three Water reforms are also expected to take effect from 1 July 2024, which raises the question as to whether this work should be done given that it would take several years to complete, and the final decision would lie with the new water entity rather than with Council.

ĀPITIHANGA / ATTACHMENTS

1. Draft Kaeo Land Disposal Options Report 02-2022 - A3607321

2. Stakeholder & Partners Analysis - Kaeo DtL - A3607279
3. Rating Impact Assessment - Kaeo DtL - A3607199
4. Rate's affordability in the Far North 2020 - A3606303
5. Economic Analysis of Discharge to Land in Kaeo 09-2021 - A3606297

Hōtaka Take Ōkawa / Compliance Schedule:

Full consideration has been given to the provisions of the Local Government Act 2002 S77 in relation to decision making, in particular:

1. A Local authority must, in the course of the decision-making process,
   a) Seek to identify all reasonably practicable options for the achievement of the objective of a decision; and
   b) Assess the options in terms of their advantages and disadvantages; and
   c) If any of the options identified under paragraph (a) involves a significant decision in relation to land or a body of water, take into account the relationship of Māori and their culture and traditions with their ancestral land, water sites, waahi tapu, valued flora and fauna and other taonga.
2. This section is subject to Section 79 - Compliance with procedures in relation to decisions.

He Take Ōkawa / Compliance Requirement	**Aromatawai Kaimahi / Staff Assessment**
State the level of significance (high or low) of the issue or proposal as determined by the Council's Significance and Engagement Policy	Deciding that it is economically viable to establish wastewater disposal to land schemes for the community of Kaeo has a high level of significance, which meets several criteria (for high significance) set out in the policy.
State the relevant Council policies (external or internal), legislation, and/or community outcomes (as stated in the LTP) that relate to this decision.	The Resource Management Act requires FNDC to hold resource consent to discharge contaminants into the environment. Replacement resource consent is being sought. This approach is viewed as more affordable than establishing disposal to land schemes for the subject community and is considered consistent with the community outcome of: *Prosperous communities supported by a sustainable economy.*
State whether this issue or proposal has a District wide relevance and, if not, the ways in which the appropriate Community Board's views have been sought.	The issue of establishing disposal to land schemes is a district wide issue, which has been focused via this report on the community of Kaeo, because of the need to replace discharge resource consents for this community.
State the possible implications for Māori and how Māori have been provided with an opportunity to contribute to decision making if this decision is significant and relates to land and/or any body of water. State the possible implications and how this report aligns with Te Tiriti o	A decision that land disposal is not economically viable will have implications for Māori, being the continued discharge of treated effluent to water. Consultation with tangata whenua regarding this matter is currently being commenced, to enable tangata whenua to contribute to the resource consent application decision making process.

Waitangi / The Treaty of Waitangi.	
Identify persons likely to be affected by or have an interest in the matter, and how you have given consideration to their views or preferences (for example – youth, the aged and those with disabilities).	All rate payers that are connected to, or have the ability to connect to, a public wastewater scheme will be affected by this matter. Consideration of the economic impact of establishing land disposal schemes has been considered via the rating impact of the activity.
State the financial implications and where budgetary provisions have been made to support this decision.	A decision that finds the activity (of land disposal) to be economically viable will have significant financial implications, which may in turn require decisions by Council to transfer funding from other areas within the organisation, or otherwise fund establishment of land disposal schemes. No budgetary provisions have yet been made either to establish land disposal schemes, or to undertake further investigation to preliminary design stage for the community of Kaeo.
Chief Financial Officer review.	The Chief Financial Officer has reviewed this report.

Kaeo Wastewater Treatment Plant

Land Disposal Options Assessment

February 2022

REPORT INFORMATION AND QUALITY CONTROL

Prepared by	 Ben Bowden Graduate 3 Waters Planner Far North District Council
External Peer Review by	 Garrett Hall Technical Director – Environments Beca Ltd
Approved by	Kim Cottle Team Leader – Infrastructure Planning Far North District Council

Contents

Executive Summary

This report provides the results of an assessment to identify potential sites for land disposal of treated wastewater from the Kaeo wastewater treatment plant (Kaeo WWTP). The work has been completed using geographic information systems (GIS) to identify potentially suitable sites along with a multi-criteria analysis to shortlist potentially suitable sites for a future detailed assessment.

This report assumes an average annual wastewater flow to the WWTP of 171 m^3/day in 2026 which is the estimated year of commissioning of any land-based disposal infrastructure. An average hydraulic loading rate of 1.14 – 4.14 mm/day was determined based on the soil drainage classes present in Kaeo and the indicative permeability rate associated with clay loam soils. Based on these assumptions, a minimum total area of 7.1 hectares of land is required for disposal to land which includes a 50% buffer to allow for future growth, adequate distance from surroundings, and a storage pond. Due to high levels of rainfall and resulting stormwater infiltration in Kaeo, the maximum flow from the WWTP is much larger than the average flow. To deal with high flows it is recommended that 28 Ha be used for irrigation and a buffer.

GIS mapping using data sets from FNDC, Northland Regional Council (NRC) and other online sources were used. Based on these data sets, it can be confirmed that there are numerous feasible options for land disposal within 5 km of the WWTP. The sites identified as a shortlist were largely located to the south of the WWTP.

Upon review of the top 10 sites, it was found that the best option was too close to potential nearby dwellings. Therefore, it would require subsurface drip irrigation as opposed to the cheaper method of spray irrigation which has meant that the second ranked site was instead identified as the preferred theoretical site.

Site specific economic analysis has been achieved for option 3 by Beca which has been included as Appendix A. This analysis gives a high-level estimate of $6.2M with an uncertainty range of $4.4M – $9.3M.

1. Introduction

The Kaeo WWTP discharges treated wastewater into the Kaeo River which flows into the Whangaroa Harbour. FNDC is currently in the process of renewing the resource consent authorising the discharge, which expires on 31st October 2022. Policy D.4.3 of the Proposed Regional Plan for Northland (Appeals Version – August 2019) sets out that an application for resource consent to discharge municipal wastewater to water will generally not be granted unless, among other things, a discharge to land has been considered and found not to be economically, environmentally, or practicably viable.

The purpose of this report is to provide an initial desktop feasibility assessment and a high-level cost estimate for land disposal of wastewater from the Kaeo WWTP. This will enable a determination of land disposal practicability and feasibility in accordance with Policy D.4.3.

Kaeo township and the surrounding area is known to be flood prone land with clay soils that are not very conducive to discharge to land. However, this desktop study identified numerous options and has ranked the top ten using a multi-criteria analysis to identify which site should be used to base an economic analysis on.

2. Methodology

To establish the feasibility of land disposal areas, GIS software was used to initially screen site suitability by excluding land areas that failed critical criteria. This first-class exclusion zone was initially developed for the area of interest (AOI) based on the following criteria:

- 20m proximity from all lakes and rivers.
- 20m proximity from all land not designated rural production, general coastal or minerals.
- Total area for land designated as minerals.
- Total area for flood susceptible land.
- Total area for 50-year coastal flooding and erosion predictions.
- Slope > 12°.
- Soil drainage classes 0 – 1.

These criteria were developed based on established best practice, considering previous similar studies in the Far North [note reference] and engineering advice provided by Beca as part of a pre-draft review process.

A long list of sites was then created by ranking each site using the criteria and weighting shown in Table 1 below.

Table 1: Long List Criteria

Criteria	Weighting
Highest Average Hydraulic Loading Rate	33.0%
Distance from Wastewater Treatment Plant	25.0%
Lowest Average Slope	17.0%
Total Available Area for Discharge	17.0%
Regularity of Site	8.0%

Lastly, the long list underwent a multi-criteria analysis (MCA) process in which qualitative measures are assessed as shown in Table 2 below. This process allows for the remaining sites to be ranked based on their suitability for land disposal so that the highest ranked can be taken forward for further analysis. Cultural consideration can not be made by staff and therefore will be made in collaboration with tangata whenua should a land owner agree to further investigations being conducted at a later date.

Table 2: MCA Criteria

Criteria	Weighting
Long List Score	40%
Proximity to archaeological sites of significance	20%
Statutory Considerations (SNA, Wetlands)	20%
Existing Land Use (Land Cover, Aerials, LINZ Land Use)	20%

The analysis was achieved using the datasets found in Table 3 to conduct the exclusion zones and criteria analysis referenced above.

Table 3: Spatial Data Sets used to Identify Land Disposal Constraints

GIS Dataset	Source
District Plan Zones	Far North District Council
Slope	LENZ[2]
MfE river flows	LINZ[1]
Northland Flood Susceptible Land	Northland Regional Council
Marae	Te Puni Kokiri Maps
NZAA Registered Sites	Far North District Council
SNA's	Far North District Council
Bore sites	Northland Regional Council
Parcel Search (Property Ownership Type)	Far North District Council
NZLRI SOIL	LRIS Portal[3]
LCDB v5.0	LRIS Portal

1 LINZ topo1:50,000 map data
2 Slope data layer used in the creation of Land Environments of New Zealand (LENZ) classification
3 Identified as the same layer used in NRC Soil Map Viewer

3. Land Disposal Methods

The work of Tonkin + Taylor (2019) in Ahipara suggests that the methods for land disposal from wastewater treatment plants are limited by volume, soil quality, and level of treatment prior to disposal.

Four potential land disposal methods have been identified for consideration:

- Soil Aquifer Treatment (SAT)
- Soil Moisture Discharge Methods (SM)
- Slow Rate Irrigation (SR)
- Combined Land and Water Discharge (CLWD)

Soil Aquifer Treatment (SAT)

According to the USEPA Process Design Manual for Land Treatment of Municipal Wastewater Effluents, (2006) soil aquifer treatment allows for higher loading rates than the other options which would significantly reduce the area required for disposal. However, this method requires high permeability soils which are free draining and require a fine level of pre-disposal filtration to operate effectively.

The area surrounding the Kaeo WWTP contains a mixture of sandstone and greywacke soils which vary from poorly drained to well-draining. These soils are likely to not have the drainage level required to consider SAT however further investigations would need to take place to be sure.

Effluent exiting the Kaeo WWTP also contains algae and other solids which can lead to clogging of the disposal system and result in runoff. For SAT to be viable, the pre-disposal treatment would need to meet a suitable standard to prevent clogging and runoff from occurring. Current pre-disposal treatment would not meet this standard and therefore SAT would only be considered in combination with upgrades to the treatment process.

Investigation into treatment requirements and costing of upgrades required to reach those requirements would need to be completed before SAT disposal could be considered. It is recommended that this is done should land disposal be carried forward as an option following this report.

Soil Moisture Discharge Methods (SM)

Soil moisture discharge methods are designed to minimize losses to groundwater following the disposal to land. This method requires a significantly larger land area than other disposal methods. For this reason, it would only be considered if on-site investigations deemed it necessary due to the potential health risk present in the event treated wastewater would flow into groundwater used by the public.

Slow Rate Irrigation (SR)

Slow rate irrigation is a method where treated wastewater effluent is applied at a low loading rate over an extensive area of land as determined by USEPA (2006). Application rates typically vary between 3 and 5 mm/d according to Tonkin + Taylor (2019). The effluent applied will soak into the upper soil layers where some is lost to evapotranspiration. When the storage capacity of moisture in the soil is exceeded, the effluent will percolate and be lost via soakage. Application methods for SR are spray irrigation (fixed

sprinkler or k-line system), and pressure compensating drip irrigation, either laid on the surface or buried within the topsoil layer (100 to 150 mm depth).

Effluent from the Kaeo WWTP is not suitable for the pressure compensating drip irrigation system due to the required small diameter effluent emitters. The wastewater being discharged contains algae that will quickly clog the emitters and compromise the operation. This was the reason the system was not further considered for the Ahipara WWTP land disposal options assessment (Tonkin + Taylor, 2019). Therefore, drip irrigation would only be considered if pre-disposal treatment of total suspended solids (TSS) was improved.

SR systems need to be developed to avoid run-off from the disposal area with all effluent being disposed of via soakage or evapotranspiration. Therefore, irrigation will need to cease during times of high soil moisture content when chances of runoff are high. Detailed investigations would be required to determine when irrigation should cease for each site. Effluent produced at such a time would need to be stored in a storage pond. Comparison sites indicate a requirement of 2 – 6 months of storage capacity is required if 100% discharge to land is pursued. Whangamata which uses a precipitation index irrigation scheme requires a 3-month storage pond, whilst a land disposal system in Mangawhai requires 6 months of storage.

SR is most suitable on land slopes up to 10° however, it can work on slopes up to 20° if drainage class is suitable. The drainage class within the area of interest allows slopes greater than 10° to be considered, however the additional runoff risk requires further investigation. For the purpose of this analysis, sites with less than 12° have been considered for disposal in accordance with the land disposal report for Kohukohu by Daniel, J. (2020). This report identified that slopes above 12° pose a greater risk of runoff and erosion issues.

Most contaminants within wastewater effluent are removed in the first few meters of soil, with finer soils resulting in a greater removal rate. Some nitrogen may be removed through nitrification on the surface of the soil, however, once it has entered the soil will move freely through the soil profile when it becomes entrained with water. This can lead to nitrogen loading downstream, the effects of which should be considered when finding an appropriate site for land disposal.

Slow rate irrigation is considered the most appropriate method for this desktop analysis.

Combined Land and Water Discharge (CLWD)

Using SR in a combined land and water discharge should also be considered where the land disposal would be considered as a ‘side-stream’ treatment to the current set-up; that is, flows that are to be directed to land disposal would undergo a separate treatment process to the flows that would be discharged to water. The benefits of a side-stream arrangement are that the capital investment required for land disposal can potentially be reduced owing to the differing treatment requirements for land disposal discharge to water. This would allow for discharge to water when the land discharge site is unable to accept treated wastewater due to soil moisture conditions. It is also noted that at least 20% of the flow is required to go through the ponds to keep them ‘alive’. Therefore, it would be ideal for the wastewater to flow through the current system before either being discharged to land or surface water depending on soil moisture conditions.

4. Flow Summary:

Total flow data for the period between 1st January 2017 and 31st Dec 2020 has been collated for analysis. Table 4 below identifies the average, median, 90th percentile, maximum, and average dry weather flows for 2021 (current year), 2026 (estimated first year of operation should the option be taken forward), and 2043 (final year of population forecast data).

Table 4: Kaeo Wastewater Inflows (Jan 2017 – Dec 2020)

Parameter	2021	2026	2043
Average Flow (m3/day)	165	171	195
Median Flow (m3/day)	128	133	151
90th Percentile Flow (m3/day)	294	305	347
Maximum Flow (m3/day)	1274	1320	1503
Average Dry Weather Flow (m3/day)	79	82	94

The inflow to the treatment plant was used to determine the amount of discharge the land would be required to handle due to the outflow being unreliable over the years. The flows recorded have been historically compliant with the average dry weather flow limit of 360 m^3/day.

Soil Drainage Class

Drainage classification is of fundamental importance to land disposal feasibility assessment. It allows for an indicative soil permeability to be determined based on the preliminary soil permeability as per the guidelines of NZS1547 (2012).

To compare the potential sites with the underlying soil, a drainage class assessment was undertaken using the following method:

- NZLRI Soil (2010) layer imported from LRIS portal. This layer forms the basis for the Northland Regional Councils (NRC) soil viewer.
- Using the soil factsheets supplied by NRC, the types of soils found in the AOI were assigned with a drainage class between 0 (No drainage) – 5 (Very well drained). Some of these soils had a range of drainage classes that were averaged out so that a single value could be attributed to them. (e.g. Omu Clay Loam (OM) has a drainage class between 2 – 4 so would become a 3).
- The assigned drainage classes were then applied to the imported layer which exists as polygons on the map. These polygons often had 2 – 3 soils attributed to them and so an average drainage class was used with it being rounded to the nearest whole number.

The output from the above assessment is set out in Figure 1 below.

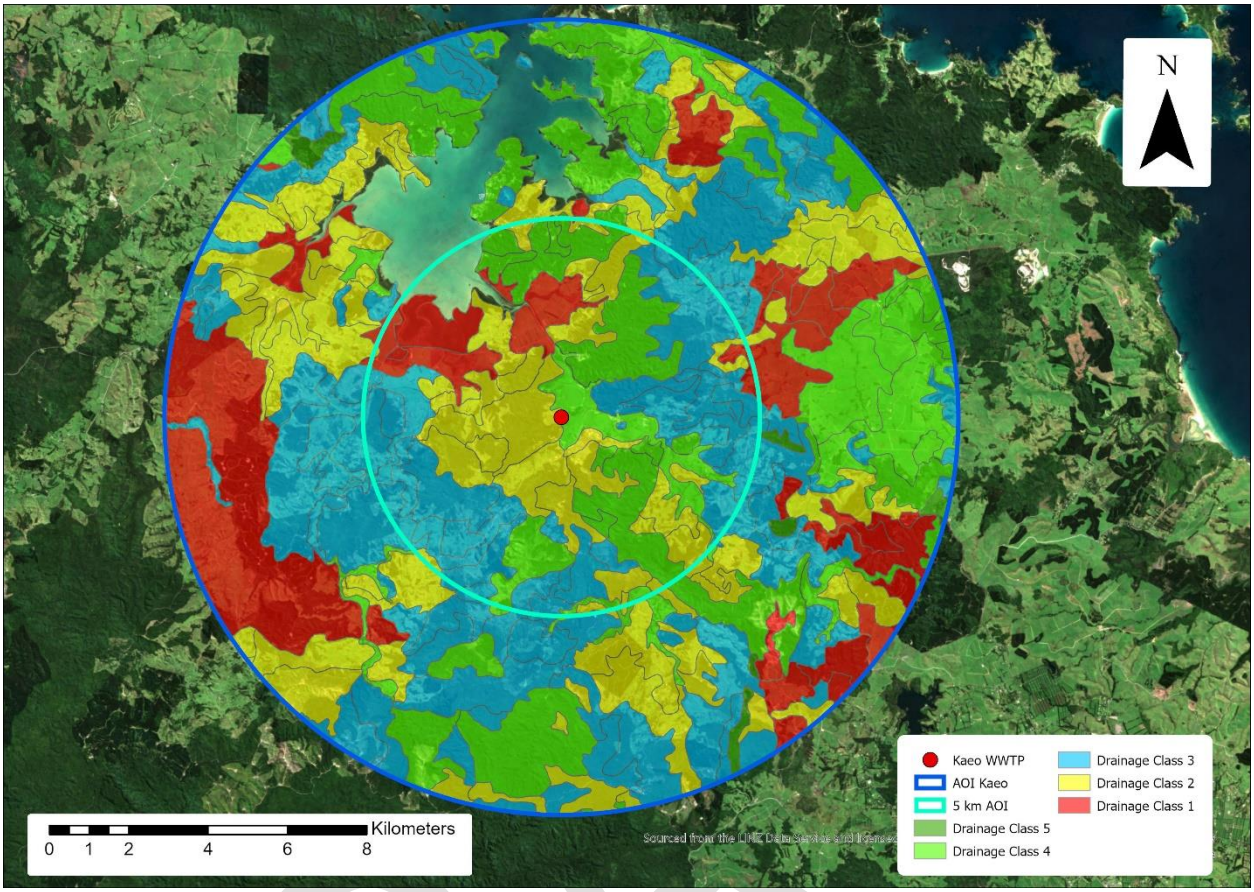

Figure 1: Soil Drainage Classes

For the purposes of this analysis a high-level approach was used to give an indicative drainage class that could be associated with the underlying soil as a comparison tool for potential sites. On-site testing to confirm the drainage of the soil would need to be carried out in the event any options are taken forward for further consideration.

5. Groundwater considerations

NRC does not currently monitor groundwater in the Kaeo area, and no groundwater investigations have been undertaken by FNDC. Therefore, onsite investigations will need to be undertaken to determine groundwater levels and flows relative to the site selected for disposal. Registered bores can be found in the Kaeo AOI and there will likely also be unconsented bores in the area. The proximity of any known bores will need to be identified if any of the options are further investigated. It can be assumed that any bore onsite of an option which is implemented will be decommissioned unless appropriate buffer distances can be accommodated within the irrigation system design.

It is vital that a flow path be charted for the treated wastewater once it has been disposed to land so that FNDC can be confident that it will not turn into an environmental or public health risk. This can be achieved using well-placed bores which are monitored to establish flow rates, depth, and direction. It is important

that this monitoring accurately reflect yearly flows and so should be done for the period of at least one year though winter months where the flows will be highest.

6. Hydraulic Loading Rate Design Basis

Following the method used by Jacobs (2020) the hydraulic loading rate has been determined based on an estimated percolation rate, average annual rainfall, and the average annual evapotranspiration for Kaeo. Annual rainfall and evapotranspiration data used is NIWA Cliflo data from the nearest stations which document that data. Rainfall was taken from the Kaeo Northland site (Network Number: A53071) and evapotranspiration was taken from the Kerikeri Ews site (Network Number: A53191).

The preliminary design for soil permeability is determined using NZS1547 (2012) which provides a broad estimate of between 60 – 120 mm/day for massive clay loam land disposal systems. This range was used to differentiate the drainage classes being considered (2 – 5) as in Table 6 below.

Table 6: Soil Permeability

Drainage Class	Preliminary Soil Permeability (mm/day)
2	60
3	80
4	100
5	120

An example of this method can be found in Table 7 below which finds a hydraulic loading rate of 4.32 mm/d for areas with a drainage class of 5. Therefore, this result is the best possible case for the area of interest and is only slightly outside the range of 3 – 5 mm/d suggested by Tonkin + Taylor (2019) for land disposal for the Ahipara WWTP.

The hydraulic loading rate found for drainage class 2 is 1.32 mm/day which is below the range considered by Tonkin + Taylor (2019). Due to the imperfectly draining nature of the class this was considered appropriate.

Table 7: Hydraulic Loading Rate Example

Parameter	Units	Value	Comment
Soil Type	-	Clay Loam	NRC Managing NZ Soils Fact Sheet Viewer
Soil Permeability (Preliminary Design)	mm/day	120	Category 4, Table 5.2 NZS1547 (2012)
Design Safety Factor	%	5	USEPA (2006)
Design Annual Percolation Rate	mm/day	6	Soil Permeability x Design Safety Factor
Annual Rainfall	mm/year	1460	NIWA (Average from past 4 years)

Annual Evapotranspiration	mm/year	782	NIWA (Average from past 4 years)
Hydraulic Loading Rate	mm/day	4.14	Percolation – Rainfall + Evapotranspiration

7. Land Disposal Design Basis

Using the values reported for the average daily flow and the hydraulic loading rate, total land disposal area requirements can be calculated. These land area requirements are reported in Table 8 for drainage class 2 and 5 to show the range considered for sizing the land disposal system. The total land requirement includes a 50% buffer to account for a storage pond, and potential growth of irrigated area. A 50% buffer has been used to accommodate for the low area requirement for land disposal present due to the low average discharge flow.

A comparison has also been included in Table 8 below to show the difference between 2026 and 2043 requirements based on assumed wastewater flows in 2043. The 50% buffer is added in addition to the exclusion zones applied as detailed in section 9 of this report.

Table 8: Total Area Required for Land Disposal

Parameter	Units	Drainage Class 2	Drainage Class 5
Average Daily Flow (2026)	m^3/day	171	171
Average Daily Flow (2043)	m^3/day	195	195
Hydraulic Loading Rate	mm/day	1.14	4.14
Irrigated Area (2026)	Ha	14.5	4.1
Irrigated Area (2043)	Ha	17.1	4.7
Irrigation Application Method		Spray	Spray
50% Buffer Area (2026)	Ha	7.2 (0.25 * (Irrigated Area))	2.1 (0.25 * (Irrigated Area))
50% Buffer Area (2043)	Ha	8.6 (0.25 * (Irrigated Area))	2.4 (0.25 * (Irrigated Area))
Total Land Area Required (2026)	Ha	21.7	6.2
Total Land Area Required (2043)	Ha	25.7	7.1

8. First-class Exclusion Process

A first-class exclusion zone has been initially developed in Arc GIS Pro for the area of interest based on the following criteria:

- 20 m proximity from all lakes and rivers.
- 20 m proximity from all land not designated rural production, general coastal or minerals.
- Total area for land designated as minerals.
- Total area for flood susceptible land.
- Total area for 50-year coastal flooding and erosion predictions.
- Slope > 12°.
- Soil drainage classes 0 – 1.

Based on these criteria, a desktop GIS analysis was conducted by first creating a 10 km buffer boundary around the Kaeo WWTP. FNDC District Plan zones were included to determine the zoning associated within the AOI. Figures 3 - 7 below show the area of the zones being excluded from further analysis as according to the criteria above.

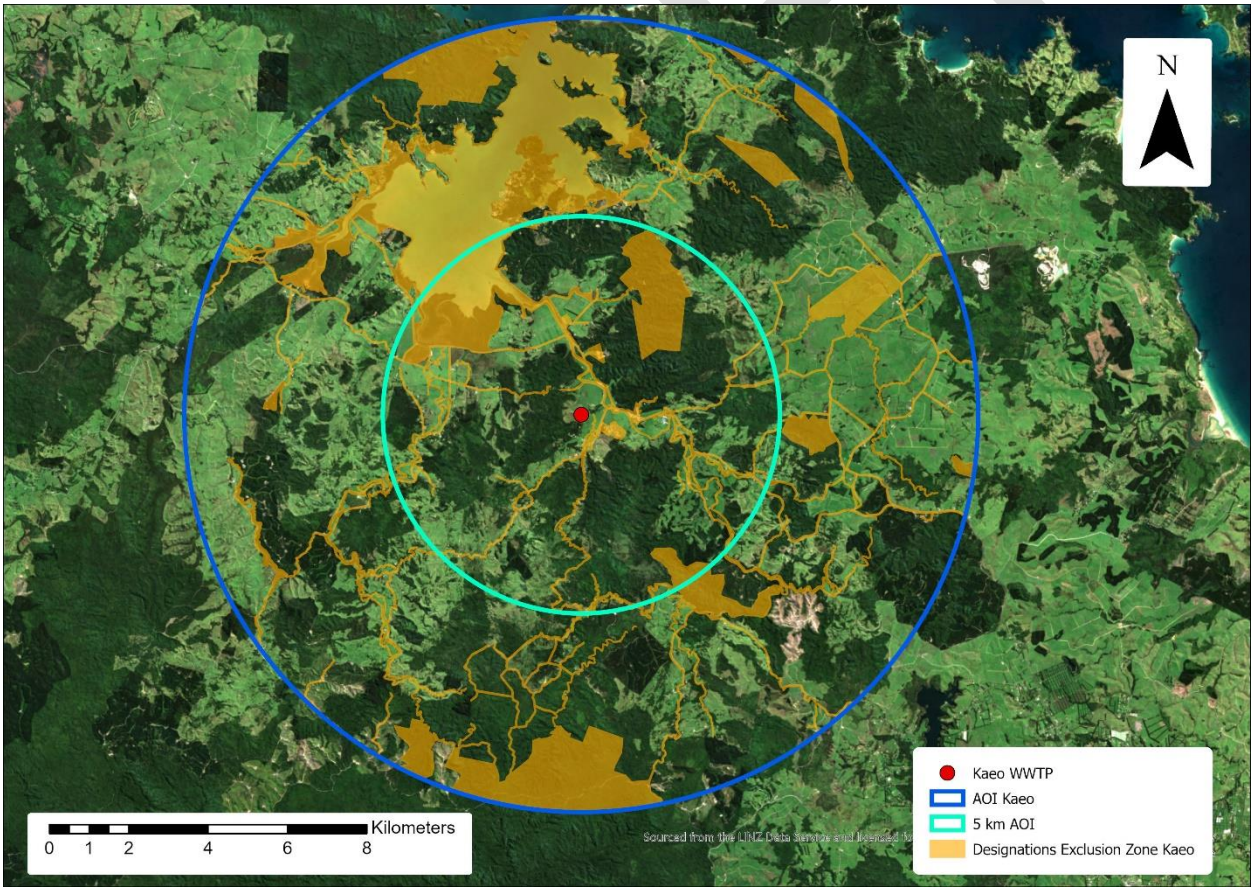

Figure 3: Land Designation

Using this zoning data, all land not zoned as either rural production or general coastal was given a 20m buffer which acts as the designation exclusion zone. The exception to this rule was the minerals zone as

it was deemed that this zoning does not require the same degree of separation due to the anticipated land use not being sensitive to the land disposal activity.

The lines stretching across the AOI is land designated as roads which have also been considered part of the exclusion zone.

River lines were then produced using data from LINZ TOPO50 NZ River Centerlines and given a buffer of 20 m as per the exclusion criteria. The output is depicted in Figure 4 below. Rivers/streams are widespread over the AOI and act as a considerable constraint compared to the other exclusion criteria.

The flood plains were also considered a total exclusion zone and have been included in Figure 4. Because no flood modeling has been completed within the surrounding catchment, the Northland Regional Council Flood Susceptible Land data was used to demarcate 100-year floodplains. It has been used as an exclusion zone due to the potential damage/contamination that could be caused in the event of a flood.

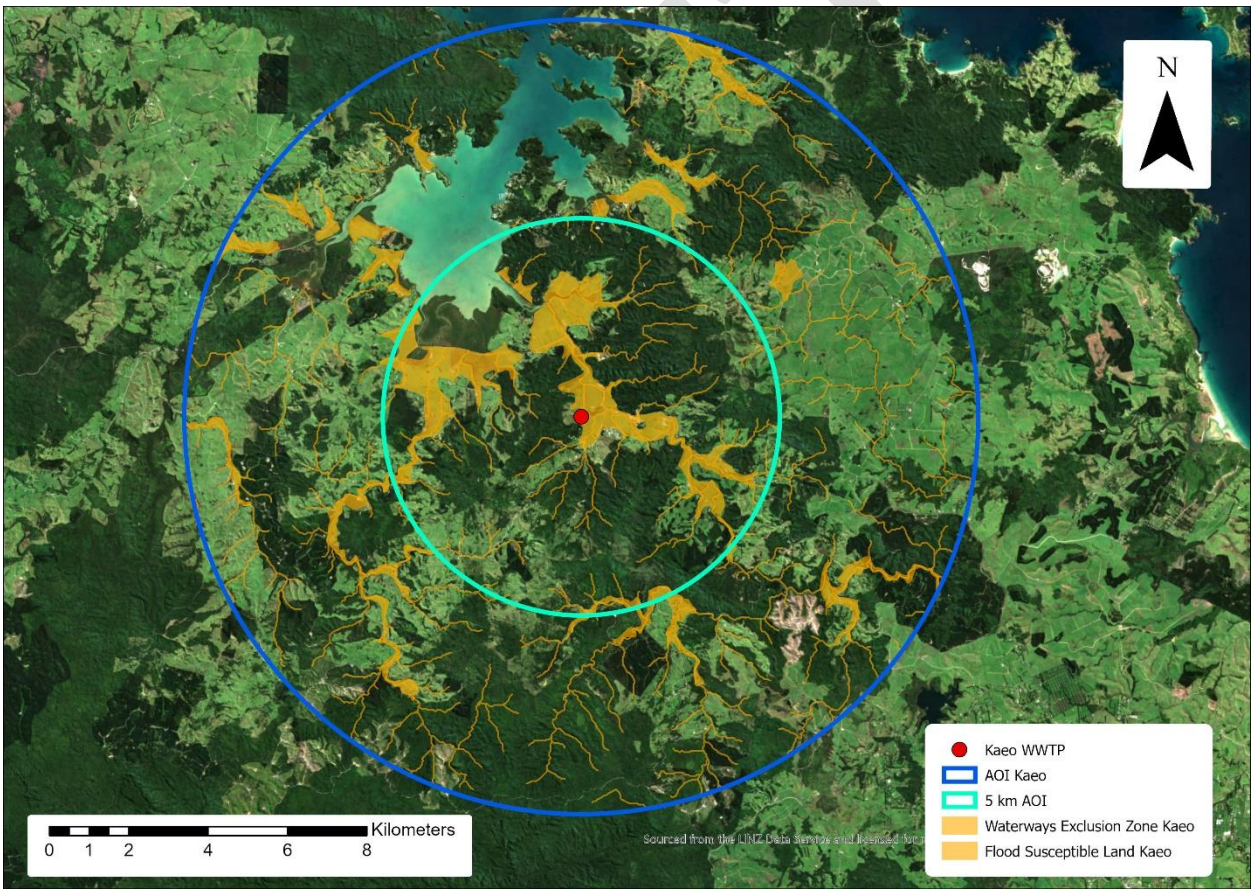

Figure 4: River, Lake, and Flood lands Exclusion Zone

Rivers are spread out across the AOI and have a significant impact on where land disposal can be applied. Flood susceptible land follows the river lines and extends out onto low lying land.

Slopes greater than 12° have been added as an exclusion zone due to the propensity for runoff to be produced from these slopes. Data from LENZ was used first to project the slope data based on a 25m

digital elevation model fitted to 20m digital contour data as seen in Figure 5 below. Following this, the areas above 12° were added to the exclusion zone.

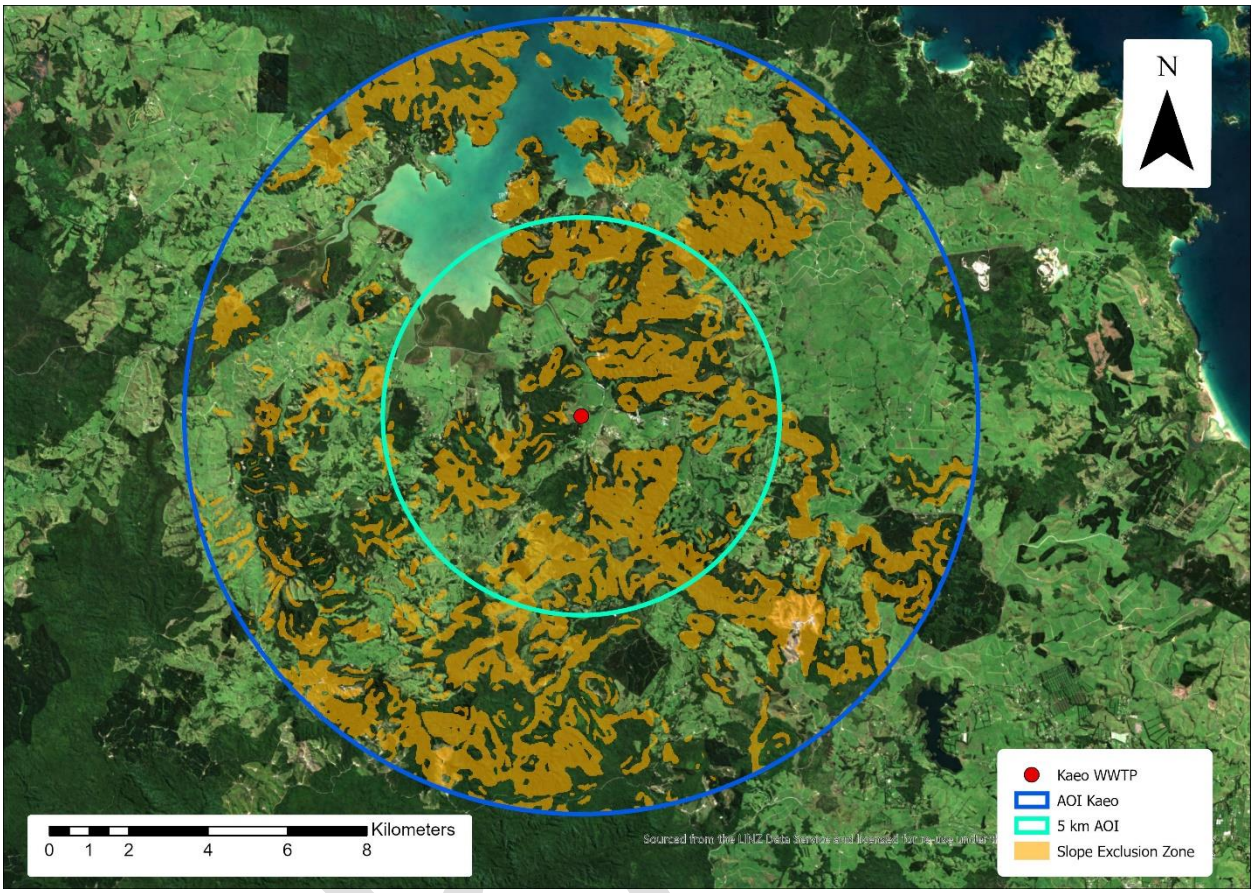

Figure 5: Slope Exclusion Zone

Slopes greater than 12° were found in high quantity throughout the AOI. This is a significant amount of area unavailable for land disposal.

As can be seen in Section 5 of this report, the soil drainage map allows for classes 0 – 1 to be excluded from further consideration. This is shown as an exclusion zone in Figure 6 below.

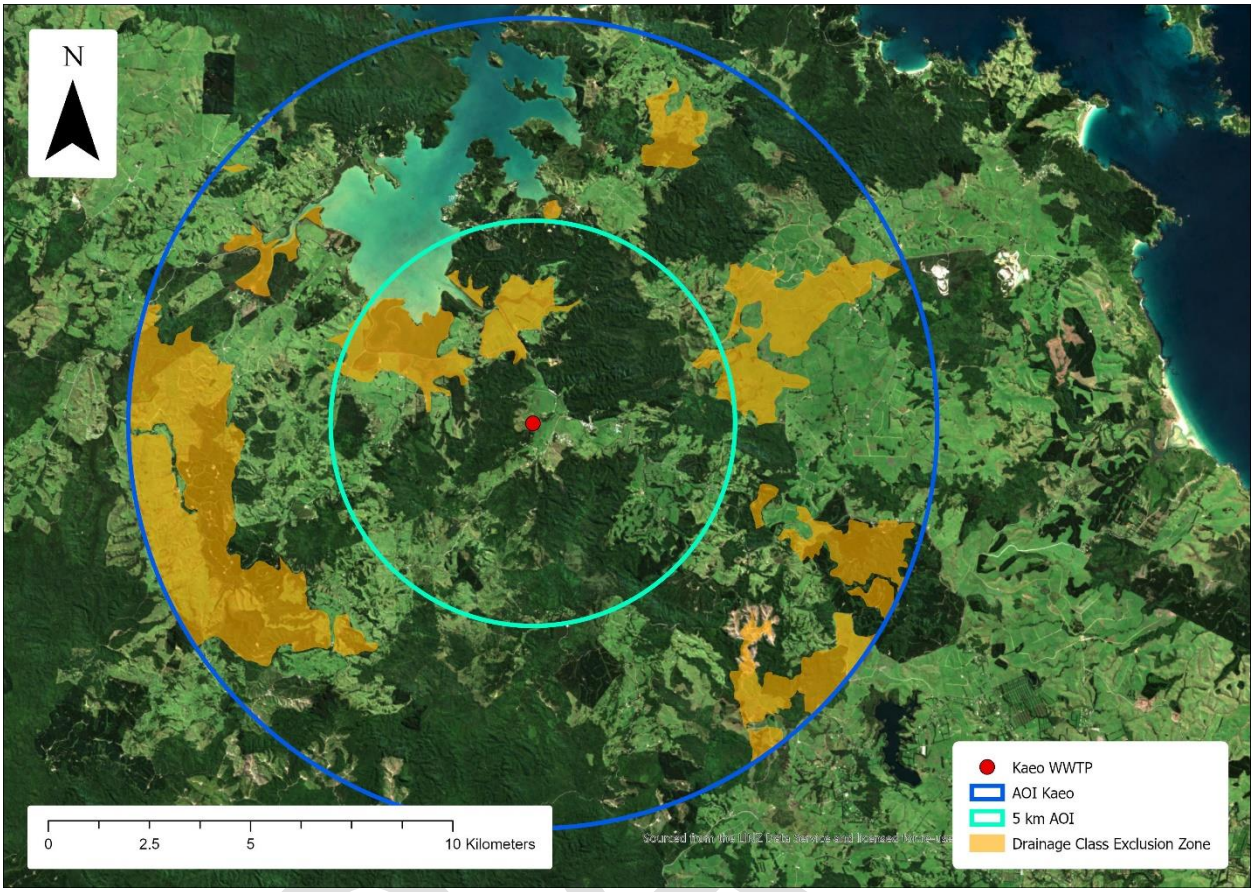

Figure 6: Soil Exclusion Zone

As can be seen, most of the land within the AOI is at a high enough drainage class to be considered for disposal of land. This is due to the large presence of sandstone and greywacke soils which dominate the area and generally have a drainage class between 2 (inconsistent) and 4 (well-draining).

Based on all the first-class exclusions a complete exclusion zone could then be formed as per Figure 7 below.

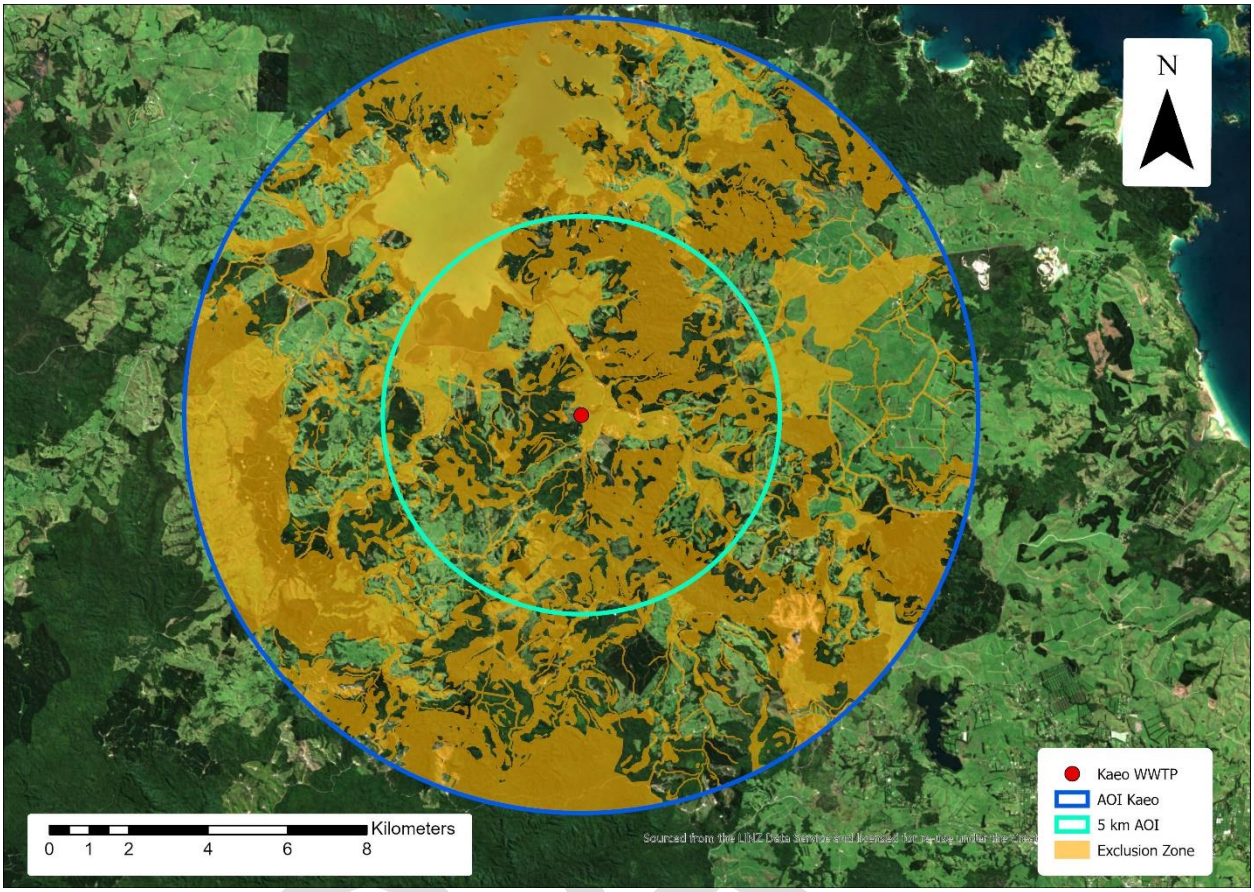

Figure 7: Total Exclusion Zone

As seen, most of the land with the AOI is currently excluded from further considerations due to the above criteria. However, given the relatively small amount of land required for land disposal in Kaeo there are still plenty of options to be considered.

This is shown below where using the total exclusion zone layer, the available land can be shown as in Figure 8.

Coastal flooding and erosion have been determined by NRC at 50 and 100-year intervals. The 100-year zones hold a 5% probability however, and so the 50-year zones have been used instead which have a 66% likelihood. These zones did not add to the exclusion zone area beyond what is already was. Maps for these layers can be supplied on request.

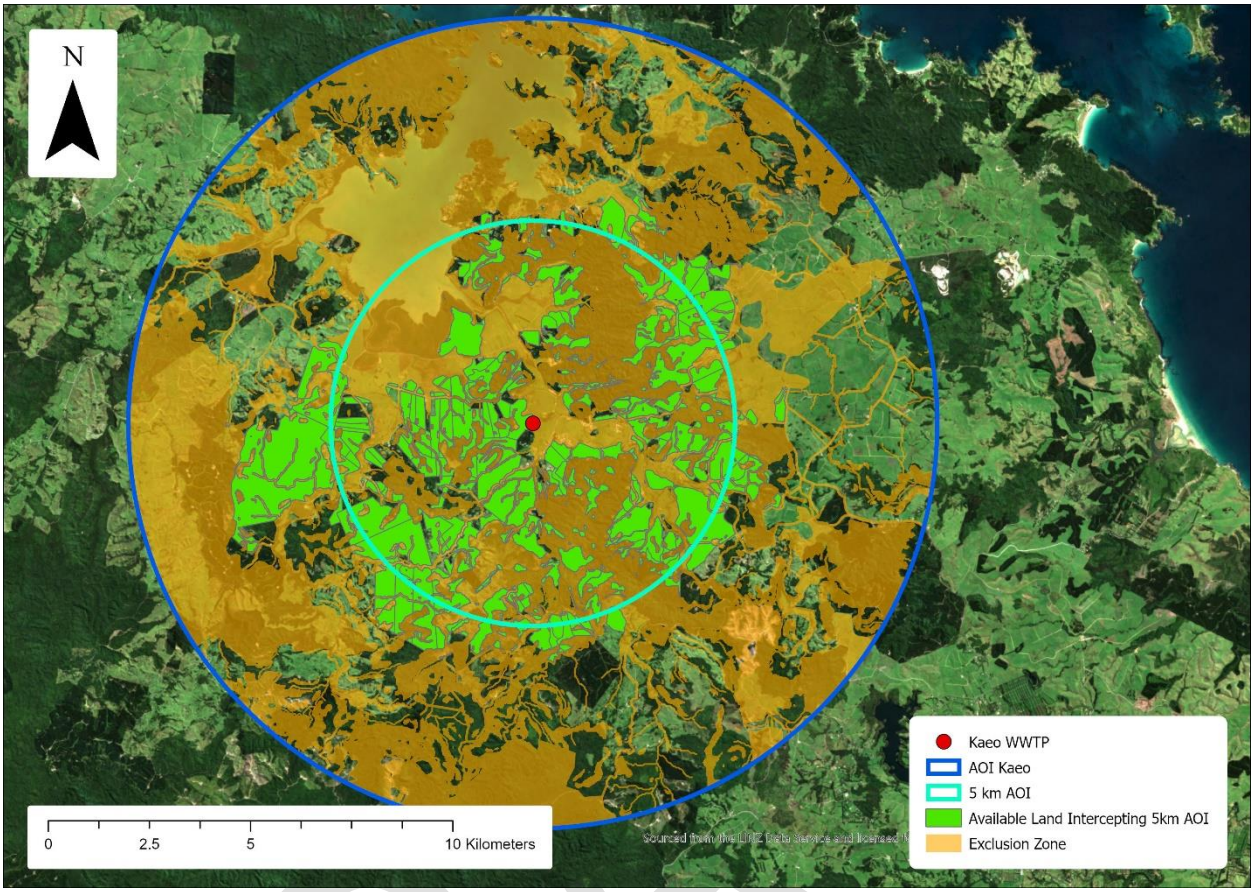

Figure 8: Available Land

The land parcels located outside the exclusion zone were processed using GIS software (ArcMap Pro) to remove small parcels and those that are deemed unusable, in addition to merging land parcels in common ownership. The methodology for this processing is outlined below:

- Available land data initially cleaned of any land parcel area below 1 Ha.
- Additional cleaning of remaining data with parcel intents labelled ROAD, HYDRO, etc. which hold unusable land for disposal.
- Parcel properties are merged based on ownership and proximity. This is done so that total land available from a single owner/ownership group can be used providing that the parcel properties are close together.
- Any land remaining with less than 4.1 Ha is excluded due to being less than the lowest disposal area requirement calculated.

This process has provided an extended list of options which can be further considered for their potential as land disposal sites. In this case there were 113 remaining sites of interest within 5km and therefore available sites further out than that were not included in further analysis. The number of sites is further refined into a long list using the qualitative method detailed in section 10 of this report.

9. Long List Development

The long list was created using the criteria shown in Table 9 below. This initial method of ranking the potential sites was purely quantitative in nature.

Table 9: Long List Criteria

Criteria
Highest Average Hydraulic Loading Rate
Distance from Wastewater Treatment Plant
Lowest Average Slope
Total Available Area for Discharge
Regularity of Site

The long list criteria were determined as follows:

- The resulting 113 sites found in the first-class exclusion process were joined with the underlying soil drainage data using the union tool in Arc GIS Pro. This allowed for the drainage classes of each option to be analyzed.
- Multiple soil drainage class polygons underlined each option and therefore a percentage was developed to show how much of each option contained each drainage class. To achieve this analysis, the available land area information was extracted from Arc GIS Pro and transferred to Excel. Here, the total area of each option was first found by summing the areas for all associated drainage class polygons. This allowed for the area of each drainage class to be given a percentage value for the area they make up of an option in relation to its total area.
- To come up with a numerical field that can be ranked, the percentage values of each drainage class are multiplied by its associated hydraulic loading rate (as calculated in section 6 of this report). This gives each option an indicative hydraulic loading rate which can then be used to score the drainage level of each option.
- Distance from the wastewater treatment plant was scored depending on proximity of the sites. An option which was within 5km would score 1 where an option within 1km would score 5.
- The average slope of each option was calculated in Excel using the AVERAGE function for all soil polygons found within an option. This gives an indicative value for the slopes on-site for each option and allows for them to be scored against each other to find the options with the lowest average slope.
- Lastly, the regularity is calculated by using the ratio AREA:Perimeter^2. This means that cuts within the available areas produced from exclusion criteria result in a lower regularity as they raise the perimeter of the polygons in Arc GIS Pro. However, it was decided that regularity would not be included in this assessment due to it counteracting larger sites from being considered. This is due to them being more likely to have rivers, pockets of high slope, or some other exclusion zone running through them and splitting up the area.

Using the output from the above analysis, scores can be set up for each of the long list criteria based on where an option sits for a certain criterion in relation to the other options. Percentiles were then used to

create 10 possible scores for each criterion based on the results found for all 113 options. An example of this is shown in Table 10 below which details how options are scored for their total available area.

Table 10: Total Available Area Scoring

Percentile	Score
Below 10%	1
Below 20%, Above 10%	2
Below 30%, Above 20%	3
Below 40%, Above 30%	4
Below 50%, Above 40%	5
Below 60%, Above 50%	6
Below 70%, Above 60%	7
Below 80%, Above 70%	8
Below 90%, Above 80%	9
Above 90%	10

The scoring for each of the criterion were then used to develop the long list using the weightings shown in Table 11 below. Hydraulic loading rates were considered the most important factor for considering land disposal and therefore got a highest weighting. Distance to the wastewater treatment plant has been proven as a significant factor in the cost of implementation and therefore was weighted accordingly. As slopes above 12° were excluded earlier this was deemed a less important criterion though it is noted that the lower the slope on-site, the better it is for land disposal and therefore it was included. Total available area allows for more options to be considered at the site but due to the small area needed for land disposal in Kaeo was given a low weighting.

Table 11: Long List Weighting

Criteria	Weighting
Highest Average Hydraulic Loading Rate	33.0%
Distance from Wastewater Treatment Plant	25.0%
Lowest Average Slope	17.0%
Total Available Area for Discharge	17.0%
Regularity of Site	8.0%

The weightings for each of the criteria were then multiplied by the associated score for each option to develop an overall ranking for each site. Based on this ranking, the top 10 sites were taken forward for further analysis using a multi-criteria analysis (MCA) which considered qualitative information. These 10 sites are included in Appendix B alongside the information used for the MCA. It is important to note that this does not rule out the remaining 113 options from consideration. Should the options taken forward prove unviable then additional sites from the available land list can be taken forward based on their ranking to be considered further.

Also included in Appendix B is the total available land in hectares. All sites identified have an available area of at least 7 Ha and therefore can support land disposal provided they have adequate soil drainage. This will need to be determined using on-site investigations which test the soils at key locations.

10. Multi-Criteria Analysis

A multi-criteria analysis (MCA) has been carried out to further rank the top 10 sites from the long list options. The MCA considers four additional criteria as shown in Table 11 below. The initial weighting of the criteria is as below, however, numerous different weighting scenarios were considered in a sensitivity analysis.

On top of the criteria listed in Table 12, bore locations and property ownership type (Public, Private, Maori) were found for each site. It was deemed that any bores onsite could be closed off before implementation of land disposal and therefore not considered in the MCA. Ownership type was excluded from the MCA and was instead set for later consideration should any sites be taken forward. However, in this case all 11 sites are on private freehold land.

Treaty settlement land was also considered following the MCA to identify if the proposed land was settled. None of the land being considered is settled, however, discussion with local iwi will need to take place to appropriately define whether each site is culturally acceptable for use.

Table 12: MCA Criteria

Criteria	Weighting
Long List Score	40%
Proximity to archaeological sites of significance	20%
Statutory Considerations (SNA, Wetlands)	20%
Existing Land Use (Land Cover, Aerials, LINZ Land Use)	20%

The initial long list ranking for each of the options was first recognized as a factor which needed to be considered due to its importance in site selection.

Impacts that the options could have on cultural sites and values is an important consideration which will not be included in the MCA due to it needing to be assessed in partnership with mana whenua. However, local marae and known sites of significance have been mapped in preparation for those discussions. Instead, archaeological sites of significance identified by NZAA have been used to identify the potential importance of the land area as a determinant for ease of consent.

Lastly, the existing land use has been determined by using the land cover database (LCDB), and locations of Significant Natural Areas (SNA) in the AOI. This was then verified using aerial photography with Photoblique. As with the drainage class, the land cover database is joined with the available land using a union in GIS and a percentage calculated for how much of the option is covered by certain types of land (e.g. High Production Exotic Grassland). SNA's are found in FNDC's geodatabase and if they cross one of the long-listed options, their impact on the usage of the site is determined and scored appropriately.

Considerations of any wetlands are also included in the land use category.

The results of this analysis can be seen below in Figures 9 – 10. Figure 9 shows the results of the chosen weighting from Table 12, where Figure 10 shows the variance exhibited by the sensitivity analysis in which differing weightings were compared. A score of 5 would represent a maximum score, whilst a score of 0 represents a minimum score for both figures.

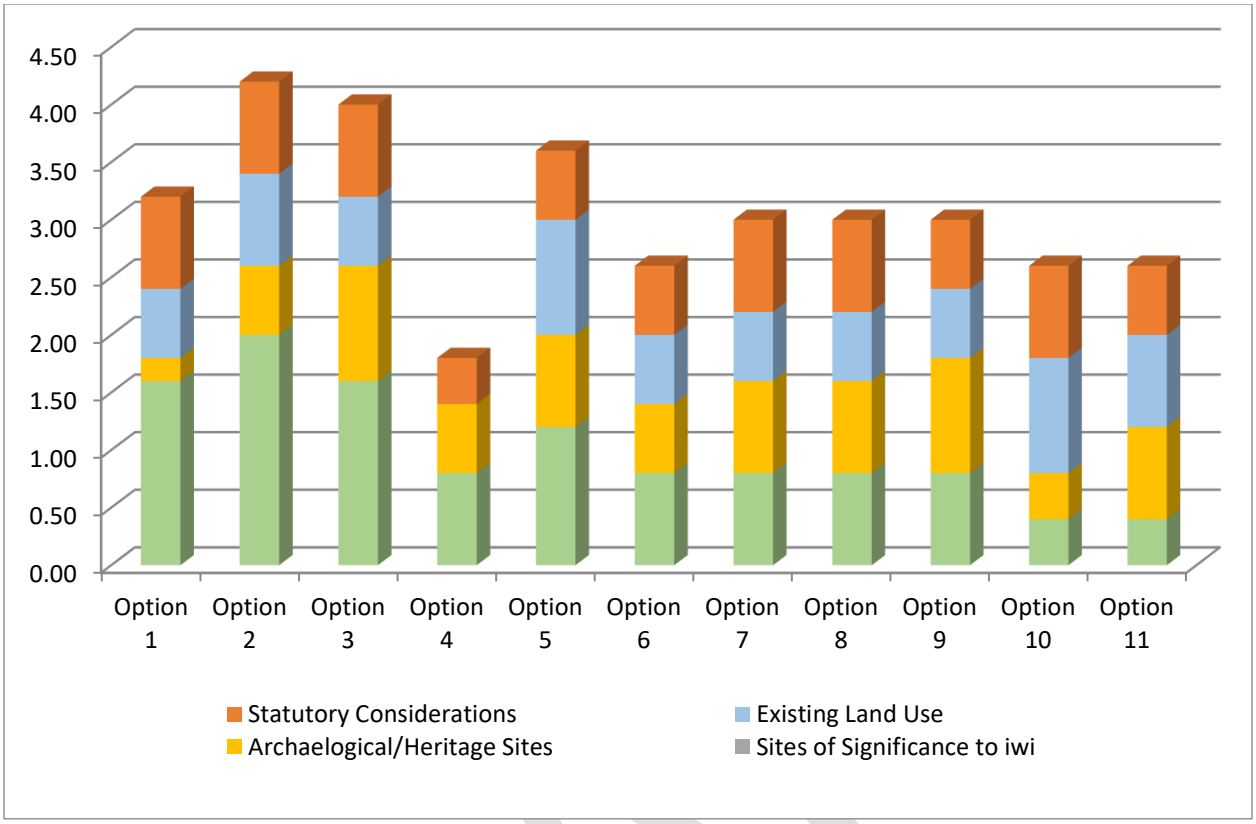

Figure 9: MCA Results

Option 2 was the top option and therefore investigated further in preparation for economic analysis. This investigation found that there were multiple dwellings with 150m of the site which would place restrictions on the method of disposal that would increase costs. It was decided instead to conduct the economic analysis on option 3 upon investigation finding it did not deal with the same issue.

The economic analysis provides FNDC a cost estimate to develop a wastewater discharge to land scheme (with -35% to +50% margin of error) to go to the community and council with. Discussion with the community and elected members as well as a rating impact assessment of the estimated cost will determine if land disposal is economically viable.

For more detail on the options displayed in Figure 9 above, see Appendix B for the sites location and long list ranking scores such as hydraulic drainage rates, and total available area for disposal.

All other options which were considered in the long list are still viable and should be considered in order of rank should the top 11 sites above prove unviable for land disposal. Should this be the case, then an MCA will be conducted from the next ten options from the long list to be investigated.

A sensitivity analysis was also conducted as below in Figure 10 to confirm the original findings.

Sensitivity: General

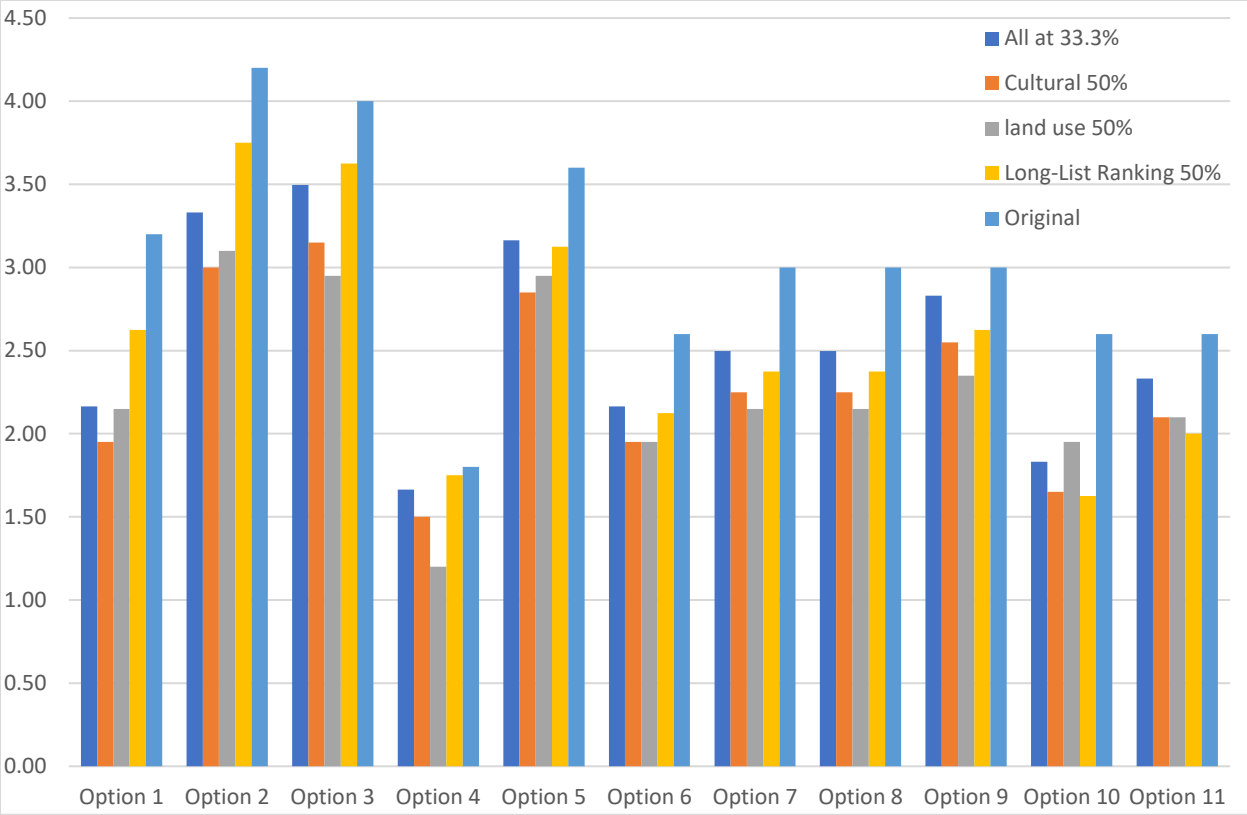

Figure 10: MCA Sensitivity Analysis

From this graph a consistent trend can be seen across the various scenarios indicating that the original weighting is reputable. This gives confidence in the original weighting results and allows for the scoring to be followed up on for further investigations should that be supported by council.

11. Closing Remarks

The Kaeo high-level economic analysis has been included as Appendix A which includes site specific costing prepared for option 3 in this report. The costing does not include land purchase or potential upgrades required by the Kaeo WWTP to discharge to land. Community engagement will be imperative to develop the relationships over time to properly consider land disposal as a viable option.

The high-level economic analysis can enable us to determine a cost estimate for establishing a wastewater discharge to land scheme for Kaeo. The cost estimate can then be used to estimate the rating impact of such a scheme. Estimated costs of a project are often criteria for determining whether a project should go ahead. While the costs for this project are relatively high, further investigation into the option of wastewater disposal to land may be warranted when considering other criteria such cultural and community preference.

If the option of wastewater discharge to land for Kaeo is to be progressed, the next steps include engagement with mana whenua and specific landowners to identify a preferred site or sites for on-site testing. On-site testing will seek to validate findings from the desktop analysis and investigate any

unforeseen issues with the sites. Upon selection of preferred site that meets technical, cultural and landowner approval, a concept scheme design can be developed that includes an assessment of potential environmental effects of the proposed activity. Costs will also need to be revised and updated based upon the results of the concept design, which can then be taken to council again for a decision on whether a land disposal scheme should be implemented for the township of Kaeo.

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Stakeholder/Partner Group	Role/Connection	Benefits of Involvement	Level of Interest	Level of Impact	Level of Influence
Individuals, sectors, or known groups.	*Role of stakeholder/partner and their connection to the project/proposition.* *What expectation does the stakeholder/partner have for their level of participation in the project?*	*What the stakeholder/partner can bring to the project that is of benefit.*	*What level of interest exists for the final outcome?*	*What level of impact will the project have on the stakeholder/partner?*	*What level of influence will be exhibited on the final outcomes? (Our promise - what is the highest level of participation we are prepared to offer?)*
Landowners of DTL project	Supplier (land purch/lease), end-user irrigation. High expectation of participation	Provides Land - Essential For Success of Project	High	High	Collaborate
Northland District Health Board	Public health and safety	Public safety assurances/trust	Medium	Low	Consult
Elected members (Infrastructure Committee)	Decision-making. Expect to be informed to be able to make decisions. Governing Body.	Decision making	Medium	Medium	Consult
Kaeo community (KC) (broad)	End-user of critical infrastructure. Use or have a relationship with the awa and moana.	Improve understanding of magnitude of effects, historical accounts of effects. Generate new ideas to mitigate adverse effects.	Medium	Medium	Consult
Rated community	Financial impact of DTL options	Inform FNDC on Affordability.	High	High	Consult
Neighbours to KWWTP	Nuisance effects of operation	Mitigating adverse effects (potential or actual).	Medium	Medium	Consult
Departmetnt of Conservation	Effects on indigenous biodiversity	Improve understanding of magnitude of effects, historical accounts of effects. Generate new ideas to mitigate adverse effects.	Medium	High	Consult
Aquaculture/Oyster Farming (Whangaroa)	Safety of harvested shellfish for human consumption	Improve understanding of magnitude of effects, historical accounts of effects. Generate new ideas to mitigate adverse effects.	High	High	Consult
Morgan whanau	kaitiaki mana whenua, highly interested/active in Council business/activity	Improve understanding of Te Mana o te Wai to Maori. Whanau trust and relationship development	Medium	Medium	Inform
Pouhere Taonga	DTL, sites downstream of discharge	Archaeological authority requirements, sites of heritage/arch significance	Medium	Medium	Consult
Te Runanga o Whaingaroa	Partnership role. High expectation of participation (local office first).	Treaty Partner. Help in facilitating engagement. Good relationship is critical to success of project.	High	High	Involve
Plastic free Kaeo	Big picture/active participants in sustainability. Water conservation, wastewater minimisation. Active and connected to community.	leverage their community connectedness (collaborative events), trusted information provider	Low	Low	Inform
Whangaroa Health Services (Charitable Trust)	Multiple service offerings to community (www.whst.org.nz). Highly connected/influential/trusted by community	leverage their community connectedness (collaborative events), trusted information provider	Medium	Low	Inform
Ecosolutions	(well) Funded by MFE. Good connections with likeminded people (sustainability), sustainable land practices, community garden projects, WHST.	leverage their community connectedness (collaborative events), trusted information provider. May want to offer ideas on waste management solutions/alternatives assessment contributions	Medium	Low	Inform
Predator free groups	Interest only.	Collaborative events and information sharing	Low	Low	Inform
River liaison management group (FNDC/NRC/Landowners/TRoW)	Significant interest RE enhancement and improvement of Te Mana o te Wai. Main focus is flooding at the moment.	Improve understanding of magnitude of effects, historical accounts of effects. Generate new ideas to mitigate adverse effects.	High	High	Involve
Waka Kotahi NZ Transport Agency	Active in Kaeo (for SH10 1-lane bridge). Interested in the project. Information sharing.	Sharing of contacts and experience of engagement in the Kaeo community	Low	Low	Inform
Waka Ama / Waka Atea	Shane Storey has a bit to do with the lady that runs it. Have large waka as well as waka ama. Kim to do a bit of follow up. High interest and expectation of participation as WQ has to be suitable for contact recreation for them to be able to get out on the water safely.	Improve understanding of magnitude of effects, historical accounts of effects. Generate new ideas to mitigate adverse effects.	Medium	Low	Inform
Great Whangaroa Kiwi Can Raft Race	High interest and expectation of participation due to impact WQ for contact recreation has to safety of participants and ability to hold event safely	Improve understanding of magnitude of effects, historical accounts of effects. Generate new ideas to mitigate adverse effects.	Medium	Low	Inform
Recreational users (awa, moana)	High interest and expectation of participation due to safety issue of kai moana/contact recreation. Role will be defined via individuals who identify recreational use interest.	Improve understanding of magnitude of effects, historical accounts of effects. Generate new ideas to mitigate adverse effects.	Low	Medium	Inform
Whangaroa District Notice Board Group (FB)	High interest but low expectation to participate given this is a medium for individuals as opposed to formal group. Posts will generate feedback. Tool to help find people who want to be involved/particpate.	Improve understanding of magnitude of effects, historical accounts of effects. Generate new ideas to mitigate adverse effects.	High	Low	Inform
Whangaroa Community Trust	Bruce Mills/Eljon Fitzgerald. Improving amenities, Christmas Parade organisers, placemaking. People may go to the Trust for more information (high trust/low trust facilitation). Expect to be involved, will participate/mobilise (see ELC).	Improve understanding of magnitude of effects, historical accounts of effects. Generate new ideas to mitigate adverse effects.	Medium	Low	Inform

Stakeholder/Partner Group	Role/Connection	Benefits of Involvement	Level of Interest	Level of Impact	Level of Influence
Individuals, sectors, or known groups.	*Role of stakeholder/partner and their connection to the project/proposition.* *What expectation does the stakeholder/partner have for their level of participation in the project?*	*What the stakeholder/partner can bring to the project that is of benefit.*	*What level of interest exists for the final outcome?*	*What level of impact will the project have on the stakeholder/partner?*	*What level of influence will be exhibited on the final outcomes? (Our promise - what is the highest level of participation we are prepared to offer?)*
Whangaroa College	BoT level, medium expectation of involvement (DTL upstream may require higher involvement). Sliding scale (see ELC)	Improve understanding of magnitude of effects, historical accounts of effects. Generate new ideas to mitigate adverse effects.	Medium	Low	Inform
Creative minds early learning centre	Nuisance, health and safety concerns. Sliding scale of participation expectations depending on proximity, information sharing and knowledge	Improve understanding of magnitude of effects, historical accounts of effects. Generate new ideas to mitigate adverse effects.	Low	Low	Inform
Bowling Club	may be near DTL site (BB to check)? Nuisance, health and safety concerns. Sliding scale of participation expectations depending on proximity, information sharing and knowledge	Improve understanding of magnitude of effects, historical accounts of effects. Generate new ideas to mitigate adverse effects.	Low	Low	Inform
BOI Community Board	Representatives of community. Influential to decision-making for DTL. Bruce Mills BOI/Kaeo-Whangaroa, Cr Rachel Smith, Cr Clendon Council appointed representatives. Expect to be informed (Method: Workshop to give/receive their feedback)	Provide representation for the Kaeo community.	High	Medium	Consult
Kaeo Service Centre	Anna works there so need to keep her updated as a means of sharing information.	Allows for a local centre where community member can go to keep informed/ask questions.	Low	Low	Inform
Ventia	Responsible for operation of Kaeo WWTP.	Improve understanding of the current performance and issues of the Kaeo WWTP	Medium	Medium	Involve
Northland Regional Council	Consenting authority, state of the environment data, river hydrology	PRE-APPLICATION: Up to date guidance on application info expectations. SoE data and consent information sharing.	Low	High	Consult
Kaeo Primary Scheool	may be near DTL site (BB to check)? Nuisance, health and safety concerns. Sliding scale of participation expectations depending on proximity, information sharing and knowledge	Improve understanding of magnitude of effects, historical accounts of effects. Generate new ideas to mitigate adverse effects.	Low	Low	Inform

Marae Name	Wharenui	Location	Iwi *	Hapu
Mangaiti	Tau te Rangimarie	Omaunu Road	Ngapuhi/Ngati Kahu ki Wh	Ngati Pakahi
Pupuke	Te Huia	Te Huia Marae Road	Ngapuhi/Ngati Kahu ki Wh	Ngati Pakahi
Mangaiti	Tau te Rangimarie	Omaunu Road	Ngapuhi/Ngati Kahu ki Wh	Ngati Uru
Pupuke	Te Huia	Te Huia Marae Road	Ngapuhi/Ngati Kahu ki Wh	Ngati Uru
Pupuke	Te Huia	Te Huia Marae Road	Ngapuhi/Ngati Kahu ki Wh	Whanau Pani

Marae	Rep
Karangahape	Stephen Rush (Paddy)
Mangatōwai	Chris Henare
Ngaitupango	Karen Williams
Ōtangaroa	Liane Panui
Tākou	Hoki Tua
Taupō	Murray Moses
Te Tahaawai	Leilani Payne
Te Huia	Toa Faneva
Te Patunga	Ruth Heta
Te Tangata	Charlene Adams
Waihapa	Natalie Williams

For more information please contact governance@whaingaroa.iwi.nz

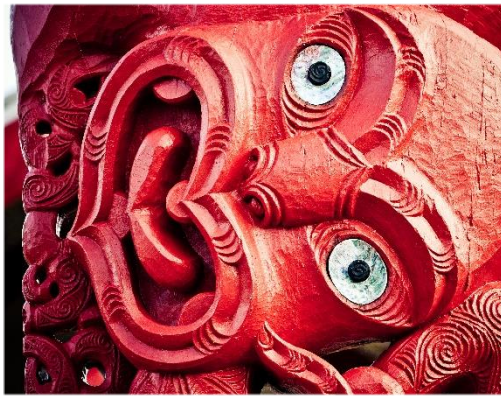
AVERAGE CAPITAL Rate - per connection	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Option Estimate	$ -	$ -	$ -	$ -	$ 1,205.60	$ 1,183.26	$ 1,160.91	$ 1,138.57	$ 1,116.22	$ 1,093.88
Option Estimate 30%	$ -	$ -	$ -	$ -	$ 843.92	$ 828.28	$ 812.64	$ 797.00	$ 781.35	$ 765.71
Option Estimate 50%	$ -	$ -	$ -	$ -	$ 1,808.40	$ 1,774.88	$ 1,741.37	$ 1,707.85	$ 1,674.33	$ 1,640.81

OPERATING Rate per connection	Rate based on opex spend on Options
Option Estimate	$ -
Option Estimate 30%	$ -
Option Estimate 50%	$ -

Current connections	CAPITAL	OPERATING
Connections	240	13038
Availability Pans		4071
Weighted Numbers	**240**	**15481**

Interest Rates										
Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
0.022	0.018	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015

			Cost Estimates										Depreciation										Debt Repayment										Interest									
Asset Detail	Total Spend	Average Depreciable Life	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Option Estimate																																										
Pre-engineered	179,608	30				179,608							0	0	0	0	5,987	5,987	5,987	5,987	5,987	5,987	0	0	0	0	8,980	8,980	8,980	8,980	8,980	8,980	0	0	0	0	2,694	2,559	2,425	2,290	2,155	2,021
4.7km of PE125	1,765,061	100				1,765,061							0	0	0	0	17,651	17,651	17,651	17,651	17,651	17,651	0	0	0	0	88,253	88,253	88,253	88,253	88,253	88,253	0	0	0	0	26,476	25,152	23,828	22,505	21,181	19,857
Allowance for air	81,640	70				81,640							0	0	0	0	1,166	1,166	1,166	1,166	1,166	1,166	0	0	0	0	4,082	4,082	4,082	4,082	4,082	4,082	0	0	0	0	1,225	1,163	1,102	1,041	980	918
Kaeo River	97,968	50				97,968							0	0	0	0	1,959	1,959	1,959	1,959	1,959	1,959	0	0	0	0	4,898	4,898	4,898	4,898	4,898	4,898	0	0	0	0	1,470	1,396	1,323	1,249	1,176	1,102
Electrical control	81,640	20				81,640							0	0	0	0	4,082	4,082	4,082	4,082	4,082	4,082	0	0	0	0	4,082	4,082	4,082	4,082	4,082	4,082	0	0	0	0	1,225	1,163	1,102	1,041	980	918
Irrigation system	1,477,687	30				1,477,687							0	0	0	0	49,256	49,256	49,256	49,256	49,256	49,256	0	0	0	0	73,884	73,884	73,884	73,884	73,884	73,884	0	0	0	0	22,165	21,057	19,949	18,841	17,732	16,624
Planting of	591,075	25				591,075							0	0	0	0	23,643	23,643	23,643	23,643	23,643	23,643	0	0	0	0	29,554	29,554	29,554	29,554	29,554	29,554	0	0	0	0	8,866	8,423	7,980	7,536	7,093	6,650
Storage pond 75m	1,518,507	50				1,518,507							0	0	0	0	30,370	30,370	30,370	30,370	30,370	30,370	0	0	0	0	75,925	75,925	75,925	75,925	75,925	75,925	0	0	0	0	22,778	21,639	20,500	19,361	18,222	17,083
Site preparation	122,460	50				122,460							0	0	0	0	2,449	2,449	2,449	2,449	2,449	2,449	0	0	0	0	6,123	6,123	6,123	6,123	6,123	6,123	0	0	0	0	1,837	1,745	1,653	1,561	1,470	1,378
Pond Area Fencing	62,308	15				62,308							0	0	0	0	4,154	4,154	4,154	4,154	4,154	4,154	0	0	0	0	3,115	3,115	3,115	3,115	3,115	3,115	0	0	0	0	935	888	841	794	748	701
Irrigation pump	40,820	15				40,820							0	0	0	0	2,721	2,721	2,721	2,721	2,721	2,721	0	0	0	0	2,041	2,041	2,041	2,041	2,041	2,041	0	0	0	0	612	582	551	520	490	459
Electrical,	48,984	10				48,984							0	0	0	0	4,898	4,898	4,898	4,898	4,898	4,898	0	0	0	0	2,449	2,449	2,449	2,449	2,449	2,449	0	0	0	0	735	698	661	625	588	551
Consent	150,000	15				150,000							0	0	0	0	10,000	10,000	10,000	10,000	10,000	10,000	0	0	0	0	7,500	7,500	7,500	7,500	7,500	7,500	0	0	0	0	2,250	2,138	2,025	1,913	1,800	1,688
													0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Opex		0											0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	6,217,760		**0**	**0**	**0**	**6,217,760**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**158,337**	**158,337**	**158,337**	**158,337**	**158,337**	**158,337**	**0**	**0**	**0**	**0**	**310,888**	**310,888**	**310,888**	**310,888**	**310,888**	**310,888**	**0**	**0**	**0**	**0**	**93,266**	**88,603**	**83,940**	**79,276**	**74,613**	**69,950**
Option Estimate -30%																																										
Pre-engineered	125,726	30				125,726							0	0	0	0	4,191	4,191	4,191	4,191	4,191	4,191	0	0	0	0	6,286	6,286	6,286	6,286	6,286	6,286	0	0	0	0	1,886	1,792	1,697	1,603	1,509	1,414
4.7km of PE125	1,235,543	100				1,235,543							0	0	0	0	12,355	12,355	12,355	12,355	12,355	12,355	0	0	0	0	61,777	61,777	61,777	61,777	61,777	61,777	0	0	0	0	18,533	17,606	16,680	15,753	14,827	13,900
Allowance for air	57,148	70				57,148							0	0	0	0	816	816	816	816	816	816	0	0	0	0	2,857	2,857	2,857	2,857	2,857	2,857	0	0	0	0	857	814	771	729	686	643
Kaeo River	68,578	50				68,578							0	0	0	0	1,372	1,372	1,372	1,372	1,372	1,372	0	0	0	0	3,429	3,429	3,429	3,429	3,429	3,429	0	0	0	0	1,029	977	926	874	823	771
Electrical control	57,148	20				57,148							0	0	0	0	2,857	2,857	2,857	2,857	2,857	2,857	0	0	0	0	2,857	2,857	2,857	2,857	2,857	2,857	0	0	0	0	857	814	771	729	686	643
Irrigation system	1,034,381	30				1,034,381							0	0	0	0	34,479	34,479	34,479	34,479	34,479	34,479	0	0	0	0	51,719	51,719	51,719	51,719	51,719	51,719	0	0	0	0	15,516	14,740	13,964	13,188	12,413	11,637
Planting of	413,752	25				413,752							0	0	0	0	16,550	16,550	16,550	16,550	16,550	16,550	0	0	0	0	20,688	20,688	20,688	20,688	20,688	20,688	0	0	0	0	6,206	5,896	5,586	5,275	4,965	4,655
Storage pond 75m	1,062,955	50				1,062,955							0	0	0	0	21,259	21,259	21,259	21,259	21,259	21,259	0	0	0	0	53,148	53,148	53,148	53,148	53,148	53,148	0	0	0	0	15,944	15,147	14,350	13,553	12,755	11,958
Site preparation	85,722	50				85,722							0	0	0	0	1,714	1,714	1,714	1,714	1,714	1,714	0	0	0	0	4,286	4,286	4,286	4,286	4,286	4,286	0	0	0	0	1,286	1,222	1,157	1,093	1,029	964
Pond Area Fencing	43,615	15				43,615							0	0	0	0	2,908	2,908	2,908	2,908	2,908	2,908	0	0	0	0	2,181	2,181	2,181	2,181	2,181	2,181	0	0	0	0	654	622	589	556	523	491
Irrigation pump	28,574	15				28,574							0	0	0	0	1,905	1,905	1,905	1,905	1,905	1,905	0	0	0	0	1,429	1,429	1,429	1,429	1,429	1,429	0	0	0	0	429	407	386	364	343	321
Electrical,	34,289	10				34,289							0	0	0	0	3,429	3,429	3,429	3,429	3,429	3,429	0	0	0	0	1,714	1,714	1,714	1,714	1,714	1,714	0	0	0	0	514	489	463	437	411	386
Consent	105,000	15				105,000							0	0	0	0	7,000	7,000	7,000	7,000	7,000	7,000	0	0	0	0	5,250	5,250	5,250	5,250	5,250	5,250	0	0	0	0	1,575	1,496	1,418	1,339	1,260	1,181
Opex		0											0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4,352,432		**0**	**0**	**0**	**4,352,432**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**110,836**	**110,836**	**110,836**	**110,836**	**110,836**	**110,836**	**0**	**0**	**0**	**0**	**217,622**	**217,622**	**217,622**	**217,622**	**217,622**	**217,622**	**0**	**0**	**0**	**0**	**65,286**	**62,022**	**58,758**	**55,494**	**52,229**	**48,965**
Option Estimate +50%																																										
Pre-engineered	269,413	30				269,413							0	0	0	0	8,980	8,980	8,980	8,980	8,980	8,980	0	0	0	0	13,471	13,471	13,471	13,471	13,471	13,471	0	0	0	0	4,041	3,839	3,637	3,435	3,233	3,031
4.7km of PE125	2,647,591	100				2,647,591							0	0	0	0	26,476	26,476	26,476	26,476	26,476	26,476	0	0	0	0	132,380	132,380	132,380	132,380	132,380	132,380	0	0	0	0	39,714	37,728	35,742	33,757	31,771	29,785
Allowance for air	122,460	70				122,460							0	0	0	0	1,749	1,749	1,749	1,749	1,749	1,749	0	0	0	0	6,123	6,123	6,123	6,123	6,123	6,123	0	0	0	0	1,837	1,745	1,653	1,561	1,470	1,378
Kaeo River	146,952	50				146,952							0	0	0	0	2,939	2,939	2,939	2,939	2,939	2,939	0	0	0	0	7,348	7,348	7,348	7,348	7,348	7,348	0	0	0	0	2,204	2,094	1,984	1,874	1,763	1,653
Electrical control	122,460	20				122,460							0	0	0	0	6,123	6,123	6,123	6,123	6,123	6,123	0	0	0	0	6,123	6,123	6,123	6,123	6,123	6,123	0	0	0	0	1,837	1,745	1,653	1,561	1,470	1,378
Irrigation system	2,216,531	30				2,216,531							0	0	0	0	73,884	73,884	73,884	73,884	73,884	73,884	0	0	0	0	110,827	110,827	110,827	110,827	110,827	110,827	0	0	0	0	33,248	31,586	29,923	28,261	26,598	24,936
Planting of	886,612	25				886,612							0	0	0	0	35,464	35,464	35,464	35,464	35,464	35,464	0	0	0	0	44,331	44,331	44,331	44,331	44,331	44,331	0	0	0	0	13,299	12,634	11,969	11,304	10,639	9,974
Storage pond 75m	2,277,761	50				2,277,761							0	0	0	0	45,555	45,555	45,555	45,555	45,555	45,555	0	0	0	0	113,888	113,888	113,888	113,888	113,888	113,888	0	0	0	0	34,166	32,458	30,750	29,041	27,333	25,625
Site preparation	183,690	50				183,690							0	0	0	0	3,674	3,674	3,674	3,674	3,674	3,674	0	0	0	0	9,185	9,185	9,185	9,185	9,185	9,185	0	0	0	0	2,755	2,618	2,480	2,342	2,204	2,067
Pond Area Fencing	93,462	15				93,462							0	0	0	0	6,231	6,231	6,231	6,231	6,231	6,231	0	0	0	0	4,673	4,673	4,673	4,673	4,673	4,673	0	0	0	0	1,402	1,332	1,262	1,192	1,122	1,051
Irrigation pump	61,230	15				61,230							0	0	0	0	4,082	4,082	4,082	4,082	4,082	4,082	0	0	0	0	3,062	3,062	3,062	3,062	3,062	3,062	0	0	0	0	918	873	827	781	735	689
Electrical,	73,476	10				73,476							0	0	0	0	7,348	7,348	7,348	7,348	7,348	7,348	0	0	0	0	3,674	3,674	3,674	3,674	3,674	3,674	0	0	0	0	1,102	1,047	992	937	882	827
Consent	225,000	15				225,000							0	0	0	0	15,000	15,000	15,000	15,000	15,000	15,000	0	0	0	0	11,250	11,250	11,250	11,250	11,250	11,250	0	0	0	0	3,375	3,206	3,038	2,869	2,700	2,531
						0							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Opex		0	0										0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	9,326,640		**0**	**0**	**0**	**9,326,640**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**237,506**	**237,506**	**237,506**	**237,506**	**237,506**	**237,506**	**0**	**0**	**0**	**0**	**466,332**	**466,332**	**466,332**	**466,332**	**466,332**	**466,332**	**0**	**0**	**0**	**0**	**139,900**	**132,905**	**125,910**	**118,915**	**111,920**	**104,925**



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Making sense of the numbers

Rates affordability in the Far North

Hōngongoi 2020

www.berl.co.nz

Authors: Hugh Dixon and Hannah Riley

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Rates as a percentage (%) of gross household income

KEY:
RATES AS A **PERCENTAGE** OF GROSS INCOME

	FNDC RATES %	NRC RATES %	TOTAL RATES %
Region	X.X	X.X	X.X

Single superannuitant
with no other income

	FNDC RATES %	NRC RATES %	TOTAL RATES %
Te Hiku	9.4	1.0	10.5
BOI-Whangaroa	9.9	1.0	10.8
Kaikohe-Hokianga	8.9	1.0	9.8
Total Far North District	**9.0**	**1.2**	**10.2**

Married superannuitant
with no other income

	FNDC RATES %	NRC RATES %	TOTAL RATES %
Te Hiku	6.2	0.7	6.9
BOI-Whangaroa	6.5	0.6	7.1
Kaikohe-Hokianga	5.9	0.6	6.5
Total Far North District	**5.9**	**0.8**	**6.7**

Single working person
(no children)

	FNDC RATES %	NRC RATES %	TOTAL RATES %
Te Hiku	4.5	0.5	5.0
BOI-Whangaroa	4.1	0.4	4.5
Kaikohe-Hokianga	4.7	0.5	5.2
Total Far North District	**4.1**	**0.5**	**4.6**

Single adult with 2 children,
on benefit

	FNDC RATES %	NRC RATES %	TOTAL RATES %
Te Hiku	11.5	1.3	12.8
BOI-Whangaroa	12.0	1.2	13.2
Kaikohe-Hokianga	10.9	1.2	12.0
Total Far North District	**11.0**	**1.5**	**12.4**

Single adult with 2 children,
employed

	FNDC RATES %	NRC RATES %	TOTAL RATES %
Te Hiku	4.5	0.5	5.0
BOI-Whangaroa	4.1	0.4	4.5
Kaikohe-Hokianga	4.7	0.5	5.2
Total Far North District	**4.1**	**0.5**	**4.6**

Couple with 2 children,
one employed

	FNDC RATES %	NRC RATES %	TOTAL RATES %
Te Hiku	4.5	0.5	5.0
BOI-Whangaroa	4.1	0.4	4.5
Kaikohe-Hokianga	4.7	0.5	5.2
Total Far North District	**4.1**	**0.5**	**4.6**

Couple with 2 children,
both employed

	FNDC RATES %	NRC RATES %	TOTAL RATES %
Te Hiku	2.2	0.2	2.5
BOI-Whangaroa	2.0	0.2	2.2
Kaikohe-Hokianga	2.4	0.3	2.6
Total Far North District	**2.0**	**0.3**	**2.3**

2 working adults,
based in Auckland

	FNDC RATES %	NRC RATES %	TOTAL RATES %
Te Hiku	1.7	0.2	1.9
BOI-Whangaroa	1.8	0.2	2.0
Kaikohe-Hokianga	1.6	0.2	1.8
Total Far North District	**1.6**	**0.2**	**1.8**

Contents

Figures

Tables

1 Introduction

The Far North District Council (FNDC) commissioned Business and Economic Research Limited (BERL) to conduct data analysis of rates affordability across the Far North District and prepare a report outlining rates affordability issues.

1.1 Scope of the report

BERL provided the FNDC with an analysis of the prevalence of rates unaffordability and affordability across the District, for eight different constructed household types. We constructed typical household types based on the residential properties in the Far North. It should be noted that the report only looked at residential rates. Establishing affordability at a commercial level is not feasible and was not considered. BERL determined the median, lower quartile and upper quartile household affordability for the District, as well as smaller geographic areas within the District.

1.2 Rates as a funding mechanism

The Local Government (Rating) Act (LGRA) came into effect in 2002, authorising local and regional authorities to set, assess, and collect rates to fund local government activities. A key aim of the LGRA is to establish clarity, certainty, and stability in rating matters.

The three main purposes of the LGRA are:

- To provide local authorities with flexible powers to set, assess, and collect rates
- To ensure rates reflect decisions made in a transparent and consultative manner
- To provide for processes and information to ensure ratepayers can identify and understand their liability for rates.[1]

Funding mechanisms, as set out in the LGRA, including general rates, such as value based general rates or uniform annual general charges (UAGC), and targeted rates, allow local and regional authorities to raise revenue from the community as a whole. As well as those who use or generate need for a service or amenity, or specified groups or categories of ratepayers. These funding tools and their manner of collection, determines the cost of local services and affects affordability of services for individual households.

1.3 Affordability

Affordability in the context of rates has two aspects:

- The cost relative to income (and wealth to the extent that wealth can be converted into income)
- The ability of ratepayers to earn greater income in the future from the spending of the rates, e.g. investment in infrastructure that will allow an individual to earn higher incomes in the future.

Sustainability can be defined as the ability to meet present needs without compromising the needs of future generations. Sustainability represents an extended definition of affordability in the sense that sustainability introduces a longer timeframe in which the issues of fairness and risk must be considered. Within this report, we will explore the cost of rates relative to income.

[1] http://www.localcouncils.govt.nz/lgip.nsf/wpg_url/Policy-Local-Government-Legislation-Local-Government-(Rating)-Act-2002 Retrieved 22 November 2018

Local and regional authorities within New Zealand have a strong reliance on property rates as a taxing instrument, and this may create some affordability issues particularly for households with low or fixed incomes, such as superannuitants, or high property values. Affordability issues may also arise where households are facing financial adversity due to the portion of income spent on housing costs, including rates. Therefore, districts with high levels of low incomes or fixed incomes, will generally face issues regarding affordability. Changes in demographics, i.e. aging populations and changes in household composition, may likewise have implications on affordability.[2]

The Local Government Funding Review stated:

> "Basing rates on the value of property means that for some individuals with reasonably valuable property but limited income, paying rates can cause financial strain. All councils will have some ratepayers in this situation, even if all the issues outlined (rating differentials and statutory rating exemptions) are addressed, and rates are set at a level that is reasonable and affordable for the majority of the community".[3]

Concerns about the impact of rates increases on low-income households led to the establishment of The Local Government Rates Inquiry (the Inquiry) in 2007. The resulting report, known as the Shand Report after the Chair David Shand, concluded that rates affordability was the ability to pay rates without serious economic difficulty. The inquiry noted that in 2004, the average rates paid by households represented 2.51 percent for all groups and although there are likely to be pockets of affordability in all types of household, they did not consider rates affordability was a problem for the average household. As an approximate benchmark, affordability concerns will arise where rates exceed five percent of gross household income.[4]

The report also suggested that particular household types will demonstrate rates affordability issues:

- Households in the lowest 40 percent of incomes
- One parent households with children
- One person households
- Households whose principal source of income is New Zealand Superannuation.

These households predominantly have low or fixed incomes.

Consequently, we have used the affordability benchmarks of:

- Rates as a percentage of gross household income, where affordability issues are likely to arise when rates exceed five percent.

To indicate rates affordability issues in each of the tables in this report, we have highlighted every table row grey, where total rates exceed five percent of the household's gross income.

[2] *Local government funding and financing: Issues Paper* (2018). New Zealand Productivity Commission

[3] *Local Government Funding Review – a discussion paper* (2015). National Council of Local Government New Zealand

[4] *Funding Local Government* (2007). Wellington: Department of Internal Affairs

1.4 Household types

Eight household types were used in this report. The following household types were derived from a case study report on rates affordability in agreement with Far North District Council (FNDC):

- Single superannuitant with no other income
- Married superannuitant with no other income
- Single adult earning average wage
- Single adult with two children, in receipt of Sole Parent Support
- Single adult with two children, earning average wage
- Couple with two children, one adult earning average wage
- Couple with two children, two adults earning average wage
- Couple with no children at home, two adults earning average wage (based in Auckland).

For all case study households, we compared the differences between lower, median and high quartile rates within each of the following areas:

- Total Far North District
- Te Hiku Ward
- Bay of Islands – Whangaroa Ward
- Kaikohe-Hokianga Ward
- Smaller areas (Kerikeri, Kaikohe, Opononi and Omapere, Kaitaia, Ahipara, Russell, Paihia, and Karikari Peninsula).

Rates figures include all local and regional rates, included targeted rates, and have a breakdown of local authority and FNDC values.

1.5 Data sources

The data in this report has been collected from the following sources:

- Statistics New Zealand (StatsNZ)
    - 2018 Census
    - Household Labour Force Survey (income module), June 2019
- Inland Revenue Department
- Ministry of Social Development
- Far North District Council.

Data on household income within each local authority for each type of household was used.

1.6 Methodology

A rates affordability model was built for each of the wards in the Far North. Within each model the income has been calculated separately for the eight household types from section 1.4.

The affordability of the relevant combined local and regional rates at the lower quartile, median and high quartile were then assessed against gross income.

1.7 Assumptions and limitations

A number of assumptions and limitations were made, and these are described in the following sub-sections.

1.7.1 Income data

As shown in Table 1, the Northland region had the sixth lowest average weekly income for employed people aged between 20 and 65 years of age, at $1,150, as at June 2019. This is $86 lower than the New Zealand average of $1,236, or just over $4,500 annually. The average weekly income for people aged between 20 and 65 years of age has been used because this fits with the five household types analysed in this report.

Table 1 Average weekly income for employed between 20 and 65 years of age, all regions, 2019

Region	Average weekly income 2019 ($)
Northland Region	1,150
Auckland Region	1,307
Waikato Region	1,188
Bay of Plenty Region	1,153
Gisborne/Hawkes Bay Regions	1,113
Taranaki Region	1,117
Manawatu-Wanganui Region	1,083
Wellington Region	1,363
Nelson/Tasman/Marlborough/West Coast Regions	1,102
Canterbury Region	1,221
Otago Region	1,083
Southland Region	1,234
New Zealand	1,236

The figures in the table are regional figures, so to estimate the average weekly earnings for employed people in the Far North District requires a number of adjustments as noted below.

For cases where wages and salary were the assumed source of income, the June 2019 weekly average individual income for people aged between 20 and 65, from the Household Labour Force Survey has been used. To calculate the annual average individual incomes, this weekly average individual income has been multiplied by 52, which does assume that effectively every employed member of the household is on a fixed salary rather than an hourly wage.

In addition, because the Household Labour Force Survey can only provide regional income, the Northland Region average income has been used. Finally we have used the average employed individual income, and total individual income from 2018 Census data to find the ratio between the overall Northland region average employed income to the Far North District Council average

employed income. As well as the individual ward and smaller locations average employed income. This allowed the model to adjust the June 2019 average income data to more fairly represent the Far North District Council area, the individual wards and the smaller locations within the District.

For example:

Northland regional average weekly income (June 2019) for employed people aged between 20 and 65 years of age = $1,150 per week.

Multiplying this weekly figure by 52 yielded the Northland regional average annual income for employed people aged between 20 and 65 years of age = $59,777.

Taking the Far North District council average income as at the 2018 Census: $42,931 and dividing it by the Northland regional average income as at the 2018 Census: $47,194 yield the following income adjustment factor = 0.91.

Multiplying the adjustment factor by the annual regional average income yielded an average annual income for employed people aged between 20 and 65 years of age = $54,378.

New Zealand Superannuation data used for single and married people on superannuation, and Sole Parent Support rates are accurate at 1 April 2019.

1.7.2 Rates data

FNDC supplied the rating data for the rating year 2019/20, inclusive of GST. The following rating information for 41,064 rating units within the District was provided:

- Unique identifier code
- Capital value
- Land value
- Land use description / Rating category
- Ward location
- FNDC fixed rates
- FNDC targeted rates
- Northland Regional Council (NRC) fixed rates
- NRC targeted rates
- Total assessed rates
- Non-rateable flag
- Location of property owner (inside or outside of the District).

Using this information, we removed all non-residential properties as identified using the land use description/rating category variable. This left 22,762 initial residential property rating units within the District.

BERL undertook a number of steps to ensure that every residential property used in the final calculation phase met the following criteria:

- Had both FNDC and NRC rates assessed for the rating unit
- Had a ward location (Te Hiku Ward, Kaikohe-Hokianga Ward, or Bay of Islands-Whangaroa Ward)

- Did not have a non-rateable flag assigned to it; this flag indicates that the flagged property does not receive a rates bill
- Did not have a residential-special accommodation, residential-public communal-licensed, residential-public communal-unlicensed, residential-communal residence dependant or other use, or residential-vacant land use description. These rating units cannot be categorised as a standard dwelling for a household to reside in, being comprised of rest homes, motels, hotels, college accommodation, or vacant land.

This process ensured that each residential property included in the rating affordability assessment had a dwelling that a household could reside in, had rating information that could be used to assess rating affordability, and fitted into the standard residential property category.

Therefore, the following steps were undertaken to ensure each property met the criteria above:

- Removal of all properties with a non-rateable flag indicator
- Removal of all properties with non FNDC and NRC rates assessed for them
- Removal of all properties with a residential-special accommodation, residential-public communal-licensed, residential-public communal-unlicensed, residential-communal residence dependant or other use, or residential-vacant land use description
- Removal of all properties without a ward location (Te Hiku Ward, Kaikohe-Hokianga Ward, or Bay of Islands-Whangaroa Ward).

Removal of these properties resulted in 17,446 of the original 22,762 residential properties being usable for the rating affordability assessment. As part of the assessment, BERL identified residential properties flagged as having owners living inside the District, as well those residential properties flagged as having owners living outside the District. Out of the 17,446 residential properties, 13,083 were flagged as having owners living inside the District, while 4,363 were flagged as having owners living outside the District.

The last step, undertaken prior to the assessment, was to identify those properties listed with multiple dwellings, and to adjust the total rates for the number of dwellings on the property. For example, a rating unit with two dwellings had their FNDC and NRC rates divided by two for assessing rating affordability, as it would be reasonable to assume that two different families could be living in the two dwellings. To do this BERL undertook the following steps:

- Assumed that rating units with land use descriptions of residential-bach and residential-single unit (other than bach) only had a single dwelling on the rating unit. This covers 16,600 of the residential properties
- For the 846 properties with the land use description of residential-multi unit and residential-multi use, the top 100 properties in terms of total rates were manually investigated by BERL to determine the total number of dwellings present on each rating unit
- Analysis of the remaining 746 properties revealed that rating units with a capital value in excess of $200,000 higher than their land value generally had two dwellings on the rating unit, while those with a capital value lower than $200,000 higher than their land value, generally only had one dwelling on the rating unit. Therefore, BERL has assumed that the 561 rating units with a capital value in excess of $200,000 higher than their land value had two dwellings, and that the 185 rating units with a capital value lower than $200,000 higher than their land value had only one dwelling.

For each of the eight household types, BERL determined the median, lower quartile and upper quartile properties of each of four locations (Total, Te Hiku Ward, Kaikohe-Hokianga Ward, and Bay of Islands-Whangaroa Ward) and compared their FNDC, NRC, and total rates against gross income.

1.7.3 Household data

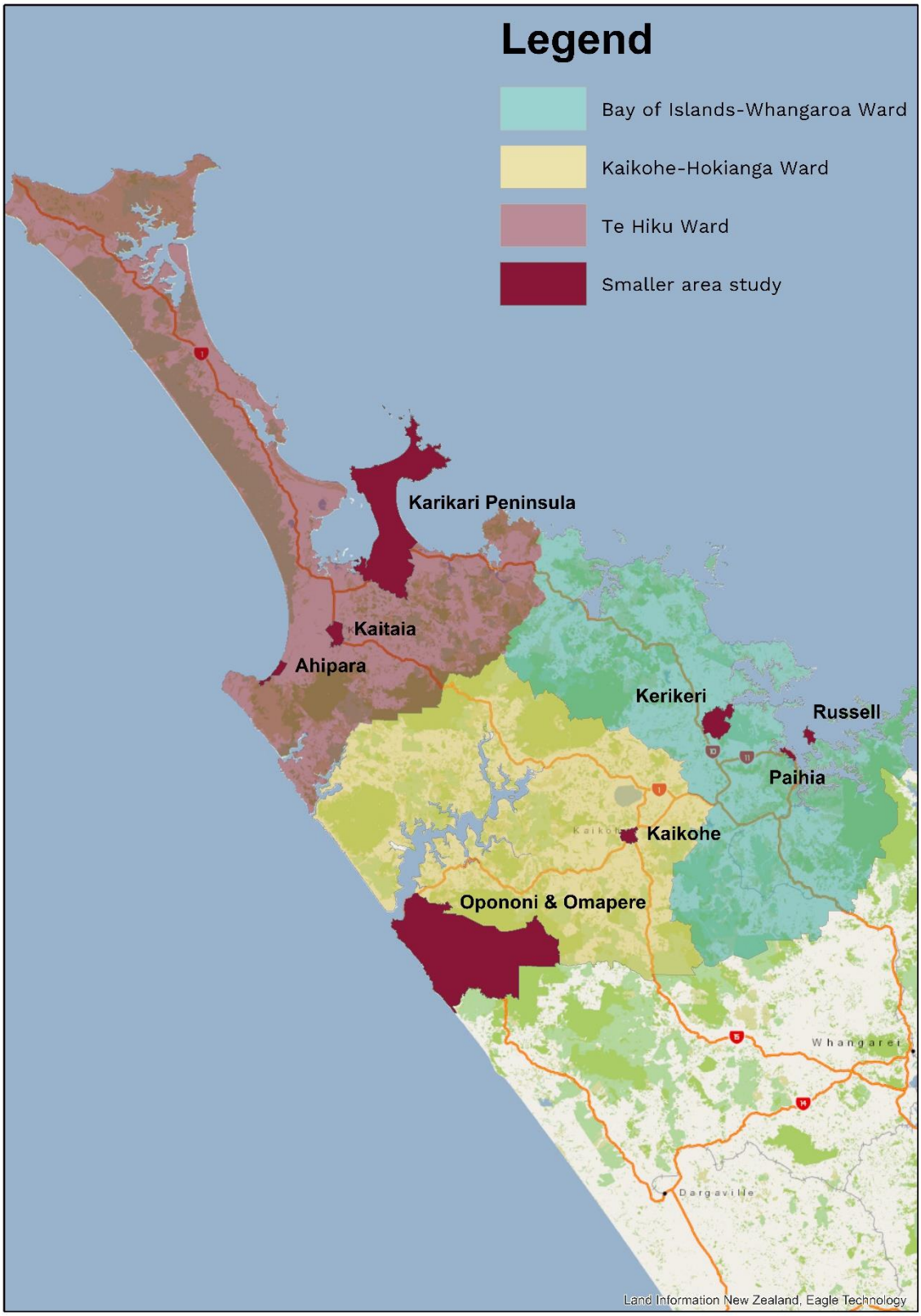
The 2018 Census data provided the number of households by household type. This information was used for the types of households, except for those households normally resident in Auckland, who own secondary houses in the Far North District. The Census is focussed on people's main residences, there is no information on secondary homes available from the Census.

Therefore, to estimate the number of households in this eighth household type, we examined the number of empty dwellings across the District as well as the three wards and eight smaller areas, from the 2018 Census. Empty dwellings in the Census are dwellings in which no one is a usual resident. These dwellings include those rented long-term but not currently occupied, those that are rented to short-term occupiers, those that are secondary homes, and other empty dwellings.

To derive an estimate of the eighth household type (two working adults, based in Auckland), BERL has combined the number of empty dwellings in an area, with information on the location of Airbnb and other short-term rentals, and information from the Far North District Council on the locations of dwellings owned by those outside the District. 2018 Household counts by household type for the Far North District, and the three wards can be found in section 4 of this report.

2 Map of Far North District areas

Figure 1 Map of Far North District study areas



3 Total Far North District

The Far North District is the northern most territorial authority District of New Zealand, consisting of the northern part of the Northland Peninsula in the North Island. It stretches from North Cape and Cape Reinga in the north, down to the Bay of Islands, Hokianga and the town of Kaikohe.

Overall BERL analysed the rates affordability for 17,446 residential properties in the Far North District.

There were a significant number of households with rates affordability issues in the Far North District. These were:

- Single superannuitant with no other income
- Married superannuitants with no other income
- Single adult with two children in receipt of Sole Parent Support households.

These households had rates in excess of five percent of gross household income across lower, median and high quartile total rates levels. For example, the average household income for a single superannuitant with no other income was $24,722, if the superannuitant was paying rates at the lower quartile ($2,113 as shown in Table 2), then Table 3 shows that 8.5 percent of their income was spent on rates. If the superannuitant was paying rates at the upper quartile ($2,985 as shown in Table 2), the superannuitant would be spending 12.1 percent of their income on rates (Table 3).

The upper quartile for single adult earning average wage, single adult with two children, earning average wage, and couple with two children, one adult earning average wage households exceed five percent of gross household income. Whereas, couple with two children, two adults earning average wage and couple with no children at home, two adults earning average wage households do not have any categories in excess of five percent of gross household income.

The highest upper quartile for total rates levels is 15.1 percent for single adult with two children in receipt of Sole Parent Support households. Not surprisingly, the lowest upper quartile is 2.3 percent for couple with no children at home, two adults earning average wages households.

The minimum rates payable in the Far North District is $141 and the maximum is $25,211. This explains the difference between the median rates value ($2,512) and the average rates value ($2,622).

As stated in section 1.7.2, to indicate rates affordability issues in each of the tables in this report it is highlighted in grey.

Far North District average household income by household composition

Household income for the following household types was used:

- Single superannuitant with no other income - $24,722
- Married superannuitants with no other income - $37,484
- Single adult earning average wage - $54,378
- Single adult with two children, in receipt of Sole Parent Support - $20,223
- Single adult with two children, earning average wage - $54,378
- Couple with two children, one adult earning average wage - $54,378

- Couple with two children, two adults earning average wage - $108,756
- Couple with no children at home, two adults earning average wage (based in Auckland) - $135,929.

Table 2 Rates payable, Far North District

	FNDC rates ($)	NRC rates ($)	Total rates ($)
Lower Quartile	1,841	272	2,113
Median	2,215	297	2,512
Upper Quartile	2,728	257	2,985

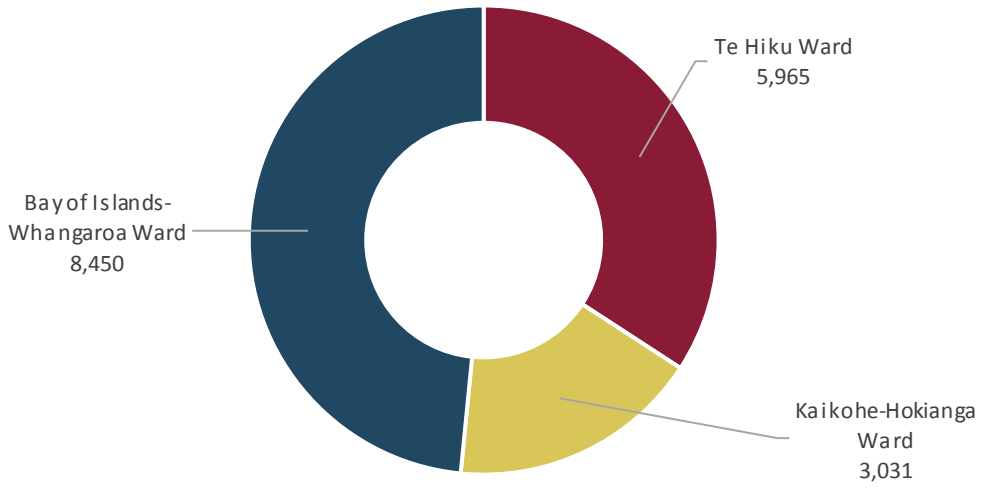
Table 3 Total rates as a percentage of gross income by household type, Far North District

Household type		FNDC rates (%)	NRC rates (%)	Total rates (%)
Single superannuitant, no other income	Lower Quartile	7.4	1.1	8.5
	Median	9.0	1.2	10.2
	Upper Quartile	11.0	1.0	12.1
Married superannuitant, no other income	Lower Quartile	4.9	0.7	5.6
	Median	5.9	0.8	6.7
	Upper Quartile	7.3	0.7	8.0
Single working person (no kids)	Lower Quartile	3.4	0.5	3.9
	Median	4.1	0.5	4.6
	Upper Quartile	5.0	0.5	5.5
Single adult, two children, on benefit	Lower Quartile	9.1	1.3	10.4
	Median	11.0	1.5	12.4
	Upper Quartile	13.5	1.3	14.8
Single adult, two children, employed	Lower Quartile	3.4	0.5	3.9
	Median	4.1	0.5	4.6
	Upper Quartile	5.0	0.5	5.5
Couple, two children, one employed	Lower Quartile	3.4	0.5	3.9
	Median	4.1	0.5	4.6
	Upper Quartile	5.0	0.5	5.5
Couple, two children, both employed	Lower Quartile	1.7	0.3	1.9
	Median	2.0	0.3	2.3
	Upper Quartile	2.5	0.2	2.7
Two working adults, based in Auckland	Lower Quartile	1.4	0.2	1.6
	Median	1.6	0.2	1.8
	Upper Quartile	2.0	0.2	2.2

4 Ratepayer and household counts

As noted in section 3, BERL analysed the rates affordability for 17,446 residential properties in the Far North District. Figure 2 below provides a breakdown of that overall number by ward. As shown in the table the largest share of ratepayer properties were located in the Bay of Islands-Whangaroa Ward (48 percent), followed by Te Hiku Ward (34 percent), and finally with the smallest share of properties is the Kaikohe-Hokianga Ward (17 percent).

Figure 2 Ratepayer count by ward, 2018



In order to provide household counts for each of the eight household types examined in this report, BERL provided an estimate of the number of households per household type.

In 2018, the Far North District had a usual resident population of 65,250, living in 22,773 households, or around 2.9 people per household. As shown in Table 4 the seven usual resident household types examined in this report comprise 8,433 households or 37 percent of total households. The largest individual household types are married superannuitants with 3,060 households, followed by single superannuitants with 2,544.

It should be noted that the 14,085 remaining households cover a wide range of household types, including superannuitant still working; single adults with one child, or three or more; couples with no children, one child, or three or more; and single adults flatting with others. Lastly, the 763 households of two working adults, based in Auckland are not included in the total household counts for the Far North District. This is because these households are usually resident in Auckland, not the Far North District.

Table 4 Household counts by household type, Far North District, 2018

Household type	Household count	Percentage of total
Single superannuitant, no other income	2,471	10.9
Married superannuitant, no other income	2,961	13.0
Single working person (no kids)	1,504	6.6
Single adult, two children, on benefit	409	1.8
Single adult, two children, employed	102	0.4
Couple, two children, one employed	749	3.3
Couple, two children, both employed	1,123	4.9
Remaining households	13,442	59.1
Total occupied households	22,761	100.0
Two working adults, based in Auckland	763	

Table 5 Household counts by household type, Far North District, 2013 and 2018

Household type	Household count 2013	Household count 2018	Percentage change
Single superannuitant, no other income	2,302	2,471	7.3
Married superannuitant, no other income	2,731	2,961	8.4
Single working person (no kids)	1,408	1,504	6.8
Single adult, two children, on benefit	384	409	6.5
Single adult, two children, employed	96	102	6.5
Couple, two children, one employed	695	749	7.7
Couple, two children, both employed	1,043	1,123	7.7
Remaining households	13,987	13,442	-3.9
Total occupied households	22,646	22,761	0.5
Two working adults, based in Auckland	1,178	763	-35.2

5 Conclusion

The data analysis of rates affordability in the Far North District highlighted that particular household types will have rates affordability issues and that these households predominantly have low or fixed incomes.

The following households had rates in excess of five percent of gross household income across lower, median and high quartile total rates levels in each of the areas:

- Single superannuitant with no other income
- Married superannuitant with no other income
- Single adult with two children, in receipt of Sole Parent Support.

As affordability issues are likely to arise when rates exceed five percent, these households likely face rates affordability issues.

There were many other pockets of rates affordability issues across the areas and the household types, these household types were usually:

- Single adult earning average wage
- Single adult with two children, earning average wage
- Couple with two children, one adult earning average wage.

Whereas the following households did not have rates affordability issues in any of the areas:

- Couple with two children, two adults earning average wage
- Couple with no children at home, two adults earning average wage (based in Auckland).

6 Impact of COVID-19

The sudden onset of the COVID-19 pandemic will have had a profound effect on the Far North District economy, as well as across New Zealand. Unfortunately there is a significant lag time before this can be seen in the official statistics. However, we expect economic activity to slow over the next few years, followed in all probability by a sluggish recovery to 2030. In the short term, the Far North District economy will have falling GDP and rising unemployment, which will result in a decrease in household income and consumer spending. This will have a significant impact upon wellbeing and the community. The ongoing effects on jobs, income and wellbeing will persist for years to come.

COVID-19 has, and will continue to, impact upon the role of central and local government. As household and businesses' spending decreases, it will be left for government to underpin spending and provide confidence in future plans. Continued spending and a focus on the four wellbeings (social, economic, environmental, and cultural) will improve outcomes for people and communities. The impact of COVID-19 has caused local authorities across the country to reassess their long term planning assumptions and documents in an environment of extreme uncertainty. As COVID-19 increases uncertainty, it is paramount that the wellbeing kaupapa remains unchanged.

The social services sector is the largest employer in the Far North District; people employed in the social services sector will be largely insulated against the impact of COVID-19. The primary sector is also a large employer. The primary sector has been deemed essential services, enabling these businesses to continue to operate throughout the COVID-19 lockdown. It is likely that people employed in the primary sector will also be reasonably insulated against the impact of COVID-19.

However, the retail and accommodation sector is likely to face severe challenges in the coming years which may result in increasing unemployment. As the retail and accommodation sector is another large employer in the Far North District, this will cause a significant loss in terms of jobs, income and ultimately negatively impact upon wellbeing. The tourism industry is already feeling the weight of COVID-19 through a drastic drop in revenue. The wage subsidy has helped save jobs in the short-term. However, this is a short-term solution and uncertainty remains about the long-term future of these jobs.

The impact on employment and income may affect people's ability to pay rates. We are aware of pressures across many councils to hold rates increases. We must advise that this kicking the can down the road is likely to jeopardise the delivery of future services. This will act directly against the kaupapa of ensuring the wellbeing (across all four dimensions) of current and future generations. We understand the need to put a realistic Long Term Plan (LTP) together, but the use of deferred payment schemes (rather than zero rates increases) should be explored. Similarly, the use of debt funding should be explored (as should a revision of the debt-ceiling constraint) – given the likelihood of incredibly low interest rates for the foreseeable future. Further, alternative funding mechanisms from central government should be actively pursued (together with LGNZ). Conversely, an untowardly narrow perspective on protecting Council finances will be reflected in deficits across other wellbeing domains – as has been experienced in recent years.

Appendix A Household counts by ward

Table 6 provides the estimated household counts for the Te Hiku, Kaikohe-Hokianaga, and the Bay of Islands-Whangaroa wards, respectively. As shown in the table the Bay of Islands-Whangaroa Ward has the largest number of households with 10,746, with the Te Hiku Ward having the second largest number of households with 7,089, while the Kaikohe-Hokianaga Ward has 4,938 households.

Table 6 Household counts by household type, wards, 2018

Household type	Te Hiku Ward	Kaikohe-Hokianga Ward	Bay of Islands-Whangaroa Ward
Single superannuitant, no other income	744	528	1,199
Married superannuitant, no other income	793	557	1,611
Single working person (no kids)	437	376	691
Single adult, two children, on benefit	118	111	179
Single adult, two children, employed	30	28	45
Couple, two children, one employed	196	172	381
Couple, two children, both employed	293	259	571
Remaining households	4,418	4,190	6,222
Total occupied households	7,029	6,221	10,899
Two working adults, based in Auckland	182	140	442

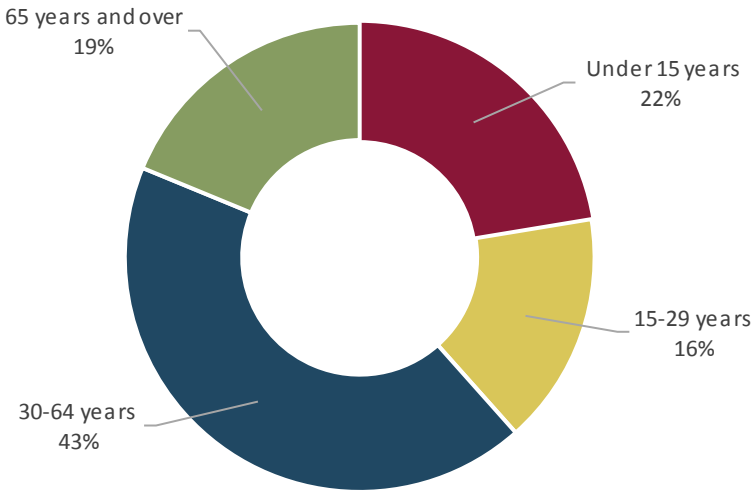
Table 7 Percentage share of households by household type, wards, 2018

Household type	Te Hiku Ward	Kaikohe-Hokianga Ward	Bay of Islands-Whangaroa Ward
Single superannuitant, no other income	10.6	8.5	11.0
Married superannuitant, no other income	11.3	9.0	14.8
Single working person (no kids)	6.2	6.0	6.3
Single adult, two children, on benefit	1.7	1.8	1.6
Single adult, two children, employed	0.4	0.4	0.4
Couple, two children, one employed	2.8	2.8	3.5
Couple, two children, both employed	4.2	4.2	5.2
Remaining households	62.9	67.4	57.1
Total occupied households	100.0	100.0	100.0
Two working adults, based in Auckland			

Appendix B Te Hiku Ward

Te Hiku Ward is the ward at the top of the Far North District as shown in Figure 1. For our analysis, we have examined 5,965 residential properties. The largest proportion of these residential properties by age group were those aged between 30 and 64 years (43 percent).

Figure 3 Percentage by broad age groups, Te Hiku Ward, 2018



Again, the following households face rates affordability issues as these households had rates in excess of five percent of gross household income across lower, median and high quartile total rates levels:

- Single superannuitant with no other income
- Married superannuitant with no other income
- Single adult with two children, earning average wage.

The upper quartile is 5.3 percent for single adult earning average wage, single adult with two children, earning average wage, and couple with two children, one adult earning average wage households. Therefore, these groups may face rates affordability issues also.

For example, the average household income for a single adult with two children, in receipt of Sole Parent Support was $24,722. As the average rates cost was $2,588 (Table 8), this would be 12.8 percent of their income (Table 9).

There were no significant outliers (minimum is $197 and maximum is $7,870) and therefore a small variance between the median ($2,588) and the average ($2,524).

Te Hiku Ward average household income by household composition

Household income for the following household types was used:

- Single superannuitant with no other income - $24,722
- Married superannuitants with no other income - $37,484
- Single adult earning average wage - $52,213

- Single adult with two children, in receipt of Sole Parent Support - $20,223
- Single adult with two children, earning average wage - $52,213
- Couple with two children, one adult earning average wage - $52,213
- Couple with two children, two adults earning average wage - $104,425
- Couple with no children at home, two adults earning average wage (based in Auckland) - $135,929.

Table 8 Rates payable, Te Hiku Ward

	FNDC rates ($)	NRC rates ($)	Total rates ($)
Lower Quartile	2,095	218	2,313
Median	2,334	254	2,588
Upper Quartile	2,502	260	2,762

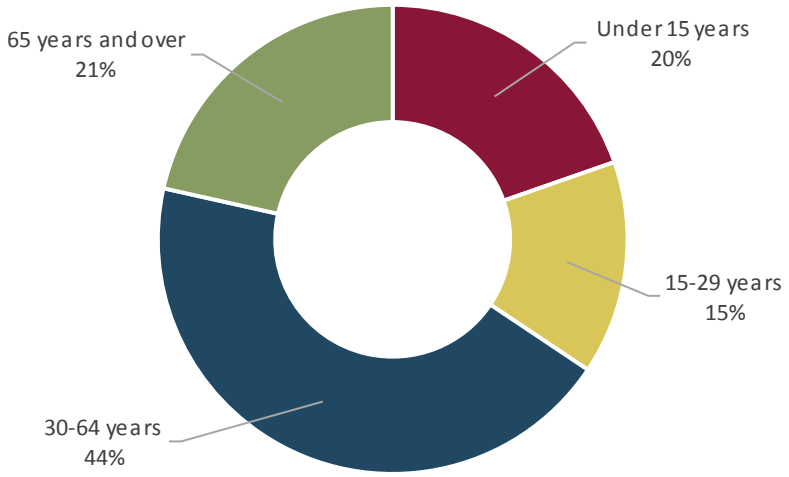
Table 9 Total rates as a percentage of gross income by household type, Te Hiku Ward

Household type		FNDC rates (%)	NRC rates (%)	Total rates (%)
Single superannuitant, no other income	Lower Quartile	8.5	0.9	9.4
	Median	9.4	1.0	10.5
	Upper Quartile	10.1	1.1	11.2
Married superannuitant, no other income	Lower Quartile	5.6	0.6	6.2
	Median	6.2	0.7	6.9
	Upper Quartile	6.7	0.7	7.4
Single working person (no kids)	Lower Quartile	4.0	0.4	4.4
	Median	4.5	0.5	5.0
	Upper Quartile	4.8	0.5	5.3
Single adult, two children, on benefit	Lower Quartile	10.4	1.1	11.4
	Median	11.5	1.3	12.8
	Upper Quartile	12.4	1.3	13.7
Single adult, two children, employed	Lower Quartile	4.0	0.4	4.4
	Median	4.5	0.5	5.0
	Upper Quartile	4.8	0.5	5.3
Couple, two children, one employed	Lower Quartile	4.0	0.4	4.4
	Median	4.5	0.5	5.0
	Upper Quartile	4.8	0.5	5.3
Couple, two children, both employed	Lower Quartile	2.0	0.2	2.2
	Median	2.2	0.2	2.5
	Upper Quartile	2.4	0.2	2.6
Two working adults, based in Auckland	Lower Quartile	1.5	0.2	1.7
	Median	1.7	0.2	1.9
	Upper Quartile	1.8	0.2	2.0

Appendix C Bay of Islands-Whangaroa Ward

Bay of Islands-Whangaroa Ward is the eastern ward of the Far North District. For our analysis, we have examined 8,450 residential properties. Again, those aged between 30 and 64 years old make up the biggest percentage of these residential properties.

Figure 4 Percentage by broad age groups, Bay of Island-Whangaroa Ward, 2018



Households that fall under the following categories face rates affordability issues:

- Single superannuitant with no other income
- Married superannuitant with no other income
- Single adult with two children, in receipt of Sole Parent Support.

These households had rates in excess of five percent of gross household income across lower, median and high quartile total rates levels.

The highest upper quartile percentage was 15.8 percent for single adults with two children, in receipt of Sole Parent Support. This means that they are paying 15.8 percent of their income ($20,223) on rates at the upper quartile ($3,205 in Table 10).

The maximum rates payable was $25,211, while the minimum is $355. Therefore, there was some variance between the median ($2,673) and the average ($2,815).

Bay of Islands-Whangaroa Ward average household income by household composition

Household income for the following household types was used:

- Single superannuitant with no other income - $24,722
- Married superannuitants with no other income - $37,484
- Single adult earning average wage - $59,897
- Single adult with two children, in receipt of Sole Parent Support - $20,223

- Single adult with two children, earning average wage - $59,897
- Couple with two children, one adult earning average wage - $59,897
- Couple with two children, two adults earning average wage - $119,793
- Couple with no children at home, two adults earning average wage (based in Auckland) - $135,929.

Table 10 Rates payable, Bay of Islands-Whangaroa Ward

	FNDC rates ($)	NRC rates ($)	Total rates ($)
Lower Quartile	1,898	276	2,174
Median	2,437	236	2,673
Upper Quartile	2,937	267	3,205

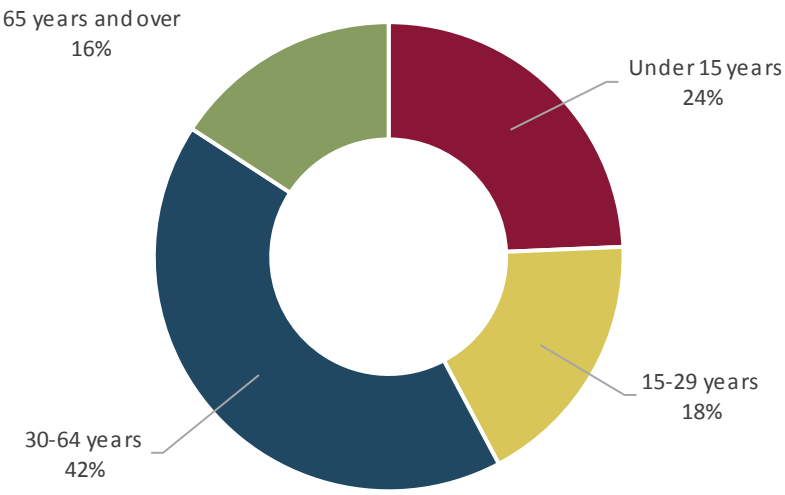
Table 11 Total rates as a percentage of gross income by household type, Bay of Islands-Whangaroa Ward

Household type		FNDC rates (%)	NRC rates (%)	Total rates (%)
Single superannuitant, no other income	Lower Quartile	7.7	1.1	8.8
	Median	9.9	1.0	10.8
	Upper Quartile	11.9	1.1	13.0
Married superannuitant, no other income	Lower Quartile	5.1	0.7	5.8
	Median	6.5	0.6	7.1
	Upper Quartile	7.8	0.7	8.5
Single working person (no kids)	Lower Quartile	3.2	0.5	3.6
	Median	4.1	0.4	4.5
	Upper Quartile	4.9	0.4	5.4
Single adult, two children, on benefit	Lower Quartile	9.4	1.4	10.8
	Median	12.0	1.2	13.2
	Upper Quartile	14.5	1.3	15.8
Single adult, two children, employed	Lower Quartile	3.2	0.5	3.6
	Median	4.1	0.4	4.5
	Upper Quartile	4.9	0.4	5.4
Couple, two children, one employed	Lower Quartile	3.2	0.5	3.6
	Median	4.1	0.4	4.5
	Upper Quartile	4.9	0.4	5.4
Couple, two children, both employed	Lower Quartile	1.6	0.2	1.8
	Median	2.0	0.2	2.2
	Upper Quartile	2.5	0.2	2.7
Two working adults, based in Auckland	Lower Quartile	1.4	0.2	1.6
	Median	1.8	0.2	2.0
	Upper Quartile	2.2	0.2	2.4

Appendix D Kaikohe-Hokianga Ward

Kaikohe-Hokianga Ward is the western ward of the Far North District. For our analysis, we have examined 3,031 residential properties. Of these residential properties, 16 percent are aged 65 years and over, 42 percent are aged between 30 and 64 years, 18 percent between 15 and 29 years, and 24 percent under 15 years.

Figure 5 Percentage by broad age groups, Kaikohe-Hokianga Ward, 2018



Even though there were less rates affordability issues in this ward, single superannuitant with no other income and single adult with two children, in receipt of Sole Parent Support households still had rates in excess of five percent of gross household income across lower, median and high quartile total rates levels.

Married superannuitant with no other income; single working person (no kids); single adult employed with two children; and couple with one employed and two children households did not have rates in excess of five percent of gross household income in the lower quartile. However their median and upper quartile still exceeded five percent. For example, the average household income for married superannuitants with no other income is $37,484. If they are paying median rates of $2,434 (Table 12), then they are spending 6.5 percent of their income on rates (Table 13).

In Kaikohe-Hokianga the average ($2,275) was below the median ($2,434). The minimum was $141 and the maximum is $8,991.

Kaikohe-Hokianga Ward average household income by household composition

Household income for the following household types was used:

- Single superannuitant with no other income - $24,722
- Married superannuitants with no other income - $37,484
- Single adult earning average wage - $46,585
- Single adult with two children, in receipt of Sole Parent Support - $20,223
- Single adult with two children, earning average wage - $46,585

- Couple with two children, one adult earning average wage - $46,585
- Couple with two children, two adults earning average wage - $93,170
- Couple with no children at home, two adults earning average wage (based in Auckland) - $135,929.

Table 12 Rates payable, Kaikohe-Hokianga Ward

	FNDC rates ($)	NRC rates ($)	Total rates ($)
Lower Quartile	1,397	241	1,638
Median	2,198	235	2,434
Upper Quartile	2,272	226	2,499

Table 13 Total rates as a percentage of gross income by household type, Kaikohe-Hokianga Ward

Household type		FNDC rates (%)	NRC rates (%)	Total rates (%)
Single superannuitant, no other income	Lower Quartile	5.7	1.0	6.6
	Median	8.9	1.0	9.8
	Upper Quartile	9.2	0.9	10.1
Married superannuitant, no other income	Lower Quartile	3.7	0.6	4.4
	Median	5.9	0.6	6.5
	Upper Quartile	6.1	0.6	6.7
Single working person (no kids)	Lower Quartile	3.0	0.5	3.5
	Median	4.7	0.5	5.2
	Upper Quartile	4.9	0.5	5.4
Single adult, two children, on benefit	Lower Quartile	6.9	1.2	8.1
	Median	10.9	1.2	12.0
	Upper Quartile	11.2	1.1	12.4
Single adult, two children, employed	Lower Quartile	3.0	0.5	3.5
	Median	4.7	0.5	5.2
	Upper Quartile	4.9	0.5	5.4
Couple, two children, one employed	Lower Quartile	3.0	0.5	3.5
	Median	4.7	0.5	5.2
	Upper Quartile	4.9	0.5	5.4
Couple, two children, both employed	Lower Quartile	1.5	0.3	1.8
	Median	2.4	0.3	2.6
	Upper Quartile	2.4	0.2	2.7
Two working adults, based in Auckland	Lower Quartile	1.0	0.2	1.2
	Median	1.6	0.2	1.8
	Upper Quartile	1.7	0.2	1.8

Appendix E Smaller areas within the Far North District

In addition to determining the rates affordability for the Far North District and its three main wards, we examined eight smaller areas within the wards which could be clearly defined within the rating unit database provided by FNDC. The eight smaller areas examined were:

- Kerikeri
- Kaikohe
- Opononi and Omapere
- Kaitaia
- Ahipara
- Paihia
- Russell
- Karikari Peninsula.

For each of the eight smaller areas, BERL examined the number of rating units owned by people living inside the District compared to the number of rating units owned by people living outside the District. For the first five areas listed above the number of units owned by people living outside the District were insufficient for analysis. Therefore, for these five areas (Kerikeri, Kaikohe, Opononi and Omapere, Kaitaia, and Ahipara) we only analysed the rating affordability of all residential properties.

For the three remaining areas (Paihia, Russell, and Karikari peninsula) there were sufficient rating units in both categories to warrant analysis. Therefore, for these three areas we examined the rating affordability of rating units split into two groups, those owned by people living in the District and those owned by people living outside the District.

Kerikeri

Kerikeri had rates affordability issues in the following categories:

- Single superannuitant with no other income
- Married superannuitant with no other income
- Single adult with two children, in receipt of Sole Parent Support.

There were also rates affordability issues for those in the upper quartile of the following categories:

- Single adult earning average wage
- Single adult with two children, earning average wage
- Couple with two children, one adult earning average wage.

Kerikeri average household income by household composition

Household income for the following household types was used:

- Single superannuitant with no other income - $24,722
- Married superannuitants with no other income - $37,484
- Single adult earning average wage - $59,102
- Single adult with two children, in receipt of Sole Parent Support - $20,223
- Single adult with two children, earning average wage - $59,102
- Couple with two children, one adult earning average wage - $59,102
- Couple with two children, two adults earning average wage - $118,205
- Couple with no children at home, two adults earning average wage (based in Auckland) - $135,929.

Table 14 Rates payable, Kerikeri

	FNDC rates ($)	NRC rates ($)	Total rates ($)
Lower Quartile	1,938	279	2,217
Median	2,190	282	2,472
Upper Quartile	2,672	316	2,988

Table 15 Total rates as a percentage of gross income by household type, Kerikeri

Household type		FNDC rates (%)	NRC rates (%)	Total rates (%)
Single superannuitant, no other income	Lower Quartile	7.8	1.1	9.0
	Median	8.9	1.1	10.0
	Upper Quartile	10.8	1.3	12.1
Married superannuitant, no other income	Lower Quartile	5.2	0.7	5.9
	Median	5.8	0.8	6.6
	Upper Quartile	7.1	0.8	8.0
Single working person (no kids)	Lower Quartile	3.3	0.5	3.8
	Median	3.7	0.5	4.2
	Upper Quartile	4.5	0.5	5.1
Single adult, two children, on benefit	Lower Quartile	9.6	1.4	10.9
	Median	10.8	1.4	12.2
	Upper Quartile	13.1	1.6	14.7
Single adult, two children, employed	Lower Quartile	3.3	0.5	3.8
	Median	3.7	0.5	4.2
	Upper Quartile	4.5	0.5	5.1
Couple, two children, one employed	Lower Quartile	3.3	0.5	3.8
	Median	3.7	0.5	4.2
	Upper Quartile	4.5	0.5	5.1
Couple, two children, both employed	Lower Quartile	1.6	0.2	1.9
	Median	1.9	0.2	2.1
	Upper Quartile	2.3	0.3	2.5
Two working adults, based in Auckland	Lower Quartile	1.4	0.2	1.6
	Median	1.6	0.2	1.8
	Upper Quartile	2.0	0.2	2.2

Kaikohe

Again, single superannuitant with no other income, married superannuitant with no other income, single adult with two children, in receipt of Sole Parent Support households had rates in excess of five percent of gross household income across lower, median and high quartile total rates levels. These households therefore face rates affordability issues. In addition for Kaikohe the single adult earning average wage, single adult with two children, earning average wage, and couple with two children, one adult earning average wage also had rates affordability issues across lower quartile, median, and upper quartile total rates levels.

Kaikohe average household income by household composition

Household income for the following household types was used:

- Single superannuitant with no other income - $24,722
- Married superannuitants with no other income - $37,484
- Single adult earning average wage - $44,894

- Single adult with two children, in receipt of Sole Parent Support - $20,223
- Single adult with two children, earning average wage - $44,894
- Couple with two children, one adult earning average wage - $44,894
- Couple with two children, two adults earning average wage - $89,788
- Couple with no children at home, two adults earning average wage (based in Auckland) - $135,929.

Table 16 Rates payable, Kaikohe

	FNDC rates ($)	NRC rates ($)	Total rates ($)
Lower Quartile	2,157	219	2,376
Median	2,226	223	2,450
Upper Quartile	2,255	225	2,480

Table 17 Total rates as a percentage of gross income by household type, Kaikohe

Household type		FNDC rates (%)	NRC rates (%)	Total rates (%)
Single superannuitant, no other income	Lower Quartile	8.7	0.9	9.6
	Median	9.0	0.9	9.9
	Upper Quartile	9.1	0.9	10.0
Married superannuitant, no other income	Lower Quartile	5.8	0.6	6.3
	Median	5.9	0.6	6.5
	Upper Quartile	6.0	0.6	6.6
Single working person (no kids)	Lower Quartile	4.8	0.5	5.3
	Median	5.0	0.5	5.5
	Upper Quartile	5.0	0.5	5.5
Single adult, two children, on benefit	Lower Quartile	10.7	1.1	11.7
	Median	11.0	1.1	12.1
	Upper Quartile	11.2	1.1	12.3
Single adult, two children, employed	Lower Quartile	4.8	0.5	5.3
	Median	5.0	0.5	5.5
	Upper Quartile	5.0	0.5	5.5
Couple, two children, one employed	Lower Quartile	4.8	0.5	5.3
	Median	5.0	0.5	5.5
	Upper Quartile	5.0	0.5	5.5
Couple, two children, both employed	Lower Quartile	2.4	0.2	2.6
	Median	2.5	0.2	2.7
	Upper Quartile	2.5	0.3	2.8
Two working adults, based in Auckland	Lower Quartile	1.6	0.2	1.7
	Median	1.6	0.2	1.8
	Upper Quartile	1.7	0.2	1.8

Opononi and Omapere

The Opononi and Omapere area had significant rates affordability issues. The following categories had rates in excess of five percent of gross household income across lower, median and high quartile total rates levels:

- Single superannuitant with no other income
- Married superannuitant with no other income
- Single adult earning average wage
- Single adult with two children, in receipt of Sole Parent Support
- Single adult with two children, earning average wage
- Couple with two children, one adult earning average wage.

There are only two categories which do not have rates affordability issues, these categories involve two adults earning average wage.

Opononi and Omapere average household income by household composition

Household income for the following household types was used:

- Single superannuitant with no other income - $24,722
- Married superannuitants with no other income - $37,484
- Single adult earning average wage - $44,094
- Single adult with two children, in receipt of Sole Parent Support - $20,223
- Single adult with two children, earning average wage - $44,094
- Couple with two children, one adult earning average wage - $44,094
- Couple with two children, two adults earning average wage - $88,189
- Couple with no children at home, two adults earning average wage (based in Auckland) - $135,929.

Table 18 Rates payable, Opononi and Omapere

	FNDC rates ($)	NRC rates ($)	Total rates ($)
Lower Quartile	2,555	259	2,814
Median	3,060	249	3,309
Upper Quartile	3,238	261	3,499

Table 19 Total rates as a percentage of gross income by household type, Opononi and Omapere

Household type		FNDC rates (%)	NRC rates (%)	Total rates (%)
Single superannuitant, no other income	Lower Quartile	10.3	1.0	11.4
	Median	12.4	1.0	13.4
	Upper Quartile	13.1	1.1	14.2
Married superannuitant, no other income	Lower Quartile	6.8	0.7	7.5
	Median	8.2	0.7	8.8
	Upper Quartile	8.6	0.7	9.3
Single working person (no kids)	Lower Quartile	5.8	0.6	6.4
	Median	6.9	0.6	7.5
	Upper Quartile	7.3	0.6	7.9
Single adult, two children, on benefit	Lower Quartile	12.6	1.3	13.9
	Median	15.1	1.2	16.4
	Upper Quartile	16.0	1.3	17.3
Single adult, two children, employed	Lower Quartile	5.8	0.6	6.4
	Median	6.9	0.6	7.5
	Upper Quartile	7.3	0.6	7.9
Couple, two children, one employed	Lower Quartile	5.8	0.6	6.4
	Median	6.9	0.6	7.5
	Upper Quartile	7.3	0.6	7.9
Couple, two children, both employed	Lower Quartile	2.9	0.3	3.2
	Median	3.5	0.3	3.8
	Upper Quartile	3.7	0.3	4.0
Two working adults, based in Auckland	Lower Quartile	1.9	0.2	2.1
	Median	2.3	0.2	2.4
	Upper Quartile	2.4	0.2	2.6

Kaitaia

Kaitaia has rates affordability issues; there were six categories with rates in excess of five percent of gross household income across lower, median and high quartile total rates levels. These categories were as follows:

- Single superannuitant with no other income
- Married superannuitant with no other income
- Single adult earning average wage
- Single adult with two children, in receipt of Sole Parent Support
- Single adult with two children, earning average wage
- Couple with two children, one adult earning average wage.

There were only two categories which did not have rates affordability issues, these categories involve two adults earning average wage.

Kaitaia average household income by household composition

Household income for the following household types was used:

- Single superannuitant with no other income - $24,722
- Married superannuitants with no other income - $37,484
- Single adult earning average wage - $46,076
- Single adult with two children, in receipt of Sole Parent Support - $20,223
- Single adult with two children, earning average wage - $46,076
- Couple with two children, one adult earning average wage - $46,076
- Couple with two children, two adults earning average wage - $92,151
- Couple with no children at home, two adults earning average wage (based in Auckland) - $135,929.

Table 20 Rates payable, Kaitaia

	FNDC rates ($)	NRC rates ($)	Total rates ($)
Lower Quartile	2,141	281	2,422
Median	2,083	545	2,628
Upper Quartile	2,152	550	2,702

Table 21 Total rates as a percentage of gross income by household type, Kaitaia

Household type		FNDC rates (%)	NRC rates (%)	Total rates (%)
Single superannuitant, no other income	Lower Quartile	8.7	1.1	9.8
	Median	8.4	2.2	10.6
	Upper Quartile	8.7	2.2	10.9
Married superannuitant, no other income	Lower Quartile	5.7	0.7	6.5
	Median	5.6	1.5	7.0
	Upper Quartile	5.7	1.5	7.2
Single working person (no kids)	Lower Quartile	4.6	0.6	5.3
	Median	4.5	1.2	5.7
	Upper Quartile	4.7	1.2	5.9
Single adult, two children, on benefit	Lower Quartile	10.6	1.4	12.0
	Median	10.3	2.7	13.0
	Upper Quartile	10.6	2.7	13.4
Single adult, two children, employed	Lower Quartile	4.6	0.6	5.3
	Median	4.5	1.2	5.7
	Upper Quartile	4.7	1.2	5.9
Couple, two children, one employed	Lower Quartile	4.6	0.6	5.3
	Median	4.5	1.2	5.7
	Upper Quartile	4.7	1.2	5.9
Couple, two children, both employed	Lower Quartile	2.3	0.3	2.6
	Median	2.3	0.6	2.9
	Upper Quartile	2.3	0.6	2.9
Two working adults, based in Auckland	Lower Quartile	1.6	0.2	1.8
	Median	1.5	0.4	1.9
	Upper Quartile	1.6	0.4	2.0

Ahipara

Ahipara has one of the widest ranges in terms of rates affordability, with a range of between 1.8–16.1 percent. Single adult with two children, in receipt of Sole Parent Support had the highest upper quartile of 16.1 percent, while two working adults based in Auckland had the lowest upper quartile of 2.4 percent.

Again, single superannuitant with no other income, married superannuitant with no other income, and single adult with two children, in receipt of Sole Parent Support households had rates affordability issues. Each of these categories had rates in excess of five percent of gross household income across lower, median and high quartile total rates levels.

Ahipara average household income by household composition

Household income for the following household types was used:

- Single superannuitant with no other income - $24,722
- Married superannuitants with no other income - $37,484
- Single adult earning average wage - $57,938
- Single adult with two children, in receipt of Sole Parent Support - $20,223
- Single adult with two children, earning average wage - $57,938
- Couple with two children, one adult earning average wage - $57,938
- Couple with two children, two adults earning average wage - $115,877
- Couple with no children at home, two adults earning average wage (based in Auckland) - $135,929.

Table 22 Rates payable, Ahipara

	FNDC rates ($)	NRC rates ($)	Total rates ($)
Lower Quartile	2,162	240	2,402
Median	2,392	255	2,647
Upper Quartile	2,962	293	3,255

Table 23 Total rates as a percentage of gross income by household type, Ahipara

Household type		FNDC rates (%)	NRC rates (%)	Total rates (%)
Single superannuitant, no other income	Lower Quartile	8.7	1.0	9.7
	Median	9.7	1.0	10.7
	Upper Quartile	12.0	1.2	13.2
Married superannuitant, no other income	Lower Quartile	5.8	0.6	6.4
	Median	6.4	0.7	7.1
	Upper Quartile	7.9	0.8	8.7
Single working person (no kids)	Lower Quartile	3.7	0.4	4.1
	Median	4.1	0.4	4.6
	Upper Quartile	5.1	0.5	5.6
Single adult, two children, on benefit	Lower Quartile	10.7	1.2	11.9
	Median	11.8	1.3	13.1
	Upper Quartile	14.6	1.4	16.1
Single adult, two children, employed	Lower Quartile	3.7	0.4	4.1
	Median	4.1	0.4	4.6
	Upper Quartile	5.1	0.5	5.6
Couple, two children, one employed	Lower Quartile	3.7	0.4	4.1
	Median	4.1	0.4	4.6
	Upper Quartile	5.1	0.5	5.6
Couple, two children, both employed	Lower Quartile	1.9	0.2	2.1
	Median	2.1	0.2	2.3
	Upper Quartile	2.6	0.3	2.8
Two working adults, based in Auckland	Lower Quartile	1.6	0.2	1.8
	Median	1.8	0.2	1.9
	Upper Quartile	2.2	0.2	2.4

Russell

Across the categories and levels those who live outside Russell tend to have greater rates affordability issues. The highest upper quartile was for single adult with two children, in receipt of Sole Parent Support from outside Russell (23.2 percent).

The following categories have rates affordability issues across the lower quartile, median and upper quartile:

- Single superannuitant with no other income, both resident owners and non-resident owners
- Married superannuitant with no other income, both resident owners and non-resident owners
- Single adult with two children, in receipt of Sole Parent Support, both resident owners and non-resident owners.

The following categories have rates affordability issues in the median and upper quartile categories, but not the lower quartile:

- Single adult earning average wage, both resident owners and non-resident owners
- Single adult with two children, earning average wage, both resident owners and non-resident owners
- Couple with two children, one adult earning average wage, both resident owners and non-resident owners.

Russell average household income by household composition

Household income for the following household types was used:

- Single superannuitant with no other income - $24,722
- Married superannuitants with no other income - $37,484
- Single adult earning average wage - $62,591
- Single adult with two children, in receipt of Sole Parent Support - $20,223
- Single adult with two children, earning average wage - $62,591
- Couple with two children, one adult earning average wage - $62,591
- Couple with two children, two adults earning average wage - $125,182
- Couple with no children at home, two adults earning average wage (based in Auckland) - $135,929.

Table 24 Rates payable, Russell

		FNDC rates ($)	NRC rates ($)	Total rates ($)
Resident owners	Lower Quartile	1,996	280	2,276
	Median	3,101	282	3,382
	Upper Quartile	3,848	332	4,180
Non-resident owners	Lower Quartile	2,721	256	2,977
	Median	3,589	314	3,904
	Upper Quartile	4,337	364	4,702

Table 25 Total rates as a percentage of gross income by household type, resident owners, Russell

Household type		FNDC rates (%)	NRC rates (%)	Total rates (%)
Single superannuitant, no other income	Lower Quartile	8.1	1.1	9.2
	Median	12.5	1.1	13.7
	Upper Quartile	15.6	1.3	16.9
Married superannuitant, no other income	Lower Quartile	5.3	0.7	6.1
	Median	8.3	0.8	9.0
	Upper Quartile	10.3	0.9	11.2
Single working person (no kids)	Lower Quartile	3.2	0.4	3.6
	Median	5.0	0.5	5.4
	Upper Quartile	6.1	0.5	6.7
Single adult, two children, on benefit	Lower Quartile	9.9	1.4	11.3
	Median	15.3	1.4	16.7
	Upper Quartile	19.0	1.6	20.7
Single adult, two children, employed	Lower Quartile	3.2	0.4	3.6
	Median	5.0	0.5	5.4
	Upper Quartile	6.1	0.5	6.7
Couple, two children, one employed	Lower Quartile	3.2	0.4	3.6
	Median	5.0	0.5	5.4
	Upper Quartile	6.1	0.5	6.7
Couple, two children, both employed	Lower Quartile	1.6	0.2	1.8
	Median	2.5	0.2	2.7
	Upper Quartile	3.1	0.3	3.3
Two working adults, based in Auckland	Lower Quartile	1.5	0.2	1.7
	Median	2.3	0.2	2.5
	Upper Quartile	2.8	0.2	3.1

Table 26 Total rates as a percentage of gross income by household type, non-resident owners, Russell

Household type		FNDC rates (%)	NRC rates (%)	Total rates (%)
Single superannuitant, no other income	Lower Quartile	11.0	1.0	12.0
	Median	14.5	1.3	15.8
	Upper Quartile	17.5	1.5	19.0
Married superannuitant, no other income	Lower Quartile	7.3	0.7	7.9
	Median	9.6	0.8	10.4
	Upper Quartile	11.6	1.0	12.5
Single working person (no kids)	Lower Quartile	4.3	0.4	4.8
	Median	5.7	0.5	6.2
	Upper Quartile	6.9	0.6	7.5
Single adult, two children, on benefit	Lower Quartile	13.5	1.3	14.7
	Median	17.7	1.6	19.3
	Upper Quartile	21.4	1.8	23.2
Single adult, two children, employed	Lower Quartile	4.3	0.4	4.8
	Median	5.7	0.5	6.2
	Upper Quartile	6.9	0.6	7.5
Couple, two children, one employed	Lower Quartile	4.3	0.4	4.8
	Median	5.7	0.5	6.2
	Upper Quartile	6.9	0.6	7.5
Couple, two children, both employed	Lower Quartile	2.2	0.2	2.4
	Median	2.9	0.3	3.1
	Upper Quartile	3.5	0.3	3.8
Two working adults, based in Auckland	Lower Quartile	2.0	0.2	2.2
	Median	2.6	0.2	2.9
	Upper Quartile	3.2	0.3	3.5

Paihia

Rates affordability issues were substantial in Paihia. Households, both resident owners and non-resident owners of Paihia, had rates in excess of five percent of gross household income across lower, median and high quartile total rates levels in most categories. These categories were:

- Single superannuitant with no other income
- Married superannuitant with no other income
- Single adult with two children, in receipt of Sole Parent Support
- Single adult earning average wage, outside of Paihia
- Single adult with two children, earning average wage, non-resident owners
- Couple with two children, one adult earning average wage, non-resident owners.

The following categories had rates affordability issues in the median and upper quartile categories, but not the lower quartile:

- Single adult earning average wage, resident owners
- Single adult with two children, earning average wage, resident owners
- Couple with two children, one adult earning average wage, resident owners.

Paihia average household income by household composition

Household income for the following household types was used:

- Single superannuitant with no other income - $24,722
- Married superannuitants with no other income - $37,484
- Single adult earning average wage - $58,004
- Single adult with two children, in receipt of Sole Parent Support - $20,223
- Single adult with two children, earning average wage - $58,004
- Couple with two children, one adult earning average wage - $58,004
- Couple with two children, two adults earning average wage - $116,007
- Couple with no children at home, two adults earning average wage (based in Auckland) - $135,929.

Table 27 Rates payable, Paihia

		FNDC rates ($)	NRC rates ($)	Total rates ($)
Resident owners	Lower Quartile	2,535	241	2,775
	Median	2,897	265	3,162
	Upper Quartile	3,265	289	3,554
Non-resident owners	Lower Quartile	2,724	253	2,978
	Median	3,093	278	3,370
	Upper Quartile	4,215	259	4,474

Table 28 Total rates as a percentage of gross income by household type, resident owners, Paihia

Household type		FNDC rates (%)	NRC rates (%)	Total rates (%)
Single superannuitant, no other income	Lower Quartile	10.3	1.0	11.2
	Median	11.7	1.1	12.8
	Upper Quartile	13.2	1.2	14.4
Married superannuitant, no other income	Lower Quartile	6.8	0.6	7.4
	Median	7.7	0.7	8.4
	Upper Quartile	8.7	0.8	9.5
Single working person (no kids)	Lower Quartile	4.4	0.4	4.8
	Median	5.0	0.5	5.5
	Upper Quartile	5.6	0.5	6.1
Single adult, two children, on benefit	Lower Quartile	12.5	1.2	13.7
	Median	14.3	1.3	15.6
	Upper Quartile	16.1	1.4	17.6
Single adult, two children, employed	Lower Quartile	4.4	0.4	4.8
	Median	5.0	0.5	5.5
	Upper Quartile	5.6	0.5	6.1
Couple, two children, one employed	Lower Quartile	4.4	0.4	4.8
	Median	5.0	0.5	5.5
	Upper Quartile	5.6	0.5	6.1
Couple, two children, both employed	Lower Quartile	2.2	0.2	2.4
	Median	2.5	0.2	2.7
	Upper Quartile	2.8	0.2	3.1
Two working adults, based in Auckland	Lower Quartile	1.9	0.2	2.0
	Median	2.1	0.2	2.3
	Upper Quartile	2.4	0.2	2.6

Table 29 Total rates as a percentage of gross income by household type, non-resident owners, Paihia

Household type		FNDC rates (%)	NRC rates (%)	Total rates (%)
Single superannuitant, no other income	Lower Quartile	11.0	1.0	12.0
	Median	12.5	1.1	13.6
	Upper Quartile	17.0	1.0	18.1
Married superannuitant, no other income	Lower Quartile	7.3	0.7	7.9
	Median	8.3	0.7	9.0
	Upper Quartile	11.2	0.7	11.9
Single working person (no kids)	Lower Quartile	4.7	0.4	5.1
	Median	5.3	0.5	5.8
	Upper Quartile	7.3	0.4	7.7
Single adult, two children, on benefit	Lower Quartile	13.5	1.3	14.7
	Median	15.3	1.4	16.7
	Upper Quartile	20.8	1.3	22.1
Single adult, two children, employed	Lower Quartile	4.7	0.4	5.1
	Median	5.3	0.5	5.8
	Upper Quartile	7.3	0.4	7.7
Couple, two children, one employed	Lower Quartile	4.7	0.4	5.1
	Median	5.3	0.5	5.8
	Upper Quartile	7.3	0.4	7.7
Couple, two children, both employed	Lower Quartile	2.3	0.2	2.6
	Median	2.7	0.2	2.9
	Upper Quartile	3.6	0.2	3.9
Two working adults, based in Auckland	Lower Quartile	2.0	0.2	2.2
	Median	2.3	0.2	2.5
	Upper Quartile	3.1	0.2	3.3

Karikari Peninsula

Again, both inside and outside of Karikari Peninsula, single superannuitant with no other income households, married superannuitants with no other income households, single adult with two children in receipt of Sole Parent Support households had rates in excess of five percent of gross household income across lower, median and high quartile total rates levels.

Karikari peninsula average household income by household composition

Household income for the following household types was used:

- Single superannuitant with no other income - $24,722
- Married superannuitants with no other income - $37,484
- Single adult earning average wage - $55,184
- Single adult with two children, in receipt of Sole Parent Support - $20,223

- Single adult with two children, earning average wage - $55,184
- Couple with two children, one adult earning average wage - $55,184
- Couple with two children, two adults earning average wage - $110,367
- Couple with no children at home, two adults earning average wage (based in Auckland) - $135,929.

Table 30 Rates payable, Karikari Peninsula

		FNDC rates ($)	NRC rates ($)	Total rates ($)
Resident owners	Lower Quartile	2,163	237	2,400
	Median	2,360	311	2,670
	Upper Quartile	2,738	276	3,014
Non-resident owners	Lower Quartile	2,255	244	2,498
	Median	2,502	260	2,762
	Upper Quartile	2,997	293	3,290

Table 31 Total rates as a percentage of gross income by household type, resident owners, Karikari Peninsula

Household type		FNDC rates (%)	NRC rates (%)	Total rates (%)
Single superannuitant, no other income	Lower Quartile	8.7	1.0	9.7
	Median	9.5	1.3	10.8
	Upper Quartile	11.1	1.1	12.2
Married superannuitant, no other income	Lower Quartile	5.8	0.6	6.4
	Median	6.3	0.8	7.1
	Upper Quartile	7.3	0.7	8.0
Single working person (no kids)	Lower Quartile	3.9	0.4	4.3
	Median	4.3	0.6	4.8
	Upper Quartile	5.0	0.5	5.5
Single adult, two children, on benefit	Lower Quartile	10.7	1.2	11.9
	Median	11.7	1.5	13.2
	Upper Quartile	13.5	1.4	14.9
Single adult, two children, employed	Lower Quartile	3.9	0.4	4.3
	Median	4.3	0.6	4.8
	Upper Quartile	5.0	0.5	5.5
Couple, two children, one employed	Lower Quartile	3.9	0.4	4.3
	Median	4.3	0.6	4.8
	Upper Quartile	5.0	0.5	5.5
Couple, two children, both employed	Lower Quartile	2.0	0.2	2.2
	Median	2.1	0.3	2.4
	Upper Quartile	2.5	0.3	2.7
Two working adults, based in Auckland	Lower Quartile	1.6	0.2	1.8
	Median	1.7	0.2	2.0
	Upper Quartile	2.0	0.2	2.2

Table 32 Total rates as a percentage of gross income by household type, non-resident owners, Karikari Peninsula

Household type		FNDC rates (%)	NRC rates (%)	Total rates (%)
Single superannuitant, no other income	Lower Quartile	9.1	1.0	10.1
	Median	10.1	1.1	11.2
	Upper Quartile	12.1	1.2	13.3
Married superannuitant, no other income	Lower Quartile	6.0	0.6	6.7
	Median	6.7	0.7	7.4
	Upper Quartile	8.0	0.8	8.8
Single working person (no kids)	Lower Quartile	4.1	0.4	4.5
	Median	4.5	0.5	5.0
	Upper Quartile	5.4	0.5	6.0
Single adult, two children, on benefit	Lower Quartile	11.1	1.2	12.4
	Median	12.4	1.3	13.7
	Upper Quartile	14.8	1.4	16.3
Single adult, two children, employed	Lower Quartile	4.1	0.4	4.5
	Median	4.5	0.5	5.0
	Upper Quartile	5.4	0.5	6.0
Couple, two children, one employed	Lower Quartile	4.1	0.4	4.5
	Median	4.5	0.5	5.0
	Upper Quartile	5.4	0.5	6.0
Couple, two children, both employed	Lower Quartile	2.0	0.2	2.3
	Median	2.3	0.2	2.5
	Upper Quartile	2.7	0.3	3.0
Two working adults, based in Auckland	Lower Quartile	1.7	0.2	1.8
	Median	1.8	0.2	2.0
	Upper Quartile	2.2	0.2	2.4

Appendix F Average rates assessment for all areas

Table 33 Median rates

	FNDC rates ($)	NRC rates ($)	Total rates ($)
Far North District	2,215	297	2,512
Kaikohe-Hokianga Ward	2,198	235	2,434
Te Hiku Ward	2,334	254	2,588
Bay of Islands-Whangaroa Ward	2,437	236	2,673
Kaitaia	2,083	545	2,628
Ahipara	2,392	255	2,647
Karikari peninsula	2,473	258	2,732
Kaikohe	2,226	223	2,450
Opononi-Omapere	3,060	249	3,309
Kerikeri	2,190	282	2,472
Paihia	2,949	268	3,217
Russell	3,331	297	3,628

Table 34 Median rates as a percentage of gross income for single superannuitant with no other income for each area

Single superannuitant, no other income	FNDC rates (%)	NRC rates (%)	Total rates (%)
Far North District	9.0	1.2	10.2
Kaikohe-Hokianga Ward	8.9	1.0	9.8
Te Hiku Ward	9.4	1.0	10.5
Bay of Islands-Whangaroa Ward	9.9	1.0	10.8
Kaitaia	8.4	2.2	10.6
Ahipara	9.7	1.0	10.7
Karikari peninsula	10.0	1.0	11.0
Kaikohe	9.0	0.9	9.9
Opononi-Omapere	12.4	1.0	13.4
Kerikeri	8.9	1.1	10.0
Paihia	11.9	1.1	13.0
Russell	13.5	1.2	14.7

Table 35 Median rates as a percentage of gross income for married superannuitant with no other income for each area

Married superannuitant, no other income	FNDC rates (%)	NRC rates (%)	Total rates (%)
Far North District	5.9	0.8	6.7
Kaikohe-Hokianga Ward	5.9	0.6	6.5
Te Hiku Ward	6.2	0.7	6.9
Bay of Islands-Whangaroa Ward	6.5	0.6	7.1
Kaitaia	5.6	1.5	7.0
Ahipara	6.4	0.7	7.1
Karikari peninsula	6.6	0.7	7.3
Kaikohe	5.9	0.6	6.5
Opononi-Omapere	8.2	0.7	8.8
Kerikeri	5.8	0.8	6.6
Paihia	7.9	0.7	8.6
Russell	8.9	0.8	9.7

Table 36 Median rates as a percentage of gross income for single working person with no kids for each area

Single working person (no kids)	FNDC rates (%)	NRC rates (%)	Total rates (%)
Far North District	4.1	0.5	4.6
Kaikohe-Hokianga Ward	4.7	0.5	5.2
Te Hiku Ward	4.5	0.5	5.0
Bay of Islands-Whangaroa Ward	4.1	0.4	4.5
Kaitaia	4.5	1.2	5.7
Ahipara	4.1	0.4	4.6
Karikari peninsula	4.5	0.5	4.9
Kaikohe	5.0	0.5	5.5
Opononi-Omapere	6.9	0.6	7.5
Kerikeri	3.7	0.5	4.2
Paihia	5.1	0.5	5.5
Russell	5.3	0.5	5.8

Table 37 Median rates as a percentage of gross income for single working person with no kids for each area

Single adult, two children, on benefit	FNDC rates (%)	NRC rates (%)	Total rates (%)
Far North District	11.0	1.5	12.4
Kaikohe-Hokianga Ward	10.9	1.2	12.0
Te Hiku Ward	11.5	1.3	12.8
Bay of Islands-Whangaroa Ward	12.0	1.2	13.2
Kaitaia	10.3	2.7	13.0
Ahipara	11.8	1.3	13.1
Karikari peninsula	12.2	1.3	13.5
Kaikohe	11.0	1.1	12.1
Opononi-Omapere	15.1	1.2	16.4
Kerikeri	10.8	1.4	12.2
Paihia	14.6	1.3	15.9
Russell	16.5	1.5	17.9

Table 38 Median rates as a percentage of gross income for single working person with two children for each area

Single adult, two children, employed	FNDC rates (%)	NRC rates (%)	Total rates (%)
Far North District	4.1	0.5	4.6
Kaikohe-Hokianga Ward	4.7	0.5	5.2
Te Hiku Ward	4.5	0.5	5.0
Bay of Islands-Whangaroa Ward	4.1	0.4	4.5
Kaitaia	4.5	1.2	5.7
Ahipara	4.1	0.4	4.6
Karikari peninsula	4.5	0.5	4.9
Kaikohe	5.0	0.5	5.5
Opononi-Omapere	6.9	0.6	7.5
Kerikeri	3.7	0.5	4.2
Paihia	5.1	0.5	5.5
Russell	5.3	0.5	5.8

Table 39 Median rates as a percentage of gross income for a couple with two children and one adult worker for each area

Couple, two children, one employed	FNDC rates (%)	NRC rates (%)	Total rates (%)
Far North District	4.1	0.5	4.6
Kaikohe-Hokianga Ward	4.7	0.5	5.2
Te Hiku Ward	4.5	0.5	5.0
Bay of Islands-Whangaroa Ward	4.1	0.4	4.5
Kaitaia	4.5	1.2	5.7
Ahipara	4.1	0.4	4.6
Karikari peninsula	4.5	0.5	4.9
Kaikohe	5.0	0.5	5.5
Opononi-Omapere	6.9	0.6	7.5
Kerikeri	3.7	0.5	4.2
Paihia	5.1	0.5	5.5
Russell	5.3	0.5	5.8

Table 40 Median rates as a percentage of gross income for a couple, with two children who are employed for each area

Couple, two children, both employed	FNDC rates (%)	NRC rates (%)	Total rates (%)
Far North District	2.0	0.3	2.3
Kaikohe-Hokianga Ward	2.4	0.3	2.6
Te Hiku Ward	2.2	0.2	2.5
Bay of Islands-Whangaroa Ward	2.0	0.2	2.2
Kaitaia	2.3	0.6	2.9
Ahipara	2.1	0.2	2.3
Karikari peninsula	2.2	0.2	2.5
Kaikohe	2.5	0.2	2.7
Opononi-Omapere	3.5	0.3	3.8
Kerikeri	1.9	0.2	2.1
Paihia	2.5	0.2	2.8
Russell	2.7	0.2	2.9

Table 41 Median rates as a percentage of gross income for two working adults with no kids, based in Auckland for each area

Two working adults, based in Auckland	FNDC rates (%)	NRC rates (%)	Total rates (%)
Far North District	1.6	0.2	1.8
Kaikohe-Hokianga Ward	1.6	0.2	1.8
Te Hiku Ward	1.7	0.2	1.9
Bay of Islands-Whangaroa Ward	1.8	0.2	2.0
Kaitaia	1.5	0.4	1.9
Ahipara	1.8	0.2	1.9
Karikari peninsula	1.8	0.2	2.0
Kaikohe	1.6	0.2	1.8
Opononi-Omapere	2.3	0.2	2.4
Kerikeri	1.6	0.2	1.8
Paihia	2.2	0.2	2.4
Russell	2.5	0.2	2.7

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Far North District Council
Memorial Avenue
Kaikohe

17 September 2021

Attention: Ben Bowden

Dear Ben,

Kaeo WWTP treated wastewater disposal to land

Far North District Council (FNDC) prepared the Kaeo Land Disposal GIS Mapping report[1] in August 2021. This report identified several potential sites for land discharge of treated wastewater from the Kaeo Wastewater Treatment Plant (Kaeo WWTP). However, the report did not include cost estimates for wastewater pumping, storing and irrigation to land. Beca was engaged to provide this cost estimate.

After initial discussions it was noticed that none of the original sites identified would be large enough for wastewater irrigation. A workshop was held with FNDC to identify other suitable sites after which a Site Information report[2] was provided by FNDC defining a new potential site for wastewater discharge for costing purposes. Further work will be required to confirm the preferred site and site suitability for discharge of wastewater.

The purpose of this letter is to provide a high level cost estimate to support planning of wastewater discharge for Kaeo to this new potential site.

Scope of Works

The scope of works includes a high level engineering design which is required to develop a high level capital cost estimate for the identified site for treated wastewater discharge to the land. The following scope is covered in this letter:

- High-level design of the pump station and conveyance to the land discharge site, provided by FNDC
- High-level consideration of potential storage
- High-level consideration of discharge system (assumed surface spray irrigation)
- Class 5 (-30% to +50% accuracy) cost estimates

[1] Kaeo Land Disposal GIS Mapping report file name 'Option 1 Kaeo DtL Sites information – GIS mapping.docx', by FNDC, August 2021
[2] Kaeo Land Disposal GIS Mapping report file name 'Kaeo Land Disposal – Site Information.docx', by FNDC, August 2021

1.1 Pump Station design and Conveyance to Preferred sites

A high level pump station design was undertaken, and the pipeline route identified to deliver treated wastewater to the potential site. The pump station and pipeline design assumed the following:

- The pump station will be located at Kaeo WWTP site for the ease of tie-in works, the centreline of the pump is assumed to be 5m above sea level +/- 1m.
- Adopted pumping design flow 12 L/s. This will provide the following approximate pumping time per day:
  - 3 hr based on average flow of 195 m^3/d (projection[3] for year 2043)
  - 24 hrs based on maximum flow of 1000 m^3/d
- Treated wastewater storage will be provided at the land discharge site.
- Treated wastewater quality will be sufficient for the pumping purpose to avoid biofilm forming in the pipeline.
- Discharge of pipeline assumed to be a potential storage location within proposed irrigation site boundaries on a relatively flat area (contour line 40 m).

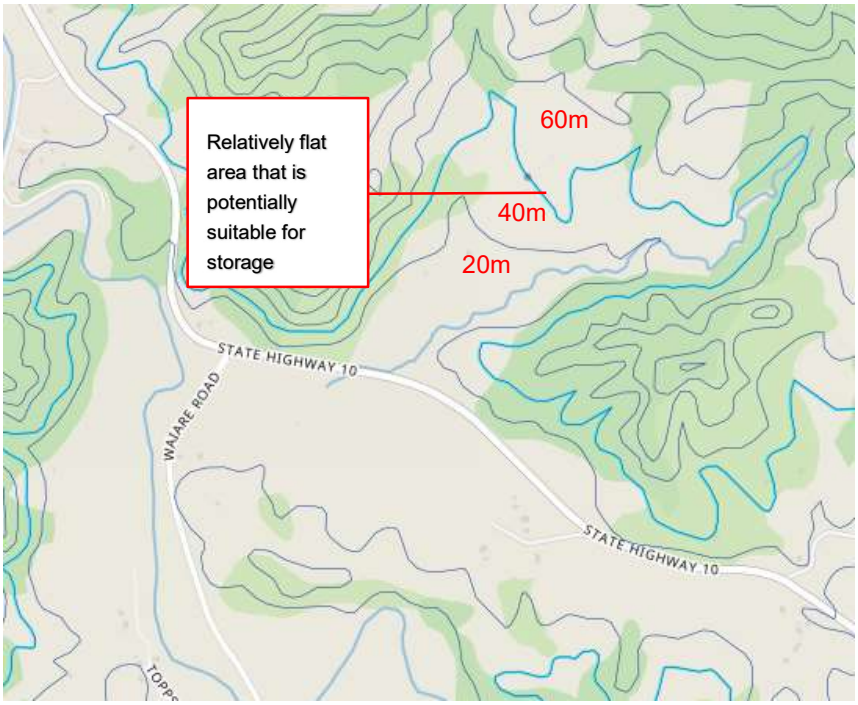


Figure 1: Potential storage location

Therefore, a total pumping head of 125m is calculated through the system assuming minor pipe losses based upon the proposed pipe route.

- Pipework to be constant diameter throughout the proposed route.
- Estimated size of PE pipeline (PN16) is OD125 at a target velocity of 1.5 m/s.

[3] Kaeo Land Disposal Calculations, excel spreadsheet, provided by FNDC

- Pipeline will be buried along the road (except for crossing the Kaeo river where we assume it can be fixed to the existing bridge structure) in a road corridor and will enter the site via council owned land.
- Assumed no clashes with existing utility services (e.g. electricity, telecommunications) and road structures.

The indicative 4.7km pipeline route is presented below.

Figure 2 Indicative pipeline route

1.1.1 Site

The land disposal area which could be suitable for irrigation, determined by FNDC for the site is presented below.

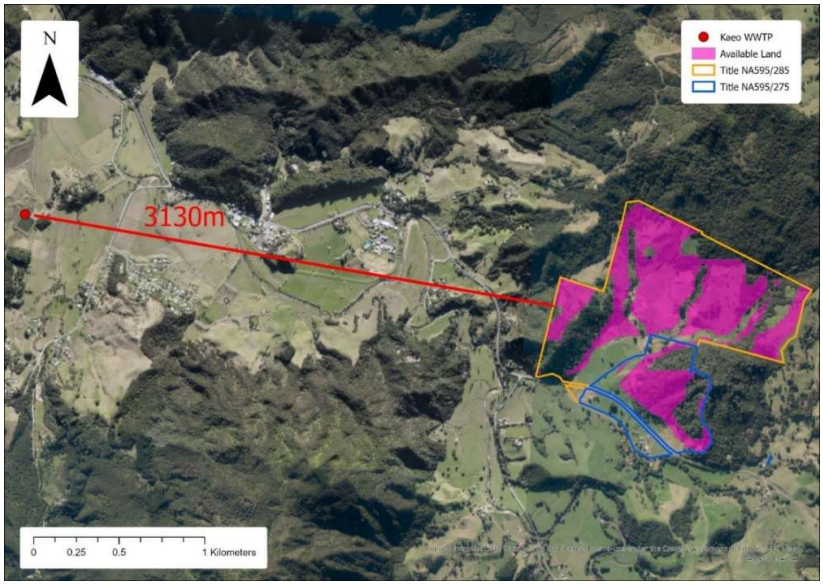


Figure 3 Potential disposal to land

It is understood that the available disposal area covers 2 titles (NA595/285 and NZ595/275) across 7 parcels of land. More specific information regarding each title is given below:

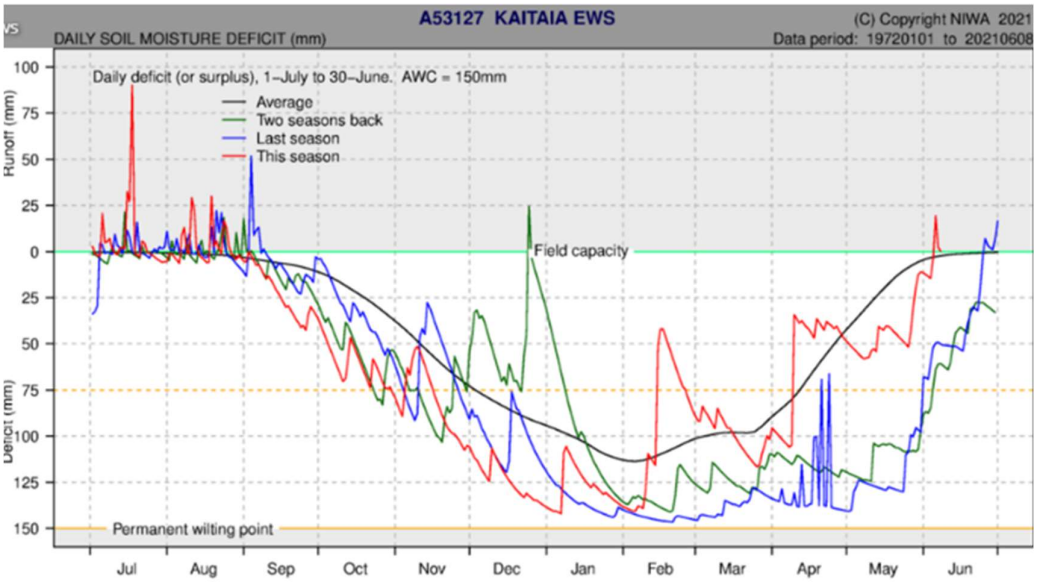
- NA595/285 - Contains 54.6 Ha of available land. With a 25 m buffer from the title boundary the available area is reduced to 50.1 Ha. Areas with high slopes and with high flooding risk have been excluded.
- NA595/275 - Contains 12.4 Ha of available land. With a 25 m buffer from the title boundary the available area is reduced to 11.0 Ha. Areas with high slopes, high flooding risk and those with roading designation have been excluded.

1.2 Irrigation and Storage

A high level assessment of required treated wastewater storage and irrigation area was undertaken to provide indicative sizing information for the cost estimate. The storage and irrigation system assumed the following:

- The storage for treated wastewater will be at the discharge point of the pipeline from the pump station and is assumed to be an open pond with a clay liner and standard slopes of 1:3.

  The pond size is based on 3 month storage of average daily flow in 2043. This assumption is based on typical soil moisture deficit in Kaitaia (see Figure below, obtained from Northland Regional Council website, NIWA data). During the months of July and August there are typically extended periods of no soil moisture deficit (i.e. soil is saturated) and therefore low volumes of treated wastewater are expected to be discharged to land during this period. At other times of the year, the storage pond is required to buffer out peak treated wastewater flows.



- It is assumed that a dry mounted pump will be installed on the bank of the pond to transfer treated wastewater from the storage pond to the irrigation system. The pump is assumed to be in-housed in a standard shed together with controls for the pump itself and irrigation system.
- Due to the relatively steep slopes on the site and assumed future site management requirements we assumed that a cut and carry operation is not feasible, therefore we have assumed that the cover will be native trees, pines or similar. Fixed Spray irrigation is assumed to be installed.
- The land requirement for irrigation was determined by applying a simple modelling tool using daily flows, rain data, hydraulic application rate of 3 mm/day and effluent storage of 17,800 m^3.
- A 50% factor was applied to total land area required to be purchased to account for buffer zones around drains/streams and the boundary.

1.2.1 Storage

An estimated storage pond volume required to accommodate 3 months treated wastewater storage is 17,800 m^3 based on the average flow future (2043) of 195 m^3/d. The approximate internal dimensions of the pond are 75m x 80m with an effective water level of 3m (total depth 3.5 m). An indicative location for the storage pond is presented below:

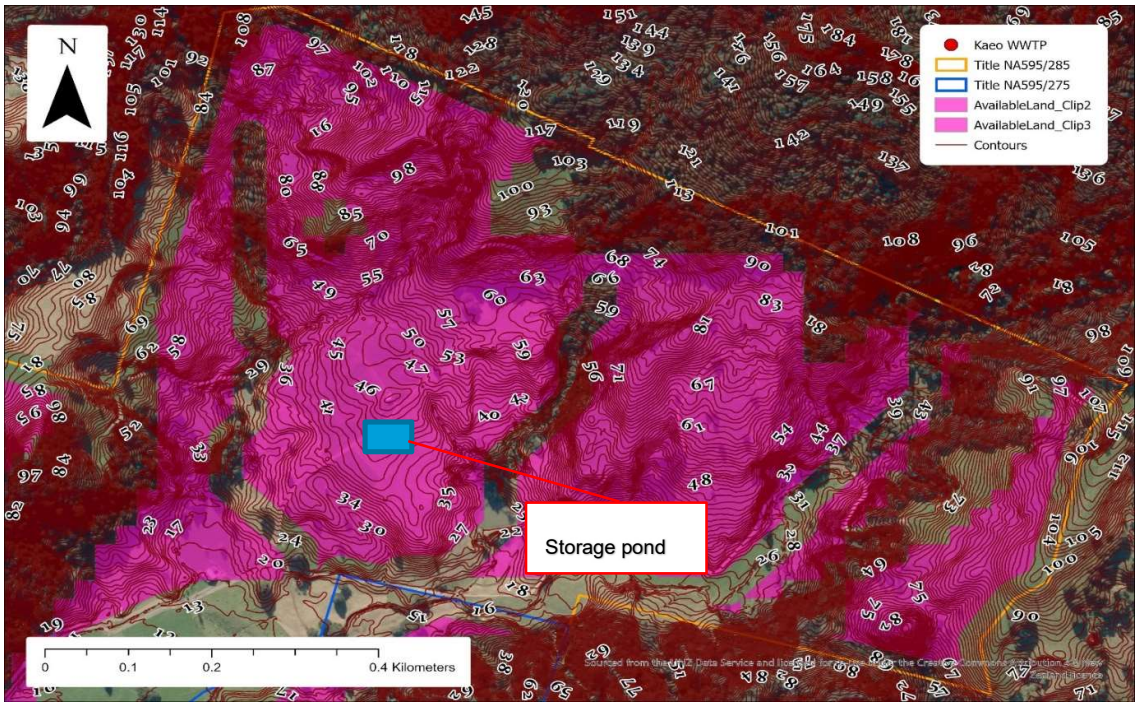


Figure 5 Indicative storage pond location

1.2.2 Irrigation system

High level modelling was applied to determine land irrigation area and therefore the size of the irrigation system. The model used flow data provided by FNDC for the period January 2017 – December 2020. Some of the data provided by FNDC for this period had some gaps, especially the winter months of 2019. Due to the missing data the 2019 year was excluded from our analysis. The outflow data for all years also appeared unreliable with many zero outflow days present. Our analysis approximated effluent outflow data using wastewater inflow which appeared more reliable.

The estimated irrigation area required for treated wastewater discharge is summarised in Table 1 below.

Table 1 Irrigation area requirements for treated effluent disposal in 2025 and 2055

	Flow m^3/d	3 month storage m^3	Rounded m^3	Hydraulic loading rate mm/d	Irrigation area (no buffer) ha	Land required (with buffer) ha	Nitrogen loading kgN/ha/year[4]
2026	171	15,636	15,600	3	16.0	24.0	102
2043	195	17,803	17,800	3	18.1	27.2	103

A minimum area of 18.1 ha is required to dispose treated wastewater to the land in the future. The area size accounts for the down time when irrigation will not be possible due to weather conditions. It is assumed that minimal irrigation will occur in July and August, where treated wastewater will be stored in the pond. No irrigation will occur if the rainfall will be greater than 3 mm/d. To catch up with the irrigation for the down time period, without exceeding the hydraulic application rate of 3 mm, more land is required in comparison to the catch-up irrigation method where an increasing hydraulic rate could be applied.

The minimum land area of 18.1 ha is required for irrigation itself, however a buffer of 50% should be applied to account for the buffer areas to a property boundary. As indicated in the table above approximately 27.2 ha of land will be required including buffer area. The buffer area could also include the area required for pond storage (1.8 ha). Further technical work on soil suitability, pond storage location, irrigation system layout and application rates is recommended before purchasing the land.

We understand that 61.1 ha of land is available for irrigation. Given that 27.2 ha of land is required for treated wastewater disposal in the future there is sufficient land available.

1.3 Capital cost estimate

At this early concept stage, the estimated construction costs have an accuracy range of -30% to + 50%.

Costs ($NZD) are summarised in table below. See Appendix A for a more detailed breakdown of the costs.

Table 2 Estimated Construction Cost (-30% to + 50%) for Disposal Site

Cost Item	Cost estimate ($)
Pump station and pressure pipeline	1,561,000
Effluent Storage Pond	1,686,000
Irrigation system	1,116,000
Electrical and controls	96,000
Planning	150,000
Professional fees, Council internal costs and contingency	1,608,000
Total	**6,218,000**
Range	**4.4 Mil to 9.3 Mil**

The above costs are based on current costs as of September 2021, exclude GST and do not include for escalation or risks associated with COVID delays and/or disruptions.

[4] Based on an assumed continuation of existing treated wastewater quality being discharged from the WWTP.

1.3.1 Limitations

This concept cost estimate is based on limited information and is therefore high level only (feasibility - 30 to +50%). It is intended to be used only for high level option assessment/selection and cannot be relied on or used for detailed pricing or budgeting purposes. Detailed construction methodology and geotechnical information is required prior to providing a detailed estimate of construction costs. There is a risk that the geotechnical conditions encountered could make this unfeasible, however this can only be determined through additional geotechnical investigations.

1.3.2 Assumptions

The following assumptions have been made for cost estimating purposes (see also the detail costs for more information)

- Only a rudimentary access allowed for along the pipe route for pipe installation
- Assume solid block fixed sprinkler irrigation is needed
- Planting of irrigation area based on 1000 pine tree seedlings per ha
- All works done during normal work hours
- The project will be procured on a competitive basis
- The contractor will be given free access to the Works site

1.3.3 Exclusions

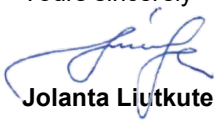
No allowance has been included in the estimates for the following costs:

- Any upgrades at the WWTP itself (we have assumed the current treated wastewater quality will continue in the future)
- Fencing reconfiguration along the pipeline route
- Effects of climate change on future irrigation system performance
- Maintenance access tracks
- Land purchase
- Relocation of any existing services / utilities
- Contaminated material removal or treatment
- GST
- Escalation
- Costs to date
- Operating cost
- Insurance costs
- Legal and finance fees
- Risk items
- Covid-19 related costs

1.3.4 Contingency Allowance

The cost estimate includes a 10% estimating allowance for design development and 15% contingency for construction/unforeseen costs. This allowance should be reassessed on completion of further site investigations and design development.

Yours sincerely



Jolanta Liutkute
Senior Process Engineer

on behalf of

Beca Limited

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Copy
Garrett Hall, Beca Limited

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Cost Estimate Schedules

	CAPITAL COST ESTIMATE			Disposal	
Code	**Description**	**Quantity**	**Units**	**Rate $**	**Subtotal $**
Pump station and pressure line					
1.01	Pre-engineered fiber glass PS at WWTP. Including D/SB pump arrangement. Pump size 15 kW.	1	LS	110,000.00	110,000.00
1.02	PE125 PN16 OD125 (ID113)	4,700	m	230.00	1,081,000.00
1.03	Allowance for air valves and chambers	1	LS	50,000.00	50,000.00
1.04	Kaeo River crossing pipeline	1	LS	60,000.00	60,000.00
1.05	Electrical, control cabinet telemetry	1	LS	50,000.00	50,000.00
Fixed Spray irrigation (solid set block)					
1.06	Irrigation system for the area of 18.1 ha	18.1	ha	50,000.00	905,000.00
1.07	Planting of irrigation area with Pines	18.1	ha	20,000.00	362,000.00
1.08	Storage pond 75mx80mx3.5m construction including earthworks	6,000	m2	155.00	930,000.00
1.09	Site preparation for pond installation	1	LS	75,000.00	75,000.00
1.10	Pond area fencing 77mx82m	318	m	120.00	38,160.00
1.11	Irrigation pump including control shed and concrete slab	1	LS	25,000.00	25,000.00
1.12	Electrical, controls, telemetry, need to bring lower from the road to the site.	1	LS	30,000.00	30,000.00
Planning					
1.13	Baseline groundwater and soil investigations	1	LS	50,000.00	50,000.00
1.14	Consenting, including AEE	1	LS	100,000.00	100,000.00
	Net Construction Cost Estimate				**3,716,160.00**
	Main Contractor On-site overheads (P&G) and Profit Margin	20%	%	3,716,160.00	743,232.00
	Gross Construction Cost Estimate				**4,609,392.00**
	Design Development Contingency	10%	%	4,609,392.00	460,939.20
	Construction Contingency	15%	%	4,609,392.00	691,408.80
	Total Construction Budget				**5,761,740.00**
	Professional Fees	6%	%	5,761,740.00	345,704.40
	Client-owned project costs	2%	%	5,761,740.00	115,234.80
	Rounding	1	LS		-4,919.20
	Total Expected Concept Capital Cost Estimate				**6,217,760.00**