Taipa Wastewater Transformation Project

Condition 10 Report

Prepared for Far North District Council
Prepared by Beca Limited

30 August 2022

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Contents

Appendices

Revision History

Revision Nº	Prepared By	Description	Date
1	Farza Feizi	Draft Report	19/08/2022
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Document Acceptance

Action	Name	Signed	Date
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on behalf of	Beca Limited		

1 Executive Summary

This report presents a summary of the wastewater treatment upgrade and discharge options for Taipa wastewater treatment plant (WWTP). Taipa WWTP is operated by Far North District Council (FNDC) and receives wastewater from Coopers Beach, Mangonui, Taipa and Cable Bay in the Far North District. The WWTP treats wastewater via a pond and wetland-based system and the treated wastewater discharges into Parapara Stream which ultimately discharges into Doubtless Bay.

For renewal of the FNDC's resource consent (AUT.004007.01.03), a hearing was held in August 2019 and a consent order (ENV-2019-AKL-000181) was issued in March 2021. According to consent order (ENV-2019-AKL-000181), significant alterations for Taipa WWTP and the wastewater discharge to the Parapara Stream (the current discharge location) were required and a direction on the options assessment for wastewater treatment and discharge was provided subject to Condition 7, 10, 11, 12 and 13.

FNDC has investigated different wastewater treatment and discharge options to meet the requirements in the consent order. A Working Group was established to provide for their involvement in the decision making process. The working group consists of three representatives of Ngāti Kahu, one representative of the broader Doubtless Bay community and two FNDC staff. Beca was engaged by FNDC to guide the Taipa Working Group through a best practice decision making framework for determining the BPO for the discharge and treatment of the wastewater collected at the Taipa WWTP, and to present that decision to Northland Regional Council in accordance with Condition 10 of the consent order.

Beca held four in-person workshops and four follow up online workshops with the Working Group to investigate wastewater treatment and land discharge options towards a BPO. The in-person workshops were the key method of communication and discussion with the working group and the online workshops were a method for decision making by providing enough time for the working group to investigate the information received from the in-person workshops. Long listing and short listing processes were completed in collaboration with the Working Group at these workshops and the BPO was identified in workshop 4 (in-person, held on 9 August 2022).

Considering requirements for quality of treated wastewater in the consent order, eight WWTP upgrade options for either land discharge and or water discharge were presented by Beca during the long listing process. Pros and cons of each treatment upgrade options and Beca's recommendations for shortlisting each option were discussed with the Working Group. A high-level traffic light assessment of the options was carried out and the preferred options for shortlisting were suggested. Moreover, an overview of 15 land discharge sites (selected through desktop GIS assessment) was provided by FNDC for discharge of treated wastewater to land, and population growth, cultural significance, buffers and onsite storage space were considered in identifying land parcels suitable for the discharge.

The eight WWTP upgrade options were discussed and assessed using traffic light colour coding. Four out of eight options were short listed and decided to be taken forward for cost estimating during the short listing process. Considering the suitability of the shortlisted WWTP upgrades options for discharge to water and/or land, the WWTP options were further refined into five schemes as shown below:

- Scheme A – Discharge to land (site to be confirmed) – pond upgrade to tertiary filtration and Ultraviolet (UV)
- Scheme B – Discharge to land (site to be confirmed) – pond upgrade with electrocoagulation (EC), solids removal and UV
- Scheme C – Discharge to land (site to be confirmed) – convert ponds into pond based Sequenced Batch Reactor (SBR) and UV

- Scheme D – Discharge to water - convert ponds into pond based SBR and UV
- Scheme E – Discharge to water – new standalone Membrane Bioreactor (MBR) plant

The top six land parcels were discussed and ranked by FNDC by using initial MCA assessment and considering six criteria: land use, distance from Taipa WWTP, suitable land area (60 req.), predicted drainage, relative level (m) from Taipa WWTP (7m pump), and slope. Results of the rankings showed property #2, property #4, and property #12 as top three preferred sites. It was concluded to investigate all top three land discharge sites (property #2, property #4, and property #12) in terms of cost estimation and meeting up with landowners to determine the level of interest in irrigating treated wastewater to their land. The land discharge sites were further reviewed and property #2 (Red site) was decided to be taken forward as an indicative of potential costs for a land discharge scheme.

The assessment of each of the five shortlisted schemes against multiple non-cost criteria using the traffic light method was undertaken and the emerging preferred options were concluded as Scheme B (EC with land discharge) and Scheme C (SBR with land discharge), considering the importance of a pilot study for proceeding with EC option. In the last workshop (in-person workshop 4), the five shortlisted schemes were further assessed by the Working Group and the EC option was determined as the BPO by the Working Group.

According to the soil moisture deficit scheme which was applied to the land discharge high level concept design, storage for treated wastewater is required. In this case, an overflow relief valve from the treated wastewater storage pond is needed to prevent overtopping the storage in severe wet weather. Staging the discharge of treated wastewater was therefore discussed with the Working Group. Staging refers to the upgrade of the Taipa WWTP in the first instance to meet the requirements of Condition 13 of the consent order, followed by the setup of a land discharge scheme. It was concluded that the BPO should therefore include a WWTP upgrade that meets the consent order standards under Condition 13 to allow for both staging of the upgrade and for a partial discharge to water from the storage pond relief valve following implementation of the land discharge scheme.

According to definition of BPO in the RMA, the BPO determined by the Working Group is considered to be in line with the RMA definition of BPO and can be successfully applied to the Taipa WWTP and meet the cultural, environmental, social, and economic constraints. However, it should be noted that the onsite trial needs to be performed to determine the capability of EC system in meeting the water quality standard required by Condition 13 of the Consent Order. If the trial shows that the quality of wastewater treated by EC option does not meet the water quality condition, scheme C will be determined as the BPO option because the SBR option is already well proven technology in New Zealand treating the wastewater to a high level and will meet the required water quality condition.

The next recommended steps for Taipa WWTP are as follows:

- Land discharge scheme needs to be confirmed by 1st July 2023 (Condition 11). However, considering the time needed for the site investigations and the EC trial, it is unlikely to have the land discharge scheme confirmed by 1st July 2023. Therefore, a variation of Condition 11 from Northland Regional Council (NRC) may be required. The following are needed in order to confirm the land discharge scheme:
    - Funding for the site investigations needs to be secured by FNDC.
    - Signed Memorandum of understanding with landowner needs to be secured.
    - Soil investigations should be carried out for the three shortlisted sites by September 2023 to determine suitability of land parcels for wastewater irrigation.
    - Irrigation design with further information needs to progress (primarily irrigation rate and seasonality).

- The land discharge scheme should be implemented by 1st September 2027 (Condition 12). During the period that the land discharge system is being established, the consent holder must provide a written progress report to the Northland Regional Council's Compliance Manager every six months. The following are needed in order to implement the land discharge scheme:
    - Site investigations need to be undertaken and the wastewater irrigation system (preliminary design is the next stage) needs to be designed.
    - Land discharge resource consent needs to be obtained (preparing consent application + AEE, pre-app with Northland Regional Council, timeframe for processing of consent application).
    - Costs and funds from FNDC need to be secured and finalised for undertaking upgrades.
    - An onsite trial of the EC option should be undertaken by September 2023.
    - Preliminary and detailed design for WWTP upgrade needs to be undertaken.
    - Storage facility and pipeline to preferred site needs to be built.
    - WWTP upgrades needs to be undertaken.

2 Introduction

2.1 Background

The East Coast Wastewater Treatment Plant (WWTP), henceforth Taipa WWTP, is operated by Far North District Council (FNDC) and receives wastewater from Coopers Beach, Mangonui, Taipa and Cable Bay in the Far North District. The WWTP treats wastewater via a pond and wetland-based system and discharges treated wastewater into a farm drain. The drain is a tributary of an unnamed creek that flows into the Parapara Stream which ultimately discharges into Doubtless Bay.

FNDC previously held resource consent AUT.004007.01.03 which authorised the discharge of treated wastewater from Taipa WWTP to the unnamed tributary of Parapara Stream. This consent expired in 2008.

For renewal of the resource consent, a hearing was held in August 2019 and a consent order (ENV-2019-AKL-000181) was issued in March 2021. The order sets out a number of amended conditions provided in Attachment 1 to the order (Appendix A) which are outlined below and include establishing a Working Group (Condition 7) to determine the Best Practicable Option (BPO) for the Taipa WWTP (Condition 10). The Working Group was to consist of members from the Te Mana o Te Wai Hapu Integration Roopu Charitable Trust, one of the listed Appellants to the resource consent as set out in the consent order, as agreed during resolution of the appeal.

2.2 Consent Order

According to consent order (ENV-2019-AKL-000181), significant alterations for the Taipa WWTP and the wastewater discharge to the Parapara Stream (the current discharge location) are required. The two options considered in the consent order are:

1) Upgrading the WWTP and discharging the treated wastewater to water at the quality standards set out in the consent order (Table 1).
2) Transferring the discharge from discharge to water to discharge to land.

The consent order has the following key conditions:

Condition 7: According to the Condition 7 of the consent order the Consent Holder must, no later than 1 October 2021, establish a Working Group and invite three representatives of Ngāti Kahu (appointed by mana whenua) and one representative of the broader Doubtless Bay community (appointed by Te Mana o Te Wai Hapu Integration Roopu Charitable Trust) to be members of the Working Group. The Working Group must also comprise of two senior officers appointed by the Consent Holder, supported by an independent person qualified and specialising in wastewater engineering and land discharge systems (appointed by the Consent Holder and certified by the Northland Regional Council's Compliance Manager as being independent and having no conflict of interest).

Condition 10: In accordance with Condition 10 of the order, the Consent Holder must, no later than 1 September 2022, provide a report to the Northland Regional Council's Compliance Manager which assesses the options for disposing treated wastewater from the East Coast Wastewater Treatment and the report must include a recommendation as to which discharge option is considered to be the BPO. The assessment must include the option of disposing the treated wastewater to land and must identify the costs and benefits of all practicable discharge options. The assessment of options must be undertaken by a suitably qualified and experienced person(s) and must involve the Working Group established in accordance with Condition 7.

Condition 11: If the report required by Condition 10 determines that the BPO is to change to land discharge then the Consent Holder must, no later than 1 July 2023, advise the Northland Regional Council's Compliance Manager, in writing, whether or not it is committing to the land discharge option.

Advice Note: The ten-month period between the date specified in Condition 10 and the date specified in Condition 11 has been provided in acknowledgement that the Consent Holder may need to undertake consultation with the local community and that funding for the land discharge system may need to go through, and may need to be approved through, its Long Term Plan or Annual Plan processes.

Condition 12: If the Consent Holder has advised the Northland Regional Council's Compliance Manager that it is committing to the land discharge option (refer Condition 11) then the Consent Holder must establish and commission the land discharge system no later than 1 September 2027. During the period that the land discharge system is being established, the Consent Holder must provide a written progress report to the Northland Regional Council's Compliance Manager every six months.

Condition 13: If the Consent Holder has advised the Northland Regional Council's Compliance Manager that it is not committing to the land discharge option (refer Condition 11) then the Consent Holder must, no later than 1 September 2026, upgrade the wastewater treatment system (and commission the upgrades) so that the quality of the treated wastewater, as measured at NRC Sample Site 101687 (discharge from the wetland), meets the following standards (listed in Table 1), based on the results of 26 fortnightly samples collected each calendar year as required by Schedule 1:

Table 1. Requirements for quality of treated wastewater if the BPO is discharged to water.

Parameter	Unit	Median*	85% Percentile*
Total Nitrogen (TN)	mg/L	12	16
Total suspended solids (TSS)	mg/L	20	30
Biological oxygen demand (BOD)	mg/L	20	40
Dissolved oxygen (DO)	mg/L	> 2	> 2
pH	mg/L	> 6.5	> 6.5
Total Phosphorus (TP)	mg/L	10	15
Faecal Coliforms (FC)	cfu/100 mL	1,000	1,500

*Based on pH 8 and temperature of 20°C.

Advice Note: The Consent Holder has advised that it will involve the Working Group required to be established in accordance with Condition 7 in determining the appropriate option to upgrade the wastewater treatment plant to meet these standards.

The consent order does not set out any standards for the wastewater quality should the discharge be moved to land discharge.

In order to address the requirements in the consent FNDC has explored various wastewater treatment and discharge options that would meet the cultural, environmental, social, and economic constraints. The Working Group has been established to provide for their involvement in the decision making process; in particular, in the following elements:

- Assessment of the discharge options,
- Providing recommendations regarding the BPO,
- Analysis of options for upgrading the WWTP (if such an upgrade is required by Condition 13),
- Providing recommendations regarding the upgrade required by Condition 13, and,
- Post-commissioning monitoring of water quality.

The Working Group comprises three representatives of Ngāti Kahu (Hikitia Hita, Julie Rickit and Trudy Allen), one representative of the broader Doubtless Bay community (Andreas Kurmann) and two FNDC staff (Mandy Wilson and Melissa Parlane). The representatives of the Working Group were commissioned to work together to support good decision making that would promote the wellbeing of Ngāti Kahu Hapū and the wider community by striving to achieve the best outcome to bring back the mauri to the wai.

Beca was commissioned by FNDC to guide the Taipa Working Group through a best practice decision making framework for determining the BPO for the discharge and treatment of the wastewater collected at the Taipa WWTP, and to present that decision to Northland Regional Council in accordance with Condition 10 of the consent order. Beca held four in-person workshops and four follow up online workshops with the Working Group to investigate wastewater treatment and land discharge options towards a BPO. The in-person workshops were the key method of communication and discussion with the Working Group and the online workshops were a method for decision making by providing enough time for the Working Group to investigate the information received from the in-person workshops. Long listing and short listing processes were completed in collaboration with the Working Group at these workshops and the BPO was identified in workshop 4 (in-person, held on 9 August 2022).

2.3 Purpose of this Report

This report is set out in the following sections:

- A review of background information on the assessment of different treatment and discharge options for treated wastewater at Taipa WWTP.
- A summary of the long and short listing processes and multi-criteria analysis (MCA)
- Selecting BPO
- An assessment of the BPO in line with the RMA definition of BPO
- A summary of suggestions and solutions

2.4 Background Information

To prepare this report, the documents below have been reviewed:

- Taipa WWTP Upgrade Issues and Options (AECOM, April 2018)
- Taipa WWTP Upgrade Issues and Options (AECOM, May 2018)
- Long List of Proposed Options for Wastewater Treatment and Disposal (Jacobs, April 2020)
- Resource consent AUT.004007.01.03 and consent order ENV-2019-AKL-000181

3 Historic Documents

A number of investigations exist that relate to the assessment of different treatment and discharge options for treated wastewater at Taipa WWTP. These documents were either undertaken as part of the resource consent process or subsequent to that. Documents reviewed to inform the condition 10 BPO decision making process include:

- Taipa WWTP Upgrade Issues and Options (AECOM, April 2018)
- Taipa WWTP Upgrade Issues and Options (AECOM, May 2018)
- Long List of Proposed Options for Wastewater Treatment and Disposal (Jacobs, April 2020)

Each of these reports is briefly summarised below and referred to as footnote references throughout the rest of this document where applicable.

3.1 Taipa WWTP Upgrade Issues and Options (AECOM, April 2018)

A site selection analysis was performed by AECOM in April 2018 to identify potentially suitable sites for land discharge of treated wastewater from Taipa WWTP. The site selection analysis was based on GIS analysis and GIS datasets from various sources. These datasets included property parcels, ground elevation, district plan zones, soil type, watercourses, 100-year floodplain extents, tsunami inundation extents, slope class, land cover, and marae locations.

GIS screening was initially completed to determine any potentially suitable sites that would meet a list of high level criteria. Based on the initial GIS screening, only sites which met these constraint criteria were analysed further. Constraint criteria included the following:

1. Less than 5 km to the existing Taipa WWTP site
2. Greater than 300 m from residential, coastal living, and rural living zones as identified within current District Plan
3. Greater than 500 m from Marae locations
4. Greater than 100 m from watercourses, including streams and land drains
5. A slope of 0-7˚ (flat to undulating Landcare slope class), or 8-15˚ (rolling) if land has sufficient vegetation cover
6. Site elevation at least 2 m (One Tree Point datum)
7. Maximum of 1 km from existing high voltage power supply network connection point
8. Site area of 70 ha minimum

According to the eight criteria initially used for screening of the sites, no potential land discharge sites were identified to meet all criteria exactly. However, by changing the slope criteria slightly and considering sites with slopes of 8-15˚ (if land has sufficient vegetation cover), and/or increasing the distance to the WWTP slightly greater than 5km, four potential sites were identified as shown in Figure 1.

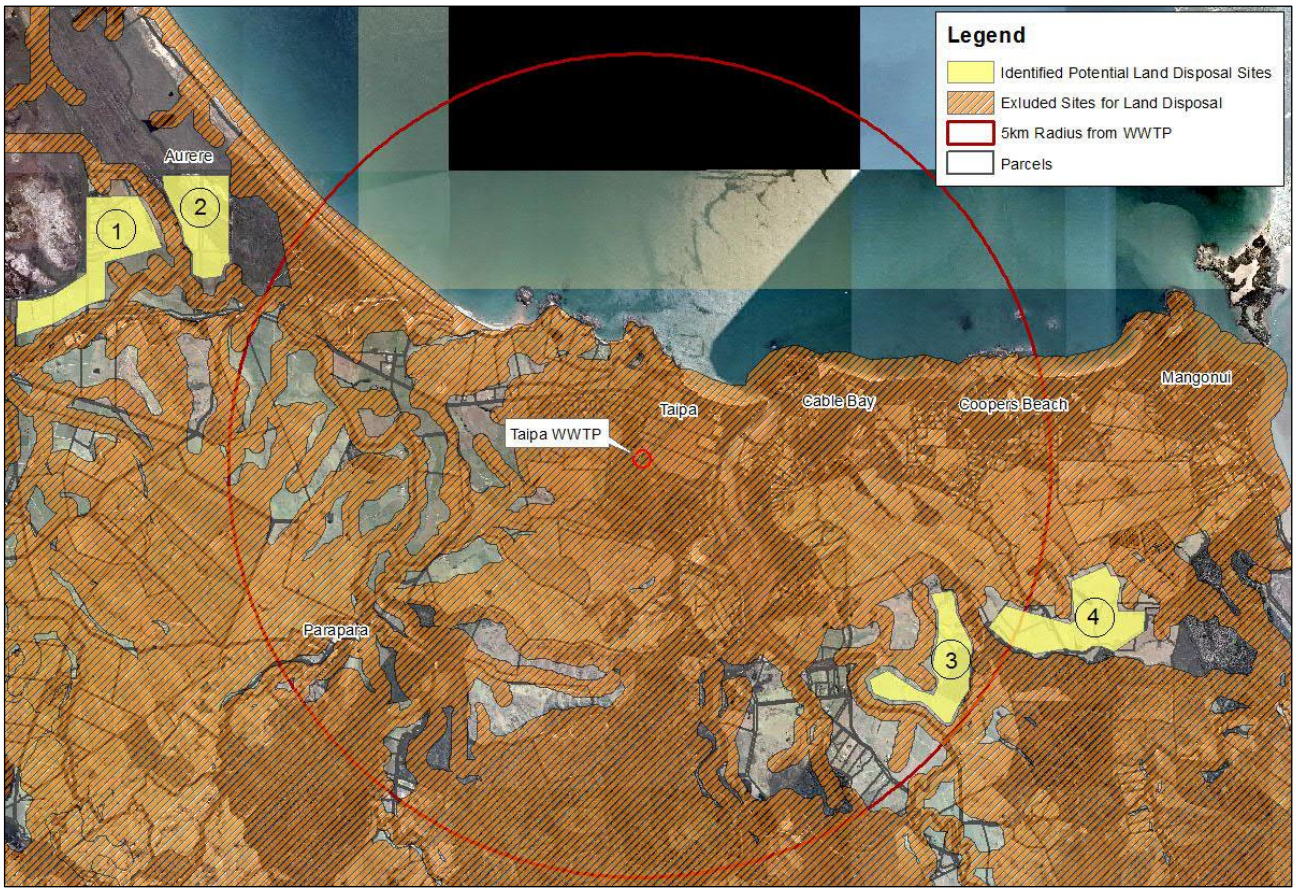


Figure 1. Identified potential land disposal sites based on initial screening criteria (AECOM, April 2018).

For the next stage of analysis, the following criteria were assessed for each of the four potential sites:

- existing land cover
- number of parcels affected,
- ownership of parcels (Council, Māori, private)
- distance from site boundary to 100-year floodplain
- site inundation from a 3m tsunami wave
- soil type (permeability)

A summary of parameters which were assessed in the secondary analysis for all four sites is shown in Table 2. According to the secondary constraints analysis, sites 2, 3 and 4 were considered to be suitable for discharge of treated wastewater. For land discharge site selection, only above ground spray irrigation was considered as sub-surface irrigation was assumed to be more expensive.

Table 2. Summary of site parameters for four proposed land discharge sites identified for Taipa WWTP (AECOM, April 2018).

Parameter	Site 1	Site 2	Site 3	Site 4
Distance from WWTP (km)	6.8	5.7	4.3	4.8
Area (ha)	97	75	71	96
Number of parcels affected	11	5	2	6
Land ownership	9 private owners	3 private owners	1 private owner	6 private owners
Land cover	Grasses, trees	Grasses, trees, bush	Grasses, trees	Grasses, trees
Soil drainage	Imperfect, excessive	Excessive, imperfect	Moderate, imperfect	Moderate, imperfect
100yr MPD flood impact	No impact	No impact	No impact	No impact
Tsunami zone	Yellow	Orange, Yellow	Orange, Yellow, Safe	Safe
Recommended for further investigation?	**No[1]**	**Yes**	**Yes**	**Yes**

1 Site 1 is not recommended due to unsuitable soil types, adjacent Conservation land, and high number of landowners affected.

3.2 Taipa WWTP Upgrade Issues and Options (AECOM, May 2018)

Possible wastewater treatment upgrade options for Taipa WWTP and issues and advantages associated with each option were investigated and summarised in a report prepared by AECOM in May 2018.

A list of 14 treatment plant options were discussed at a hui with the Taipa WWTP Working Group on 19 April 2018. The Working Group comprised FNDC staff, Hapū representatives, local landowners, and AECOM staff.

In the hui, three options for discharge of treated wastewater were presented. These included discharge to a freshwater watercourse, discharge to land by irrigation and discharge to sea/marine environment. However, any discharge to surface water or to coastal waters was excluded from further investigation as these were not supported by the Te Mana o Te Wai Hapū Integration Roopu (the Roopu). Therefore, discharge to land by irrigation was the only option to be carried forward for further investigation.

As discussed at the hui and based on technical merits and cultural input, the long list of wastewater treatment options were refined, and this resulted in six shortlisted options for WWTP replacement or upgrade. The shortlisted treatment options were investigated further to provide more detailed information about the technology reliability, constructability, operational requirements, environmental and consenting considerations. A qualitative rating system for 16 non-price criteria was defined to compare the six options against each other and against the current system. High-level cost estimates were also provided for capital cost comparison.

A summary of wastewater treatment options is shown in Table 3. Assessment of each option based on a qualitative rating scale (H = Highly desirable (Green), M = Moderately desirable (Yellow), L = Least desirable (Orange)) is also presented in Table 3.

Table 3. Summary of treatment options considered for Taipa WWTP upgrade (AECOM, May 2018).

Option No.	Option description	Technology Reliability	Constructability	Operational requirements	Environmental Outcomes	Working group acceptability	Approx. Capital Cost
1	Sequencing batch reactor (SBR) with UV	H	H	M	H	H	$5.0M
2	Membrane bioreactor (MBR)	H	H	M	H	H	$6.9M
5	Algae bioreactor pond upgrade with electrocoagulation and UV	L	H	M	M	M	$4.8M
10	Submerged Media pond upgrade with dissolved air flotation and UV	L	M	L	L-M	L	$4.4M
11	Enhanced Pond System pond upgrade with UV	M	M	M	M	M	$2.6M
12	Carrousel configuration pond upgrade with UV	M	H	M	H	M	$4.6M
14	Business as Usual (existing pond system and constructed wetlands)	L	H	H	L	L	$0

The only discharge option carried forward from the hui was discharge to land using spray irrigation. Two proposed sites (site 3 and site 4 as identified in the AECOM report (April 2018)[1]) for discharge of treated wastewater were discussed in the report for further investigation. The sites were similar in terms of location, land use, slope, and distance from the Taipa WWTP location. The cost of implementing a land discharge scheme for site 3 and site 4 were estimated $8.5 million and $7.9 million, respectively. These costs included land purchase, pumping and pipelines to discharge field, holding ponds on the site and spray irrigation equipment.

[1] Taipa WWTP Upgrade Issues and Options, AECOM, April 2018.

3.3 Long List of Proposed Options for Wastewater Treatment and Disposal (Jacobs, April 2020)

A memorandum was prepared for assessment of wastewater treatment and discharge options for Taipa WWTP by Jacobs in April 2020.

The identified discharge solutions are summarised below:

Option 1 - Existing Stream Discharge: The discharge from the WWTP to the current location was proposed to be retained in this option. However, the discharge to the stream was strongly opposed by tāngata whenua due to discharge of human waste into surface waterbodies.

Option 2 – Discharge to same catchment with onsite wetland

The wastewater from Taipa WWTP (located in the Taipa catchment) was proposed to discharge to Parapara Stream which is located in another catchment. This option proposed construction of a wetland, consisting of multiple wetland cells, beside the WWTP and then discharge of the treated wastewater within the adjacent catchment via the Oruru River. As the Oruru River has cultural values and is used for different recreation activities, consultation with local Hapū was required to assess community and cultural perspective and viability of this option.

Option 3 – Land Disposal

Two potential sites which were shortlisted in AECOM report were considered as land discharge options. The sites are located within a 5km radius of Taipa WWTP, indicating similar costs for constructing pipelines. In the assessment, the spray irrigation was considered as land discharge method which limits the number of available sites. Land area requirements were met for both sites. The land discharge options will require conducting further landowner consultations. Based on a high-level assessment conducted by Jacobs, the sites had no specific problems for consenting, however further land investigations were required to provide clarity on the suitability of the sites and environmental impacts.

Option 4 - Ocean Outfall

Another potential discharge option was discharge to Doubtless Bay via an ocean outfall. This option does require WWTP upgrades as mixing and tidal action can provide enough dilution to decrease contaminants concentrations. A very long outfall pipeline (greater than 10 km) is required to transfer the treated wastewater beyond the kai moana-rich area within Doubtless Bay. Apart from the potential high expense for the consultation, design, construction and operation of a robust ocean outfall, the discharge option is unlikely to be accepted by local community as it would have potential adverse effects on aquatic ecosystems and recreational activities within Doubtless Bay. In addition, Doubtless Bay is a source of kai moana (sea food) for many local Hapū and the direct wastewater discharge would make some cultural challenges. Thus, the option was not considered viable.

The memorandum used previous investigations for treatment and discharge of wastewater at Taipa WWTP and identified the long-listed treatment and discharge options for further investigation. The combined discharge and treatment options were proposed as below:

- Option 1 – Maintain Existing WWTP and Land Discharge
- Option 2 – Electrocoagulation and Land Discharge
- Option 3 – Pond-based SBR, continued discharge to Parapara Stream
- Option 4 – Pond-based SBR, new wetland, discharge to Oruru River
- Option 5 – MBR, continued discharge to Parapara Stream

Consultation with local Hapū and stakeholders on the combined discharge and treatment options were recommended. Reviewing the long list of options was also recommended to confirm a shortlist of three combined discharge and treatment options and development of cost estimates for the shortlisted options. Finally, the three shortlisted options were suggested to be compared using MCA in collaboration with the stakeholders, including local Hapū.

It is noted that this memorandum was not presented to the Working Group as mediation between the Roopu and FNDC as a result of the Environment Court hearing was occurring at this time.

4 Methodology for Determining the Best Practicable Option

Beca facilitated four in-person workshops and four online workshops with the Taipa Working Group in order to discuss wastewater treatment and land discharge options, provide technical advice to the Working Group, and guide them towards a decision for the BPO within the consent timeframes.

The first in-person workshop was considered as an introductory workshop for information sharing and trust building. A long listing process to determine wastewater treatment and discharge options was discussed at the second in-person workshop. A short listing process towards a BPO was investigated during the June and July online workshops and the third in-person workshop. Selecting the BPO was also discussed at the fourth in-person workshop (see Appendix F for workshops minutes and presentation slides). The workshops details are listed in Table 4 below:

Table 4. Workshops List.

Workshop Type	Date	Purpose
In-person Workshop 1	3 May 2022	Trust building and information sharing
Online Workshop	19 May 2022	Agreeing the proposed approach for contacting landowners
In-person Workshop 2	31 May 2022	Discussing a long list of wastewater treatment and discharge options
Online Workshop	7 June 2022	Short listing the long listed WWTP options using the traffic light assessment
In-person Workshop 3	5 July 2022	Presenting the short list of WWTP options and shortlisting the land discharge sites
Online Workshop	15 July 2022	Selecting the top land discharge sites for the cost estimation exercise and presenting the initial assessment of shortlisted WWTP upgrade and discharge options against MCA by Beca
Online Workshop	18 July 2022	Assessment of shortlisted WWTP upgrade and discharge options against MCA by the Working Group to select the emerging preferred options
In-person Workshop 4	9 August 2022	Identifying BPO and discussing the cost estimate

4.1 Introductory Workshop

4.1.1 In-person Workshop 1 (3 May 2022)

The first workshop was held with the aim of building trust by getting to know each other and the group's mission, and information sharing. An overview of the work undertaken to date (work previously completed by AECOM and Jacobs, and by the Working Group), national wastewater matters (New Zealand Wastewater Sector Report, Water Reform and Taumata Arowai) and land discharge schemes in New Zealand (mention of three other land discharge wastewater projects: Raglan Wastewater Project, Central Hawkes Bay Big Wastewater Story and Rawene Wastewater Optioning) were presented in the first in-person workshop.

The list of options prepared by Jacobs in April 2020 were presented to the Working Group[2]. The following types of discharge were considered for Taipa WWTP:

[2] Long List of Proposed Options for Wastewater Treatment and Disposal, Jacobs, April 2020.

1. Discharge of treated wastewater from the existing Taipa WWTP to land;
2. Discharge of treated wastewater from an upgraded Taipa WWTP to land;
3. Discharge of treated wastewater from an upgraded Taipa WWTP via the existing constructed wetlands to the Parapara Stream;
4. Discharge of treated wastewater from an upgraded Taipa WWTP via a new wetland system to the Oruru River;
5. Discharge of treated wastewater from an upgraded Taipa WWTP via a new ocean outfall.

Options 1, 4 and 5 were not considered as acceptable options and option 2 was the preferred option. In addition, due to strong opposition from community to discharge of poorly treated wastewater to land from the WWTP and also due to the limits set out for discharge to water in the consent order, upgrading the WWTP was considered to be required for both the discharge to land and discharge to water.

In addition, the work carried out to date for selection of land discharge sites through desktop GIS assessment for Taipa was discussed by FNDC. An initial assessment of land parcels was carried out. This assessment was built on the work by AECOM in April 2018. According to the initial assessment, site number 1 from the FNDC assessment was the same as site 3 identified from the AECOM work.

It was suggested that FNDC proceed with the desktop GIS land-based methodology to identify the top 15 potential land parcels suitable for discharge and ensure that the previous work (by AECOM[3]) is in accordance with current FNDC best practice.

The consent order requirement to consider both water discharge and land discharge options in the initial long list was also noted and discussed in the workshop.

4.1.2 Online Workshop 19 May 2022

A follow up hui was held online (via Teams) on 19 May 2022 to discuss the proposed approach for engaging with the landowners for the top 15 sites. A memo from Mandy Wilson (Senior Infrastructure Planner) and Melissa Parlane (3 Waters Asset Manager) addressed to Andy Finch (General Manager Infrastructure & Asset Management) and Helen Ronaldson (Manager Asset Management Infrastructure Planning) briefing them on the plans to contact landowners identified in the high-level desktop assessment was also circulated to the Group.

The Working Group noted that the discussions with landowners were time critical as they want to ensure the landowners heard from the Working Group first and not from third parties. Initial conversations would be completed following determination of the top 15 land parcels.

The concept of a public meeting to provide the community with information was discussed. However, it was agreed that FNDC would set up a project specific webpage for the Taipa WW transformation project similar to the Kaitaia WWTP upgrade webpage to communicate information to landowners and the general public once the initial landowner contact had been made.

During this workshop it was also established that FNDC would work with the Roopu to map out areas of cultural significance for inclusion in the desktop GIS land-based assessment. It was agreed that landowner discussions would not commence until the cultural mapping was completed.

[3] Taipa WWTP Upgrade Issues and Options, AECOM, May 2018.

4.2 Long Listing Process

4.2.1 In-person Workshop 2 (31 May 2022)

The consent order requirements and the long-list options for treatment and discharge of wastewater were discussed in this workshop. Considering the requirements for the quality of treated wastewater (for discharge to water) in the consent order, eight WWTP upgrade options for either land discharge and or water discharge were presented by Beca.

Prior to this workshop, FNDC undertook a site selection exercise to determine the top 15 land parcels to be considered in the long list. It was acknowledged that to fully discharge treated wastewater to land from Taipa WWTP the minimum land requirement would be 60ha, although this is dependent upon well drained soils. FNDC subsequently completed a GIS analysis of possible land parcels within 10km of the WWTP to identify sites suitable for discharge.

Exclusion zones were applied to remove all non-suitable land. Exclusions characteristics included poor draining soils (Soil drainage classes 0 – 1 as per Northland soil map), flood susceptible land, land within the 50-year coastal flooding and erosion zone, 20m buffers from all waterways, 20m buffers from all non-urban zones in the district plan, and land with a slope greater than 12. These criteria were chosen based on best practice, considering previous similar studies in the Far North and engineering advice provided by Beca as part of a pre-draft review process.

All available land parcels with less than 30ha of available land were also excluded to reduce the need for multiple land parcels and property owners. The list of sites was further reduced by excluding land parcels greater than 5km from the WWTP. The result was a list of 23 land parcels. It was noted that 15 of those would be able to take the full discharge from Taipa WWTP whilst the remaining 8 could take partial discharge.

These 23 sites were then ranked using the FNDC established criteria including drainage level, land area, slope, regularity of the site, and distance from the WWTP. Site summaries were prepared for the top 15 sites and these were circulated to the working group prior to Workshop 2.

Moreover, an overview of the top 15 land discharge sites was provided by FNDC in Workshop 2 as shown in Figure 2. Taipa population growth, cultural significance, buffers and onsite storage space were considered in identifying land parcels suitable for the discharge. None of the land parcels were noted as being ‘No Goes’ by the Working Group.

During the workshop the Working Group went over each of the top 15 land parcels and identified how they would approach the landowners. The Working Group committed to speaking to the landowners and gauging interest before the next workshop,

Contact with these landowners was made with a prioritisation on selecting a site capable of supporting full discharge to land. Initial interest was shown by 6+ owners.

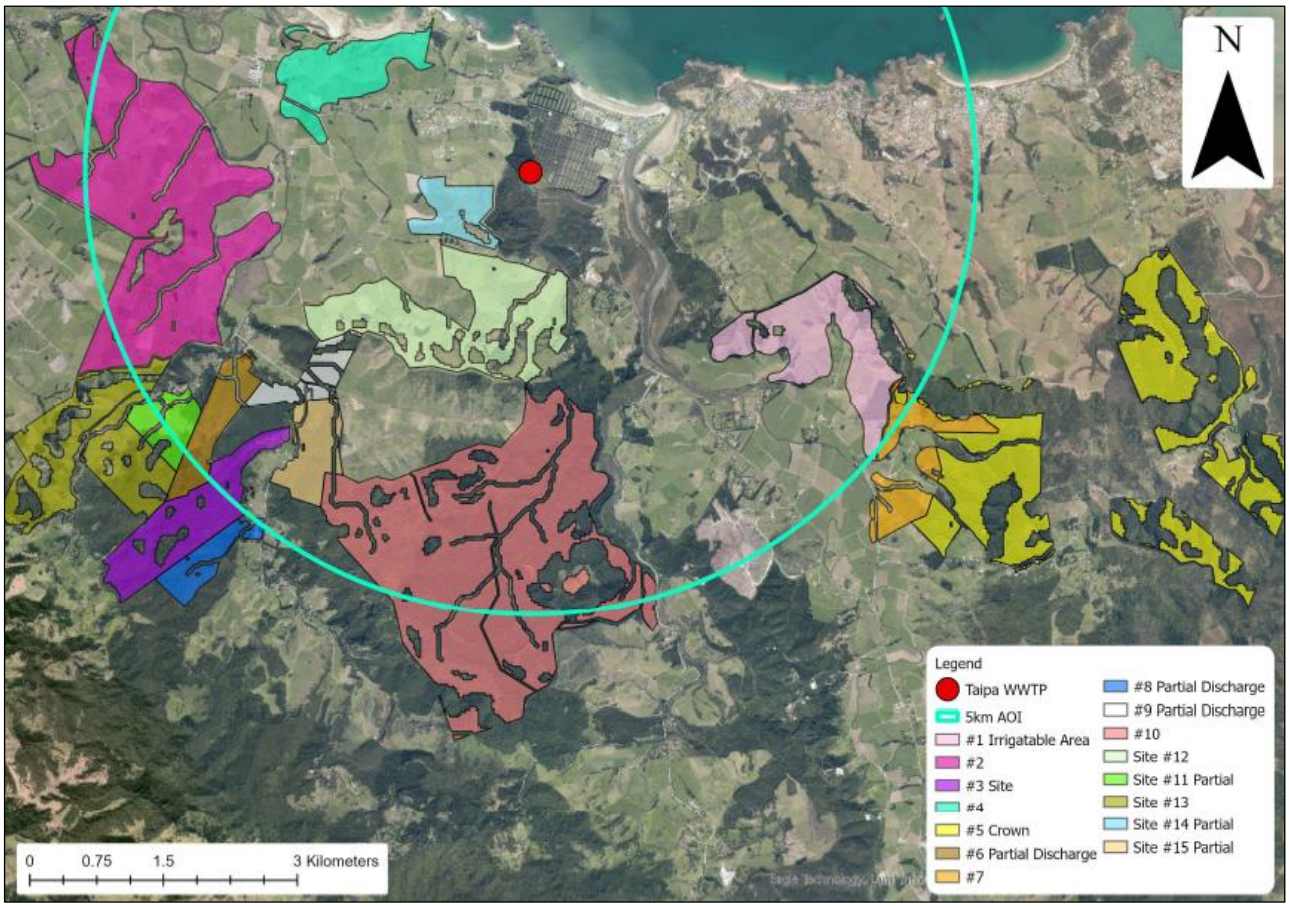


Figure 2. Top 15 potential land discharge sites determined by FNDC on desk-top GIS analysis.

A draft long list memo which outlined a long list of wastewater treatment and discharge options was also issued to the Working Group on 3 June 2022 by Beca[4] (Appendix B).

According to the previous studies carried out by AECOM[5] and Jacobs[6] and the feedback from the Working Group, including strong preference for considering new and emerging technologies such as Bioshells and Electrocoagulation, the options below were considered for WWTP upgrades for wastewater discharge to land or water (see Appendix B for more information and details for each option):

- Option 1: Pond upgrade with tertiary filtration and Ultraviolet (UV)
- Option 2: Pond upgrade with electrocoagulation and solids removal and UV
- Option 3: Converting ponds into pond based SBR with UV
- Option 4: Converting ponds into in pond Modified Ludzack-Ettinger (MLE) plant with UV
- Option 5: New standalone MLE plant with UV
- Option 6: New standalone MBR plant

[4] Long List Memorandum, Taipa WWTP Transformation Project, Beca, June 2022.

[5] AECOM, 2018. Taipa WWTP Upgrade Issues and Options Report - for use at Taipa WWTP Working Group Hui #2. Prepared for Far North District Council. Issued 25 May 2018.

[6] Jacobs, 2020. Long List of Proposed Options for Wastewater Treatment Disposal. Memorandum prepared by Jessica Daniel for Far North District Council. Issued 7th April 2020.

- Option 7: New side stream Moving Bed Bio Reactor (MBBR) plant with Tertiary filtration and UV
- Option 8: Bioshells in the ponds with tertiary filtration and UV

Table 5 below shows a summary of pros and cons of each treatment upgrade options and the Beca recommendation for shortlisting each option. According to the table, options 1 and options 2 were considered suitable for land discharge, options 5 and options 6 for water discharge, options 3 and options 4 and for both water and land discharge. Any discharge to water is expected to continue via the existing constructed wetlands as per the consent order, however any discharge to land option is anticipated be taken from the outlet of the WWTP.

Table 5. Treatment Upgrade Options Summary.

Description	Advantages	Disadvantages	Beca recommends treatment option?
Option 1. Pond upgrade with Tertiary filtration and UV	Low operation costs, Utilizing all existing assets.	Large footprint, Variable performance during summer peaks and rain events UV disinfection performance variable due to algae, Periodic de-sludging is a complex and costly undertaking Algae issues for Tertiary filtration, springtime algal blooms can be especially problematic, and filters require careful sizing. Disc filters may require daily attendance on site. Larger land areas may be required due to higher TN loads	Maybe – Do Minimum option
Option 2. Electrocoagulation + secondary clarification + UV	Reasonable removal of suspended solids, Utilizing existing assets, EC provides some disinfection, UV likely to be more effective with lower TSS	Requires a solids removal process to separate out the solids, such as DAF or centrifuge (there are multiple parameters that influence the optimal operating conditions of the EC process). No full-scale plant is operating in NZ and therefore no comparable data available for cross-comparison. Sludge is produced which needs to be managed regularly, not every 10 years or so. Uncertain track record.	Yes, but only for discharge to land
Option 3. Pond based SBR + UV (Ponds plastic lined and under drained)	Utilizing existing assets. Cost effective solution. Reliable, easy to operate (fully automated with some operator-changeable parameters) Existing pond depth is likely to be suitable.	Careful design of decanter will need to be caried out to make system work. Have a tendency to a) grow filamentous algae in the warm, black lined decant pond and b) accumulate settled biomass in the bottom of the decant tank which can become anaerobic and float. Both are a nuisance but can be managed. Plastic liners in the ponds can be damaged if aerator or mixer come loose. Could be difficult to implement while WWTP is running - but could be done out of season. Sludge produced will need to be managed.	Yes, could be discharged to river or land
Option 4. In Pond activated sludge (MLE) + clarifier + UV (Ponds plastic lined and under drained)	Reliable, resilient process, good nutrient removal, Utilizing some of existing assets Small increase footprint	Moderate operational complexity. Limited availability for expansion. Plastic liners in the ponds can be damaged if aerator or mixer come loose. Could be difficult to implement while WWTP is running - but could be done out of season. Sludge produced will need to be managed.	Yes, could be discharged to river or land

Description	Advantages	Disadvantages	Beca recommends treatment option?
Option 5. Standalone MLE + clarifier +UV (Concrete tank reactor/s)	Reliable, resilient process, good nutrient removal, some ability to stage, could potentially be a standalone SBR	Not utilising existing assets. Moderate footprint Moderate operational complexity Sludge produced will need to be managed daily High CAPEX	Yes - recommended for water discharge but not land discharge due to high capital
Option 6. MBR – stand-alone plant Concrete tank reactors and membrane tanks	Robust process Very high-quality treated wastewater Small footprint Some ability to stage Fine screening required	Not utilising existing assets, High complexity, step up in power consumption, Sensitive to flow changes, flow balancing is required due to membrane operation, Membranes have limited life (10 years), Higher capital and operational costs, Sludge produced will need to be managed daily	Yes - for Water only. But high capital/operating cost and less resilience to flow changes.
Option 7. Side stream MBBR + tertiary filtration +UV MBBR could be containerised or concrete tank	Good reduction of NH_4-N, utilising existing assets, Able to be automated, Small additional footprint	Only a portion of the flow is treated through the MBBR to reduce organics and nitrogen. UV disinfection performance affected by algae.	No for discharge to water. Land discharge is possible but not preferred as other options offer better quality for same cost.
Option 8. Bioshells in Maturation Pond + tertiary filtration + UV (includes recycle back to Pond 1) Similar to that used at Paihia	Some reduction of TSS and nutrients, very little increase in site footprint	Requires regular operator inspections and control of alkalinity Can be tricky to optimize air demand Noise mitigation is required UV disinfection performance affected by algae	No for discharge to water. Land discharge is possible but not preferred because of higher nitrate content in treated wastewater.

In addition, a high-level traffic light assessment of the options was carried out and the preferred options for shortlisting were suggested. An initial traffic light assessment for the WWTP options was provided to the Working Group by Beca in order to provide guidance to the group; however, it was noted that this initial assessment should in no way restrict the Working Group's own assessment of the options. The Working Group's assessment of the WWTP options using the traffic light assessment approach was carried out in a follow up online hui on 7th June 2022 which allowed the Working Group a week to familiarise themselves with the options first. The proposed MCA was also briefly presented by Beca team in this workshop.

4.3 Short Listing Process

4.3.1 Online Workshop 7 June 2022

In the online workshop held on 7 June 2022 via Teams, Beca further discussed the WWTP options from the Long List Memorandum dated 3 June 2022 and their initial traffic light assessment.

Based on the information provided, a traffic light assessment and short-listing exercise was completed by the Working Group in this workshop to take forward a short list of WWTP upgrade options for land discharge and/or water discharge.

The eight long listed WWTP upgrade options were discussed and assessed using traffic light colour coding. Five out of eight options (all green and amber options) were short listed and decided to be taken forward for cost estimating (Figure 3).

WWTP Options	Take forward to Short List?
Pond upgrade with Tertiary filtration and UV	Maybe – land
Pond upgrade with Electrocoagulation and solids removal and UV	Yes - land (maybe water)
Convert ponds into pond based SBR with UV	Yes – land or water
Convert ponds into in pond MLE plant with UV	No
New standalone MLE plant with UV	No
New standalone MBR plant	Maybe – water
New side stream MBBR plant with Tertiary filtration and UV	No
Bioshells in the ponds with Tertiary filtration and UV	Maybe - land

Figure 3. Working Group traffic light assessment for long list WWTP options.

Further discussion with FNDC showed that option 8 (Bioshells) was not as much of a viable option compared to the others due to less certainty around the use of the technology as a standalone treatment solution the option. As such it was removed from the short list options.

Therefore, the four short listed options are listed as follows:

- Option 1: Pond upgrade with tertiary filtration and UV
- Option 2: Pond upgrade with Electrocoagulation, solids removal and UV
- Option 3: Convert ponds into pond based Sequenced Batch Reactor (SBR) with UV
- Option 6: New standalone Membrane Bioreactor (MBR) plant

In addition, the proposed MCA for assessing the short list of WWTP options were further discussed by the Beca team.

The MCA for assessing the short list of top 15 land discharge sites were also discussed by Ben Bowden of FNDC.

4.3.2 In-person Workshop 3 (5 July 2022)

In-person workshop 3 was held on 5 July 2022 with the aim of presenting the short list of WWTP options to the Working Group and shortlisting the land discharge sites.

To provide inputs into the high-level concept designs for the shortlisted WWTP options, wastewater flows and loads were developed based on the current (2022) and expected future (2045) wastewater production volumes at FNDC WWTP. Table 6 presents the proposed and agreed basis of design for the Taipa WWTP.

Table 6. Basis design used for the design and the cost estimates

Parameter	Unit	Average
Design Flows and Loads – Current (2022)		
Population[1]	pp	2586
Average Dry Weather Flow (ADWF)[1]	m^3/d	524
Carbonaceous biochemical oxygen demand ($CBOD_5$)	kg/d	261
Total Nitrogen (TN)	kg/d	52.04
Total Suspended Solids (TSS)	kg/d	294
Design Flows and Loads – Future (2045)		
Population[1]	pp	3383
Average ADWF[1]	m^3/d	613
$CBOD_5$	kg/d	327
TN	kg/d	60.93
TSS	kg/d	368

[1] The estimated population (average value) and the ADWF from the flow spreadsheet provided by FNDC.

The available influent quality data was averaged for each parameter ($CBOD_5$, TN, TSS, etc) and was multiplied by the ADWF value (current or future) to get the load for the concept design calculations.

High level capital cost estimates undertaken for all short listed WWTP upgrade options (excluding land discharge cost) are summarised in Table 7. The cost estimates are not a statement of absolute cost and are based on different factors such as extent of relevant information provided, the certainty of data and the level of detail available at the time of preparation. In addition, the cost estimates are based on extrapolation of recent similar project pricing, new and historical quotes for some equipment items, industry unit rates and Beca's general experience.

Table 7. High level Capital Cost Estimates for upgrade options

Taipa WWTP Upgrade	Option 1	Option 2	Option 3	Option 6
	Pond Upgrade TF + UV	EC + Solid Removal + UV	Pond Based SBR + UV	MBR - Stand Alone Plant
Total cost including provisional NZD excl GST* **	$0.97 M	$5.7 M*	$6.8 M**	$12.0 M
Provisional Costs* **	$75,000	$180,000	$221,000	$100,000

*Costs associated with the suggested trial and will Installing a new tap water line to site are not included.

**Excludes anoxic zone required for Intermittent Decanted Extended Aeration (IDEA) set up for higher nitrogen removal.

***See Disclaimer appended to short list memorandum.

Cost estimates were undertaken primarily on the lump sums of the items, not schedules of quantity.

Considering the suitability of the shortlisted WWTP upgrades options for discharge to water and/or land, the WWTP options were further refined into five schemes as shown below:

- Scheme A – Discharge to land (site to be confirmed) – pond upgrade to tertiary filtration and UV
- Scheme B – Discharge to land (site to be confirmed) – pond upgrade with electrocoagulation, solids removal and UV
- Scheme C – Discharge to land (site to be confirmed) – convert ponds into pond based SBR and UV

- Scheme D – Discharge to water - convert ponds into pond based SBR and UV
- Scheme E – Discharge to water – new standalone MBR plant

A draft short list memorandum outlining the short list of options considered by the Working Group was then issued on 13 July 2022 by Beca (Appendix C).

Further, FNDC provided an overview of land discharge sites and the amount of land required for the land discharge scheme (~62 ha) during In-person workshop 3. The maps of six interested sites (property #1, property #2, property #4, property #7, property #12 and property #13) which included voltage power lines, roading, potential dwelling buffers (150 m) and cultural sites of significance were presented in the workshop (Figure 4).

FNDC presented the initial MCA assessment of the top six land parcels including ranking of the sites (

Figure 5). The sites were discussed and ranked considering six criteria: land use, distance from Taipa WWTP, suitable land area (60 req.), predicted drainage, relative level (m) from Taipa WWTP (7m pump), and slope. This ranking did not account for cultural considerations. Results of the rankings showed property #2, property #4, and property #12 as top three preferred sites. However, it was concluded to investigate all top three land discharge sites (property #2, property #4, and property #12) in terms of cost estimation and meeting up with landowners to determine the level of interest in irrigating treated wastewater to their land. Therefore, further engagement with the property owners and a significant amount of future work are required to identify the preferred site for discharge of treated wastewater. It should be noted that there has been no discussion with property owners beyond being open to concept.

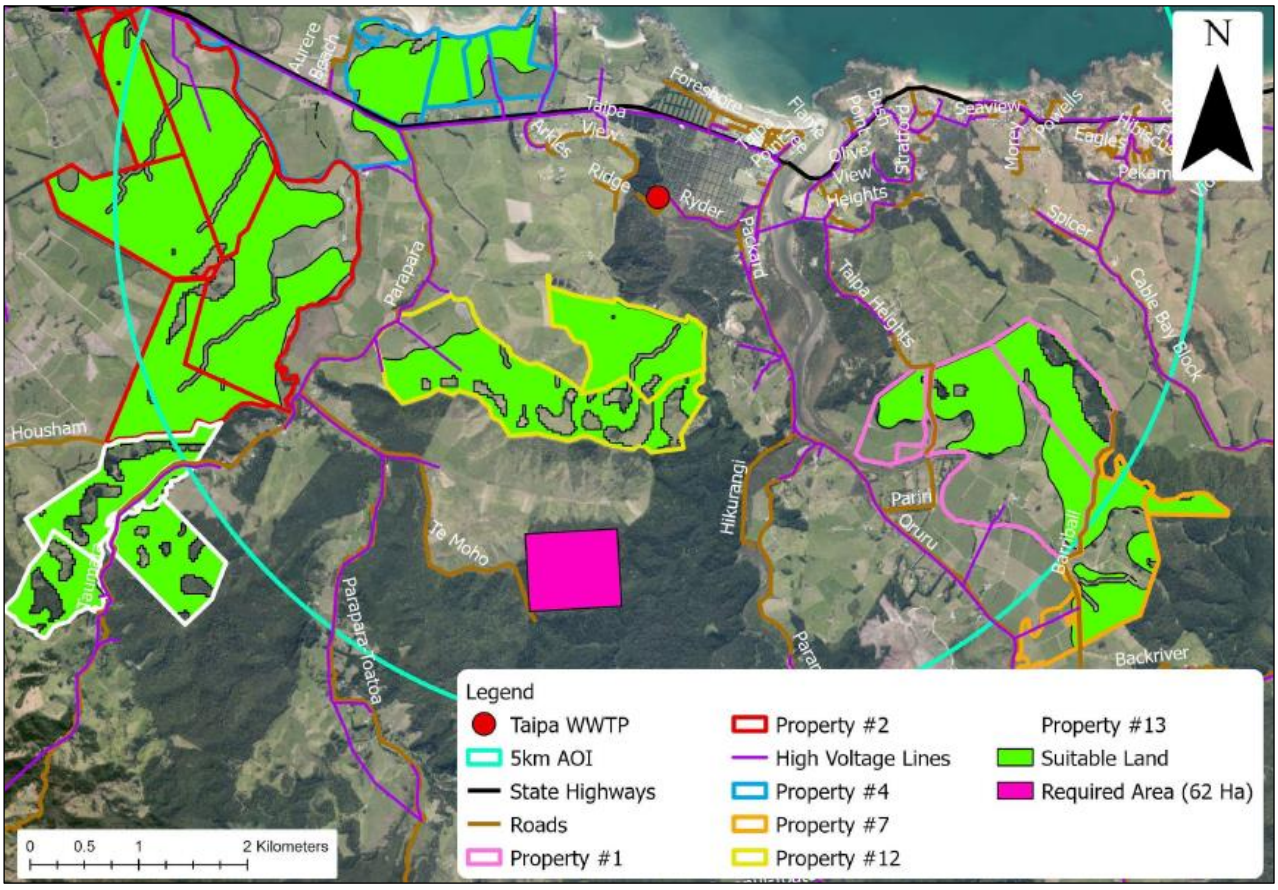


Figure 4. Six potential land sites for the land discharge scheme.

Property # and Owner	Colour on Map	Land Use	Distance	Suitable Land Area (60 req.)	Predicted Drainage	Relative Level (m) from WWTP (7m pump)	Slope
1	Pink	Dairy	Direct: 2.3km Road: 8.9km Paper: 4.4km	156 Ha	Well	Main: 6m (13) Paper: 94m (101)	Steep
2	Red	Dry Stock (TBC)	Direct: 2.8km Road: 7.4km	447 Ha	Well	Main: -4m (3) Point: 4m (11)	Flat
4	Blue	Dry Stock (TBC)	Direct: 1.5km Road: 3.8km	90 Ha	Moderate	Main: 9m (16) Point: 20m (27)	Moderate
7	Orange	Dry Stock (TBC)	Direct: 4.7km Road: 8.3km	65 Ha	Well	Main: 6m (13)	Flat
12	Yellow	Dry Stock (TBC)	Direct: 1km Road: 7.2km CWL: 0km	186 Ha	Imperfect	Main: 7m (14) Point: 6m (34)	Steep
13	White	Dry Stock (TBC)	Direct: 4.6km Road: 9.8km	133 Ha	Moderate	Main: 7m (14)	Steep

Figure 5. Initial commentary provided for potential land discharge sites.

In addition, Beca presented the MCA assessment undertaken for the short-listed WWTP upgrade options outlining Beca's initial ratings (with the exception of cultural criteria). The initial ranking provided by Beca was considered as a guidance and without restricting the final ratings of the Working Group. The presented MCA for the short-listed options were required to be reviewed by the Working Group prior to the online workshop on 15 July 2022 and amended by the Working Group during that workshop.

4.3.3 Online Workshop 15 July 2022

In a follow up workshop via Teams (online workshop 2), the top six land discharge sites were reviewed (MCA shown in Figure 5) and property #2 (Red site) was determined as the preferred site for the cost estimation exercise. The property #2 (Red site) was decided to be taken forward as an indicative of potential costs for a land discharge scheme. Considering types of soils in the preferred sites, there might be a need for a soil deficit irrigation scheme to permit irrigation based on soil moisture conditions. Therefore, the sites will require treated wastewater storage given wet winter periods when irrigation is not possible. The storage needs to be a properly engineered structure capable of holding the treated wastewater for the wet weather period. It was noted by Beca that SBR option does not require the maturation pond and therefore this could be used for partial storage of the treated wastewater (once desludged and re-lined).

Following this, a high-level engineering design of a discharge to land scheme at the preferred site was undertaken. Cost estimates for land discharge was decided to be developed for pump station located at WWTP site, pipeline between WWTP and land discharge site, storage pond and irrigation infrastructure.

In addition, shortlisted WWTP options upgrades options were discussed further with the main focus on SBR and EC systems. It was note that EC, SBR and MBR will all require an upgrade to the electricity supply. All WWTP upgrade options have been designed to 2045 flows. SBR can meet post-2045 flows if adding in the IDEA system. However, a trial is required for the EC option to ensure that it will be capable to meet post-2045 flows.

4.3.4 Online Workshop 18 July 2022

An additional follow up online workshop (Online workshop 3) was held via Teams on 18 July 2022 for purpose of discussing the WWTP options and undertaking the MCA assessment for WWTP upgrade and discharge options as a group.

The assessment of each of the five shortlisted schemes against multiple non-cost criteria using the traffic light method was undertaken in this workshop. Costs for each of the schemes were presented separately and were not ranked using the MCA.

Each option was evaluated considering the 11 criteria as presented in Table 8 and the traffic light ranking was shown for each option. As shown in Table 8, the emerging preferred options were concluded as Scheme B (EC with land discharge) and Scheme C (SBR with land discharge), considering the importance of a pilot study for proceeding with EC option.

Table 8. MCA for short list assessment of WWTP upgrade and discharge options.

Criteria	Scheme A Discharge to land (site to be confirmed) – pond upgrade to tertiary filtration and UV	Scheme B Discharge to land (site to be confirmed) – pond upgrade with electrocoagulation, solids removal and UV	Scheme C Discharge to land (site to be confirmed) – convert ponds into pond based SBR and UV	Scheme D Discharge to water - convert ponds into pond based SBR and UV	Scheme E Discharge to water – new standalone MBR plant
Public health					
Aquatic ecosystems					
Cultural					
Amenity values					
Reliability					
Re-use of existing WWTP assets					
Constructability					
Operation					
Sustainable growth					
Transition between schemes					

4.4 Cost Estimates and Concept Design of Land Discharge Scheme

To support the assessment of feasibility of treated wastewater discharge to land at the preferred red site (Property #2), a high-level capital cost estimate for the discharge of treated wastewater to land was undertaken by Beca[7] (See Appendix D for more detail). This was issued to the Working Group on 5 August 2022 prior to the fourth in-person workshop on 9 August 2022.

To develop a high-level capital cost estimate for the site, a high-level engineering design was included in the report as follows:

[7] Treated Wastewater Disposal to Land Report, Beca, August 2022.

- The high-level concept design of the pump station and conveyance from the WWTP to the preferred discharge site, provided by FNDC
- High-level consideration of potential storage volume and location
- High-level consideration of irrigation area required
- High-level consideration of discharge system (assumed surface spray irrigation)
- High-level review of the preferred site to identify which parcels would potentially be most suitable for irrigation
- Class 5 (-30% to +50% accuracy) cost estimates

The cost estimate (-25% to + 30% accuracy) for the land discharge scheme with two storage options is listed in Table 9. The storage could be provided at the irrigation site (Option 1), or it could be lined and re-purposed for storage with the remainder of storage provided at the irrigation site if the maturation pond is not required for the treatment process (Option 2).

Table 9. Estimated Construction Cost (-25% to + 35%) for Storage Options 1 and Option 2.

Cost Item	Option 1 - New storage at irrigation site 68,000 m^3 $	Option 2 - Maturation pond storage 28,000 m^3 + 40,000m^3 irrigation site storage $
Pump station and pressure pipeline	1,553,000	1,553,000
Storage Pond (at irrigation site)	3,448,000	2,263,000
Maturation Pond PE liner installation	-	540,000
Irrigation system	4,050,000	4,050,000
Electrical and controls	138,000	138,000
Planning	350,000	350,000
P&G, professional fees, Council internal costs and contingency	7,672,000	7,143,000
Rounding	5,000	3,500
Total	17,380,000	16,210,000
Range	13.0 to 22.6 M	12.2 to 21.1 M

Although the cost estimates are based on Property #2, it was noted that further investigations for all three shortlisted sites (Property #2, Property #4 and Property #12) are required as next steps.

The details of preferred top three land discharge sites (property #2, property #4, and property #12) are presented in the section below:

4.4.1.1 Property #2 (Red Site)

The property #2 identified as the first preferred option for discharge of treated wastewater from Taipa WWTP is Shown in Figure 6 below. The site has an approximate area of 604.5 ha (irrigation area: 462 ha) with 5 titles: 600859, NA121D/347, NA121D/348, NA86C/113, NA86D/863. This property is located at 4527 State Highway 10, Lake Ohia, Karikari Peninsula (1.2km northwest of Parapara Marae). According to NZ Archaeological Association (NZAA), a Pa site (a Māori house, 14.7 ha) at the centre of the identified land. This decreases the irrigation area to 447 ha, considering a 150m buffer for spray irrigation.

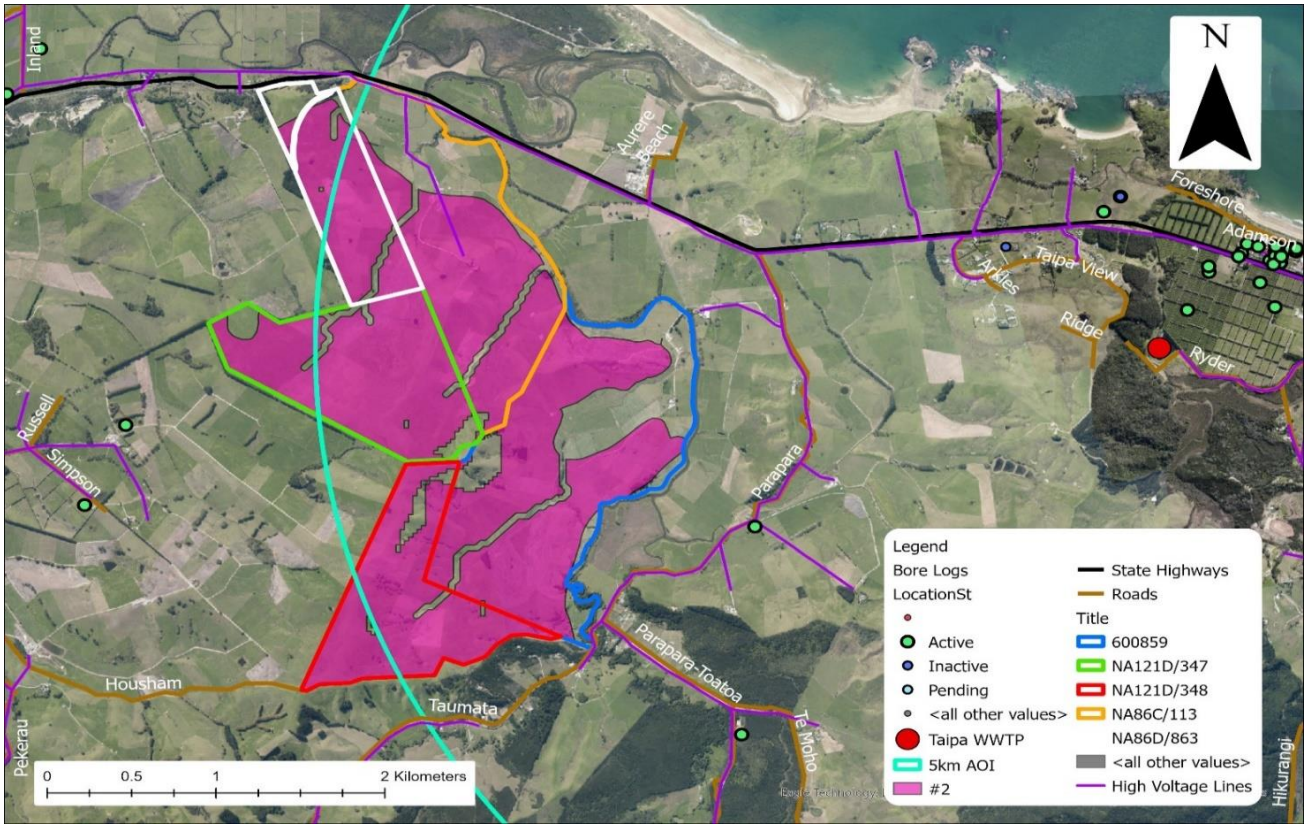


Figure 6. Property #2 with titles, bore locations, high voltage lines, and roads (the site is coloured in pink).

The irrigatable area is mainly covered with high producing exotic grassland (97.25%) and is currently used for pastoral farming (non-dairy). There are two active bores in proximity of the irrigatable area, approximately 700 m west (a bore with 124m depth for stock) and east of the area (a bore with 16.4m depth for stock).

A soil map of the site is shown in Figure 7. The largest part of the site (~145 ha, shown in light green) consists of HK (Hukerenui Silt Loam) and OE (Ohia Sand), and is considered drainage class 3 (well drained). The second largest part of the site (~130.5 ha) consists of YK (Waikare Silt Loam), OA (Okaka Clay and Silty Clay) is considered drainage class 2 (imperfectly drained). The third largest parcel has an approximate area 129 ha and comprises HK (Hukerenui Silt Loam), YK (Waikare Silt Loam) and OA (Okaka Clay and Silty Clay). This site is considered to have a drainage class of 2 (imperfectly drained). Other areas include HK and OE soils and have overall drainage classes of 3 and 2 respectively. Table 10 details soils of the irrigatable area with the associated drainage classes.

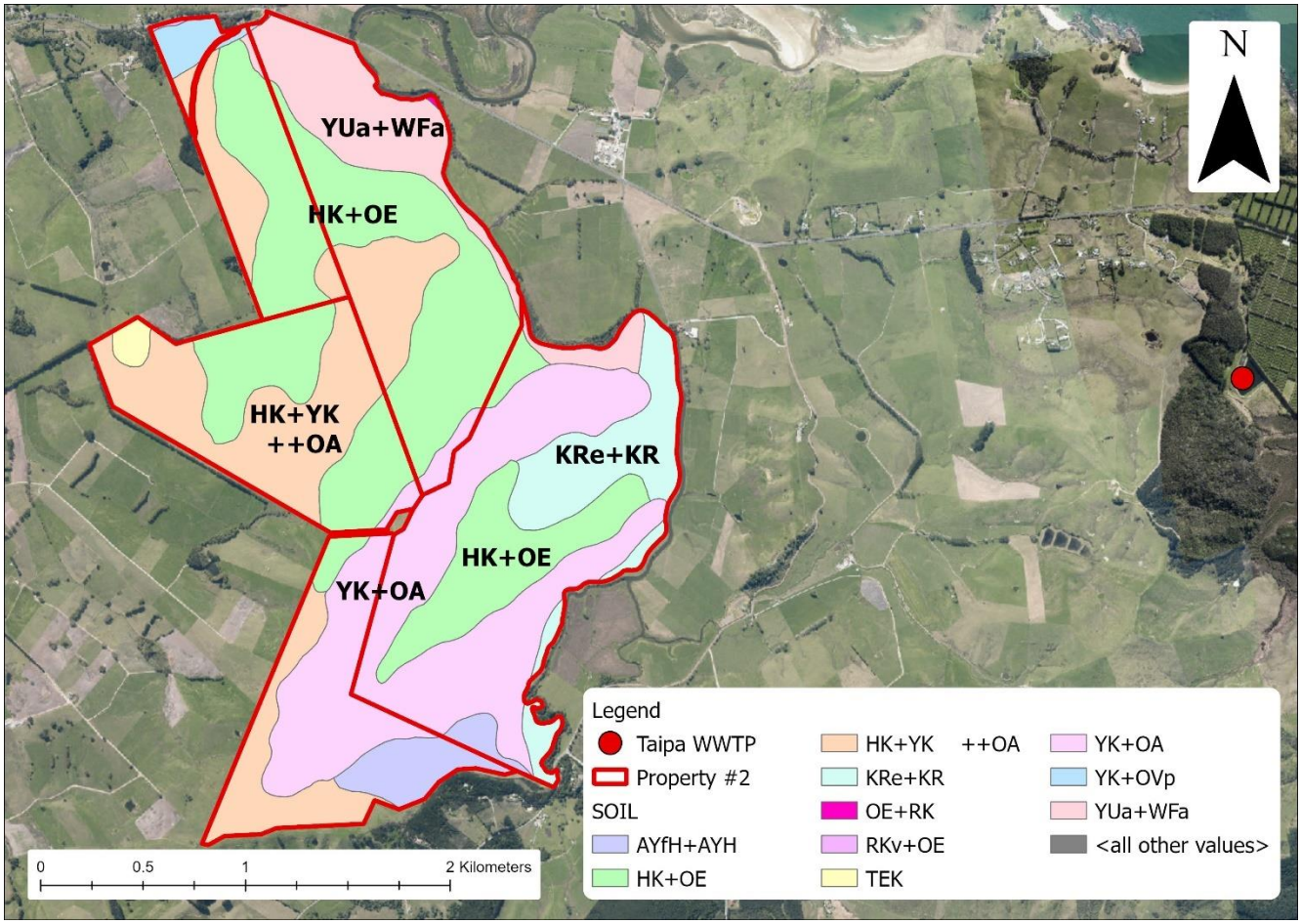


Figure 7. Soil map of Property #2.

Table 10. Soils of the irrigatable area with the associated drainage classes Property #2.

Soil Abbreviation	Soil Name	Drainage Class Range
HK	Hukerenui Silt Loam	1 – Poorly Drained
YK	Waikare Silt Loam	1 to 3 – Poor to Well Drained
OA	Okaka Clay and Silty Clay	1 to 2 – Poor to Imperfectly Drained
OE	Ohia Sand	5 – Very Well Drained
YUa	Waipu Sand	1 – Poorly Drained
WFa	Whakapara Sand	4 – Well Drained
KRe	Kara Clay	0 to 1 – Very Poorly to Imperfectly Drained
KR	Kara Silt Loam	0 to 1 – Very Poorly to Imperfectly Drained
AYfH	Awanui Fine Sandy Loam and Sandy Clay	2 – Imperfectly Drained
AYH	Awanui Clay and Sandy Clay	2 – Imperfectly Drained
RKv	Ruakaka Peaty Silt Loam	0 – Very Poorly Drained
OVp	Omaiko Gravelly Silt Loam with Pan	0 to 1 – Very Poorly to Imperfectly Drained

It should be noted that a soil investigation is required for the site to confirm the soil types, drainage class and the presence of any soil horizons that might limit sub-surface drainage (e.g. clay).

4.4.1.2 Property #4 (Red Blue)

The property #4 is one of the preferred options for discharge of treated wastewater from Taipa WWTP (Shown in Figure 8). The site is located at 4365 State Highway 10, Taipa and has an area of 233.5 ha (irrigation area: 101.5 ha). The land is mainly used for stock fattening.

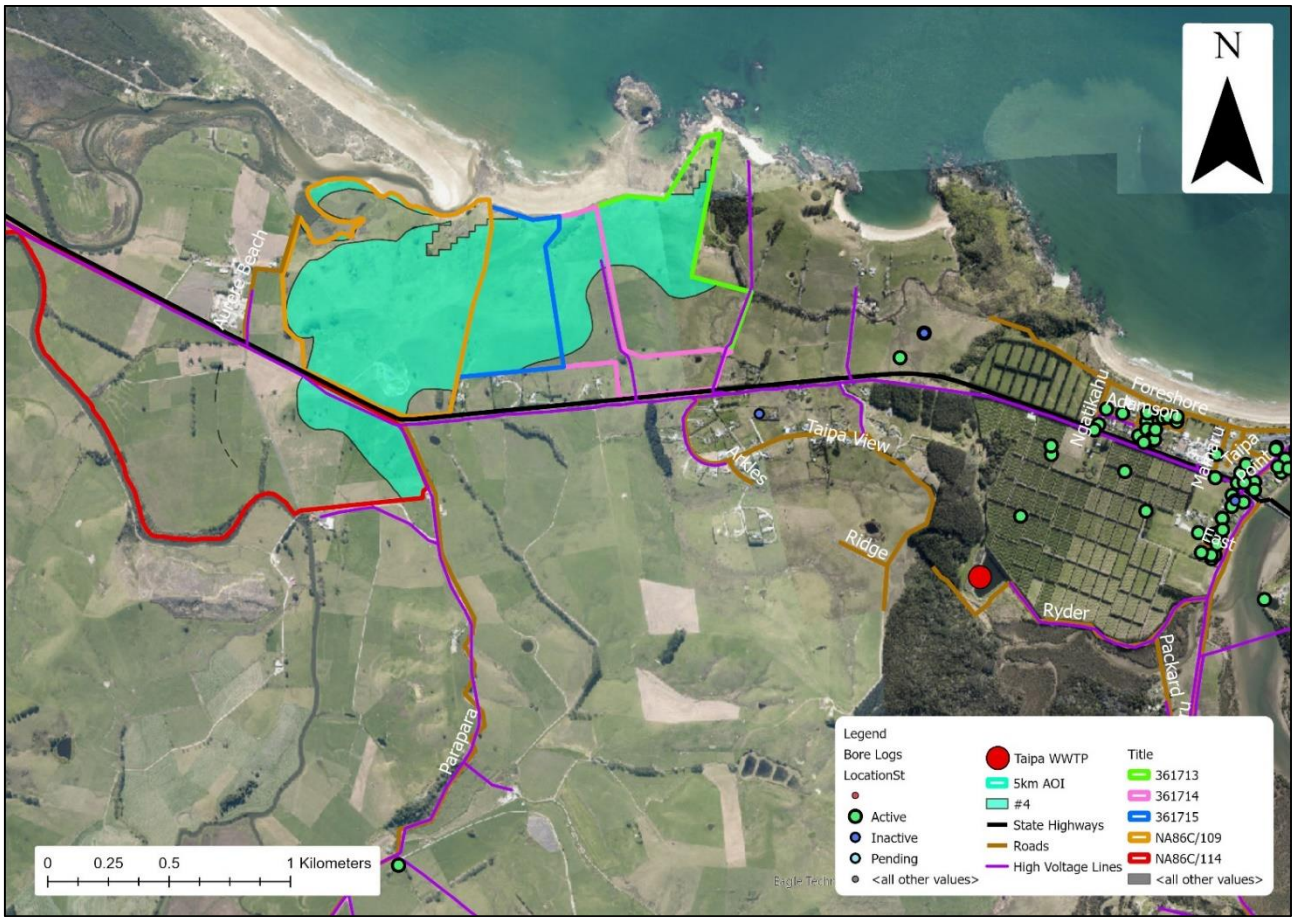


Figure 8. Property #4 with titles, bore locations, high voltage lines, and roads.

The land cover of irrigatable area is mainly exotic grassland (96.52%). The existing dwellings along the property borders on all sides can affect the irrigatable area if spray irrigation is used. The overlapping buffer area which is 10.9 ha reduces the irrigatable area to 90.6 ha which is still above the area required for land discharge. One active bore (38.4 m depth) is located in ~660m east of Properties and used for stock. In addition, the site borders the sea and there are a few Pa sites in the area (according to NZAA). Table 11 details soils of the irrigatable area with the associated drainage classes.

Table 11. Soils of the irrigatable area with the associated drainage classes for Property #4.

Soil Abbreviation	Soil Name	Drainage Class Range
AKH	Awapuku clay loam	1 to 4 – Poor to Well Drained
MNH	Mangonui clay	3 to 4 – Moderate to Well Drained
OE	Ohia sand	5 – Very Well Drained
RK	Ruakaka peaty sandy loam	1 – Poorly Drained

Soil Abbreviation	Soil Name	Drainage Class Range
YK	Waikare silt loam	1 to 3 – Poor to Moderately Drained
OA	Okaka clay and silty clay	1 to 2 – Poor to Imperfectly Drained

A soil map of the site is shown in Figure 9. The northern half of the irrigatable area (closer to the sea) contains AKH (Awapuku clay loam) and MNH (Mangonui clay) (49 ha), with a moderate to high drainage level. The southern half is made up of YK (Waikare silt loam) and OA (Okaka clay and silty clay) (50.2 ha) with imperfect drainage level.

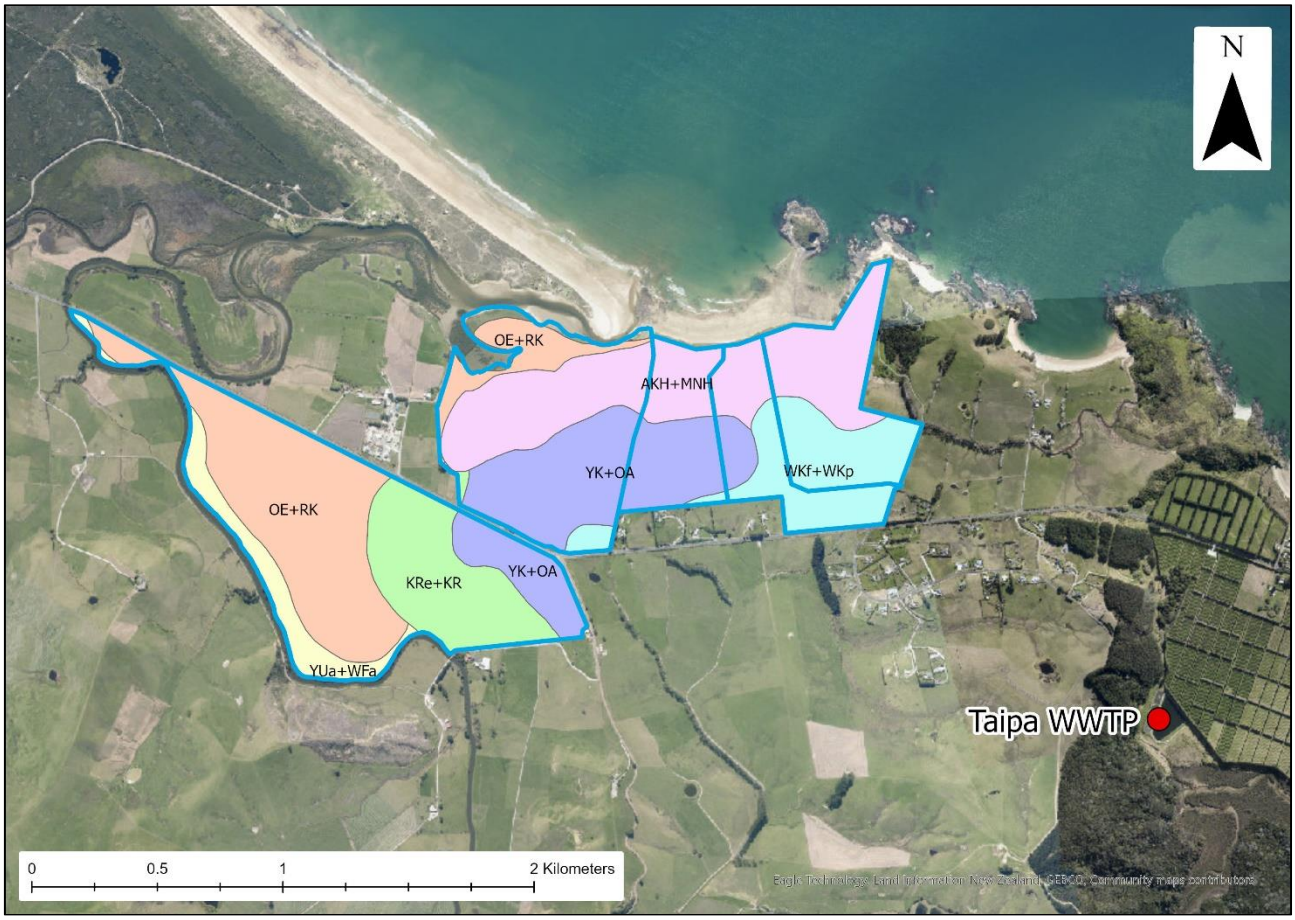


Figure 9. Soil map of Property #4.

4.4.1.3 Property #12 (Red Red)

The Property #12 which is one of the preferred sites for discharge of wastewater from Taipa WWTP has an approximate area of 276.5 ha (irrigation area: 197.3 ha). The site is located at 211 Parapara Road, Taipa, Taipa 0483 and stock fattening is the primary industry in this site. The potential dwelling on the western side of the site reduces the area suitable for irrigation. However, there is still enough area to support full discharge to land from the Taipa WWTP. The site is shown in Figure 10.

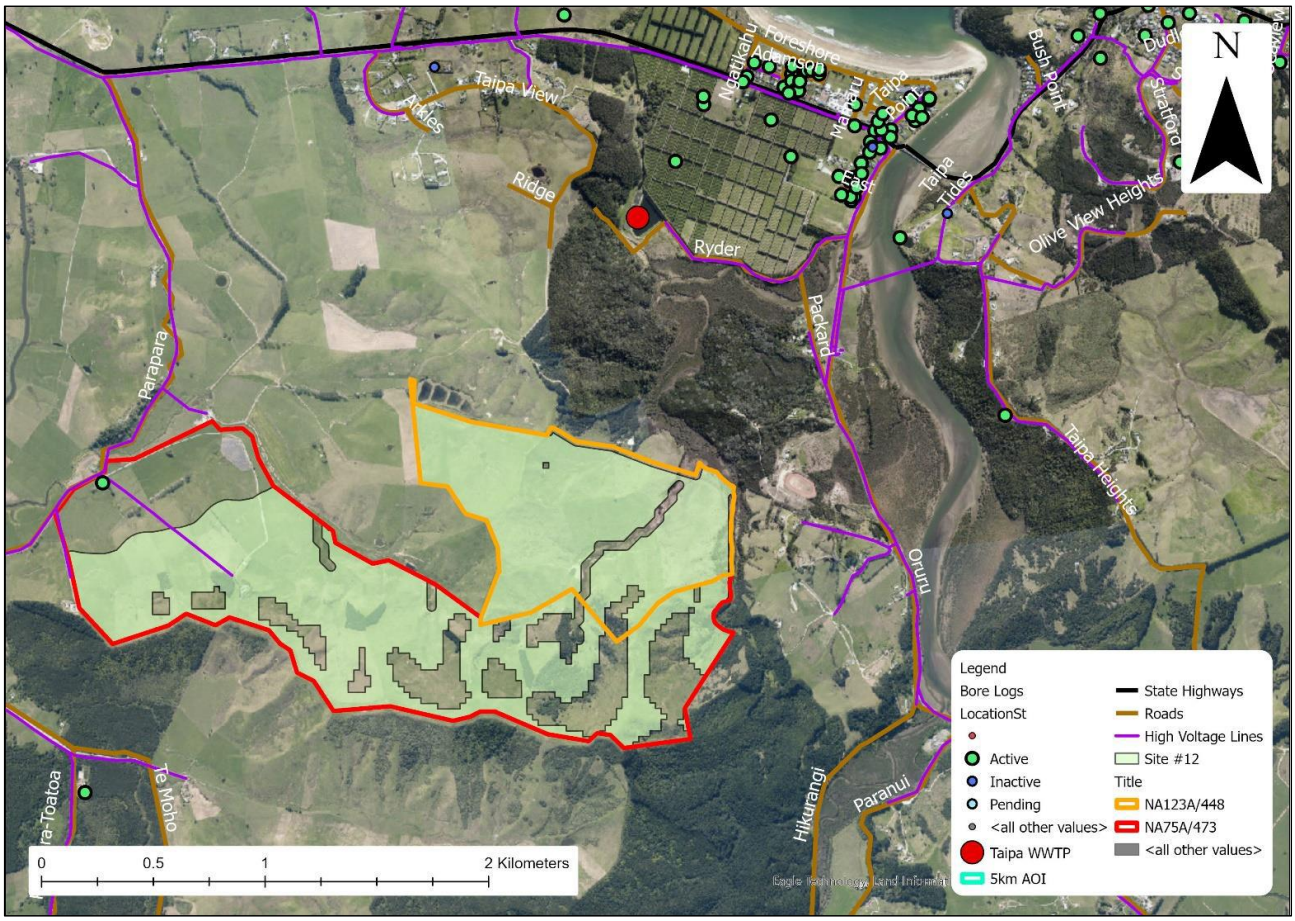


Figure 10. Property #12 with titles, bore locations, high voltage lines, and roads.

There are two bores in the site: 1 bore with the depth of 16.4 m (purposed in 2002 for stock) is on western end of the property and is outside the irrigation area. The other bore (60 m and purposed in 2005 for Miscellaneous) is located ~680m to the south of the site. In addition, as the site borders the constructed wetlands of the Taipa WWTP, minimal piping to transfer treated wastewater would be required.

Details of the soils of the irrigatable area is listed in Table 12.

Table 12. Soils of the irrigatable area with the associated drainage classes for Property #12.

Soil Abbreviation	Soil Name	Drainage Class Range
AYH	Awanui clay and sandy clay	2 – Imperfectly Drained
AYfH	Awanui fine sandy loam and sandy clay	2 – Imperfectly Drained
HKf & HKfH	Hukerenui fine sandy loam	1 to 2 – Poor to imperfectly Drained
OA & OAH	Okaka clay and silty clay	1 to 2 – Poor to imperfectly Drained
RPH	Riponui clay & sandy clay	2 – Imperfectly Drained

The area bordered in red (Figure 10) is made up of HKf, AYH, AYfH, and some RPH soils which have poor to imperfect drainage and equates for ~125 Ha of the irrigatable land. This area has the potential to take full discharge from the Taipa WWTP although it is broken up by some high slopes. The area bordered in orange (~65.5 ha) consists of OA, OAH, and some RPH soils which have poor to imperfect drainage, which will restrict the ability for this site to be used in high soil moisture conditions. Onsite soil testing should be carried out to determine the potential of the site to take full discharge from the Taipa WWTP. A soil map of the site is shown in Figure 11.

In general, it should be noted that a detailed hydrogeological investigation is required to determine the suitability of the preferred sites for the discharge of the treated wastewater from Taipa WWTP.

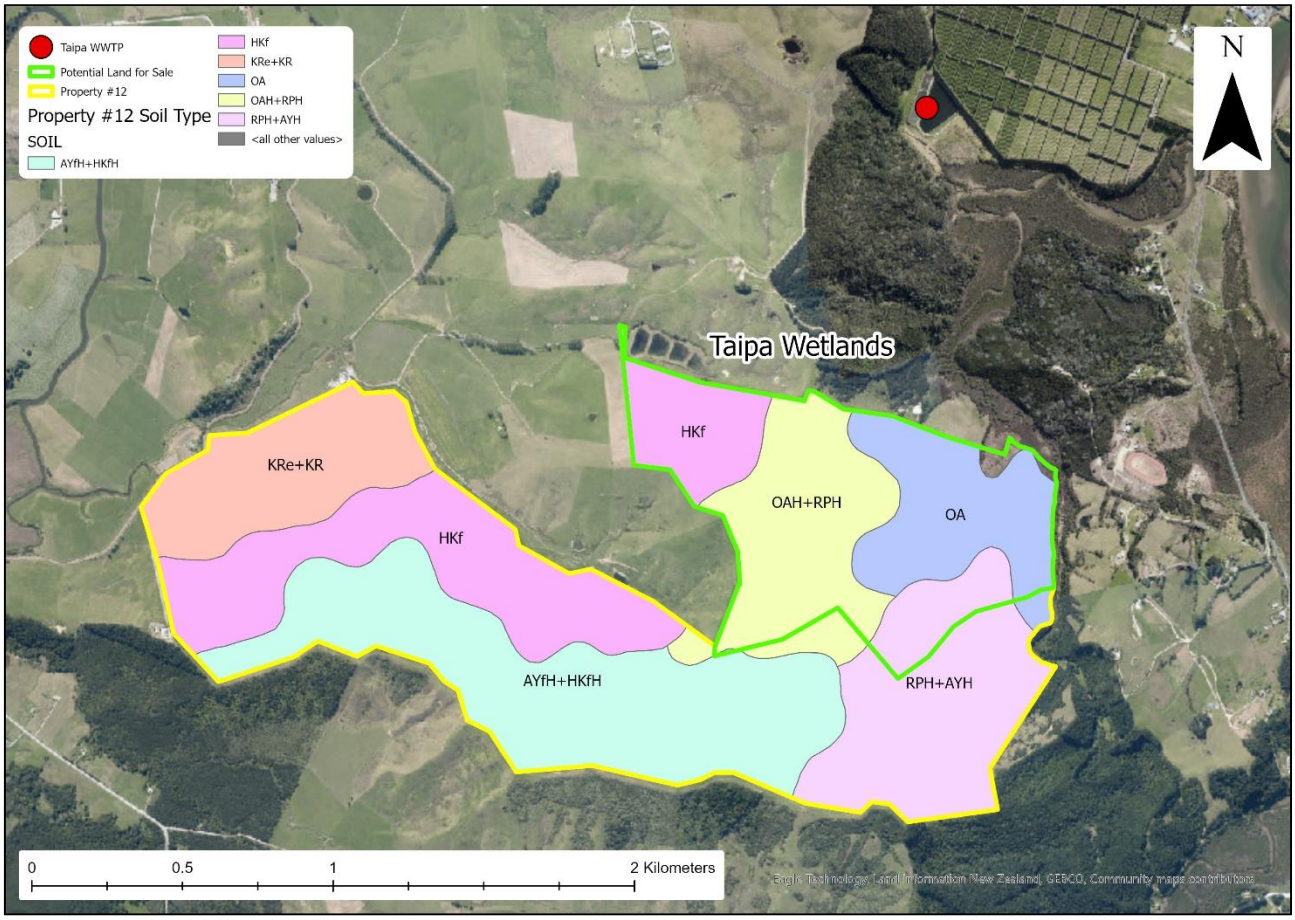


Figure 11. Soil map of Property #12.

4.5 Selecting the Best Practicable Option

4.5.1 In-person Workshop 4 (9 August 2022)

A letter outlining the BPO for Taipa WWTP was issued to the Working Group by Beca on 7 August 2022, prior to in-person workshop 4 (Appendix E). The details for selection of the BPO for the treatment and discharge of wastewater from the Taipa WWTP were set out in the letter.

During in-person workshop 4, the Working Group assessed the advantages of the five shortlisted schemes and the EC option was determined as the BPO by the Working Group.

The Working Group discussed the merits of a staged approach whereby the WWTP would be upgraded to meet Condition 13 standards for discharge to water whilst the land discharge scheme is established. The Working Group also agreed to a relief valve for the treated wastewater storage pond that would allow a discharge to water during severe wet weather to prevent to pond overtopping. As such it was decided that the BPO would need to be able to meet the water quality standards set out in Condition 13 of the consent order.

The Working Group is committed to undertaking a full-scale trial of the EC unit in order to establish confidence that the EC option can meet the water quality standards required by Condition 13 of the consent order and that the option in line with the RMA definition of BPO. However, it was noted that if the EC trial does not demonstrate that the EC system can meet the Condition 13 of the consent order standards for discharge to water, then Scheme C will be selected as the BPO.

In addition, the key points from the Treated Wastewater Disposal to Land Report[8] were discussed including conveyance to the preferred land (Property #2) and storage requirements (storage of treated wastewater for irrigation). According to the report, K-line irrigation (moveable) is assumed to be used in the irrigation scheme. However, it was noted in the meeting that a mixed scheme involving both K-line and fixed sprinklers (around the edges of the property) may be more practical due to the size of the property. A mix of these irrigation methods are used in other land discharge schemes.

According to the soil moisture deficit scheme which was applied to the land discharge high level concept design, irrigation to land from end of June to early September (3 months) may not be possible. Therefore, storage for treated wastewater is required. In this case, an overflow relief valve from the treated wastewater storage pond is needed to prevent overtopping the storage in severe wet weather. As a portion of treated wastewater might be discharged to a waterbody during the wet weather, the discharge location needs to be confirmed and this scenario needs to be included in any future resource consent.

Staging the discharge of treated wastewater was therefore discussed in the workshop. Staging refers to the upgrade of the Taipa WWTP in the first instance to meet the requirements of Condition 13 of the consent order, followed by the setup of a land discharge scheme. The only schemes considered for staging were schemes B and C as it was noted that Scheme A could not be used for water discharge and Scheme E was prohibitively expensive for staging into a land discharge scheme. The main points for staging for Schemes B and C are as follows:

- Scheme B (EC + land discharge)
    - EC trial required to confirm whether discharge is suitable for water discharge
    - Maturation pond required for treatment, full storage at land discharge site
    - Less ability to be staged, full transition to land likely required
- Scheme C (SBR + land discharge)
    - SBR can meet discharge to water standard
    - Maturation pond not required for treatment (could be used for part storage)
    - Less storage required at the discharge site
    - More ability to enable a staged transition to land

Undertaking an onsite trial of the EC option prior to upgrading the Taipa WWTP with EC units was recommended by Beca to ensure that the treated wastewater meet the water quality condition (Condition 13) to be discharged to water. The trial is recommended to be for minimum 6 months (preferably one full year) with a continuous flow rate of at least 20 m^3/day. It was agreed to undertake the trial of EC system with capacity of 30 m^3/day for 12 months. A trial proposed by Maurilogical Limited on 6 July 2022 included the following:

- Electrocoagulation system (capacity 30 m^3/day) delivered to site consisting of EC system and a pump to deliver flows to this system, 2 x 30 m^3 tanks for solids settling, 1 x 1 m^3 tank for separated water, shed (installation and commissioning), 2 control units including remote control and chemical cleaning system.
- Maintenance of the system @ $65/hr (no more than 30 min per service is required)

Other items will be required in the EC trial as follows:

- Preparing the area close to pond embankment near Maturation Pond outlet structure
- Installation of concrete slab for EC equipment and shed

[8] Treated Wastewater Disposal to Land Report, Beca, August 2022.

- Installation costs of EC system
- Providing 2 IBCs to hold fresh water for chemical cleaning
- Preparing chemical storage area (level the ground only) and provide fencing around it.
- Allowance for dry mounted pump. Treated effluent from the EC unit is expected to be discharged by gravity, allowance for a pump is made to mitigate the risk of hydraulic installation.
- Geobags for sludge dewatering, including site preparation and drainage line back to Maturation Pond.

These items are included in the cost estimate for the EC trial. Other ongoing costs for the EC trial for 12 months will include freshwater delivery to fill IBCs, chemical delivery to wash electrodes, running costs of the EC unit, power consumption, lab testing and solids composition testing (for more details see Appendix E).

EC trial costs for 12 months are list in Table 13 and are in conjunction with Table 14 below.

Table 13. Electrocoagulation Trial Cost Estimate.

Description	Cost NZD excl GST
Electrocoagulation (EC) system as supplied by Maurilogical Ltd	66,395
Installation costs of EC unit	13,279
Pump with flexible hose	1,000
OPEX for 12 months trial	16,216
Geobags including installation	25,000
Site works such as electrical, set up, fencing	19,279
Professional and general (P&G), Contingency, Client owned costs	64,106
Rounding	4,725
Total Expected Capital Cost Estimate	**210,000**

Table 14. Cost estimates assumptions and exclusions.

Assumptions	Exclusions
Included 20% on the plant items for electrical Included 10% on the plant items for the update telemetry and SCADA Provisional allowance for power upgrading Included 20% Main Contractor On-site overheads (P&G) Contingency Included 10% Construction Contingency Included 2% Design Development Contingency Included 8% Client-owned project costs Operating cost Included for chemical and water delivery, EC maintenance labour component and power consumption	Asbestos removal / disposal GST Realignment of existing services Repairs to existing surfaces and structures Escalation Capitalised interest Costs to date Lab Costs Insurance costs Legal and finance fees Risk items Covid-19 related costs Property costs Percentages for professional fees and procurement excluded from the EC trial as will be done and handled by the client

Storage requirements for the BPO was determined based on current inflow and growth projections up to 2045 (as provided by FNDC): storage volume 68,000 m^3, at 4 m water depth, pond size of 145 m x 140m and located on the irrigation site.

An overview of the total estimated costs for the BPO (Scheme B) and Scheme B are listed in Table 15:

Table 15. Summary of cost estimate for the BPO.

Taipa WWTP Upgrade	BPO (Scheme B)	Scheme C
WWTP system upgrade	5,870,000	6,820,000
Onsite trial cost	210,000	N/A
Treated Wastewater Storage (and/or maturation pond lining)[1]	6,280,000	5,110,000
Land discharge system (conveyance and discharge)[1]	11,100,000	11,100,000
Total	**23,460,000 (19M – 28.6M)**	**23,030,000 (19M – 28M)**

[1]Refer to Treated Wastewater Disposal to Land Report dated 5th August 2022 for assumptions, exclusions, and disclaimers.

*It should be noted that these are the Capital (CAPEX) cost estimates only and do not include Operating and Maintenance (OPEX) costs. All cost estimate assumptions, exclusions and disclaimers are provided in the relevant memorandums and reports with the original cost estimates.

5 Assessment of Best Practicable Option

According to definition of BPO in the RMA, the BPO needs to prevent or minimise the adverse effects on the environment with regards to matters outlined in Table 16. The assessment of the BPO is illustrated in the table below:

Table 16. Assessment of BPO based on the definition BPO in the RMA.

Definition of BPO in the RMA	Assessment
a) The nature of the discharge or emission and the sensitivity of the receiving environment to adverse effects	As Scheme B was identified as the BPO, Taipa WWTP would be upgraded with Electrocoagulation, solids removal and UV and discharge of treated wastewater from Taipa WWTP will be to land. However, according to the soil moisture deficit scheme, discharge of treated wastewater to land from end of June to early September (3 months) may not be possible. In this case, an overflow relief valve from the treated wastewater storage pond will be required to prevent overtopping the storage in severe wet weather and treated wastewater needs to be discharged to a waterbody when the storage is full. To discharge the treated wastewater to water, the EC trial needs to be carried out first to ensure that the quality of treated wastewater meets the water quality condition mentioned in Table 1. If the trial shows that the quality of wastewater treated by EC option does not meet the water quality condition, then Scheme C (SBR with land discharge) will be considered as the BPO because the SBR option is capable of treating the wastewater to a high level and will meet the required water quality condition.
b) The financial implications, and the effects on the environment, of that option when compared with other options	The total cost estimate for the BPO (Scheme B) is around $23.5M as outlined in Table 15. This is similar to the cost estimate for Scheme C. Whilst Scheme B (and C) were noted as having higher estimated costs then the other schemes, the BPO was determined as the best option for achieving the goal of returning the mauri of the wai. The financial implications when considered against the environmental benefits justify the additional costs of Scheme B (and C) when compared to Schemes A, D and E. However, with the available budget in the FNDC Long Term Plan (LTP) for the Taipa WWTP upgrade, which is around $7M, the upgrade of the WWTP can be only undertaken for now. Once the additional funding is provided, the discharge of treated wastewater to land can be performed. However, it should be noted that future funding to implement the discharge of treated wastewater to land will be subject to the transition to the New Water Entity A infrastructure funding process. It is also noted that Scheme B will require a full-scale trial. However, the Roopu are of the opinion that the EC system may prove to provide greater levels of treatment than SBR and as such the cost of the trial was justified when selecting Scheme B over Scheme C as the BPO.

Definition of BPO in the RMA	Assessment
c) The current state of technical knowledge and the likelihood that the option can be successfully applied	EC is an emerging technology for municipal wastewater treatment in New Zealand. This technique has been used across several countries worldwide mainly on industrial wastewater application. There is a number of studies demonstrating success in industrial wastewater treatment, however there is limited studies available demonstrating success on municipal wastewater treatment. Therefore, as EC is considered to be a new technique in New Zealand and has not been used in full scale municipal plants in New Zealand, an onsite trial of the EC option will be undertaken prior to upgrading the Taipa WWTP with EC units. Undertaking the trial as proposed by Maurilogical Limited (see section 4.5.1) will determine the capability of EC system in meeting water quality standard required by Condition 13 of the Consent Order.

According to the assessment notes mentioned in Table 16, the BPO determined by the Working Group is considered to be in line with the RMA definition of BPO and can be successfully applied to the Taipa WWTP and meet the cultural, environmental, social, and economic constraints. However, it should be noted that the onsite trial needs to be performed to determine the capability of EC system in meeting water quality standard required by Condition 13 of the Consent Order. If the trial shows that the quality of wastewater treated by EC option does not meet the water quality condition, scheme C will be determined as the BPO option because the SBR option is already well proven technology in New Zealand treating the wastewater to a high level and will meet the required water quality condition.

6 Suggestions and Solutions

The next recommended steps for Taipa WWTP are as follows:

- Land discharge scheme needs to be confirmed by 1st July 2023 (Condition 11). However, considering the time needed for the site investigations and the EC trial, it is unlikely to have the land discharge scheme confirmed by 1st July 2023. Therefore, a variation of Condition 11 from Northland Regional Council (NRC) may be required. The following are needed in order to confirm the land discharge scheme:
    - Funding for the site investigations needs to be secured by FNDC.
    - Signed Memorandum of understanding with landowner needs to be secured.
    - Soil investigations should be carried out for the three shortlisted sites by September 2023 to determine suitability of land parcels for wastewater irrigation.
    - Irrigation design with further information needs to progress (primarily irrigation rate and seasonality).
- The land discharge scheme should be implemented by 1st September 2027 (Condition 12). During the period that the land discharge system is being established, the consent holder must provide a written progress report to the Northland Regional Council's Compliance Manager every six months. The following are needed in order to implement the land discharge scheme:
    - Site investigations need to be undertaken and the wastewater irrigation system (preliminary design is the next stage) needs to be designed.
    - Land discharge resource consent needs to be obtained (preparing consent application + AEE, pre-app with Northland Regional Council, timeframe for processing of consent application).
    - Costs and funds from FNDC need to be secured and finalised for undertaking upgrades.
    - An onsite trial of the EC option should be undertaken by September 2023.
    - Preliminary and detailed design for WWTP upgrade needs to be undertaken.
    - Storage facility and pipeline to preferred site needs to be built.
    - WWTP upgrades needs to be undertaken.

Anticipated Consent Requirements for the BPO under National, Regional, and District Plans are:

- Groundwater takes and/or diversions, potentially for a source of freshwater to use in the WWTP;
- Bulk earthworks, vegetation removal, stream works, and works within proximity to wetlands, all associated with the construction of a DTL scheme, plant upgrades, and pipeline routes;
- Disturbance of contaminated soils, and associated environmental and human health effects;
- Structures within a stream, where new outfalls, intakes, and/or vehicle crossings are required for the construction and/or operation of a DTL scheme and associated plant upgrades; and
- Discharges of treated wastewater from a municipal treatment plant to land where it may enter water and air.

A range of technical assessment regardless of which final site and design methodology will be required to support the required resource consent applications. These include: groundwater assessments, qualitative microbial risk assessment (QMRA), ecological assessments, odour assessment, water quality assessments, soil suitability assessment and geological assessment, preliminary and detailed site investigations for contaminated soils, flood risk assessment, archaeological assessment and cultural impact assessment.

A

Appendix A – Consent Order

IN THE ENVIRONMENT COURT
AT AUCKLAND

I TE KŌTI TAIAO O AOTEAROA
KI TĀMAKI MAKAURAU

	IN THE MATTER	of the Resource Management Act 1991 (**the Act**)
	AND	of an appeal pursuant to s120 of the Act in relation to the discharges from the East Coast Waste Water Treatment at Taipa
	BETWEEN	TE MANA O TE WAI HAPU INTERGRATION ROOPU CHARITABLE TRUST
		CLEANWATERS TO THE SEA – TOKARAU MOANA CHARITABLE TRUST
		TE RUNANGA A IWI O NGATI KAHU (ENV-2019-AKL-181)
		Appellants
	AND	NORTHLAND REGIONAL COUNCIL
		Respondent
	AND	FAR NORTH DISTRICT COUNCIL
		Applicant

Court: Environment Judge J A Smith sitting alone under s 279 of the Act

Date of Order: 08 MAR 2021

Date of Issue: 08 MAR 2021

CONSENT ORDER

THE SEAL OF THE ENVIRONMENT COURT OF NEW ZEALAND

A. Under s 279(1)(b) of the Act, the Environment Court, by consent, orders that consent is granted to the Far North District Council for the activities and discharges specified in **Attachment 1** subject to the amended conditions set out in **Attachment 1**.

B. The appeal is otherwise dismissed.

C. Under s 285 of the Resource Management Act 1991, there is no order as to costs.

REASONS

Introduction

[1] This appeal is against a decision of the Northland Regional Council (**Regional Council**) that granted the following resource consents to the Far North District Council (**the Applicant**) to undertake activities associated with the operation of the East Coast Waste Water Treatment System (**Taipa WWTP**):

(a) AUT.004007.01.03 To discharge treated municipal wastewater to an unnamed tributary of Te Wai o Te Parapara (Parapara Stream), at or about location co-ordinates 1640435E 6126160N.

(b) AUT.004007.02.02 To discharge contaminants to land from the base of a wastewater treatment system, at or about location co-ordinates 1641450E 6126950N and 1640435E 6126160N.

(c) AUT.004007.03.02 To discharge contaminants to air (primarily odour) from a wastewater treatment system, at or about location co-ordinates 1641450E 6126950N and 1640435E 6126160N.

The appeal

[2] The appellants sought the following relief:

(a) Quash the consents.

(b) Direct the Regional Council to issue new consents that:

(i) Accept an environmental sensitive discharge to the receiving environment with new discharge parameters designed equally with the appeal group, including the international discharge standards.

(ii) Require the weekly collection and monitoring of wastewater samples from the discharge after the wetland under the additional parameters as stated in (b)(i) above.

(c) Require all sample collection to be done by an authorised independent person and the tests to be performed by an independent Laboratory.

The agreement reached

[3] The parties have now reached an agreement that will resolve the appeal in its entirely. A summary of the agreement reached is set out below:

(a) The quantitative microbiological risk assessment (**QMRA**) required by Condition 5 of the consent subject to appeal indicated that the discharge of treated wastewater from the Taipa WWTP is not likely to result in an unacceptable public health risk downstream of the Council's Sample Site 105941 and that further pathogen reduction is not required. Condition 5 has been satisfied, and Conditions 5 and 6 can accordingly be deleted from the consent.

(b) The consent subject to appeal set a discharge standard in the event the Applicant was not committing to land disposal following the best practicable option (**BPO**). Condition 13 required an upgrade to be commissioned in this scenario to enable the Taipa WWTP to meet the specified standards for Total Ammoniacal Nitrogen (**TAN**), Biological Oxygen Demand and Total Suspended Solids. The solution agreed between the parties is to:

(i) Replace TAN with Total Nitrogen, amending the standard accordingly.

(ii) Convert the method of measuring exceedances from a maximum number of samples to a percentile.

(iii) Introduce new parameters - dissolved oxygen, pH, total phosphorus and faecal coliforms.

(iv) Introduce a water quality standard that applies in the interim (new Condition 5) and requires the Applicant to de-sludge the ponds and remove excess vegetation from the wetland in order for it to be met. In the event the Applicant commits to land disposal following the BPO, the new standard in proposed Condition 5 will apply for the life of this consent.

[4] The membership and role of the Working Group has also been expanded in Condition 8:

(i) In addition to the three representatives of Ngati Kahu (appointed by mana whenua) there will also be a representative of the broader Doubtless Bay community appointed by Te Mana o Te Wai Hapu Integration Roopu Charitable Trust on the Working Group.

(ii) In the event the BPO is a continued discharge to water, the Working Group will not only be involved in the analysis of options for upgrading the Taipa WWTP but will also provide its recommendation to the Applicant regarding the upgrade and be involved in post-commissioning monitoring of water quality.

(b) The Terms of Reference for the Working Group have been agreed. Condition 9 has been updated accordingly.

(c) With one exception, the "hard dates" set by the Council in its decision have all been adjusted by 2 years to accommodate the delay in commencement as a consequence of the appeal. The exception is in Condition 13 where the date has been extended by 3 years to reflect the processes and time required to design, procure and commission an upgrade in the event that following the BPO the Applicant does not commit to a land disposal option.

(d) A minor change has been made in Schedule 1: Monitoring Programme to clarify that the samples must be analysed in an independent laboratory.

[5] The parties are satisfied that these amendments fall within the Court's jurisdiction and conform to the relevant requirements and objectives of the Act.

Consideration

[6] In making this order the Court has read and considered the consent memorandum of the parties dated 25 February 2021.

[7] No person has given notice of an intention to become a party this appeal under s 274 of the Act.

[8] The Court is making this order under s 279(1) of the Act, such order being by consent, rather than representing a decision or determination on the merits pursuant to s 297. The Court understands for present purposes that:

(a) all parties to the proceedings have executed the memorandum requesting this order;

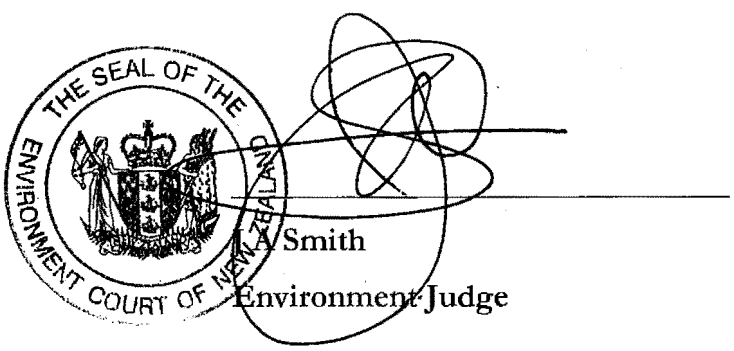
(b) all parties are satisfied that all matters proposed for the court's endorsement fall within the court's jurisdiction, and conform to the relevant requirements and objectives of the Act including, in particular, Part 2.

Order

[9] Under s 279(1)(b) of the Act, the Environment Court, by consent, orders that consent is granted to the Far North District Council for the activities and discharges specified in **Attachment 1** subject to the amended conditions set out in **Attachment 1** to this order.

[10] The appeal is otherwise dismissed.

[11] There is no issue as to costs.



J A Smith
Environment Judge

ATTACHMENT 1

FAR NORTH DISTRICT COUNCIL, PRIVATE BAG 752, KAIKOHE 0440

To undertake the following activities associated with the operation of the East Coast Wastewater Treatment System on Pt Allot 24 PSH of Taipa and Sec 1 SO 69379 Blk IV Mangonui SD (treatment plant) and Sec 1 SO 65075 Blk IV Mangonui SD (wetland)Pt:

AUT.004007.01.03	**To discharge treated municipal wastewater to an unnamed tributary of Te Wai o Te Parapara (Parapara Stream), at or about location co-ordinates 1640435E 6126160N.**
AUT.004007.02.02	**To discharge contaminants to land from the base of a wastewater treatment system, at or about location co-ordinates 1641450E 6126950N and 1640435E 6126160N.**
AUT.004007.03.02	**To discharge contaminants to air (primarily odour) from a wastewater treatment system, at or about location co-ordinates 1641450E 6126950N and 1640435E 6126160N.**

Note: All location co-ordinates in this document refer to Geodetic Datum 2000, New Zealand Transverse Mercator Projection.

Subject to the following conditions:

AUT.004007.01.03 and AUT.004007.02.02 - DISCHARGE TO WATER AND LAND

1 The volume of treated wastewater discharged to the unnamed tributary of Te Wai o Te Parapara must not, based on a 30-day rolling average dry weather flow, exceed 790 cubic metres per day. The average dry weather flow is defined in Section 1 (Wastewater Volumes) of Schedule 1 (**attached**).

2 The Consent Holder must install and maintain an operational flow meter with a measurement error of no more than ±5% to measure the volume of wastewater discharged into the unnamed tributary.

3 The Consent Holder must keep a record of the daily volume of wastewater through the flow meter required by Condition 2 and the calculated 30-day rolling average dry weather flow discharge volume. A copy of these records must be forwarded to the Northland Regional Council's Compliance Manager by the 15th of each month and also upon request by the Northland Regional Council's assigned Monitoring Officer.

4 The Consent Holder must calibrate the flow meter at least annually. The calibration must be undertaken by a suitably qualified and experienced person. Written verification from the suitably qualified and experienced person that the meter accuracy has been verified must be forwarded to the Northland Regional Council's assigned Monitoring Officer within one month of the verification being completed.

5. ~~The Consent Holder must, no later than 1 September 2020, provide a written report to the Northland Regional Council's Compliance Manager which outlines the results of a quantitative microbiological risk assessment (**QMRA**) that the treated wastewater discharged from the East Coast Wastewater Treatment Plant poses to the health of people as affected by their contact with water in, and consumption of aquatic species from, Te Wai o Te Parapara and Te Wai o Te Awapoko (Awapoko River and Estuary). The scope of the QMRA, in particular selecting the sites and aquatic species to be assessed by the QMRA, must be developed in consultation with the Working Group required to be established by Condition 7. If the outcome of the QMRA indicates that the discharge of treated wastewater from the East Coast Wastewater Treatment Plant is likely to be resulting in an unacceptable public health risk downstream of NRC Sample Site 105941, then the QMRA report must also recommend a level of pathogen reduction required to reduce the risk associated with the East Coast Wastewater Treatment Plant discharge to an acceptable level. The QMRA and recommended risk reduction, if required, must be undertaken by a suitably qualified and experienced independent person(s) with specialisations in faecal pathogen microbiological risk assessments. The Consent Holder must make the report publicly available on its website and provide the findings and recommendations to Te Rūnanga ā Iwi o Ngāti Kahu and the Working Group required to be established by Condition 7.~~

   The Consent Holder must, no later than 1 October 2022, de-sludge the ponds, remove the excess vegetation present in the wetland and undertake any other improvements necessary so that the quality of the treated wastewater, as measured at NRC Sample Site 101687 (discharge from the wetland) meets the following standards, based on the results of 26 fortnightly samples collected each calendar year as required by Schedule 1 (**attached**):

Parameter	Unit	Average*	85% percentile*	95% percentile*
Total Nitrogen	mg/L	16	23	25
TSS	mg/L	35	55	85
BOD	mg/L	15	25	30
DO	mg/L	>2	>2	>2
pH	-	>6.5	>6.5	>6.5
Faecal coliforms	CFU/100ml	850	1500	3000

*Based on pH8 and 20°C.

6. ~~If the report required by Condition 5 recommends that additional pathogen reduction in the treated wastewater discharge is required to reduce risks to the health of people as affected by their contact with water in, and~~

~~consumption of aquatic species from, Te Wai o Te Parapara and Te Wai o Te Awapoko (Awapoko River and Estuary), then the Consent Holder must:~~

~~(a) Provide a written report to the Northland Regional Council's Compliance Manager no later than 1 March 2021 on how the required pathogen reduction will be achieved in the treated wastewater prior to it being pumped to the wetlands; and~~

~~(b) Upgrade the wastewater treatment system in accordance with that report no later than 1 March 2022.~~

~~***Advice Note:*** *If the method of pathogen removal introduces any new contaminants into the discharge, then a new consent for these contaminants may be required.*~~

[Condition 6 has been deleted and the number not re-used so is intentionally blank]

7. The Consent Holder must, no later than 1 October ~~2019~~2021, establish a Working Group and invite ~~a minimum, of~~ three representatives of Ngāti Kahu (appointed by ~~tangata~~ mana whenua) and one representative of the broader Doubtless Bay community (appointed by Te Mana o Te Wai Hapu Integration Roopu Charitable Trust) to be members of the Working Group. The Working Group must also comprise of two senior officers appointed by the Consent Holder, supported by an independent person qualified and specialising in wastewater engineering and land disposal systems (appointed by the Consent Holder and certified by the Northland Regional Council's Compliance Manager as being independent and having no conflict of interest).

8. The purpose of the Working Group is to provide for the involvement of Ngāti Kahu in:

   a. ~~The scoping of the QMRA required to be undertaken by Condition 5~~[DELETED];

   b. The assessment of disposal options for the treated wastewater required by Condition 10;

   c. Providing a recommendation to the Consent Holder regarding the best practicable option for the disposal of treated wastewater required by Condition 10; ~~and~~

   d. The analysis of options for upgrading the wastewater treatment plant if such an upgrade is required by Condition 13;

   e. Providing a recommendation to the Consent Holder regarding the upgrade required by Condition 13; and

   f. Post-commissioning monitoring of water quality.

9. ~~The Consent Holder must, no later than 1 November 2019, establish a Terms of Reference with the representatives of Ngāti Kahu in the Working Group, that sets out:~~

~~a. The frequency and format of the Working Group meetings and methods for decision-making within the Working Group; and~~

~~b. A dispute resolution process whereby any differences that may arise may be resolved by direct discussions between the parties in dispute, and failing that, by reference to mediation by an Arbitrators' and Mediators' Institute of New Zealand (AMINZ) affiliated mediator, the costs of which must be met by the Consent Holder.~~

Schedule 2 sets out the initial Terms of Reference for the Working Group.

10. The Consent Holder must, no later than 1 September ~~2020~~ 2022, provide a report to the Northland Regional Council's Compliance Manager which assesses the options for disposing treated wastewater from the East Coast Wastewater Treatment and the report must include a recommendation as to which disposal option is considered to be the best practicable option (**BPO**). The assessment must include the option of disposing the treated wastewater to land and must identify the costs and benefits of all practicable disposal options. The assessment of options must be undertaken by a suitably qualified and experienced person(s) and must involve the Working Group established in accordance with Condition 7.

11. If the report required by Condition 10 determines that the BPO is to change to land disposal then the Consent Holder must, no later than 1 July ~~2021~~ 2023, advise the Northland Regional Council's Compliance Manager, in writing, whether or not it is committing to the land disposal option.

Advice Note: *The ten-month period between the date specified in Condition 10 and the date specified in Condition 11 has been provided in acknowledgement that the Consent Holder may need to undertake consultation with the local community and that funding for the land disposal system may need to go through, and may need to be approved through, its Long Term Plan or Annual Plan processes.*

12. If the Consent Holder has advised the Northland Regional Council's Compliance Manager that it is committing to the land disposal option (refer Condition 11) then the Consent Holder must establish and commission the land disposal system no later than 1 September ~~2025~~ 2027. During the period that the land disposal system is being established, the Consent Holder must provide a written progress report to the Northland Regional Council's Compliance Manager every six months.

13. If the Consent Holder has advised the Northland Regional Council's Compliance Manager that it is not committing to the land disposal option (refer Condition 11) then the Consent Holder must, no later than 1 September ~~2023~~ 2026, upgrade the wastewater treatment system (and commission the upgrades) so that the quality of the treated wastewater, as measured at NRC Sample Site 101687 (discharge from the wetland), meets the following standards, based on the results of 26 fortnightly samples collected each calendar year as required by Schedule 1 (**attached**):

~~Parameter~~	~~Compliance metric~~	~~Standard~~
~~Total ammoniacal nitrogen (TAN)~~	~~Annual median*~~	~~≤10 grams per cubic metre~~
	~~Maximum number of samples exceeding >15 g TAN/m³ per year per calendar year*~~	~~4~~
~~Five-day biochemical oxygen demand (BOD_5)~~	~~Annual median~~	~~≤20 grams per cubic metre~~
	~~Maximum number of samples exceeding >30 g BOD_5/m³ per calendar year~~	~~4~~
~~Total suspended solids (TSS)~~	~~Annual median~~	~~≤20 g grams per cubic metre~~
	~~Maximum number of samples exceeding >40 g TSS/m³ per year per calendar year~~	~~4~~

~~* Based on pH 8 and temperature of 20°C. Compliance with the standards should be undertaken after pH adjustment.~~

Parameter	Unit	Median*	85% percentile*
Total Nitrogen	mg/L	12	16
TSS	mg/L	20	30
BOD	mg/L	20	40
DO	mg/L	>2	>2
pH		>6.5	>6.5
Total Phosphorus	mg/L	10	15
Faecal coliforms	CFU/100ml	1000	1500

*Based on pH8 and 20°C.

Advice Note: *The Consent Holder has advised that it will involve the Working Group required to be established in accordance with Condition 7 in determining the appropriate option to upgrade the wastewater treatment plant to meet these standards.*

14. The treated wastewater discharged from the constructed wetland must not result in any of the following effects in the waters of the unnamed tributary of Te Wai o Te Parapara downstream of NRC Sample Site 105941 (refer NRC Plan 3078A **attached**):

(a) The pH must not be outside the range of 6.0 to 9.0.

(b) The production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials

(c) Any conspicuous change in the colour or visual clarity

(d) Any emission of objectionable odour.

15. The Consent Holder must maintain easy and safe access to the discharge point from the constructed wetland for the purposes of sampling.

AUT.004007.03.02 - DISCHARGE TO AIR

16. The exercise of this consent must not result in the discharge of contaminants which are deemed by a Monitoring Officer of the Northland Regional Council to be noxious, dangerous, offensive or objectionable at or beyond the property boundary of the East Coast Wastewater Treatment Plant.

GENERAL CONDITIONS

17. The Consent Holder must maintain the treatment system so that it operates effectively at all times, and a written record of all maintenance undertaken must be kept. A copy of this record must be forwarded as soon as practicable to the Northland Regional Council upon written request.

18. The Consent Holder must monitor the exercise of these consents in accordance with Schedule 1 (**attached**).

Advice Note: *The Consent Holder should attempt to maintain fencing of the drain, an unnamed tributary of the Parapara Stream, between NRC sampling sites 101687 and 105940, as shown on NRC Plan 3078A (**attached**), to prevent stock access.*

19. The Consent Holder must, on becoming aware of any unauthorised discharge associated with the East Coast Wastewater Treatment System:

    (a) Take immediate action to stop and/or contain the discharge; and

    (b) Immediately notify the Northland Regional Council by telephone of the discharge; and

    (c) Take all reasonable steps to remedy or mitigate any adverse effects on the environment resulting from the discharge; and

    (d) Notify the Northland Regional Council in writing within one week on the cause of the unauthorised discharge and the steps taken or being taken to remedy of mitigate the effects of the discharge.

    For telephone notification during the Northland Regional Council's opening hours (8.00 a.m. to 5.00 p.m.), the Northland Regional Council's assigned Monitoring Officer for these consents must be contacted. If that person cannot be spoken to directly, or it is outside of the Northland Regional Council's opening hours, then the Environmental Hotline (0800 504 639) must be contacted.

20. The Northland Regional Council may, in accordance with Section 128 of the Resource Management Act 1991, serve notice on the Consent Holder of its intention to review the conditions of these consents:

    (a) Annually for one or more of the following purposes:

(i) To deal with any adverse effects on the environment that may arise from the exercise of the consents and which it is appropriate to deal with at a later stage, or

(ii) To require the adoption of the best practicable option to remove or reduce any adverse effect on the environment.

(b) Within three months of receiving the written report required by Condition 10 to provide for additional work on land disposal options; and

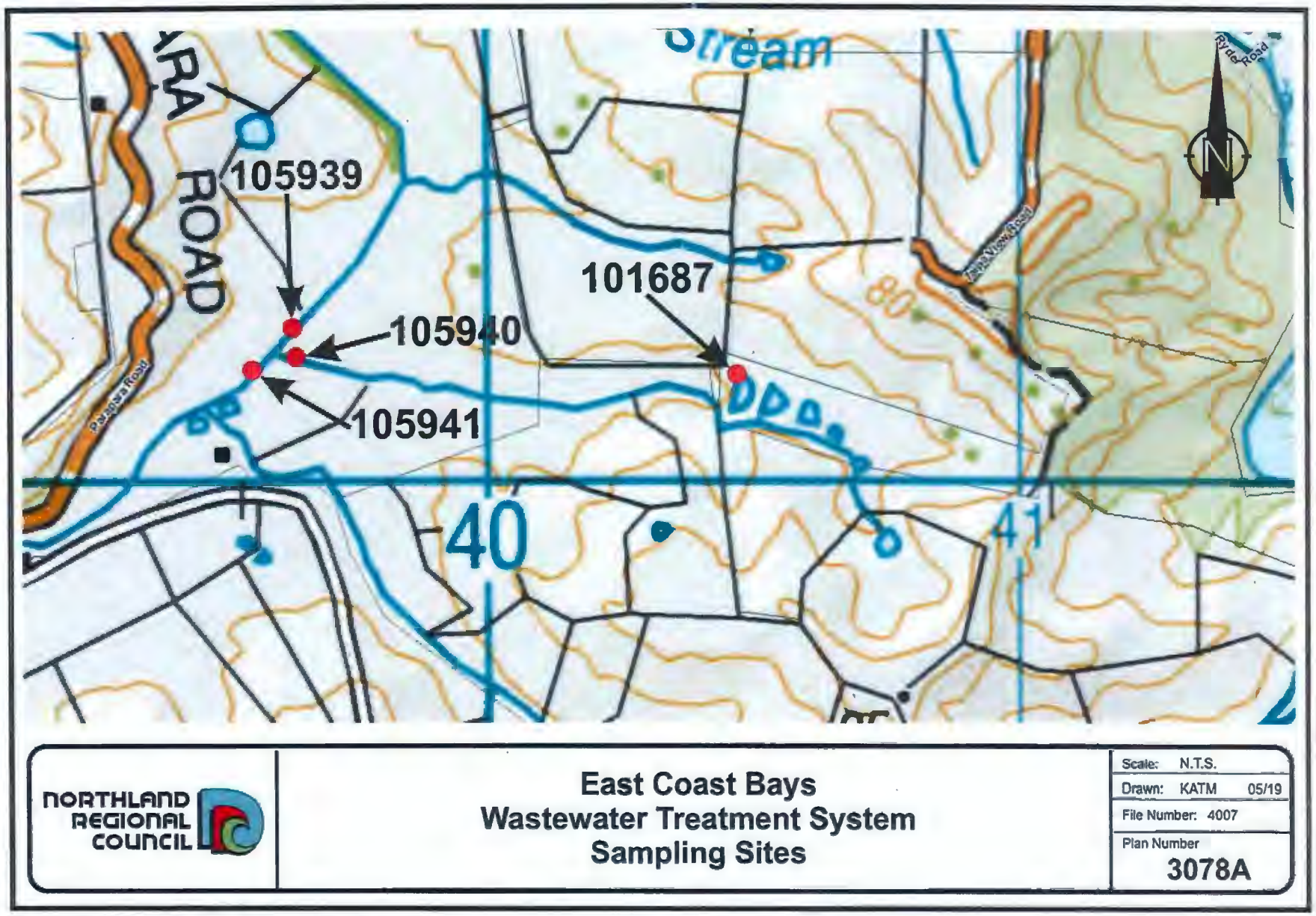
~~(c) Within three months of receiving the written report required by Condition 6(a) to insert new conditions or change the Monitoring Programme in Schedule 1 to deal with the ongoing monitoring and compliance of the pathogen reduction system that is to be installed.~~ [DELETED]

(d) Annually during the month of October to change the Monitoring Programme in Schedule 1 to deal with the ongoing monitoring of the wastewater treatment system.

The Consent Holder must meet all reasonable costs of any such review.

EXPIRY DATES

Resource consents AUT.004007.01.03, AUT.004007.02.02 and AUT.004007.03.02 will expire eight years from their dates of commencement.



NORTHLAND REGIONAL COUNCIL

East Coast Bays
Wastewater Treatment System
Sampling Sites

Scale:	N.T.S.
Drawn:	KATM 05/19
File Number:	4007
Plan Number	3078A

SCHEDULE 1

MONITORING PROGRAMME

The Consent Holder, or its authorised agent, must undertake the following monitoring:

1. WASTEWATER VOLUMES

The Consent Holder must keep a record of the daily (midnight to midnight) treated wastewater flows through the meter required by Condition 2 of the consent. The 30-day rolling average dry weather flow discharge volume must be calculated and recorded daily. A wet weather flow day is defined as any day with 10 or more millimetres of rain and the two subsequent days. A dry weather flow day is defined as any day that is not a wet weather flow day.

The daily rainfall must be taken from the Northland Regional Council's automatic rain station 530511 (Oruru Bowling Club). This data can either be downloaded from the Northland Regional Council's website or supplied by the Northland Regional Council on request. An alternative rainfall station may be used with the prior written approval of the Northland Regional Council's Compliance Manager.

2. MONITORING OF THE WASTEWATER WITHIN THE WASTEWATER TREATMENT PLANT

At fortnightly intervals, samples of wastewater must be collected at the influent to the WWTP, outflow from Pond 3, and the outflow from the Maturation Pond, and analysed for the following:

(a) Total ammoniacal nitrogen (g/m^3)

(b) Five-day biochemical oxygen demand (g/m^3)

(c) pH

(d) Dissolved oxygen (g/m^3)

(e) Temperature (^0C).

3. MONITORING OF THE DISCHARGE FROM THE CONSTRUCTED WETLAND

At fortnightly intervals, samples of wastewater must be collected at NRC Sampling Site 101687 (discharge point from the wetland) and analysed for the following:

(a) Total ammoniacal nitrogen (g/m^3)

(b) Five-day biochemical oxygen demand (g/m^3)

(c) pH

(d) Dissolved oxygen (g/m^3)

(e) Total suspended solids (g/m^3)

(f) Temperature (^0C)

(g) Escherichia coli (cfu/100 mL)

(h) Enterococci (cfu/100 mL).

4. MONITORING OF RECEIVING WATER QUALITY

Each calendar month, samples of water must be collected from the unnamed tributaries of the Te Wai o Te Parapara at NRC Sampling Sites 105939, 105940, and 105941, as shown on NRC Plan 3078A (**attached**), and analysed for the following:

(a) Total ammoniacal nitrogen (g/m^3)

(b) pH

(c) Dissolved oxygen (g/m^3)

(d) Escherichia coli (cfu/100 mL)

(e) Enterococci (cfu/100 mL).

5. SAMPLE COLLECTION, SAMPLE TRANSPORT, AND LABORATORY REQUIREMENTS

All samples must be collected using standard procedures and in appropriate laboratory supplied containers.

All samples collected as part of this monitoring programme must be transported in accordance with standard procedures and under chain of custody to the laboratory.

All samples collected must be analysed at an independent laboratory with registered quality assurance procedures#, and all analyses are to be undertaken using standard methods, where applicable.

Registered Quality Assurance Procedures are procedures which ensure that the laboratory meets recognised management practices as would include registrations such as ISO 9000, ISO Guide 25, Ministry of Health Accreditation.

6. REPORTING

By the 15th of each month, the results of monitoring in accordance with Sections 2, 3 and 4 of this schedule, for the previous calendar month, must be forwarded to the Northland Regional Council.

This information must be in an electronic format that has been agreed to by the Northland Regional Council.

SCHEDULE 2

TERMS OF REFERENCE FOR WORKING GROUP

1. Kaupapa

The Working Group is made up of representatives of Ngāti Kahu hapu, Far North District Council and the community. The Working Group representatives will work together to support good decision making for the upgrade of the Taipa wastewater treatment plant that will promote the wellbeing of Ngāti Kahu hapu and the wider community by striving to achieve the best outcome to bring back the mauri to the wai.

Attachment 1 provides the context within which parties enter this relationship.

2. Ngati Kahu

In 1988 the Waitangi Tribunal reported on its findings of Claim number Wai-171. The claim was put forward by Ngāti Kahu and related to the Taipa wastewater treatment plant, and in particular the siting of the plant on the Adamson- Ngāti Kahu farm and the discharge of treated wastewater into the Parapara catchment. Although the outcome of the Tribunal hearing did not grant the claim being sought by Ngāti Kahu, the report itself is very important because it sets down a detailed account of the significance of the Parapara area to Ngāti Kahu; and the grievance suffered by tangata whenua with the implementation of the Taipa sewerage scheme. With that in mind, it is important to consider the records contained in the Waitangi Tribunal report to gain an understanding of the context behind the Kaupapa outlined in these terms of reference.

3. Background

The Taipa Wastewater Treatment Plant discharges treated wastewater into a tributary of the Parapara Stream. The discharge is authored by Northland Regional Council resource 4007. That resource consent expired in 2008 and an application for replacement resource consent was lodged with the Regional Council before it expired. The resource consent application was notified in 2010 to allow for public submissions on the proposal. Far North District Council requested that the application be placed on hold after the submission period to try and resolve the concerns that were raised by

[1] Report of the Waitangi Tribunal on the Ngāti Kahu - Mangonui Sewerage Claim (Wai-17). - Wellington, N.Z

submitters, particularly those of Ngāti Kahu hapu. The application remained on hold until it proceeded to a hearing in 2019. A decision granting the resource consent for a term of eight years was issued in August 2019.

The decision was appealed to the Environment Court by Te Mana O Te Wai Hapu Integration Roopu Charitable Trust & Others. The appellants and FNDC have worked together to develop these terms of reference as a means of resolving the appeal.

4. TERMS OF REFERENCE

4.1 Vision

To bring back the mauri to the wai for the benefit of the whanau, hapu and the community.

4.2 Values

The parties making up the Working Group will work together with the intention and commitment to establishing a collaborative, interactive, positive and balanced relationship exercising good faith, co-operation and flexibility and responsiveness in working together.

4.3 Objectives

The Working Group will strive to achieve the following objectives:

- Providing a forum for Ngāti Kahu mana whenua, Te Mana o Te Wai Hapu Integration Roopu Charitable Trust and FNDC to develop a mutual understanding of specific issues and constraints associated with the Taipa wastewater treatment plant.
- Working to facilitate the sharing, development and gathering of information for the purpose of developing options for addressing the adverse effects of the wastewater discharge from the Taipa wastewater treatment plant.
- Working together acknowledging Council's duty to promote the social, economic, environmental, and cultural well-being of communities in the present and for the future.
- Working towards the long-term objective of reducing or removing any discharge of wastewater to freshwater from the Taipa Wastewater Treatment Plant.
- Supporting education and engagement with the community about tikanga (why)

and upgrade and disposal options (what) to enable the community to give informed feedback to Council in respect of the upgrade/disposal recommendations put forward by the Working Group.

- Working together to develop agreed ways of measuring the long-term health of the receiving environment affected by the wastewater treatment plant discharge. This includes exploring options to include mātauranga Māori approaches to monitoring water quality and stream health.
- Continuing to investigate means of improving the discharge from the wastewater treatment plant by reviewing and recommending wastewater treatment standards that are better than those in the resource consent including associated upgrade and discharge options.
- Addressing these objectives in both the short term and long term.

4.4 Milestones

The Working Group will work towards achieving the milestones in the consent.

In terms of the September 2026 milestone in condition 10, the Working Group will strive to achieve 1 September 2025 (a year earlier).

4.5 Membership

(a) Working Group

The Working Group is to comprise representatives of Ngāti Kahu mana whenua, TMOTWHIRCT and the Far North District Council including as a minimum:

- Two senior Council staff
- Any other Council staff as required to support any meetings that require Council delegations that are not held by the regular attendees.
- Three hapu representatives of Ngāti Kahu mana whenua.
- A representative of the community appointed by TMOTWHIRCT.

(b) Independent Wastewater Engineer

- An Independent person qualified and specialising in wastewater engineering and land disposal systems to be appointed by the consent holder and certified by NRC (as being independent and having no conflicts of interest).

- The independent wastewater engineer is responsible for providing independent and objective expert advice to the Working Group in respect of matters relating to wastewater treatment and disposal.

4.6 Responsibilities

(a) Council

- FNDC staff to liaise with members of the working group to keep them updated to ensure they are fully informed of the agreed work being completed.
- Any feedback from elected members will be reported back to the Working Group.
- Key FNDC elected members will be brought to the table as required.
- FNDC commits to working with marae representatives to achieve the required outcomes, this includes building capacity of, and providing support to, the hapu to ensure all parties are able to fully engage with the working group process.
- FNDC will hold a master folder containing / storing all key documentation /information esp. minutes, reference material, plans and maps associated with this project that will be duplicated and shared with TMOTWHIRCT.

(b) Hapu and Community responsibilities

- Marae representatives on the working group will liaise with respective marae and report all feedback from the marae back to the working group on a regular basis.
- Marae representatives to provide cultural knowledge and capabilities to support the working group.
- Community representative to report to the community they represent and report back. Community representatives liaise with Doubtless Bay community groups and report all feedback and concerns to the Working Group on a regular basis.

(c) Shared responsibilities

- Engaging with the wider community to report on the progress and outcomes of the milestones of the Working Group.

4.7 Resourcing

- Council will pay a meeting allowance of $250 per member per meeting. For

clarity, this sum is to cover the costs of meeting attendance, meeting preparation, mileage to the meetings, and work associated with reporting back to parties each attendee represents.

- It may be necessary for Working Group members to undertake work outside regular meetings (and associated ancillary tasks), such as consultation meetings with the community, meetings during the Long Term Plan preparation and/or meetings of Council to present recommendations. It is acknowledged personal expense as a result of participating in other work, workshops and hui may be incurred. Council will resource the Working Group members for additional work under the principle that members should not be financially disadvantaged by the work requirements of the Working Group.

(a) Technical Expertise

- Independent technical expertise will be engaged to support the recommendations put forward to Council by the Working Group. Costs to be met by FNDC and FNDC procurement process will apply.
- Technical expertise is to be agreed mutually by the Working Group representatives via supplier a panel process.
- Technical expertise is to include peer review services and decision making facilitation if required.

4.8 Decision Making and Recommendations to FNDC

- The Working Group will follow best practice approaches when identifying and shortlisting disposal and upgrade options.
- Recommendations to council for the BPO will be by consensus of the group.
- If consensus cannot be reached, an independent facilitator will be selected from the supplier panel to assist with a resolution.
- If the recommendation(s) made by the Working Group are not accepted by FNDC , then the matter will be sent back to the Working Group to reconsider and to make further recommendation(s).

TERMS OF REFERENCE ATTACHMENT 1: CONSTITUTIONAL CONTEXT FOR THE WORKING GROUP

This section is a synthesis from the teachings of the late McCully Matiu (Te Whānau Moana), Māori Marsden (The Woven Universe) and other elders; the research and writings of Professor Margaret Mutu, Dr Moana Jackson, Dr Ani Mikaere, Associate Professor Claire Charters and others; the websites of the Human Rights Commission, Waitangi Action Group, Waitangi Tribunal, Matike Mai o Aotearoa and the Aotearoa Independent Monitoring Mechanism on the Rights of Indigenous Peoples.

These are the constitutional foundations that underpin the working group:

1. **Tikanga Māori**
2. **He Hakaputanga 1835**
3. **Te Tiriti o Waitangi 1840**
4. **Resource Management Act 1991**
5. **Pouhere Taonga Act 2016**
6. **United Nations Declaration on the Rights of Indigenous Peoples**
7. **Matakairiri Haukanga Hapū and Ngati Tara Cultural Impact Assessments**

Short Form Definitions:

1. **Tikanga Māori:** A set of cultural values and principles as well as a body of laws and practices. The first law of this land. The nearest western legal equivalent in New Zealand to Tikanga Māori is English Law.

2. **He Hakaputanga (1835) – aka He Whakaputanga and/or He Wakaputanga:** A written declaration made to the world by Rangatira Māori declaring the independence and sovereignty of their Hapū and Iwi.

3. **Te Tiriti o Waitangi (1840):** A treaty of peace and friendship between Rangatira Māori and the English Sovereign.

4. **Resource Management Act 1991:** An Act of Parliament and the principal legislation for environmental management in New Zealand.

5. **Pouhere Taonga Act 2016:** An Act of Parliament that promotes the identification, protection, preservation, and conservation of the historical and cultural heritage of New Zealand.

6. **United Nations Declaration on the Rights of Indigenous Peoples:** An internationally recognised human rights instrument which solemnly proclaims and codifies the Rights of Indigenous Peoples to a set of minimum standards of achievement to be pursued in a spirit of partnership and mutual respect by signatory nation state members of the UN and their respective indigenous peoples.

7. **Cultural Impact Assessments:** Cultural impact assessments (CIA) have been prepared by hapū Matakariri and Ngati Tara and referenced below:

    - Karipori/Taipa Marae, Matakairiri Haukanga Hapū - Cultural Impact Assessment on the Taipa Wastewater Plant Upgrade, dated June 2019.

    - Ngati Tara – Cultural Impact Assessment on the Impact of Sewage Discharge into Te Wai o Parapara, dated August 2020.

Long Form Definitions:

Tikanga Māori

The laws by which Māori customarily conduct ourselves and carry out our responsibilities are called tikanga. The RMA describes tikanga Māori as *"Māori customary values and practices".*
Under Māori constitutionalism, mana and tikanga are like the maihi and amo of a whare tūpuna – they hold the *"house"* of the people together.
Historically, tikanga was both the law and a discrete set of values by which mana was given constitutional structure and expression. It still is
"... tikanga Māori controls interpersonal relationships, provides ways for groups to meet and interact, and even determines how individuals identify themselves. It is difficult to imagine any social situation where tikanga Māori has no place." [Professor Sir Hirini Moko Mead – in his work "Tikanga Māori – Living by Māori Values"]
"Tikanga may be seen as Māori principles for determining justice ... The principles of tikanga provide the base for the Māori jural order." [Sir Edward Taihakurei Durie – former Chair of the Waitangi Tribunal]
As a practical law, tikanga still influences every aspect of Māori constitutionalism, from the political organisation of our Hapū and Iwi to the social interactions of individuals.
As a set of values it ... is the *"ought to be"* of Māori existence. Together, both aspects of tikanga mutually reinforce mana.
"Mana was always about political power or personal status, but it was always about protecting the whakapapa and the whenua too ... that was its tikanga, the whole idea of relationships and making sure they were in sync."
"... we've got trapped in the last few years to only see rangatiratanga as a right or some sort of power ... and sometimes we think it's just about making money. But it was always a legal authority more than anything else ... just like sovereignty is, except it rests on tikanga ..."
"If we look at what or how mana was exercised ... nothing could be done unless it was done in the name of the law ... tikanga was like a precondition for mana ... and there is no doubt that mana or rangatiratanga was always meant to be exercised in a tika way."
While some Tauiwi fear a strong Māori constitutionalism, many more do not.
"... for a long time [some] Pakeha said we didn't have real law, and now they just say their law should prevail ... their law should be the one law for all ..."
"Saying you can have a Māori constitution without tikanga is like Pakeha saying they can have their constitution without the Magna Carta ... It doesn't make sense."
Although we come from different constitutional and cultural traditions and have a way to go yet, we and our Tauiwi allies are already modelling the kind of tikanga relationships upon which practical constitutional transformation is already happening.
"... Tikanga was created because our old people knew humans were prone to make mistakes or act in a non-tikanga way ... it's where we need to start."
Tikanga Māori is essentially the correct way to carry out something in Māori cultural terms. Tikanga Māori is the Māori equivalent of English law. For example, the manner in which people respect or treat wāhi tapu is the tikanga in respect of that wāhi tapu.
For each whānau and hapū, tikanga is a vast body of knowledge, wisdom and custom. It derives from the very detailed knowledge gained from residing in a particular geographic area for many years, of developing relationships with other neighbouring communities as well as those further afield and learning from practical experience what works and what does not. This body of law is very different from English law in how it is established.
Māori cannot be reduced to writing and hence fixed as a prescriptive set of rules in the way that legislation works.
As a body of law, Tikanga Māori is very flexible and each situation requires its own particular form of tikanga. An important aspect of Māori culture is the tikanga of hui. When a take (issue, topic) arises, it will be determined by consensus of the whānau, hapū or iwi concerned, particularly if the matter is anything other than very straight forward. As a result, whānau and hapū may spend considerable time in hui discussing what an appropriate tikanga for a particular take should be. Consensus in such hui is very important, and for that reason they may invariably run for several hours to allow all possible aspects of the take to be thoroughly aired. If consensus is not reached the hui will either continue until it has been reached, even if it takes several

days, or, if the divisions are too great, the hui will be adjourned and reconvened at a later time when everyone has had more time to reflect on the matter.
As a set of values, Tikanga Māori provides stability and assurance to its adherents that they will be treated respectfully and fairly when important decisions that affect them are to be made.
Time is not an influencing factor when important decisions are to be made. This is a trait of Tikanga Māori which has often frustrated and annoyed non-Māori affected by the process. The philosophy of elders in this respect is that they would far rather take their time and reach a well-considered decision than rush it through and end up having to fix up a mess afterwards.

Summary

The legal flexibility of Tikanga Māori, anchored by a stable values base, makes it an important constitutional foundation for the Working Party.

He Whakaputanga o Te Rangatiratanga o Nu Tireni (1835)

Any consideration of He Whakaputanga begins with understanding both its unique origins and the practical limitations of its reach after 1835 due to the pressures of colonisation which inevitably affected people's understanding of it.
The ideals it expressed were acknowledged and respected by all because they saw it as a novel and brave articulation of an old concept and site of constitutional power that had allowed an adjustment to changing circumstances, but remained consistent with traditional Māori legal, philosophical and religious thought.
Essentially, He Whakaputanga proposed that a collective of Iwi and Hapū polities should regularly come together in a Whakaminenga, or assembly, to make joint decisions on matters of common concern, while respecting the mana of each participating polity. That joint decision-making power is defined in Article Two of He Whakaputanga as a *"Kingitanga"* where *"all sovereign power and authority"* is
"... declared to reside entirely and exclusively in the hereditary chiefs and heads of tribes ... who also declared they will not permit any legislative authority separate from themselves."
At the Waitangi Tribunal hearings into He Whakaputanga and Te Tiriti, the kaumātua Nuki Aldridge stated that
"The purpose of Te Wakaminenga was for Māori to control their own changes in the 'new world' ... [it was] about how Māori were able to think and put themselves into the future."
In the same hearings, Professor Patu Hohepa described it simply as
"a declaration of our independence and sovereignty as a nation of independent rangatira."
Professor Dame Anne Salmond also stated at those hearings that under He Whakaputanga
"the rangatira ... foreshadowed the possibility that they might delegate kāwanatanga or function of government to someone whom they themselves had appointed. In such an arrangement however, they would retain their rangatiratanga or independence, and their mana and Kingitanga or sovereign authority and power. The Declaration is unambiguous and the relationship between these key terms is clear."

Summary

Because of its core ideals and clear expression of an existing constitutional authority, He Whakaputanga is a necessary constitutional baseline for the Working Party.

Te Tiriti o Waitangi (1840)

Te Tiriti o Waitangi consists of a Preamble and four Articles; the fourth Article was added at Waitangi on 6 February 1840, although it does not appear in the Crown's English-language version. The significant differences between Te Tiriti and the Crown's English-language version are most crucially evident in Articles 1 and 2 but are to be found in all parts of the documents.

Preamble

The Preamble is an introductory statement, expressing the Queen's good will to the Rangatira and hapū of New Zealand, asking them to allow a place for her Governor, and committing to a peaceful future together. It recognises that other people will come.

Article I

Te Tiriti o Waitangi says that the Rangatira and hapū agree to the Queen's Governor exercising kāwanatanga (a transliteration of the word governorship) within the lands granted to non-Māori. Clearly this did not mean

that the Governor was to have authority over Māori but rather only over the British subjects and others *"living here in a state of lawlessness"*.
The Crown's English version says that the Rangatira would cede their sovereignty to the Queen, meaning the Crown would have complete power and authority over everything and everybody throughout the land.

Article II

Te Tiriti o Waitangi says that the Crown recognises and will uphold the paramount authority (tino rangatiratanga) of the many Rangatira of the many hapū in their lands, villages and all that is precious to them (taonga). This directly contradicts the cession of sovereignty referred to in Article 1 of the Crown's English version, which in Article II guarantees to Māori only "the full, exclusive and undisturbed possession of their lands and estates, forest, fisheries, and other properties" as long as they wish. Many of the cases brought to the Waitangi Tribunal have succeeded because it has been shown that, following the signing of the Treaty the Crown took actions that forced land and other taonga out of Māori hands.
The word taonga in te Tiriti is not limited to property and possessions, as stated in the Crown's English-language version; understood within the Māori cultural context, taonga are recognised as having inherent value and the word encompasses all things held precious: for example, language, culture, access to traditional food sources, people, yet-to-be born descendants, a clean environment and health.
Article II in the Crown's English version allows the Crown priority over individuals in land dealings with hapū. In Te Tiriti o Waitangi, the Rangatira just allow the Crown to trade for the use of those pieces of land that hapū consent to allocate.

Article III

Article III in both texts accords to Māori the same rights as British people, that is, additional to the rights they already enjoy in their own society.

Article IV

At the first Treaty signing, William Colenso (Anglican) recorded a discussion on religious freedom between Bishop Pompallier (Catholic) and Captain Hobson. In answer to a direct question from Pompallier, Hobson and the Rangatira agreed to add the following statement which was read out in te reo Māori and written on the document before anyone had signed:
"*The Governor says the several faiths (beliefs) – of England, of the Wesleyans, of Rome, and also Māori custom and religion – shall all alike be protected by him.*"
In the Māori language Tiriti, the word *ritenga* is used in reference to beliefs and practices of the spiritual relationship between humans and the rest of the natural world. The Crown's English-language Treaty does not include this Article.
The Māori language Tiriti was signed by Captain Hobson and over 500 Rangatira, more than 40 of them at Waitangi on February 6th, 1840.
The Treaty of Waitangi was written after February 6th and was only signed by about 40 rangatira at Port Waikato/Manukau later in 1840, where the discussion was about the content of the Māori document (Te Tiriti) but the English document Treaty was presented for signing.
When two documents conflict ...
In international law where there is any ambiguity:

- The contra preferendum principle applies, which means that a decision is made against the party that drafts the document, and
- the indigenous language text takes preference. In oral cultures such as Māori, verbal agreements take preference over what is written.

This means that for the Treaty of Waitangi the text in te reo takes precedence on all these counts.
In November 2014 the Waitangi Tribunal summarised their conclusions on the Nga Puhi claim (WAI 1040):

- The rangatira who signed te Tiriti in February 1840 did not cede their sovereignty to Britain. That is, they did not cede authority to make and enforce law over their people or their territories.
- The rangatira agreed to share power and authority with Britain. They agreed to the Governor having authority to control British subjects in New Zealand, and thereby keep the peace and protect Māori interests.

- The rangatira consented to the treaty on the basis that they and the Governor were to be equals, though they were to have different roles and different spheres of influence. The detail of how this relationship would work in practice, especially where the Māori and European populations intermingled, remained to be negotiated over time on a case-by-case basis.
- The rangatira agreed to enter into land transactions with the Crown, and the Crown promised to investigate pre-treaty land transactions and to return any land that had not been properly acquired from Māori.
- The rangatira appear to have agreed that the Crown would protect them from any foreign threats and represent them in international affairs, where that was necessary.

In summary

Te Tiriti o Waitangi is a treaty of peace and friendship which confirms Māori authority and sovereignty, guaranteeing to Māori the full control and authority in their lands, people, settlements and all that is of value to them, including their social, political and economic relationships and institutions.
It allows a place for a Governor to exercise control over non-Māori within the lands allocated to them.
Te Tiriti o Waitangi provides a framework for relationships and political organisation between Tangata Whenua and the Crown, to ensure peace and good order into the future. Similarly, it provides a relational framework for members of the Working Party.

Resource Management Act 1991

Part II of the Resource Management Act 1991 [the Act].
Principles and Purposes of the Act.

- **Section 6.** Matters of national importance
  (e) The relationship of Māori and their culture and traditions with their ancestral lands, water, sites, waahi tapū, and other taonga.

- **Section 7.** Other matters
  in relation to managing the use, development, and protection of natural and physical resources, shall have particular regard to -
  (a) Kaitiakitanga

- **Section 8.** Treaty of Waitangi
  the principles of the Treaty of Waitangi (Te Tiriti o Waitangi).

- **The Fourth Schedule of the Act**
  Identifies cultural effects, any effects on ecosystems, and any effect on natural and physical resources having spiritual or cultural value for present or future generations.

Pouhere Taonga Act 2016:

In Part 1:

- **Section 3**

promote the identification, protection, preservation, and conservation of the historical and cultural heritage of New Zealand.

- **Section 4**

the relationship of Māori and their culture and traditions with their ancestral lands, water, sites, wāhi tūpuna, wāhi tapu, and other taonga.

United Nations Declaration on the Rights of Indigenous Peoples

What is it? The Declaration consists of an introduction, called the Preamble, and 46 articles that set out the rights and responsibilities of the Declaration.
When was it adopted? The United Nations General Assembly adopted the Declaration on the Rights of Indigenous Peoples in September 2007. New Zealand was the second to last country in the world to sign up to it on 20th April 2010.

How does the Declaration apply to New Zealand? Māori are the indigenous people of New Zealand and the rights set out in the Declaration apply to them. The Declaration reflects and elaborates on the provisions of Te Tiriti o Waitangi as well as the Universal Declaration of Human Rights.
What does the Preamble say? The Preamble proclaims the Declaration to be "a standard of achievement to be pursued in a spirit of partnership and mutual respect". It is an aspirational document, whose text is not legally binding on States.
The Preamble sets out some of the reasons which led to the development of a declaration on indigenous peoples' rights, and the principles that underpin it.

- Everyone has human rights: Indigenous peoples are equal to all other peoples and have all the human rights that everyone has – including the right to self-determination; the right to be free from discrimination; the right to be respected as distinct peoples; and collective, as well as individual rights.
- Indigenous peoples have not always been able to fully realise their human rights: Historical injustices, including through colonisation and the loss of lands and resources, have prevented indigenous peoples from fully exercising all of their rights. Therefore, there is an urgent need to respect and promote the rights of indigenous peoples.
- The Declaration offers assistance to better ensure indigenous peoples are able to fully enjoy their rights, and to strengthen the relationship between States and indigenous peoples: The Declaration is a standard of achievement to be pursued in a spirit of partnership and mutual respect.

What do the Articles Say: The articles of the Declaration set out the rights indigenous peoples have, as well as States' responsibilities to respect and protect those rights.
Indigenous peoples have the right to:

1) All human rights, including collective rights
2) Equality and non-discrimination
3) Self-determination
4) Autonomy or self-government
5) Their own institutions
6) A nationality
7) Life, liberty and security
8) Protection from cultural destruction or assimilation
9) Belong to indigenous communities or nations
10) Freedom from forced removal from their lands
11) Their culture and cultural property
12) Their spiritual and religious customs
13) Their languages, stories and names
14) Education, including in their own language
15) The dignity and diversity of their culture
16) Their own media and equal access to all other media
17) Protection in employment
18) Participation in decisions that affect them
19) Good faith consultation on laws and policies that affect them
20) Their own political, social and economic institutions and activities
21) Improvement of their economic and social conditions
22) Particular attention to the needs of elders, women, youth, children and disabled people
23) Development
24) Health and to their traditional medicinal resources and health practices
25) Their spiritual relationship with their lands and resources
26) Recognition and protection of their lands and resources
27) Fair processes for dealing with their rights to lands and resources
28) Redress for lands and resources taken or damaged without consent
29) Environmental protection
30) Consultation before their lands are used for military activities
31) Their cultural and intellectual property
32) Use and develop their lands and resources, and consultation on projects that would affect these
33) Determine their own identity and membership

34) Their own institutions, laws and customs
35) Determine the responsibilities of individuals to their communities
36) Maintain and develop contacts across borders
37) Observance of their treaties with States

Who does the Declaration apply to? The final articles of the Declaration provide guidance on how it is to be interpreted and applied.

The Declaration is applied:

38) By States, in consultation and cooperation with indigenous peoples, through appropriate measures, including legislation
39) Through financial and other assistance to indigenous peoples
40) By ensuring indigenous peoples have access to fair procedures for resolving disputes with States, and remedies for breaches of their rights
41) With financial and other assistance from the United Nations and other international organisations, and by establishing ways to ensure indigenous peoples' participation in matters that affect them
42) Through promotion and follow up by the United Nations and States.

The rights set out in the Declaration:

43) Are minimum standards
44) Apply equally to males and females
45) Do not diminish any other rights that indigenous peoples have
46) Do not allow actions that are contrary to the Charter of the United Nations, or which diminish the territorial integrity of States.

In summary:

Although the UNDRIP is currently still an aspirational document, it is also a set of normative standards that the New Zealand government, as a signatory, is obligated to implement. To that end, in 2019 the New Zealand government appointed a Working Party which completed *He Puapua: The Report of the Working Group on a Plan to Realise the UN Declaration on the Rights of Indigenous Peoples in Aotearoa/New Zealand*. Although completed in November 2019, it was only released under the Official Information Act in January 2021 and has yet to be publicised by government. However, it can be read in its current form by clicking the hyperlink above.

The UNDRIP is "a landmark declaration that brought to an end nearly 25 years of contentious negotiations over the rights of native people to protect their lands and resources, and to maintain their unique cultures and traditions." As such, it provides a useful constitutional context for this Working Party.

A final word about English translations of Māori terms and concepts in this Terms of Reference:

It must always be borne in mind that the value system associated with Māori terms and concepts is a system embedded in Māori culture. As such, Māori terms and contexts in this Terms of Agreements can best be understood within that cultural context and the Māori language.

Translations into English of Māori terms rarely adequately explain the terms. We simply note here that each and every one of the world's languages is the expression of the culture to which that language belongs and no language can describe the concepts of another culture adequately, especially if the two cultures are totally unrelated as Māori and English are.

Any Māori terms used in the English text of this Terms of Reference has been used because there is no equivalent term in English. Notwithstanding this, the purpose of this section is to attempt to provide some understanding of these concepts. While they are explained in English, they are approached from a Māori perspective. It is important to bear this in mind.

It is also noted that these concepts have their origins in traditional Māori life. Contact with Western culture and the subsequent settlement of New Zealand by the British has not changed either the values which underpin these concepts or the concepts themselves. The Whare Wānanga o Te Taitokerau has ensured this is the case for the iwi of the north. As such, they are still relevant and practiced today.

However, the practical implementation of the concepts has and continues to be adapted to accommodate the changing social environment in the same way that all cultures adapt to changing circumstances in order to survive.

B

Appendix B – Long List Memorandum

Memorandum

To:	Taipa Wastewater Transformation Project Working Group	**Date:**	3 June 2022
From:	Jolanta Liutkute	**Our Ref:**	4210957-1911211654-262
Copy:	Garrett Hall, Brigette Priestley		
Subject:	Long List Memorandum		

This memo outlines the long list of options considered by the Working Group at the workshop on 31st May 2022.

1.0 Introduction and Context

The discharge of treated wastewater from the existing for Taipa Wastewater Treatment Plant (WWTP) and associated constructed wetlands to the Parapara Stream is acknowledged as requiring significant alterations under consent order ENV-2019-AKL-000181 (dated 08 March 2021).

The consent order offers two (2) options for consideration; these are:

1. Upgrade the WWTP and discharge the treated wastewater to water at the quality standards set out in the consent order.
2. Move the discharge from discharge to water to discharge to land.

The consent order sets out the following standards for the wastewater quality should the discharge continue to be discharged to water:

Parameter	Unit	Median*	85% percentile*
Total Nitrogen	mg/L	12	16
TSS	mg/L	20	30
BOD	mg/L	20	40
DO	mg/L	>2	>2
pH		>6.5	>6.5
Total Phosphorus	mg/L	10	15
Faecal coliforms	CFU/100ml	1000	1500

*Based on pH8 and 20°C.

The consent order does not set out any standards for the wastewater quality should the discharge be moved to land disposal.

2.0 Type of Discharge

The following types of discharge have been considered as part of the previous work undertaken as part of the solution planning for Taipa WWTP;

1. Discharge of treated wastewater from the existing Taipa WWTP to land;
2. Discharge of treated wastewater from an upgraded Taipa WWTP to land;
3. Discharge of treated wastewater from an upgraded Taipa WWTP via the existing constructed wetlands to the Parapara Stream;
4. Discharge of treated wastewater from an upgraded Taipa WWTP via a new wetland system to the Oruru River;
5. Discharge of treated wastewater from an upgraded Taipa WWTP via a new ocean outfall.

It is understood from the first workshop held that options 1, 4 and 5 are not acceptable to the working group. Option 2 is the preferred option.

3.0 WWPT Upgrades – Previous Studies

It is acknowledged from the first workshop that an upgrade to the WWTP is required for both the discharge of wastewater to water (as per the consent order) and the discharge of wastewater to land.

From a review of the work completed by AECOM in 2018[1] the following WWTP upgrade options were selected for further consideration on the basis of their technical merits and cultural input. A high level of wastewater quality was sought from the Working Group for both land and water discharge.

- Sequencing batch reactor (SBR) with UV
- Membrane bioreactor (MBR)
- Algae bioreactor pond upgrade with electrocoagulation and UV
- Submerged Media pond upgrade with dissolved air flotation and UV
- Enhanced Pond System pond upgrade with UV
- Carrousel configuration pond upgrade with UV

Following on this from this work, Jacobs proposed the following long list of WWTP upgrade options in April 2020[2]. This work focused on pairing different disposal routes with different levels of treatment to provide a ‘complete’ scheme:

- Maintain current WWTP and land disposal

[1] AECOM, 2018. Taipa WWTP Upgrade Issues and Options Report - For use at Taipa WWTP Working Group Hui #2. Prepared for Far North District Council. Issued 25 May 2018.

[2] Jacobs, 2020. Long List of Proposed Options for Wastewater Treatment Disposal. Memorandum prepared by Jessica Daniel for Far North District Council. Issued 7th April 2020.

- Electrocoagulation and land disposal
- Pond-based SBR and continued Parapara stream discharge
- Pond based SBR and a new wetland, Oruru River discharge
- MBR and continued Parapara stream discharge.

During the first workshop in May 2022 the Working Group identified 'electrocoagulation and land disposal' as well as 'pond based SBR and continued discharge to stream' as viable options from the Jacobs work, with a strong preference for land disposal. Maintaining the current WWTP was strongly opposed due to prior backlash from the community around discharging poorly treated wastewater to private land.

4.0 WWPT Upgrades – Proposed Options

Drawing on both the previous studies as well as feedback from the Working Group, the following options have been considered for land discharge and / or water discharge:

- Option 1: Pond upgrade with Tertiary filtration and UV
- Option 2: Pond upgrade with Electrocoagulation and solids removal and UV
- Option 3: Convert ponds into pond based SBR with UV
- Option 4: Convert ponds into in pond Modified Ludzack-Ettinger (MLE) plant with UV
- Option 5: New standalone MLE plant with UV
- Option 6: New standalone MBR plant
- Option 7: New side stream Moving Bed Bio Reactor (MBBR) plant with Tertiary filtration and UV
- Option 8: Bioshells in the ponds with Tertiary filtration and UV

These options are described further below.

4.1 **Option 1:** Existing system to be upgraded with tertiary filtration and Ultraviolet (UV) disinfection

This option will improve treated wastewater quality by reducing total suspended solids (TSS) and providing additional disinfection. Screened wastewater will receive treatment in Ponds 1-3, followed by final treated wastewater polishing in the Maturation Pond. Disk Filters will be installed after the treated wastewater pumps on the pressure line followed by the UV. Backwash from the filter will be returned to Pond 1. Any ongoing issues such as pond leakage or sludge build up will need to be resolved by desludging and lining the ponds including underdrainage. The process diagram of Option 1 is provided in Figure 1 below.

Disk filters are a potential option for reducing the level of TSS in the pond discharge prior to UV disinfection. Arkal Spin Klin filters are the type of filters that have been used in similar installations. This type of filter consists of multiple disk filters (ranging from 400 microns to 20 microns) stacked on

the spine, which creates a multiple barrier filtering in addition to depth filtration. This avoids the situation that can occur with single screen filters where the build-up of solid material causes the material to be squeezed against a single filter layer. The resulting pressure on a single filter layer can cause the material (especially algae) to be extruded through the mesh in long clumps, this problem is avoided with the multiple layers used in disk filters making this type of filter suitable for algae filtration. For land disposal 130 micron screen filter can be expected on most of the treatment pond systems, however due to the type of algae in Maturation Pond a two-stage filtration including 100 micron and 40 micron filter could be required. Disk filters do require backwashing (automatic) over time as the filter is blocked – multiple filters are used to allow one filter to be in backwash as the others continue forward filtration. Backwash is recycled back to the pond.

UV disinfection involves the application of ultra-violet light to the wastewater to destroy pathogens. Natural UV reaching the maturation pond surface also performs this purpose, but natural light often does not penetrate far into pond wastewater due to the presence of solids such as algae. To improve the wastewater an in-pipe UV disinfection unit can be provided as treated wastewater discharge is pumped. The performance of UV disinfection units on pond wastewater is limited due to poor transmissivity, therefore tertiary filtration selection is important for UV performance.

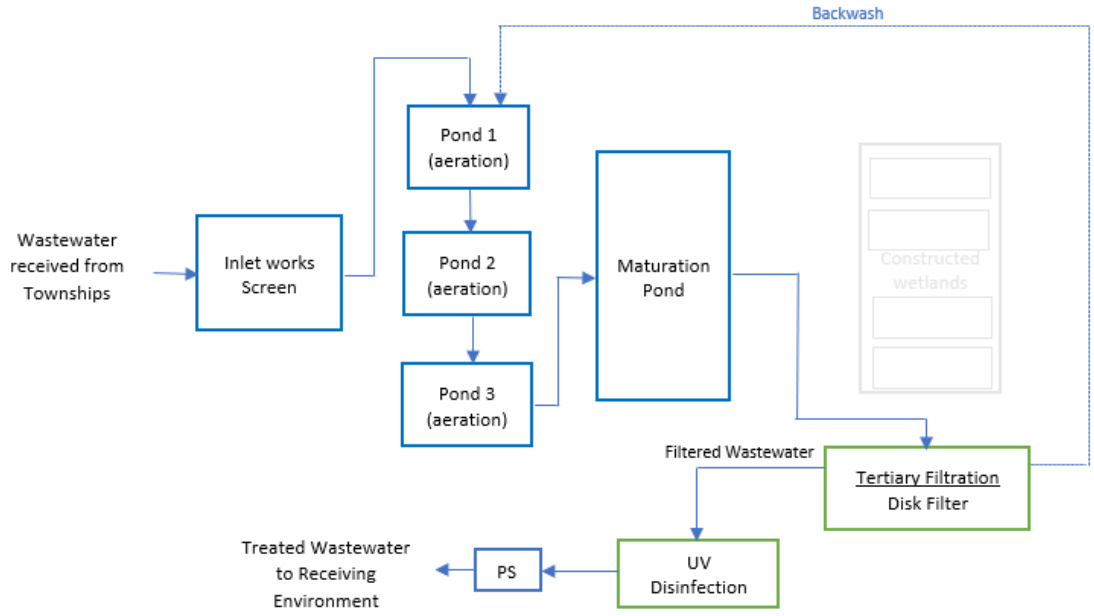


Figure 1 Process Diagram of Option 1 (Pond Upgrade with tertiary filtration + UV)

4.2 **Option 2:** Existing system to be upgraded with Electrocoagulation (EC) followed by Secondary Clarification

This option will reuse the existing pond system and add electro coagulation as tertiary treatment after Maturation Pond. Screened wastewater will receive treatment in Ponds 1-3, followed by final treated wastewater polishing in the Maturation Pond. The EC process will be added after the Maturation Pond and before treated wastewater is pumped out for discharge to land. There are multiple parameters that influence the optimal operating conditions of the EC process including:

• Wastewater characteristics – pH, TSS, TDS, electrical conductivity, ionic composition, temperature,

• Cell configuration – electrode material, electrode orientation, inter-electrode spacing, electrical connection,

• Residence time – wastewater flow rate, EC volume,

• Power input – voltage, current, current density, polarity reversal

The EC process will generate sludge which will need to be separated by some form of secondary clarification. Options such as a conventional gravity clarifier, lamella clarifier or filtration can be used. Separated sludge will need to be dewatered to reduce transportation costs for sludge disposal. This could be done using mechanical dewatering or geobags. Sludge filtrate will be returned to Pond 1. The process diagram for Option 2 is provided in figure 2 below.

The EC process proposed for this option is intended to improve treated wastewater quality in respect of TSS, TDS (total dissolved solids), Organics, Nitrogen, Phosphorus, Microbiological, Heavy metals. EC works in a similar manner to chemical coagulation, but instead of chemicals, electric current is used to provide positive ions. Natural suspended particles, such as sediments or algae, carry a negative charge which is neutralized by the positive ions, causing the particles to clump together and form a sludge. Removing the sludge leaves cleaned water for discharge. A conventional secondary clarifier or lamella clarifier can be used to separate sludge from clean effluent. The sedimentation process is based on the ability of the sludge to settle, therefore if the flocculated sludge settles well either option can be used. If sludge settles poorly, treated wastewater filtration can be used instead.

It is expected that EC will provide some disinfection however, UV disinfection would likely be required for land irrigation purposes.

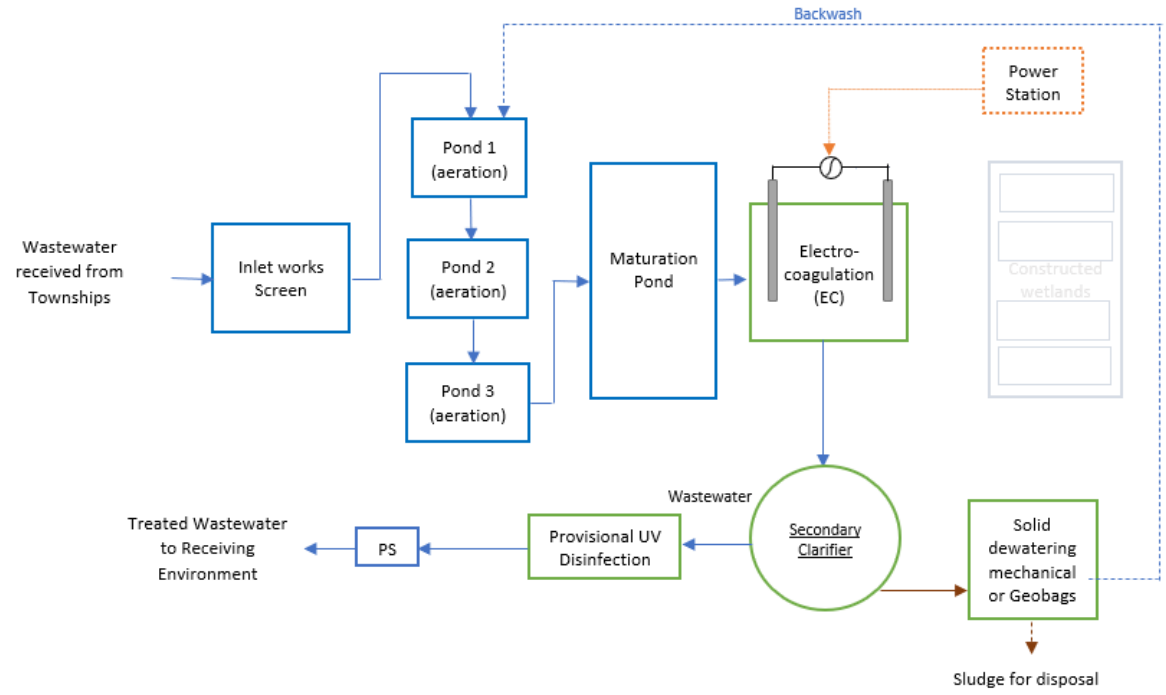


Figure 2 Process Diagram of Option 2 (Electrocoagulation + Solids Removal + UV)

4.3 **Option 3**: Pond Based Sequenced Batch Reactor (SBR).

SBRs have treatment of the raw waste and sedimentation of the biomass occurring in the same tank in a timed sequence. This allows SBR systems to be designed with a high degree of flexibility in terms of treating varying flows and concentrations (typically experienced in seasonal populations), and to achieve specific treatment quality requirements. Typically, a depth of 3 to 5 m is required in rectangular tank to achieve treatment and decanting cycles. Given that existing ponds 1 to 3 have a depth of 5.5 m, it is likely that it can be converted to a SBR plant. SBRs tend to work more reliably in a reactor configuration that is designed specifically for that application rather than in a retrofit of a sub-optimal space, particularly with regard to operating depth.

To convert the ponds to SBR, the existing inlet works will be reused and Pond 1 and 3 (TBC) will be lined and converted to SBR reactors. SBR 1 (Pond 1) would be in operation all year long and SBR 2 (Pond 3) will provide seasonal treatment during the peak Christmas to Easter period. A splitter chamber will be required to direct the flows to the individual SBRs. Each reactor will have surface aerators to provide air and mixing. Ideally, this style of plant would use high efficiency, fine bubble diffusers. However, the shape and likely profile of the reactor base makes this largely impractical (not impossible) for these reactors. The existing aerators could potentially be retrofitted, but are unlikely to be sufficient on their own.

The reactors would operate in a cycle to fill, aerate, settle and decant. Both SBRs would decant (over a 1 hour period) to the newly lined Pond 2 from where effluent would be transferred to subsequent process stages at the average day rate to minimize the size of downstream infrastructure. Waste activated sludge (WAS) would be removed daily from the bottom of each reactor toward the end of the ‘settle’ phase when the sludge concentration is highest. The maturation pond could be divided into lagoons and geobags area to provide sludge thickening and drying in geobags after which eventually taken offsite. Filtrate from geobags area would be returned to Pond 1. Decanted treated wastewater in Pond 2 would be disinfected by UV prior to discharge. Further solids removal such as tertiary filtration may be required to achieve the desired UV performance or protect the land discharge system.

The process diagram for Option 3 is provided in figure 3 below.

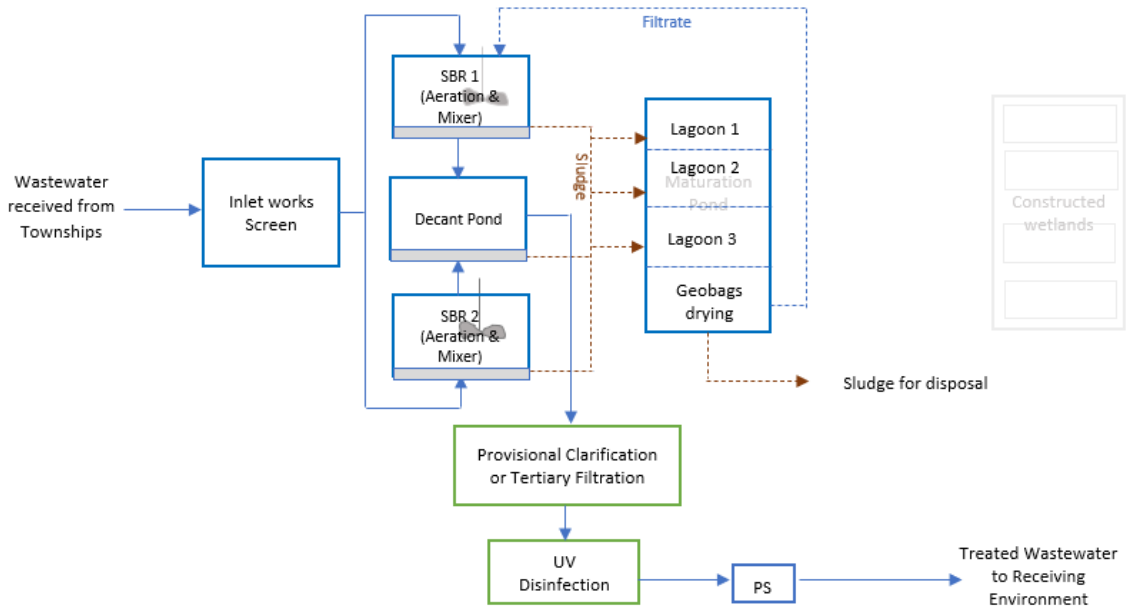


Figure 3 Process Diagram of Option 3 (Pond Based SBR + UV)

4.4 **Option 4**: Pond based Modified Ludzack-Ettinger (MLE) plant.

This option proposes to convert the existing ponds system to an activated sludge plant. The proposed process comprises of the inlet works, two biological reactors in Ponds 1 and 3, secondary clarification in part of Pond 2 and UV disinfection. Screened wastewater would undergo grit removal to protect downstream mixers and avoid grit build-up in the reactors. Ponds 1 and 3 will be lined and converted to reactors. Reactor 1 will operate all year long and Reactor 2 will be used during the high season (Christmas to Easter). Each reactor will comprise of two zones: anoxic and aerobic. In a trapezoidal shaped reactor such as this, the zones can be separated by a polyethylene curtain connected to the liner. Precast concrete panels or marine ply walls are also sometimes used. Wastewater will enter an anoxic zone equipped with mechanical mixers, followed by an aerobic zone equipped with a surface aeration system, which will provide both air and mixing. For nitrogen removal it is essential to return nitrates created in the aerobic zone back to the anoxic zone, where it is mixed with incoming wastewater. A pump or 'flow maker' will be required for creating the internal recirculation.

After treatment, wastewater will be separated from sludge in a conventional clarifier installed in part of Pond 2, after which clarified effluent would be UV disinfected prior to discharge. Sludge settled in the secondary clarifier will be returned to the anoxic zone (RAS) to maintain the treatment process. As with the SBR, excess biomass would rapidly accumulate, and this would need to be wasted (WAS) and stabilized. It is intended to store this in the remaining half of Pond 2, which will be lined. Accumulated sludge in Pond 2 will eventually need to be dewatered before taking it off of site to reduce transportation costs. The maturation pond will become redundant, except perhaps as an irrigation water storage lagoon. The process diagram for Option 4 is provided in Figure 4 below.

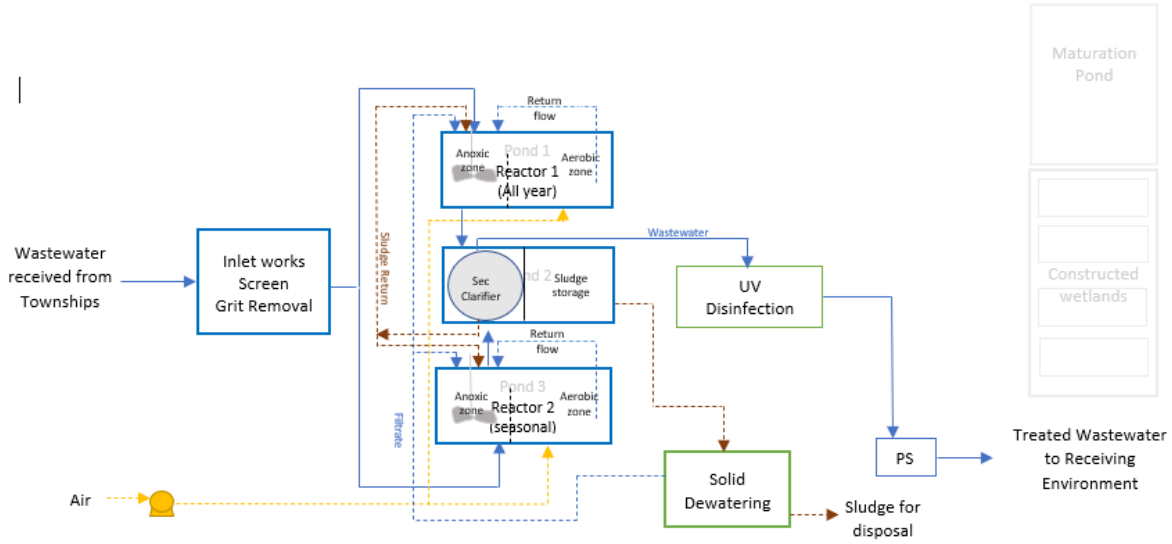


Figure 4 Process Diagram of Option 4 (MLE + UV)

4.5 **Option 5**: Standalone Conventional MLE plant.

This option proposes to build a new stand-alone wastewater treatment plant using the activated sludge process comprising of the inlet works, biological reactor, secondary clarification and UV disinfection. Screened wastewater will undergo grit removal to protect downstream mixers and avoid grit build-up in the reactors. Pond 1 would be de sludged and divided into sections, one of which would be used to balance wet weather flows. Two reactors will be provided for redundancy and flexibility, therefore pre-treated treated wastewater will first go to the splitter chamber, before entering each reactor (peak season). Reactors will comprise of two zones: anoxic and aerobic. First wastewater will enter the anoxic zone, followed by aerobic zone equipped with aeration system. For nitrogen removal it is essential to return nitrate created in the aerobic zone back to the anoxic zone, where it is mixed with raw incoming wastewater (fresh carbon). Mechanical mixers will be required to ensure good mixing in the anoxic zone/s.

Treated wastewater will be separated from sludge in a conventional gravity clarifier and disinfected by UV prior to discharge. Sludge settled in the secondary clarifier will be returned to the anoxic zone (RAS) to maintain the treatment process. As with the in pond MLE, excess biomass would rapidly accumulate, and this would need to be wasted (WAS) and stabilized. It is intended to store this in the remaining half of Pond 1. Accumulated sludge in Pond 1 will eventually need to be dewatered before taking it off of site to reduce transportation costs. Oxidation ponds 2-3 and Maturation pond will become redundant, except Maturation pond could perhaps be used as an irrigation water storage lagoon.

A lifting pump station would be required to convey flows from the wet weather storage to the reactor for treatment. The Process diagram for Option 5 is provided in Figure 5 below.

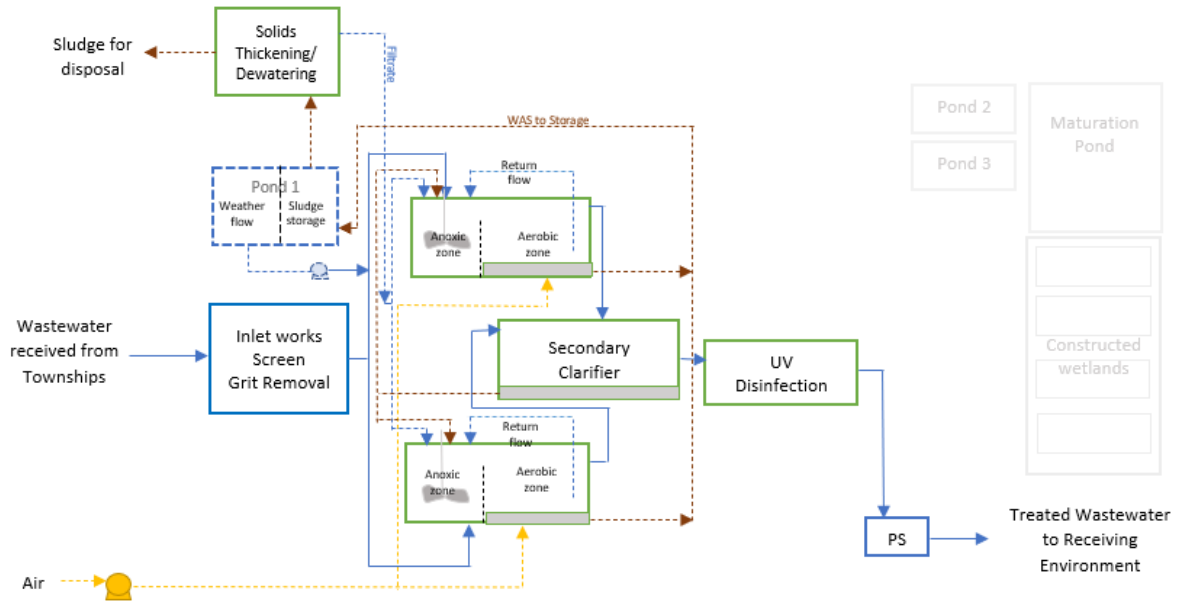


Figure 5 Process Diagram of Option 5 (MLE + UV)

4.6 **Option 6:** Standalone Membrane Bioreactor (MBR).

This option will completely replace existing ponds infrastructure except that Pond 1 could be reused for flow balancing. An upgrade of the inlet facility will be required, which might require replacement of the current screen, including grit removal and adding a second 1-2 mm screen after Grit removal. MBR is a physical variant of the activated sludge process, which comprises of biological reactor and replaces solids removal by the physical clarifier, with membranes. Biologically, the proposed process is MLE except that membranes are used, instead of a conventional clarifier, to separate solids. Two reactors will be provided for redundancy and flexibility, therefore pre-treated treated wastewater will first go to the split chamber, before entering each reactor. Reactors themselves will consist of Anoxic and Aerobic zones for Nitrogen removal and will be equipped with mixers and an aeration system. An internal recycle will be required to return nitrates from the end of the aerobic zone to the anoxic zone. Membranes will separate the treated wastewater from sludge into permeate tanks, from where it can be pumped out for disposal. Part of the sludge separated in the membrane tank will be returned to the anoxic zone (RAS). Excess sludge (WAS) will be removed, thickened and dewatered on site. Ponds 2-3 and the maturation ponds will become redundant. Pond 1 (or part of it) could be turned into wet weather flow storage for the flows which undergo mechanical treatment. A lifting pump station will be required to convey flows from the storage to the reactor for treatment. The process diagram for Option 6 is provided in Figure 6 below.

A sub-option of an MBR plant could be considered by creating a single, lined reactor in one of the ponds (potentially Pond 2) and feeding treated wastewater into membrane trains as necessary.

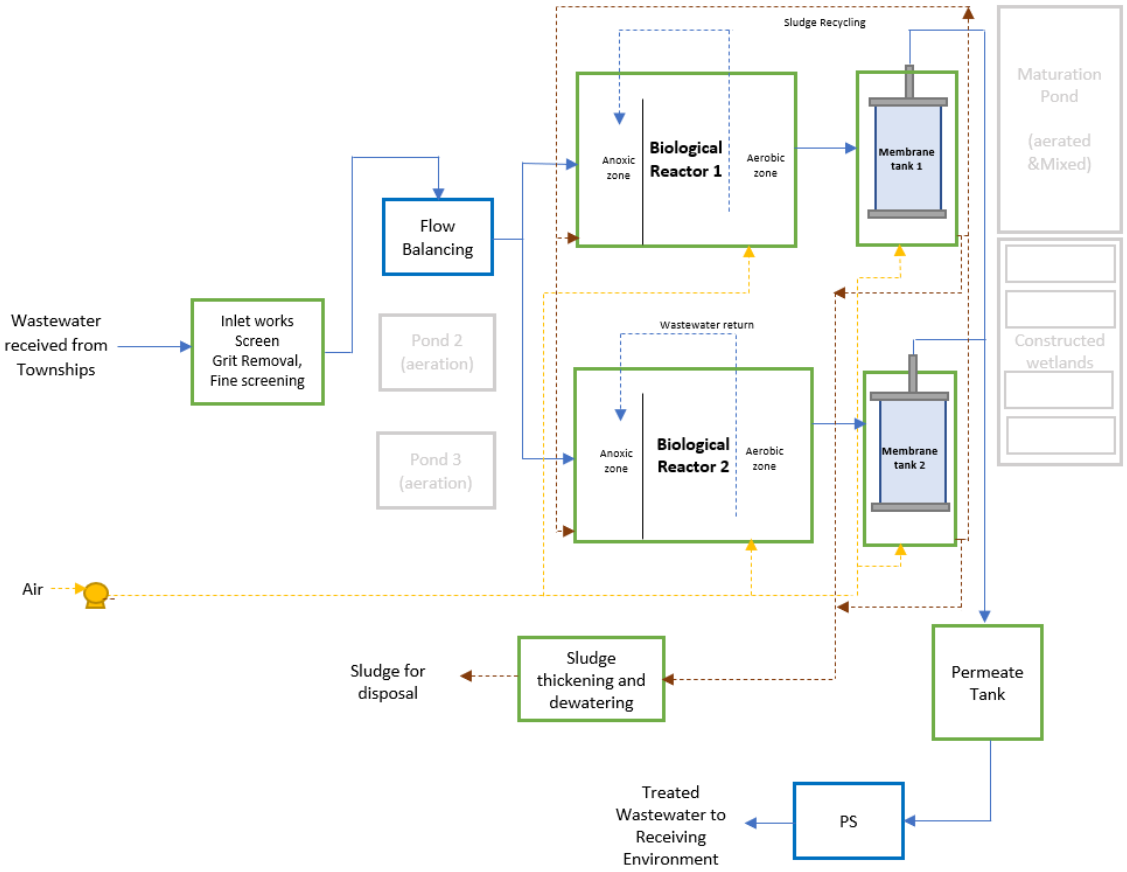


Figure 6 Process Diagram of Option 6 (MBR + Stand Alone Plant)

4.7 **Option 7**: Moving Bed Bio Reactor (MBBR) side stream nitrogen removal.

This option envisages that the existing pond system would continue to operate and that an MBBR plant would be added as a side stream treatment, returning nitrified effluent to the front end of the treatment plant. Treated wastewater from the Maturation Pond will be divided into two streams. One stream will be pumped to the MBBR as part of nitrogen removal step, creating an internal recycle loop. The other will continue to the filtration, UV and discharge pump station. Treated wastewater high in nitrates would be returned from the MBBR to Pond 1 close to the Pond 1 inlet for denitrification. The MBBR would comprise of a single standard “MBBR Pack” package plant which will be filled with plastic media and fine bubble diffuser system and solids separation. The MBBR plant would have capacity for the high season flows and loads. Tertiary filtration might be required before UV disinfection and will be installed upstream of the treated wastewater discharge pump station. Backwash from tertiary filtration will be returned to Pond 1. The process diagram for Option 7 is provided in Figure 7 below.

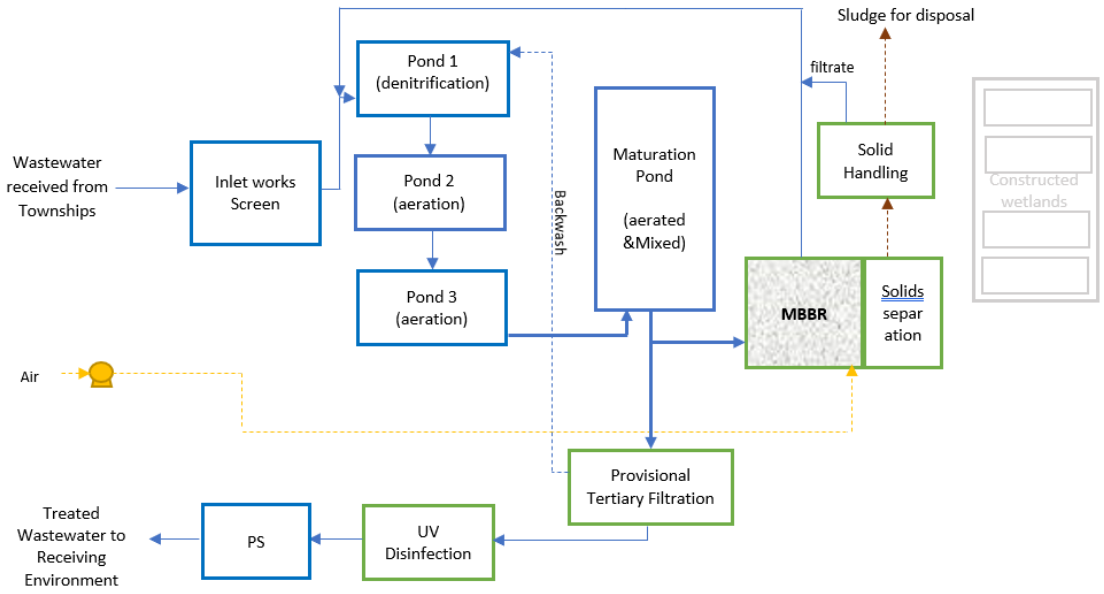


Figure 7 Process Diagram of Option 7 (Side Stream MBBR + Tertiary Filtration + UV)

4.8 **Option 8:** Bioshells in Maturation Pond.

This option would require an upgrade to the existing pond system with installation of Bioshells (such as used at Paihia), tertiary filtration and UV disinfection. Incoming screened wastewater will receive treatment in Pond 1, followed by treatment in Pond 2 and Pond 3, where (TBC) Bioshells will be installed. A portion of pre-treated wastewater from Pond 2 will be recirculated back to Pond 1 (close to an inlet pipe) as the rest of the stream will continue receiving treatment in Pond 3, followed by polishing in the maturation pond. Tertiary filtration and UV will be installed upstream of the treated wastewater discharge pump station. Backwash from tertiary filtration will be returned to Pond 1. The process diagram for Option 2 is provided in Figure 8 below:

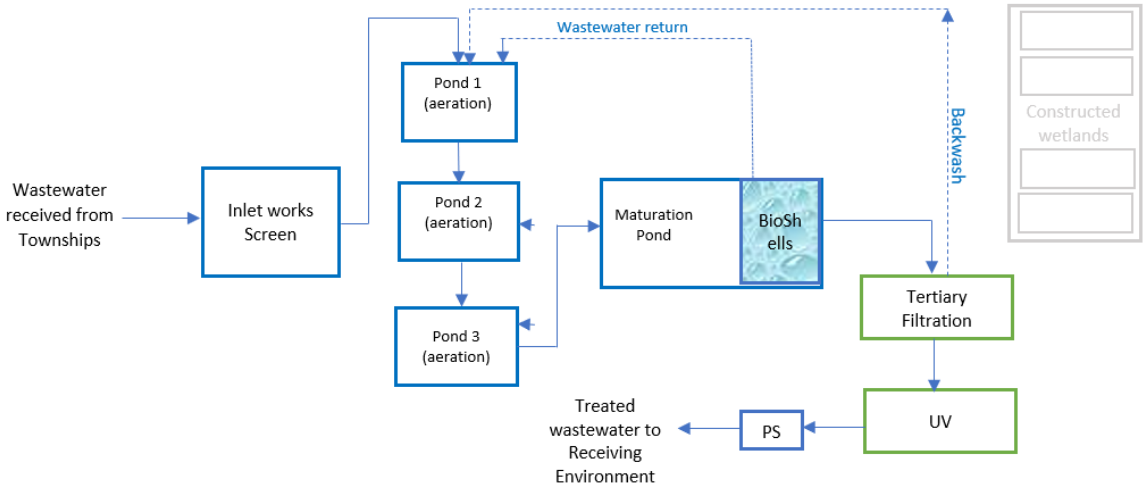


Figure 8 Process Diagram of Option 8 (Bioshells in Maturation Pond + tertiary filtration + UV)

'Bio-Shells' is a form of a retrofit for oxidation pond systems. They take the form of concentric layers of media in the shape of a shell or dome. They are lowered onto the pond floor fixed to a weight. An aeration system beneath each device diffuses air up between the shells and past the biomass growing on the surface of the shells.

One of the objectives of the devices is to provide a secure (against wash out) growth surface for a nitrifying biomass population to grow and remove BOD and ammonia in the water column. It is understood that this process has been effective at low winter temperatures in the mid-west USA but has not so far been fully proven in New Zealand. Several Bioshells upgrades were installed in New Zealand to assist with specific issues in pond systems and good outcome were achieved. However, none of those installations can be directly compared with the requirements for Taipa. The proposed upgrade with Bioshells described above is aiming to reduce Total Nitrogen utilizing current assets, without introducing a side stream treatment.

5.0 Treatment Upgrade Options Summary

A summary of treatment upgrade options for Taipa is presented in Table1. This summary provides initial commentary on the potential application of each treatment for river discharge or land discharge including expected effluent quality, and recommendation to shortlist.

The wastewater quality presented in Table1 represents the indicative quality of the treated wastewater at the outlet of the WWTP, not the outfall of the existing constructed wetlands. These values are based on a preliminary assessment using Beca's experience from similar sites with similar wastewater characteristics.

It is anticipated that any discharge to water option would continue via the existing constructed wetlands as per the consent order, whilst any discharge to land option would likely be taken from the outlet of the WWTP.

Table1 Treatment Upgrade Options Summary

Option	Description	Advantages	Disadvantages	Indicative treated wastewater quality	CAPEX/OPEX	Meets River Discharge quality requirement	Beca recommends treatment option?
1	Pond upgrade with Tertiary filtration and UV	Low operation costs Utilizing all existing assets.	Large footprint Variable performance during summer peaks and rain events UV disinfection performance variable due to algae Periodic de-sludging is a complex and costly undertaking Algae issues for Tertiary filtration, spring time algal blooms can be especially problematic and filters require careful sizing. Disc filters may require daily attendance on site. Larger land areas may be required due to higher TN loads	• TSS – 20-30mg/L (depending on the TSS prior filters) • $_{C}BOD_{5}$ – 20mg/L • NH4-N – 15-30mg/L • TN – 25-40mg/L • P <10 mg/L • E.Coli <1,000 cfu/100mL	Low/Low	No	Maybe – Do Minimum option
2	Electrocoagulation + secondary clarification + UV	Reasonable removal of suspended solids Utilizing existing assets EC provides some disinfection UV likely to be more effective with lower TSS	Requires a solids removal process to separate out the solids, such as DAF or centrifuge (There are multiple parameters that influence the optimal operating conditions of the EC process). No full-scale plant is operating in NZ and therefore no comparable data available for cross-comparison. Sludge is produced which needs to be managed regularly, not every 10 years or so. Uncertain track record.	No full-scale results are available. NIWA bench trials indicate the following removal. Based of effluent data quality provided the following could be expected: TSS removal > 90% Organics >90% TKN associated with particular matter - 50-80% Ammonia - around 50% E.Coli – 3 log removals Heavy metals – close to 100%	Moderate/Moderate	No - Generally expected to meet median requirements but could breach NH4-N from time to time and potentially during the holiday period when loading is high; could cause regular non-compliances with Total N limit for water discharge.	Yes, but only for discharge to land
3	Pond based SBR + UV (Ponds plastic lined and under drained)	Utilizing existing assets. Cost effective solution.	Careful design of decanter will need to be caried out to make system work.	• TSS – <10mg/L • $_{C}BOD_{5}$ – <10mg/L • NH_4-N – <2mg/L • TN – <12mg/L • P - 7mg/L • E.Coli <100 cfu/100mL	Moderate/Moderate	Yes	Yes, could be discharged to river or land

Option	Description	Advantages	Disadvantages	Indicative treated wastewater quality	CAPEX/OPEX	Meets River Discharge quality requirement	Beca recommends treatment option?
		Reliable, easy to operate (fully automated with some operator-changeable parameters) Existing pond depth is likely to be suitable.	Have a tendency to a) grow filamentous algae in the warm, black lined decant pond and b) accumulate settled biomass in the bottom of the decant tank which can become anaerobic and float. Both are a nuisance but can be managed. Plastic liners in the ponds can be damaged if aerator or mixer come loose. Could be difficult to implement while WWTP is running - but could be done out of season. Sludge produced will need to be managed.				
4	In Pond activated sludge (MLE) + clarifier + UV (Ponds plastic lined and under drained)	Reliable, resilient process Good nutrient removal Utilizing some of existing assets Small increase footprint	Moderate operational complexity. Limited availability for expansion. Plastic liners in the ponds can be damaged if aerator or mixer come loose. Could be difficult to implement while WWTP is running - but could be done out of season. Sludge produced will need to be managed.	• TSS – <10mg/L • $_{C}BOD_{5}$ – <10mg/L • NH4-N – <2 mg/L • TN – <10mg/L • P – 7mg/L • E.Coli <100 cfu/100mL	High/Moderate	Yes	Yes could be discharged to river or land
5	Standalone MLE + clarifier +UV (Concrete tank reactor/s)	Reliable, resilient process Good nutrient removal Some ability to stage Could potentially be a standalone SBR	Not utilising existing assets. Moderate footprint Moderate operational complexity Sludge produced will need to be managed daily High CAPEX	• TSS – <10mg/L • $_{C}BOD_{5}$ – <10mg/L • NH_4-N – <2 mg/L • TN – <10mg/L • P – 7mg/L • E.Coli <100 cfu/100mL	High/Moderate	Yes	Yes - recommended for water discharge but not land discharge due to high capital
6	MBR – stand-alone plant Concrete tank reactors and membrane tanks	Robust process Very high quality treated wastewater Small footprint	Not utilising existing assets High complexity Step up in power consumption	• TSS – <5mg/L • $_{C}BOD_{5}$ – <5mg/L • NH_4-N – <2 mg/L • TN – <10mg/L • P – 7mg/L • E.Coli <10 cfu/10mL	High/High	Yes	Yes - for Water only. But high capital/operating cost and less resilience to flow changes.

Option	Description	Advantages	Disadvantages	Indicative treated wastewater quality	CAPEX/OPEX	Meets River Discharge quality requirement	Beca recommends treatment option?
		Some ability to stage Fine screening required	Sensitive to flow changes, flow balancing is required due to membrane operation Membranes have limited life (10 years) Higher capital and operational costs Sludge produced will need to be managed daily				
7	Side stream MBBR + tertiary filtration +UV MBBR could be containerised or concrete tank	Good reduction of NH_4-N Utilising existing assets Able to be automated Small additional footprint	Only a portion of the flow is treated through the MBBR to reduce organics and nitrogen. UV disinfection performance affected by algae.	• TSS – 20-30mg/L • $_cBOD_5$ – 10-20mg/L • NH4-N – <2 mg/L For side stream only • TN – <10mg/L • P – 7mg/L • E.Coli <1000 cfu/100mL	Moderate/Moderate	No – risk that pond performance variability could result in TSS, $cBOD_5$ and NH_4-N non-compliance from time to time	No for discharge to water. Land discharge is possible but not preferred as other options offer better quality for same cost .
8	Bioshells in Maturation pond + tertiary filtration + UV (includes recycle back to Pond 1) Similar to that used at Paihia	Some reduction of TSS and nutrients. Very little increase in site footprint	Requires regular operator inspections and control of alkalinity Can be tricky to optimize air demand Noise mitigation is required UV disinfection performance affected by algae	Performance indicated by research: • TSS – 20-30mg/L (depending on the TSS prior filters) • $_cBOD_5$ – <10mg/L • NH_4-N – <10mg/L • TN – <25mg/L • P <7 mg/L • E.Coli <1,000 cfu/100mL •	Moderate/Moderate (Based on pro-rata of Paihia costs)	Unclear from current performance data available in NZ	No for discharge to water. Land discharge is possible but not preferred because of higher nitrate content in treated wastewater.

A summary of initial mapping of treatment options to viable disposal routes is provided in Figure 9:

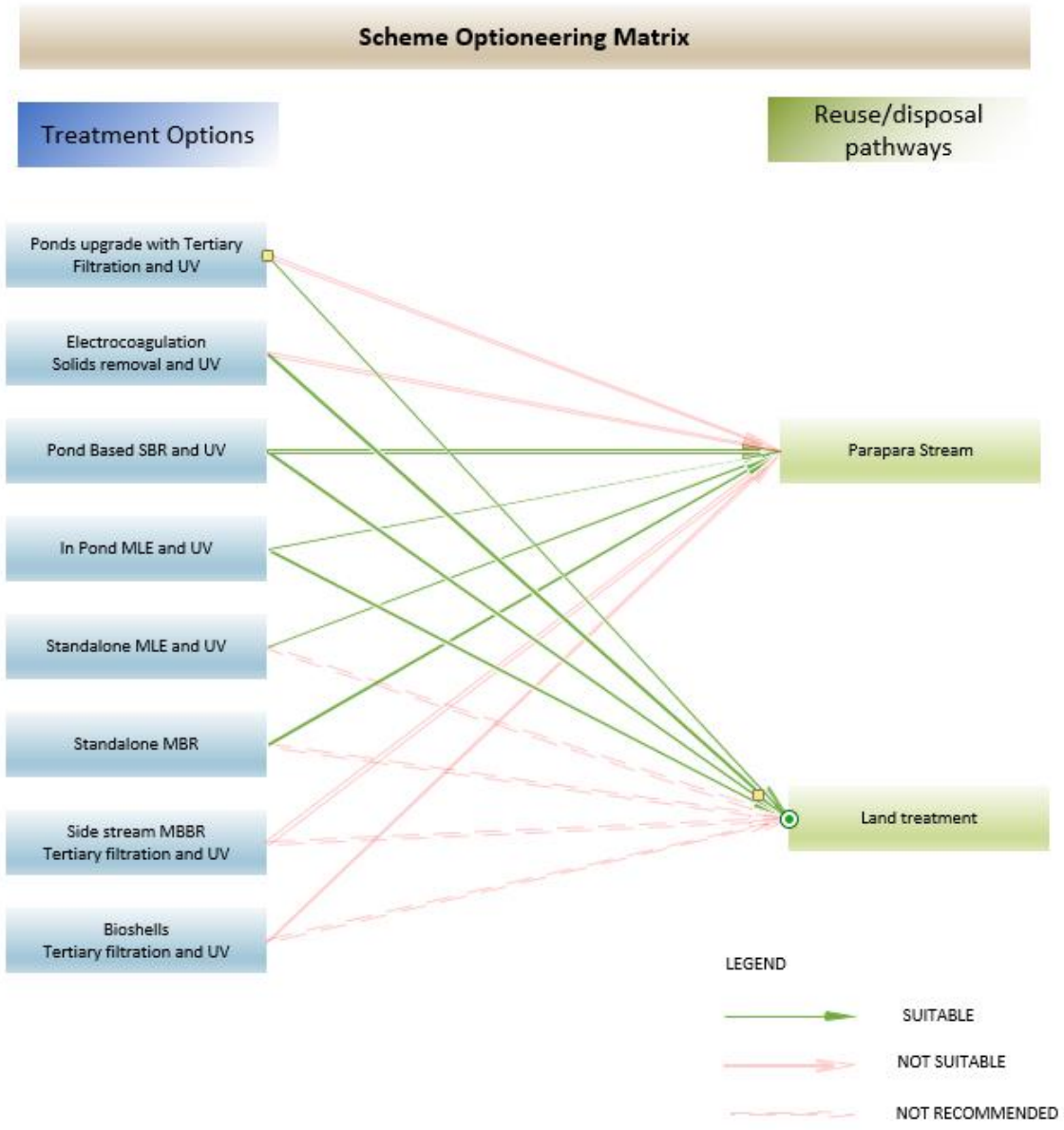


Figure 9 Scheme optioneering matrix for the oxidation ponds upgrades options

Jolanta Liutkute

Associate - Process Engineering

on behalf of

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C

Appendix C – Short List Memorandum

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Far North District Council
Private Bag 752
Kaikohe 0440

13 July 2022

Attention: Melissa Parlane,

Dear Melissa

Taipa WWTP Transformation Project - Short List Memorandum

This memorandum outlines the short list of options to be considered by the Working Group at the Short List Workshop.

1.0 Introduction and Context

During the workshop on 31st May 2022 the working group were presented with eight Wastewater Treatment Plant (WWTP) upgrade options for the Taipa WWTP. These were as follows:

- Option 1: Pond upgrade with Tertiary filtration and Ultraviolet disinfection (UV)
- Option 2: Pond upgrade with Electrocoagulation, solids removal and UV
- Option 3: Convert ponds into pond based Sequenced Batch Reactor (SBR) with UV
- Option 4: Convert ponds into in pond Activated Sludge plant (Modified Ludzack-Ettinger- MLE process) with UV
- Option 5: New standalone Activated sludge (MLE) plant with UV
- Option 6: New standalone Membrane Bioreactor (MBR) plant
- Option 7: New side stream Moving Bed Bio Reactor (MBBR) plant with tertiary filtration and UV
- Option 8: Bioshells in the ponds with Tertiary filtration and UV

Further details of these options are presented in the Long List Memorandum dated 3rd June 2022.

The proposed approach for short listing the long list options was to use a traffic light assessment (see Figure 1) to determine the Working Group's preference based on the information provided. The Working Group were invited to consider the options for land or water discharge, or both.

	Preferred
	Less Preferred
	Not Preferred

Figure 1 Traffic Light Assessment

Following the 31st July workshop, the Working Group agreed that they would complete the traffic light assessment in a follow up online workshop to allow the Working Group to familiarise themselves with the options.

A follow up workshop was undertaken online, via Teams, on 7th June 2022. During this workshop the Working Group assessed each of the eight WWTP options and allocated a traffic light colour coding accordingly (see Figure 2).

WWTP Options	Take forward to Short List?
Pond upgrade with Tertiary filtration and UV	Maybe – land
Pond upgrade with Electrocoagulation and solids removal and UV	Yes - land (maybe water)
Convert ponds into pond based SBR with UV	Yes – land or water
Convert ponds into in pond MLE plant with UV	No
New standalone MLE plant with UV	No
New standalone MBR plant	Maybe – water
New side stream MBBR plant with Tertiary filtration and UV	No
Bioshells in the ponds with Tertiary filtration and UV	Maybe - land

Figure 2 Work Group Traffic Light Assessment for Long List WWTP Options

It was decided that all green and amber options would be taken forward for cost estimating (five options); however, during follow up discussions with Far North District Council (FNDC) it was determined that Option 8 (Bioshells) would not progress due to budget restrictions, and that only four options would proceed to the short list phase. These short-listed options are therefore as follows:

- Option 1: Pond upgrade with Tertiary filtration and Ultraviolet (UV)
- Option 2: Pond upgrade with Electrocoagulation, solids removal and UV
- Option 3: Convert ponds into pond based Sequenced Batch Reactor (SBR) with UV
- Option 6: New standalone Membrane Bioreactor (MBR) plant

2.0 Basis of Design

The flows and loads were developed to provide inputs into the high-level concept designs for the options. These are based on the current (2022) and expected future (2045) wastewater production volumes at FNDC WWTP.

The proposed and agreed basis of design for the FNDC WWTP is outlined in Table 1 below. The estimated population (average value was used) and the Average Dry Weather Flow (ADWF) for the current and expected future were taken from the flow spreadsheet provided by FNDC[1], which is based on Gross Per Capita Wastewater Production. It is important to note that the current flow was based on the pond outflow data due to incomplete and unreliable inflow data provided by FNDC in the spreadsheet with the potential risk that this is slightly underestimating flow due to evapotranspiration from the ponds in prolonged dry periods.

The loads were calculated based on the East Coast (Taipa) WWTP 2019-2020 interstage water quality monitoring report[2] provided by FNDC. The data available was limited and only provided sampling results for the summer season (Dec 2019 – Feb 2020), the winter influent loads may be lower due to the lower resident population. The available influent quality data was averaged for each parameter ($_{C}BOD_{5}$, TN, TSS, etc) and was multiplied by the ADWF value (current or future) to get the load for the concept design calculations.

Table 1 shows the basis of design used for the design and the cost estimates

Parameter	Unit	Average
Design Flows and Loads – Current (2022)		
Population	pp	2586
Average Dry Weather Flow (ADWF)	m^3/d	524
Carbonaceous biochemical oxygen demand (CBOD5)	kg/d	261
Total Nitrogen (TN)	kg/d	52.04
Total Suspended Solids (TSS)	kg/d	294
Design Flows and Loads – Future (2045)		
Population	pp	3383
Average Dry Out Weather Flow (ADWF)	m^3/d	613
Carbonaceous biochemical oxygen demand (CBOD5)	kg/d	327
Total Nitrogen (TN)	kg/d	60.93
Total Suspended Solids (TSS)	kg/d	368

[1] DtL Land Area and Flow Calculations spreadsheet provided by FNDC

[2] Summer Water Quality and Load spreadsheet provided by FNDC

3.0 Short Listed WWTP Upgrade Options

As outlined in section 1.0 above, the following options were selected for inclusion in the short list assessment.

The below descriptions apply regardless of the receiving environment (i.e., land discharge or water discharge). The proposed upgrade options are considered for the design horizon until 2045.

Option 1: Existing system to be upgraded with tertiary filtration and Ultraviolet (UV) disinfection.

This option will improve treated wastewater quality by reducing total suspended solids (TSS) and providing additional disinfection. Screened wastewater will receive treatment in Ponds 1-3, followed by final treated wastewater polishing in the Maturation Pond. Disk Filters will be installed after the treated wastewater pumps on the pressure line followed by the UV. Backwash from the filter will be returned to Pond 1. Any ongoing issues such as pond leakage or sludge build up will need to be resolved by desludging and lining the ponds including underdrainage. Additional aeration and potential operational configuration charges might be required to increase treatment capacity. The process diagram for Option 1 is provided in Figure 3 below.

Disk filters are a potential option for reducing the level of TSS in the pond discharge prior to UV disinfection. Arkal Spin Klin filters have been used in similar installations and have been included here as an indicative filter. This type of filter consists of multiple disk filters (ranging from 400 microns to 20 microns) stacked on the spine, which creates a multiple barrier filtering in addition to depth filtration. This avoids the situation that can occur with single screen filters where the build-up of solid material causes the material to be squeezed against a single filter layer; the resulting pressure on a single filter layer can cause the material (especially algae) to be extruded through the mesh in long clumps. This problem is avoided with the multiple layers used in disk filters making this type of filter suitable for algae filtration. For land discharge a 130-micron screen filter can be expected on most of the treatment pond systems, however due to the type of algae in Maturation Pond a two-stage filtration including a 100 micron and a 40-micron filter could be required. Disk filters do require backwashing (automatic) over time as the filter becomes blocked – multiple filters are used to allow one filter to be backwashed whilst the others continue forward filtration. Backwash is recycled back to Pond 1 as noted above.

UV disinfection involves the application of ultraviolet light to the wastewater to inactivate pathogens. Natural UV reaching the maturation pond surface also performs this purpose, but natural light often does not penetrate far into pond wastewater due to the presence of solids such as algae. To improve the quality of the wastewater an in-pipe UV disinfection unit can be provided as the treated wastewater is pumped to the discharge site. The performance of UV disinfection units on pond wastewater is limited due to poor transmissivity (or clarity of the treated wastewater), therefore the tertiary filtration selection is important for determining UV performance.

Treated wastewater is then pumped to the receiving environment (constructed wetlands for water discharge, land discharge site for land discharge) via the existing onsite pump station (PS).

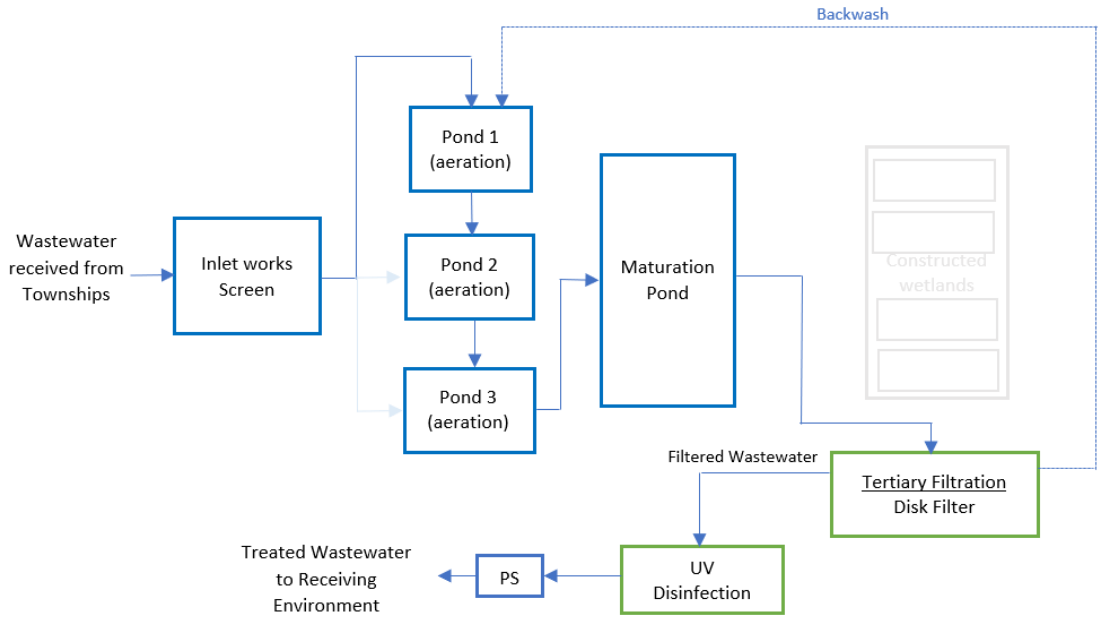

Figure 3 Process Diagram of Option 1 (Pond Upgrade with tertiary filtration + UV)

Option 2: Existing system to be upgraded with Electrocoagulation (EC) followed by Secondary Clarification

This option will reuse the existing pond system and add electro coagulation as tertiary treatment after the Maturation Pond. Screened wastewater will receive treatment in Ponds 1-3, followed by final treated wastewater polishing in the Maturation Pond. The EC process will be added after the Maturation Pond and before treated wastewater is pumped out for discharge.

There are multiple parameters that influence the optimal operating conditions of the EC process including:

• Wastewater characteristics – pH, TSS, TDS, electrical conductivity, ionic composition, temperature,

• Cell configuration – electrode material, electrode orientation, inter-electrode spacing, electrical connection,

• Residence time – wastewater flow rate, EC volume,

• Power input – voltage, current, current density, polarity reversal

The EC process proposed for this option is intended to improve treated wastewater quality in respect of TSS, TDS (total dissolved solids), Organics, Nitrogen, Phosphorus, Microbiological, Heavy metals. EC works in a similar manner to chemical coagulation, but instead of chemicals, electric current is used to provide positive ions. Natural suspended particles, such as sediments or algae, carry a negative charge which is neutralized by the positive ions, causing the particles to clump together and form a sludge. Removing the sludge leaves cleaned water for discharge.

A conventional gravity clarifier, lamella clarifier or filtration can be used to separate sludge from clean effluent. A single 8m diameter secondary clarifier would be required to meet flows up to 2045. The sedimentation process is based on the ability of the sludge to settle, therefore if the flocculated sludge settles well either option can be used. If sludge settles poorly, treated wastewater filtration can be used instead.

Separated sludge will need to be dewatered to reduce transportation costs for sludge disposal. This could be done using mechanical dewatering or geobags. Sludge filtrate will be returned to Pond 1.

It is expected that EC will provide some disinfection however, UV disinfection may be required before discharge.

The process diagram for Option 2 is provided in Figure 4 below.

An onsite EC trail is recommended for a continuous flow of at least 8 m^3/d, ideally with the solids separation stage included to confirm performance.

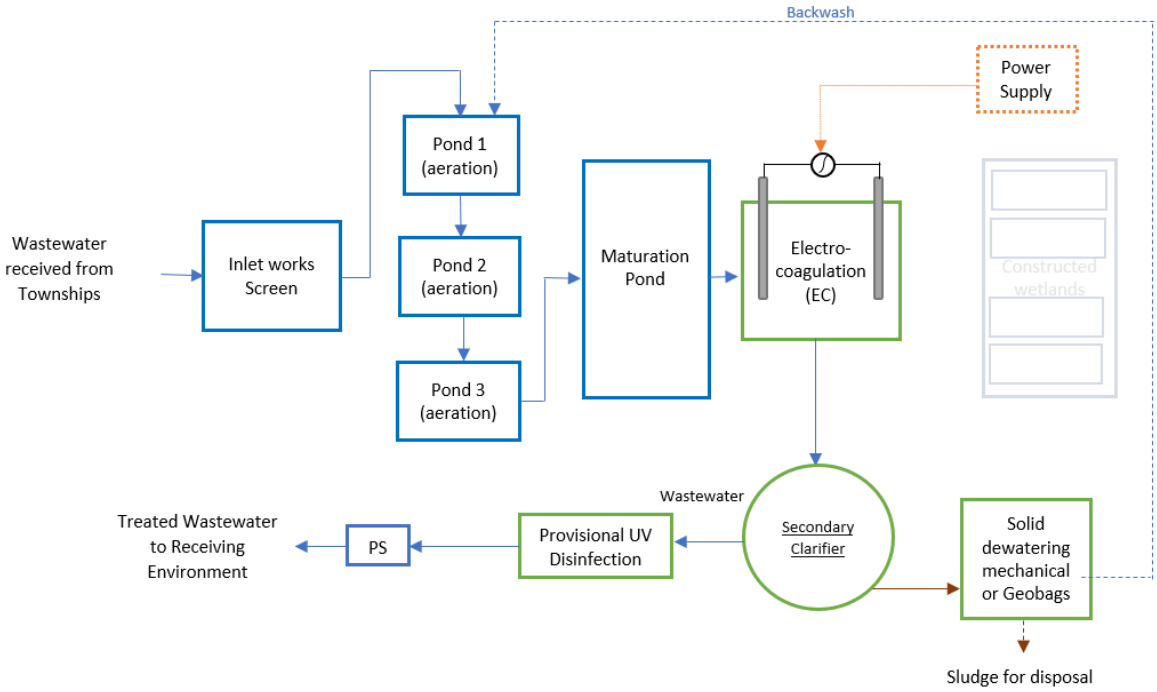

Figure 4 Process Diagram of Option 2 (Electrocoagulation + Solids Removal + UV)

Option 3: Pond Based Sequenced Batch Reactor (SBR)

SBRs include treatment of the raw wastewater and sedimentation of the biomass within the same tank in a timed sequence. This allows SBR systems to be designed with a high degree of flexibility in terms of treating varying flows and concentrations (typically experienced in seasonal populations), and to achieve specific treatment quality requirements. Typically, a depth of 3 to 5 m is required in a rectangular tank to achieve treatment and decanting cycles. Given that existing Ponds 1 to 3 have a total depth of 4.5 m, it is likely that the Taipa WWTP can be converted to a SBR plant. SBRs tend to work more reliably in a reactor configuration that is designed specifically for that application rather than in a retrofit of a sub-optimal space, particularly with regard to operating depth.

A total volume of approximately 1,200 m^3 is required for two SBRs, meanwhile the volume of each pond is around 3,500 m^3. Therefore, two SBRs could be established in one pond. Approximately 1,200 m^3 volume would be required for the decanting pond.

To convert the ponds to SBR, the existing inlet works will be reused. Pond 1 and 2 will be lined and split in halves converting Pond 1 to SBR 1 reactor and a decanting zone and Pond 2 to SBR 2 (remaining half would become redundant). SBR 1 would be in operation all year long and SBR 2 will provide seasonal treatment during the peak Christmas to Easter period. A splitter chamber will be required to direct the flows to the individual SBRs. Each reactor will have surface aerators to provide air and mixing. Ideally this style of plant would use high efficiency, fine bubble diffusers. However, the shape and likely profile of the reactor base makes this largely impractical (not impossible) for these reactors. The existing aerators could potentially be retrofitted but are unlikely to be sufficient on their own.

The reactors would operate in a cycle to fill, aerate, settle and decant. Both SBRs would decant (over a 1 hour period) to the portion of Pond 1 from where effluent would be transferred at the average day rate to minimize the size of downstream infrastructure. Waste activated sludge (WAS) would be removed daily from the bottom of each reactor toward the end of the 'settle' phase when the sludge concentrations are highest. The maturation pond could be divided into an aerated sludge lagoon and geobags area to provide sludge stabilisation, thickening and dewatering in geobags. The sludge in the geobags would eventually be taken offsite. Filtrate from the geobags area would be returned to SBR 1. Decanted treated wastewater in a portion of Pond 1 would be disinfected by UV prior to discharge. Further solids removal such as secondary clarification or tertiary filtration may be required to achieve the desired UV performance or protect the land discharge system.

The process diagram for Option 3 is provided in Figure 5 below.

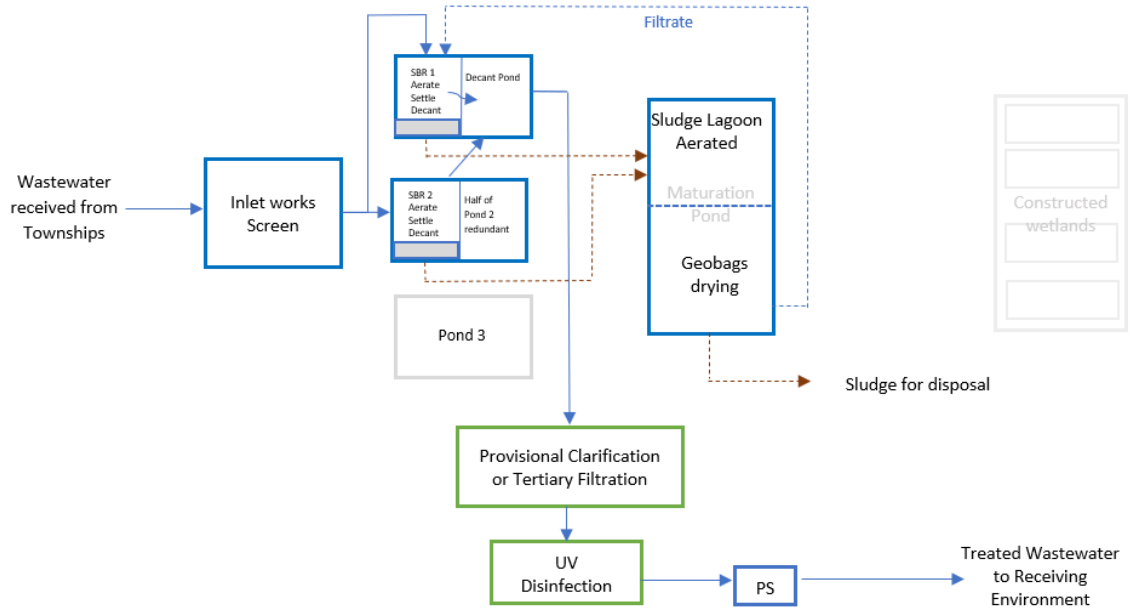

Figure 5 Process Diagram of Option 3 (Pond Based SBR + UV)

Option 6: Standalone Membrane Bioreactor (MBR)

This option will completely replace the existing ponds infrastructure except that Pond 1 could be reused for flow balancing. An upgrade of the inlet facility will be required, which may require replacement of the current screen, including grit removal and adding a second 1-2 mm screen after grit removal.

MBR is a physical variant of the activated sludge process, which comprises of a biological reactor and solids removal by membranes. Biologically, the proposed process similar to the Modified Ludzack-Ettinger (MLE) plant explained in the Long List Memo except that the membranes are used instead of a conventional clarifier to separate solids. Membrane treatment also removes most bacteria in the wastewater.

The bioreactor would consist of anoxic and aerobic zones where treatment would occur. Treated wastewater would be separated from the activated sludge by the membranes in a separate tank. For nitrogen removal a portion of treated wastewater (rich in nitrates) would be returned from aerobic reactor to anoxic reactor, this is called A-recycle.

A reactor of approximately 440 m^3 would be required for treatment initially. Two reactor trains of approximately 220 m^3 each would be provided for redundancy and flexibility. A third reactor of 220 m^3 could be added later to meet future needs (up to 2045). Pre-treated treated wastewater therefore would go first to the splitter

chamber, before entering each reactor. The reactors themselves would consist of anoxic and aerobic zones for Nitrogen removal and would be equipped with mixers and an aeration system. An internal recycle will be required to return nitrates from the end of the aerobic zone to the anoxic zone. Two membrane trains with one membrane cassette in each would be provided for redundancy to separate the treated wastewater from sludge into permeate tanks, from where it can be pumped out for disposal. To sustain activated sludge concentration in the reactor, a portion of sludge separated in the membrane tank would be return back to anoxic zone, this cycle is called returned activated sludge (RAS). Excess WAS will be removed, thickened and dewatered on site.

Ponds 2-3 and the maturation ponds will become redundant. A part of Pond 1 (approximately 1000 m^3) could be turned into wet weather flow storage for the flows after mechanical treatment (grit removal and coarse screen). Wet weather flow buffering is required as the membranes do not allow for large fluctuations of flow. A lifting pump station will be required to convey flows from the storage to the fine screen followed by reactors for treatment.

The process diagram for Option 6 is provided in Figure 6 below.

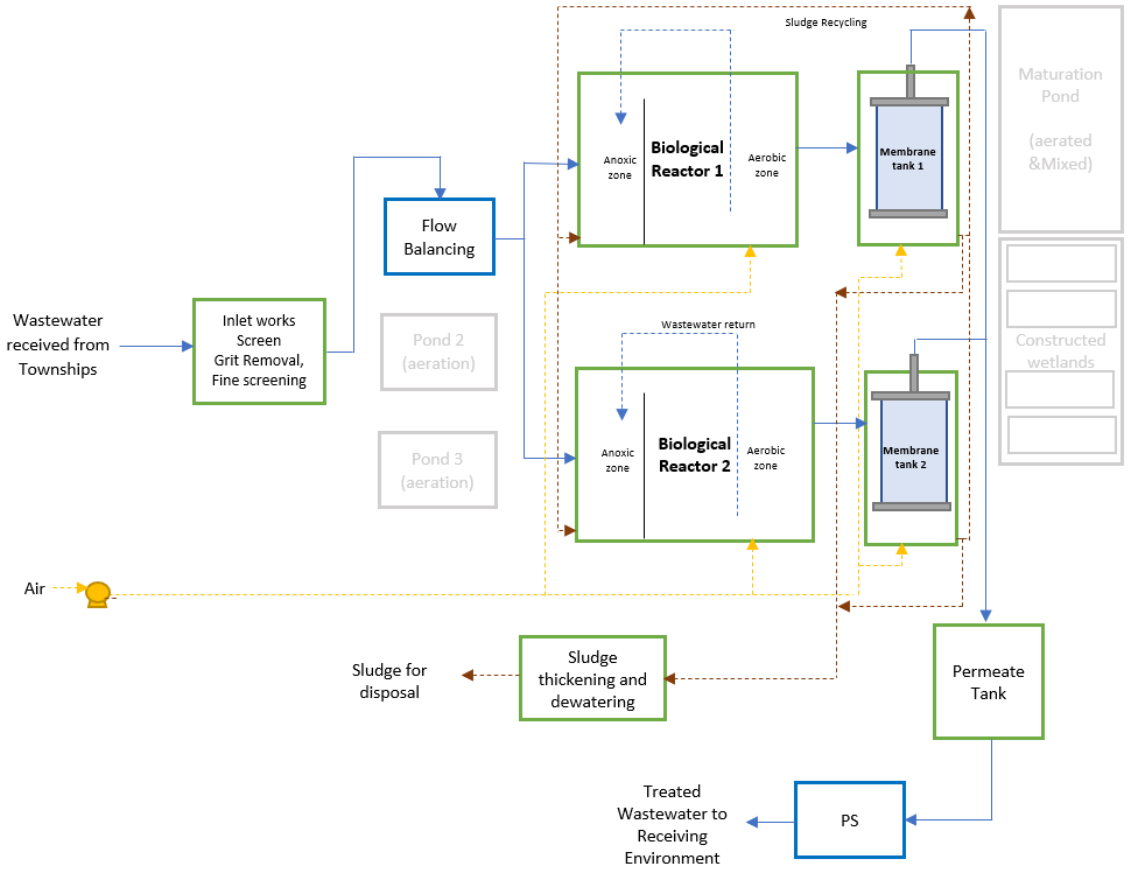

Figure 4 Process Diagram of Option 6 (MBR + Stand Alone Plant)

4.0 High level Comparative Capital Costs for WWTP Upgrade

High level capital cost estimates were undertaken for all WWTP upgrade options presented above. These cost estimates are for the WWTP upgrade only and exclude land discharge costs. Treatment upgrade costs are summarised and presented in Table 3 on the following basis:

1. It should be noted that the cost estimates provided as part of the Services are not a statement of absolute cost, rather they will have an accuracy range commensurate with various factors such as

extent of relevant information provided, the certainty of data and the level of detail available at the time of preparation.

2. The cost estimates presented in this section are typically developed based on extrapolation of recent similar project pricing, new and historical quotes for some equipment items, industry unit rates and Beca's general experience. The estimates are based on pre-concept design and other information and are not warranted or guaranteed by Beca. The accuracy of these estimates is not expected to be better than approximately -30% to +50% for the scope of options described in this document and are **not suitable for final Capex approval**. Further design should be undertaken if a more reliable estimate is required.
3. Cost estimates were undertaken primarily on the lump sums of the items, not schedules of quantity.

Table 2 Cost estimates assumptions and exclusions

Assumptions	Exclusions
Included 20% on the plant items for electrical	Excavation in rock
Included 10% on the plant items for the update telemetry and SCADA	Asbestos removal / disposal
Included 10% on the reactor UV system (Xylem) for the controls	GST
Provisional allowance for power upgrading	Realignment of existing services
Included 20% Main Contractor On-site overheads (P&G)	Repairs to existing surfaces and structures
Included 10% Design Development Contingency	Escalation
Included 15% Construction Contingency	Capitalised interest
Included 10% Professional Fees	Costs to date
Included 2% Procurement Fees	Operating cost
Included 8% Client-owned project costs	Insurance costs
	Legal and finance fees
	Risk items
	Covid-19 related costs
	Property costs

Table 3 High level Capital Cost Estimates for upgrade options

Taipa WWTP Upgrade	Option 1	Option 2	Option 3	Option 6
	Pond Upgrade TF + UV	**EC + Solid Removal + UV**	**Pond Based SBR + UV**	**MBR - Stand Alone Plant**
Total cost including provisional NZD excl GST* **	$0.97 Mil	$5.7 Mil*	$6.8 Mil**	$12.0 Mil
Provisional Costs* **	$75,000	$180,000	$221,000	$100,000

**Costs associated with the suggested trial are not included.*

***Excludes anoxic zone required for Intermittent Decanted Extended Aeration (IDEA) set up for higher nitrogen removal.*

****See Disclaimer appended to this memorandum.*

5.0 Cost Estimates for Discharge to Land

The cost estimates provided in Section 3.0 of this report are for the WWTP upgrades only, and do not include the costs for installing a land discharge scheme. These costs include:

- Pump station located at WWTP site (potential to upgrade existing)
- Pipeline between WWTP and land discharge site
- Storage pond (if required depending on selected scheme)
- Irrigation infrastructure

Following confirmation of the preferred land parcel Beca will develop high level concept design and cost estimates for the land discharge scheme. These will be in addition to the costs for the WWTP upgrade as presented in Section 3.0 above.

6.0 Short List Options by Scheme

As outlined in Section 1.0 of this memo, not all of the above WWTP options apply to both land discharge and water discharge. As such, the WWTP options have been further refined into the following schemes:

- **Scheme A –** Discharge to land (site to be confirmed) – pond upgrade to tertiary filtration and UV
- **Scheme B –** Discharge to land (site to be confirmed) – pond upgrade with electrocoagulation, solids removal and UV
- **Scheme C –** Discharge to land (site to be confirmed) – convert ponds into pond based SBR and UV
- **Scheme D** – Discharge to water - convert ponds into pond based SBR and UV
- **Scheme E –** Discharge to water – new standalone MBR plant

7.0 MCA Criteria

During the Short List Assessment workshop, the Working Group will be invited to assess each of the five schemes listed above against multiple non-cost criteria. Costs for each of the schemes will be presented separately but will not be ranked using the Multiple Criteria Assessment (MCA).

Ranking of the criteria will again use the traffic light method. Table 4 below provides a summary of each of the criteria along with the traffic light ratings to be applied.

Table 4 MCA Criteria for Short List Assessment

Criteria	Description	Allocation of Rating
Public health	The extent to which the scheme will reduce existing public health impacts of the discharge, including impacts on shellfish gathering and primary contact recreation.	Green: Removal of direct discharge to water resulting in improvements to public health Orange: Improved discharge quality resulting in reduced impact from direct discharge Red: May be able to achieve reduced public health impacts but with variable results

Aquatic ecosystems	The extent to which the scheme will reduce existing impacts of the discharge on aquatic ecosystems.	Green: Removal of direct discharge to water resulting in improvements to aquatic ecosystems Orange: Improved discharge quality resulting in reduced impact from direct discharge Red: May be able to achieve reduced ecological impacts but with variable results
Cultural	*Cultural importance as determined by roopu iwi representatives*	Green: Supported by roopu (discharge to land) Orange: Supported by roopu but with reservations Red: Opposed by roopu
Amenity values* **For land discharge, impacts on odour / visual appearance / public access / presence of buffers. For water discharge, could cause a loss of amenity in the Parapara Stream and the Awapoko River / colour of discharge / odour*	The extent to which the scheme will impact upon local amenity values.	Green: water discharge is unlikely to cause negative impacts on the Parapara Stream or Awapoko River, land discharge scheme is unlikely to have negative impacts on adjoining properties. Orange: water discharge results in no conspicuous changes in color or clarity of the water in the Parapara Stream and the Awapoko River due to the discharge, OR land discharge scheme will have minor impacts on adjoining landowners. Red: May be able to achieve reduced amenity impacts but with variable results, land discharge scheme has potential to have negative impacts on adjoining properties
Reliability	The extent to which the scheme can handle summer peaks and wet weather flows whilst maintaining effluent quality.	Green: Will produce consistent high-quality effluent under variable conditions Orange: Could possibly produce consistent effluent quality under variable conditions Red: Could achieve partial consistency in effluent quality standards, but with operation challenges

Re-use of existing WWTP assets	The use of existing assets when converting the existing WWTP into the proposed scheme	Green: ponds can be retrofitted with new technology; option retains assets that have plenty of 'life' left in them Orange: ponds can be partially retrofitted/some ponds can be retained Red: no retrofitting of ponds
Proven technology	The level of confidence that the proposed scheme can successfully demonstrate results.	Green: Commonly used technology, sufficient information to be confident of success, New Zealand examples from established WWTPs Orange: Established technology, some New Zealand examples Red: No municipal scale examples in New Zealand, limited information available
Constructability	The ease of constructing the proposed scheme	Green: Simple to construct Orange: Some difficulty with construction, could be lengthy Red: Difficult and lengthy
Operation and Maintenance	The ease of operation and maintenance and the amount of operator input, and skill needed to operate the process.	Green: Simple to operate, can use existing staff with minimal additional training required Orange: Moderately difficult, may require additional personnel and/or upskilling Red: significant additional operational and maintenance inputs, additional skilled operators required
Sustainable growth	The extent to which the scheme allows for growth of Taipa and surrounds	Green: Provides for anticipated growth above and beyond predictions Orange: Capacity can meet predicted population growth to 2045 Red: Can meet predicted population growth but with operational challenges
Transition between schemes	The extent to which the scheme allows for the transition from water discharge to land discharge to be staged.	Green: Effluent quality and scheme design allow for ease of transition Orange: May allow for the scheme to be used for water discharge in the first instance, some operational limitations Red: Does not lend itself to being used for a staged approach

The group will be presented with a draft MCA assessment as a separate attachment which outlines Beca's initial ratings. It is important to note that Beca's initial ratings are to provide guidance only, as requested by the Working Group at the last workshop and in no way restrict the final ratings of the Working Group.

Yours sincerely,

Jolanta Liutkute

Associate - Process Engineering

on behalf of

Beca Limited

Phone Number:
Email: Jolanta.Liutkute@beca.com

Copy: Garrett Hall, Brigette Priestley

Disclaimer:

Cost information provided in this memorandum is solely for Client's use for the purpose for which it is intended in accordance with the agreed scope of work. It may not be disclosed to any person other than Client and any use or reliance by any person contrary to the above, to which Beca has not given its prior written consent.

While Beca believes that the use of the assumptions, as set out in this report, are reasonable for the purposes of this study, Beca makes no assurances with respect to the accuracy of such assumptions, and some may vary significantly due to unforeseen events and circumstances. To the extent that the conditions differ from those assumed in this report, the opinions expressed by Beca in this report may no longer be valid and should be reviewed.

In preparing this estimate, Beca has relied on the accuracy, completeness and currency of the information provided, therefore is not responsible for the information provided, and has not sought to independently verify it. To the extent that the information is inaccurate or incomplete, the opinions expressed by Beca may no longer be valid and should be reviewed.

The conceptual cost estimates presented in this section have been developed solely for the purpose of comparing and evaluating competing options, **not for budget purpose**. They are sufficiently accurate to serve this purpose. They cannot be used for budget-setting purposes as common elements between options may have been omitted and/or the works not fully scoped. A functional design should be undertaken if a budget estimate is required.

D

Appendix D – Taipa WWTP treated wastewater disposal to land

Sensitivity: General

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Far North District Council
Memorial Avenue
Kaikohe

5 August 2022

Attention: Melissa Parlane

Dear Melissa,

Taipa WWTP treated wastewater disposal to land

Far North District Council (FNDC), the Taipa Working group and Beca attended an online hui to determine a preferred irrigation site for land discharge of treated wastewater from the Taipa Wastewater Treatment Plant (Taipa WWTP) on the 7th July 2022. During this hui five sites were looked at: red, blue, yellow, pink and orange. It was determined that the red site (also referred to as site #2) is the preferred site for irrigation.

FNDC prepared the Taipa Discharge to Land – Site#2 Summary report in April 2022. The summary provided results of an assessment to review potential parcels within the preferred site. However, the summary did not specify which land parcels from the site could be used for irrigation and treated wastewater storage nor did it include cost estimates for the wastewater pumping, storage and irrigation system.

This letter aims to provide a high-level cost estimate to support the assessment of feasibility of treated wastewater discharge to land at the preferred red site.

Scope of Works

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

- The high-level concept design of the pump station and conveyance from the WWTP to the preferred discharge site, provided by FNDC
- High-level consideration of potential storage volume and location
- High-level consideration of irrigation area required
- High-level consideration of discharge system (assumed surface spray irrigation)
- High-level review of the preferred site to identify which parcels would potentially be most suitable for irrigation, based on Site #2 information provided by FNDC.
- Class 5 (-30% to +50% accuracy) cost estimates

Pump Station Design and Conveyance to the site

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

- The pump station will be located at the Taipa WWTP site for the ease of tie-in works, assumed to be at sea level +/- 4m.
- Adopted pumping design flow 25 L/s. This will provide the following approximate pumping time per day:

  - 9.5 hrs based on the average daily flow of 854 m^3/d (projection[1] for the year 2045)
  - 16 hrs based on the 90%ile average daily flow of 1445 m^3/d (projection[2] for the year 2045)
- It is assumed that 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.
- Treated wastewater storage of 68,000 m^3 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 location for pipeline assumed to be a potential storage location within proposed irrigation site boundaries on a relatively flat area (contour line 60 m assumed). Therefore, the subsequent mid head loss is calculated through the system, assuming minor pipe losses based on the proposed pipe route is 128m.

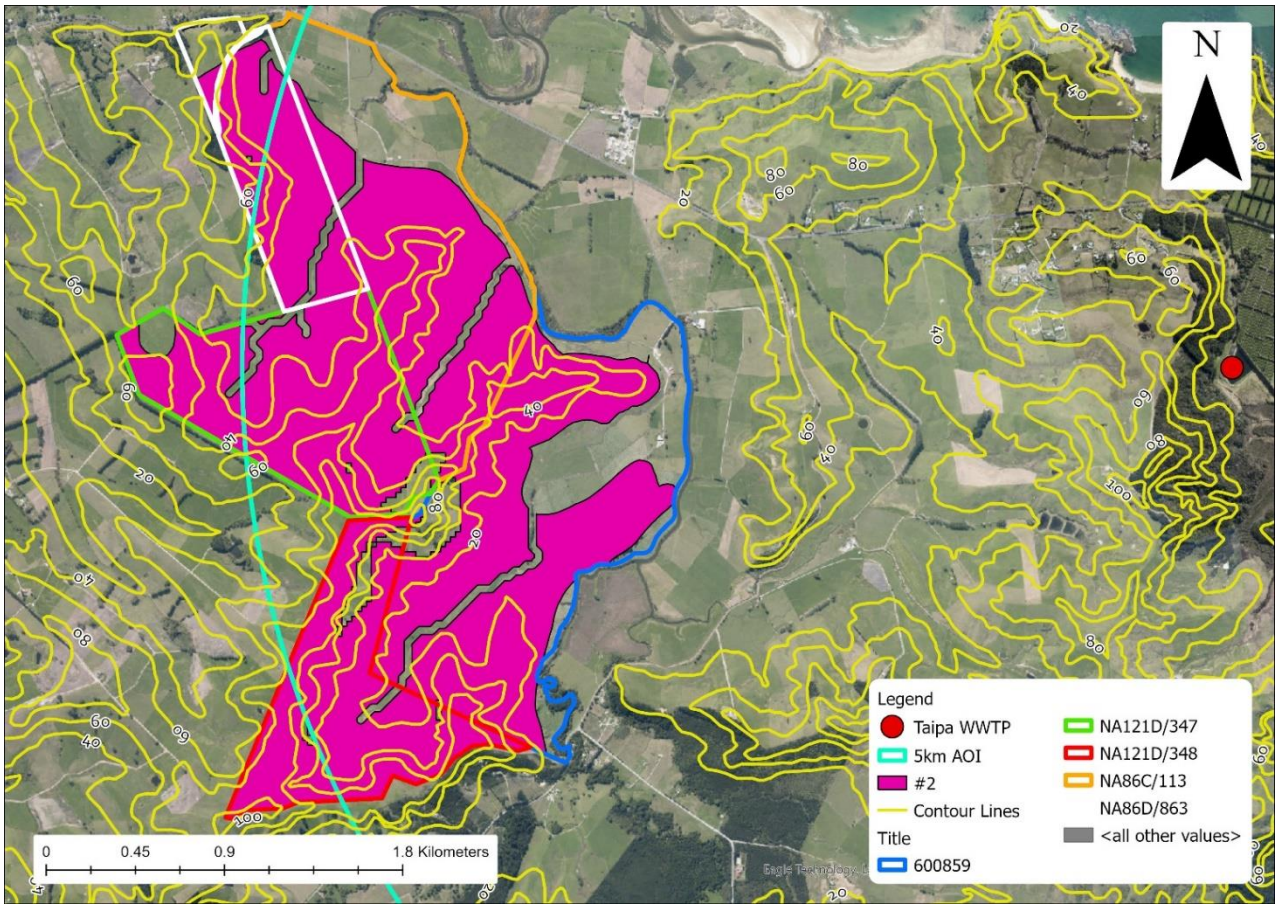

Figure 1 Potential Site with Contours

[1] Taipa Land Disposal Calculations, excel spreadsheet, provided by FNDC

- Pipework to be constant diameter throughout the proposed route.
- The estimated size of the PE pipeline is OD200 PE100 SDR 11 (PN16).
- The pipeline will be buried along the road in a road corridor and enter each site via the nearest road avoiding crossing other private property.
- Assumed no clashes with existing utility services (e.g. electricity, telecommunications) and road structures.
- Assumed Parapara stream bridge can be used to attach the pipe to for the stream crossing.
- 50 m of Stainless Steel OD200 will be used to cross Parapara stream.
- An easement will be used for route from WWTP to Taipa View RD.

Indicative pipeline route to the potential Site are presented in Figure 2 and Figure 3 below.

Figure 2 Proposed conveyance route to irrigation

Figure 3 Parapara stream crossing

The area which could be suitable for irrigation, determined by FNDC for the Site, is presented in Figure 3 and Figure 4 below shown in pink colour. The figure shows nearby dwellings with a 150 m buffer to indicate where spray irrigation is unlikely to be viable across the irrigatable area.

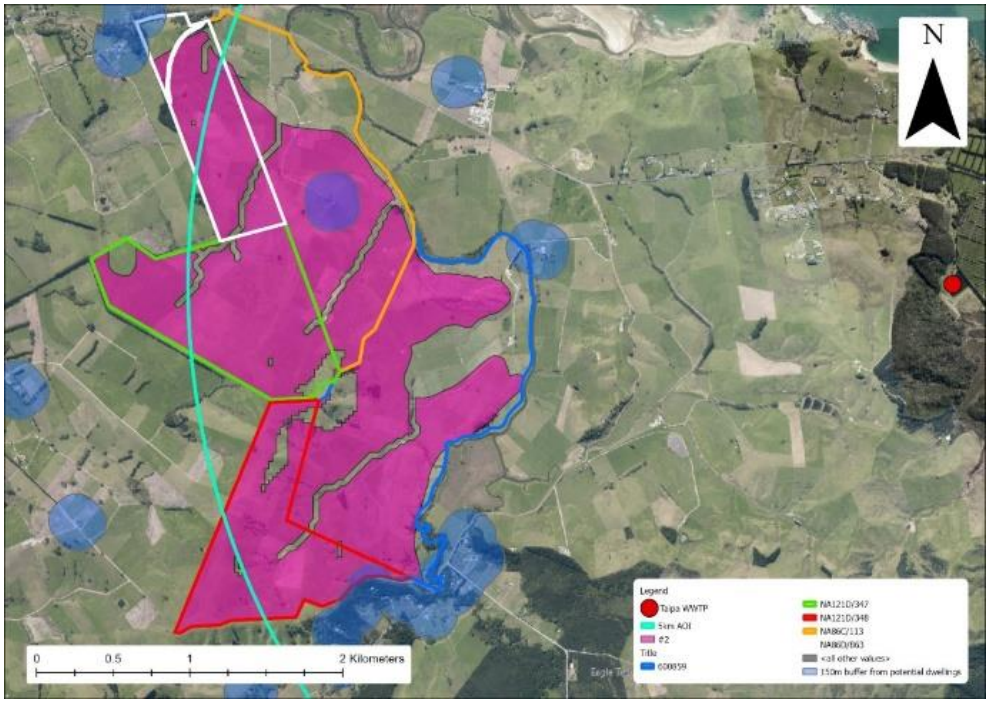

Figure 4 Potential disposal to land Site buffer zones

It is understood that the potentially irrigatable area is 462 Ha (property area 604.5 Ha). As can be seen in Figure 4, an existing house is in the middle of the irrigatable area and there are some neighbours in the south which have buffers which just overlap with the irrigatable area. Accounting for buffers to avoid houses reduces the irrigatable area to 446 Ha which is still well above the area required to discharge to land.

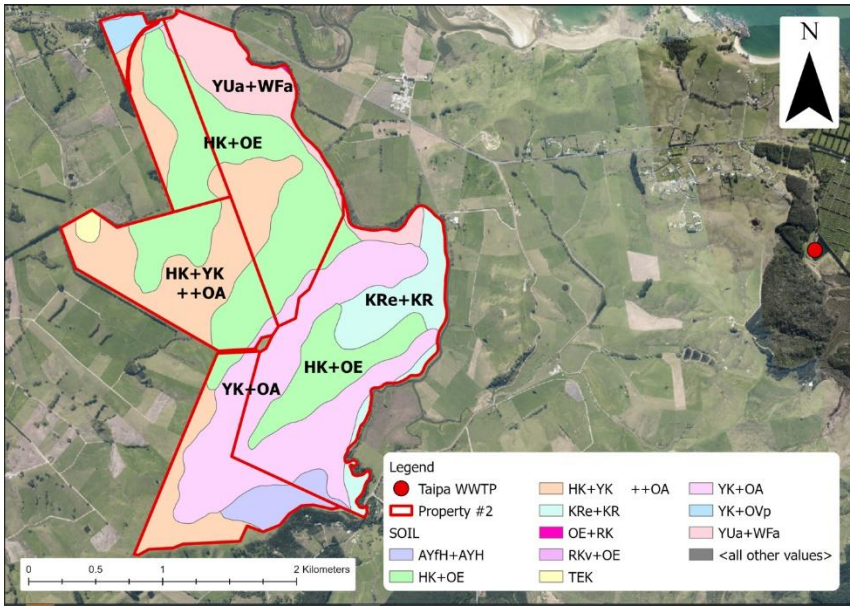

Figure 5 Soil map

The most suitable soils for irrigation are located in the northern part of the property and consist of HK (Hukerenui Silt Loam) and OE (Ohia Sand) and makes up most of titles NA86C/113 (orange outline in Figure 3) and NA86D/863 (White outline) and part of title NA121D/347 (Green outline). Overall, this land is considered drainage class 3 (well drained) though this will depend on how much of the land is HK/OE soils as they are not well drained. The northern area has been assumed as the location for the irrigation system and storage pond for costing purposes.

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 estimates. The storage and irrigation system assumed the following:

- The storage for treated wastewater will be at the discharge point from 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 approximate external dimensions of the pond are 145m x 140m with an effective water level of 4m (total depth 4.5 m).

  The pond size is based on approximately 3 months storage of average daily flow in 2045. This assumption is based on typical soil moisture deficit in Kaitaia (see Figure 6 below, obtained from Northland Regional Council website, NIWA data). During the winter months 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 disposed of on land during this period. At other times of the year, the storage pond is required to buffer out peak treated wastewater flows and avoid irrigating during rainfall events.

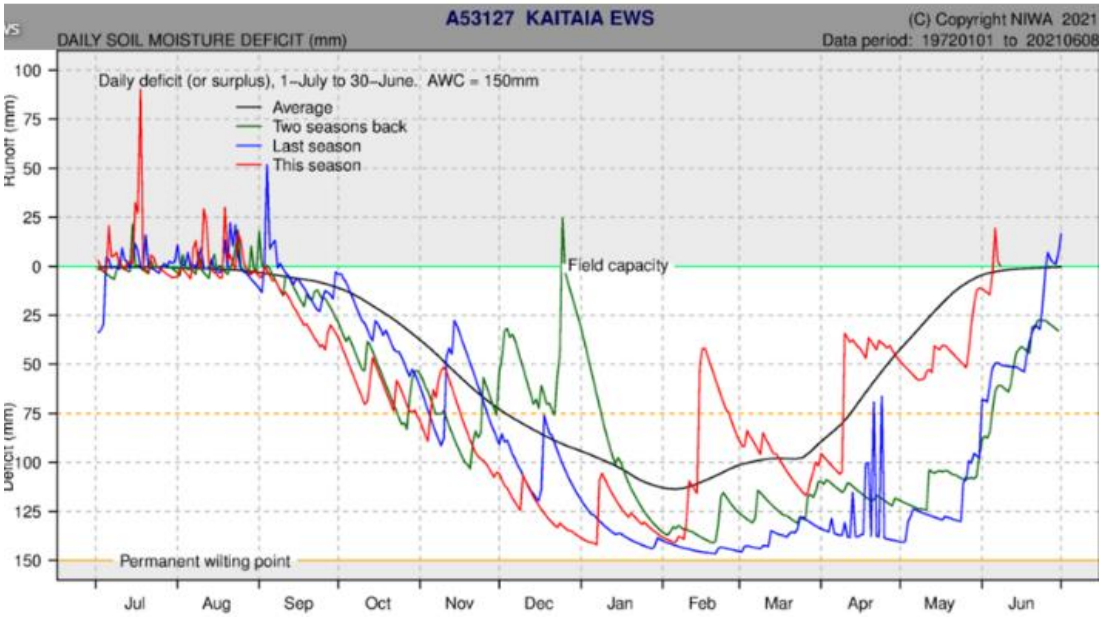

Figure 6 - Daily Soil Moisture Deficit Data for Kaitaia AWS

- It is assumed that the cover will be grass for grazing. Fixed Spray irrigation/k-lines is assumed to be installed. Cut and carry operation feasibility is to be confirmed following further engagement with the landowner.
- The land requirement for irrigation was determined by applying a simple modelling tool using soil moisture deficit, daily flows for last 5 years with 25% increase to account for expected growth, rain data for last 5 years, hydraulic application rate of 3 mm/day and treated wastewater storage of 68,000 m^3.
- A 50% factor was applied to total land area required to account for buffer zones around drains/streams and the boundary.

An indicative location for the storage pond is presented below:

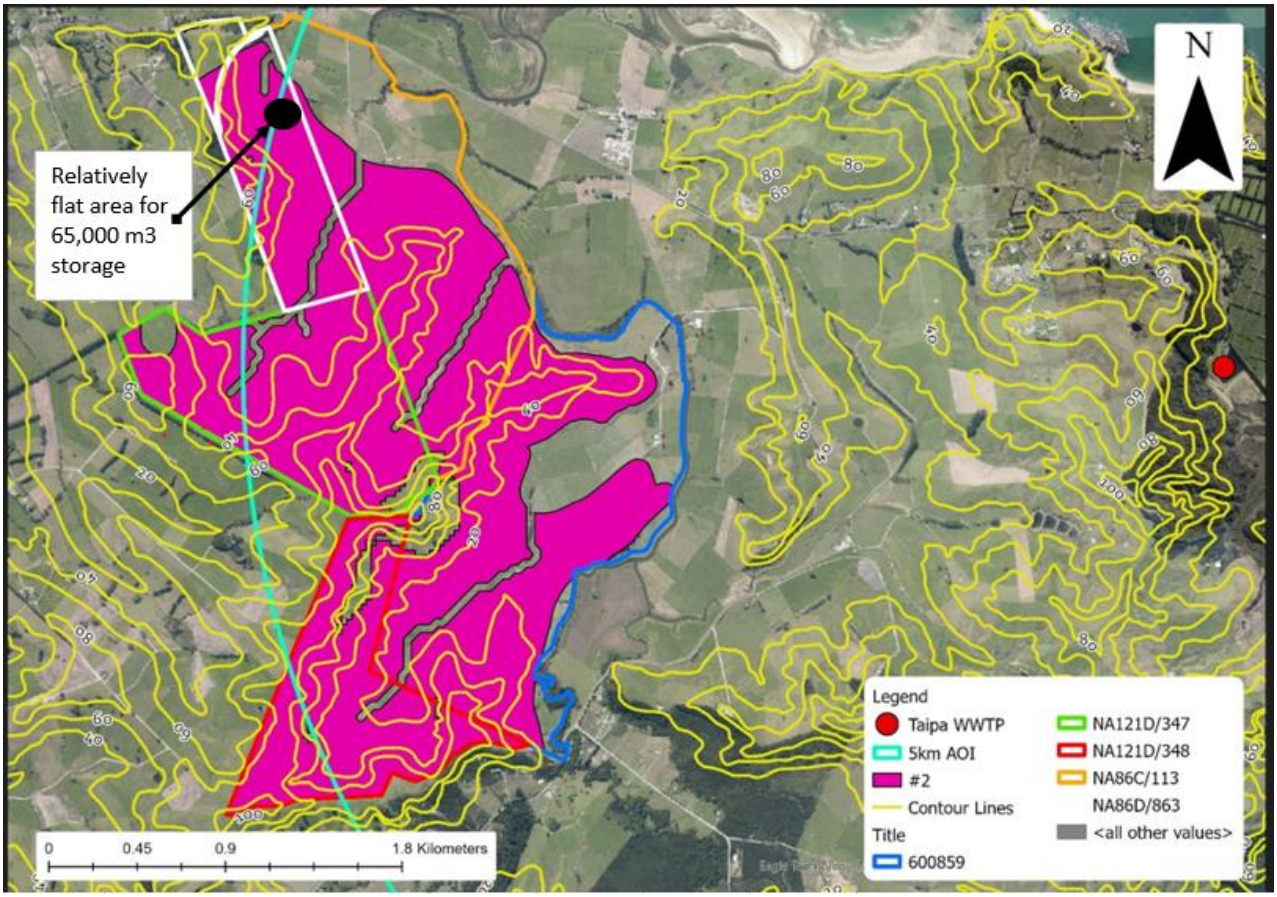

Figure 7 Storage location at potential irrigation site

Irrigation system area

High level modelling was applied to determine land irrigation area and therefore the size of irrigation system. The model used flow data provided by FNDC for the period July 2017 – July 2022. Rain data and soil moisture deficit were taken from data provided by NIWA (Kaitaia AWS).

The estimated irrigation area required for effluent disposal is summarised in Table 1 below.

Table 1 Irrigation area requirements for treated effluent disposal in 2025 and 2045

	Flow m^3/d	Assumed storage m^3	Hydraulic loading rate mm/d	Irrigation area (no buffer) ha	Land required (with buffer) ha	Nitrogen loading kgN/ha/year[2]
2022	596	55,500	3	60	90	62
2045	746	68,000	3	80	120	58

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

A minimum area of 80 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 and soil conditions. It is assumed that minimal irrigation will occur in and around 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 and soil moisture deficit will be lower than 3mm/d.

The minimum land area of 80 ha is required for future irrigation itself, however a buffer of 50% should be applied to account for the buffer areas to a property boundary and around waterways and other sensitive environments. As indicated in the table above approximately 120 ha of land will be required including buffer area. The buffer area could also include the area required for pond storage (2.2 ha) and areas too steep for irrigation. Further technical work on soil suitability, slope, pond storage location, irrigation system layout and application rates is recommended before progressing the land irrigation system.

The northern parcels of the preferred site, approximately 145 Ha (consists of orange, white and green parcels) are likely to a be the most suitable for irrigation for the following reasons:

- Overall rated as well drained site (drainage class of 3)
- Has the most-flat area available for storage and irrigation
- Can provide good pumping route to storage, providing storage can be installed at the proposed location.

Capital cost estimate

Estimated Construction Costs (-25% to + 30% accuracy) for the land discharge scheme with 2 storage options are provided in Table 2. The storage could be provided entirely at the irrigation site or if the maturation pond is no longer required for the treatment process, it could be lined and re-purposed for irrigation storage with the remainder of storage provided at the irrigation site. See Appendix A.1 for a more detailed breakdown of the costs.

Table 2 Estimated Construction Cost (-25% to + 35%) for Storage Options 1 and Option 2

Cost Item	Option 1 - New storage at irrigation site 68,000 m^3 $	Option 2 - Maturation pond storage 28,000 m^3 + 40,000m^3 irrigation site storage $
Pump station and pressure pipeline	1,553,000	1,553,000
Storage Pond (at irrigation site)	3,448,000	2,263,000
Maturation Pond PE liner installation	-	540,000
Irrigation system	4,050,000	4,050,000
Electrical and controls	138,000	138,000
Planning	350,000	350,000
P&G, Professional fees, Council internal costs and contingency	7,672,000	7,143,000
Rounding	5,000	3,500
Total	**17,380,000**	**16,210,000**
Range	**13.0 Mil to 22.6 Mil**	**12.2 Mil to 21.1 Mil**

The above costs are based on current costs as of August 2022, exclude GST and do not include for escalation or risks associated with COVID delays and/or disruptions.

Limitations

These estimates are in the order of -25% to +35% accuracy and are to be read in conjunction with the notes, assumptions, exclusions and detail of this estimate.

It should be noted that the cost estimates provided as part of the Services are not a statement of absolute cost, rather they will have an accuracy range commensurate with various factors such as the extent of relevant information provided, the certainty of data and the level of detail available at the time of preparation.

The cost estimates presented in this section are typically developed based on extrapolation of recent similar project pricing, industry unit rates and Beca's general experience. The estimates are based on very limited design inputs and other information provided by FNDC and are not warranted or guaranteed by Beca for budget setting purposes.

1.1.1 Assumptions

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

- Only a basic unsealed access allowed for along the pipe route for pipe installation.
- Assume solid block fixed sprinkler irrigation is needed.
- 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.

Exclusions

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

- Any upgrades at the WWTP itself these are covered separately
- Excavation in rock
- 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
- Capitalised interest
- Costs to date
- Operating cost
- Insurance costs

- Legal and finance fees
- Risk items
- Covid-19 related costs

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
Associate Process Engineer

on behalf of

Beca Limited

Phone Number:
Email: Jolanta.Liutkute@beca.com

Copy
Garrett Hall, Beca Limited

A.1

Cost Estimate Schedules

Appendix A.1 – Cost estimate breakdown

	CAPITAL COST ESTIMATE			Site #2 68,000 m3	
Code	**Description**	**Quantity**	**Units**	**Rate $**	**Subtotal $**
	Taipa WW Transformation Project - Discharge to land 2045				
Pump station and pressure line					
1.01	Dry mounted multistage centrifugal pump station with two pumps. Pump size 55 kW.	1	LS	65,000.00	65,000.00
1.02	OD200 PE100 SDR 11 (PN16) pipeline in trench	6,200	m	225.00	1,395,000.00
1.03	OD200 SS pipeline river crossing mounted on the bridge	50	m	1,850.00	92,500.00
1.03	Electrical, control cabinet, telemetry	1	LS	13,000.00	13,000.00
Fixed spray irrigation/K-line					
1.04	Irrigation system for the area of 80 ha	80	ha	50,000.00	4,000,000.00
1.05	Storage pond 145mx140mx4m construction including earthworks	20,300	m2	165.00	3,349,500.00
1.06	Site preparation for pond installation	1	LS	30,000.00	30,000.00
1.07	Pond area fencing 140mx145m	570	m2	120.00	68,400.00
1.08	Irrigation pump including control shed and concrete slab	1	LS	50,000.00	50,000.00
1.09	Electrical, controls, telemetry, power from the road	1	LS	50,000.00	50,000.00
Planning					
1.10	Baseline groundwater and soil investigations	1	LS	150,000.00	150,000.00
1.11	Consenting, including AEE	1	LS	200,000.00	200,000.00
Provisional					
1.12	Provisional allowance for power upgrade	1	PS	75,000.00	75,000.00
	Net Construction Cost Estimate				**9,538,400.00**
	Main Contractor On-site overheads (P&G)	20%	%	9,538,400.00	1,907,680.00
	Gross Construction Cost Estimate				11,446,080.00
	Design Development Contingency	10%	%	11,446,080.00	1,144,608.00
	Construction Contingency	15%	%	12,590,688.00	1,888,603.20
	Total Construction Budget				**14,479,291.20**
	Professional Fees	10%	%	14,479,291.20	1,447,929.12
	Procurement Fees	2%	%	14,479,291.20	289,585.82
	Client-owned project costs	8%	%	14,479,291.20	1,158,343.30
	Rounding	1	LS	4,850.56	4,850.56
	Total Expected Concept Capital Cost Estimate				**17,380,000.00**
	Expected Concept Capital Cost Estimate Range -25% + 30%			$13.035M to $22.594M	

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	CAPITAL COST ESTIMATE			Site #2 28,000 m3+ 40,000 m3	
Code	**Description**	**Quantity**	**Units**	**Rate $**	**Subtotal $**
	Taipa WW Transformation Project - Discharge to land 2045				
Pump station and pressure line					
1.01	Dry mounted multistage centrifugal pump station with two pumps. Pump size 55 kW.	1	LS	65,000.00	65,000.00
1.02	OD200 PE100 SDR 11 (PN16) pipeline in trench	6,200	m	225.00	1,395,000.00
1.03	OD200 SS pipeline river crossing mounted on the bridge	50	m	1,850.00	92,500.00
1.03	Electrical, control cabinet, telemetry	1	LS	13,000.00	13,000.00
Fixed spray irrigation/K-line					
1.04	Irrigation system for the area of 80 ha	80	ha	50,000.00	4,000,000.00
1.05	Storage pond 120mx110mx4m construction including earthworks	13,200	m2	165.00	2,178,000.00
1.06	Site preparation for pond installation	1	LS	30,000.00	30,000.00
1.07	Pond area fencing 120mx110m	460	m2	120.00	55,200.00
1.08	PE liner to Maturation Pond 28,000m3 Volume	13,500	m2	40.00	540,000.00
1.09	Irrigation pump including control shed and concrete slab	1	LS	50,000.00	50,000.00
1.10	Electrical, controls, telemetry, power from the road	1	LS	50,000.00	50,000.00
Planning					
1.11	Baseline groundwater and soil investigations	1	LS	150,000.00	150,000.00
1.12	Consenting, including AEE	1	LS	200,000.00	200,000.00
Provisional					
1.13	Provisional allowance for power upgrade	1	PS	75,000.00	75,000.00
	Net Construction Cost Estimate				**8,893,700.00**
	Main Contractor On-site overheads (P&G)	20%	%	8,893,700.00	1,778,740.00
	Gross Construction Cost Estimate				10,672,440.00
	Design Development Contingency	10%	%	10,672,440.00	1,067,244.00
	Construction Contingency	15%	%	11,739,684.00	1,760,952.60
	Total Construction Budget				**13,500,636.60**
	Professional Fees	10%	%	13,500,636.60	1,350,063.66
	Procurement Fees	2%	%	13,500,636.60	270,012.73
	Client-owned project costs	8%	%	13,500,636.60	1,080,050.93
	Rounding	1	LS	9,236.08	9,236.08
	Total Expected Concept Capital Cost Estimate				**16,210,000.00**
	Expected Concept Capital Cost Estimate Range -25% + 30%			$12.157M to $21.073M	

E

Appendix E – BPO for Taipa WW Transformation Project

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7 August 2022

Far North District Council
Private Bag 752
Kaikohe 0440

Attention: Melissa Parlane,

Dear Melissa,

RE: Best Practicable Option for Taipa WW Transformation Project

This letter sets out the details to be considered by the Working Group at the workshop on 9th August 2022 for selection of the Best Practicable Option (BPO) for the future treatment and discharge of wastewater from the Taipa Wastewater Treatment Plant (WWTP).

1.0 Introduction and Context

During the workshop on 5th July 2022 as well as the follow up online workshop on 15th July the Working Group were presented with five schemes for the Taipa WWTP that incorporated the short listed WWTP upgrade options as well as the options of either land or water discharge. These five schemes were as follows:

- **Scheme A –** Discharge to land (site to be confirmed) – pond upgrade to tertiary filtration and Ultraviolet disinfection (UV)
- **Scheme B –** Discharge to land (site to be confirmed) – pond upgrade with electrocoagulation, solids removal and UV
- **Scheme C –** Discharge to land (site to be confirmed) – convert ponds into pond based Sequenced Batch Reactor (SBR) and UV
- **Scheme D** – Discharge to water - convert ponds into pond based SBR and UV
- **Scheme E –** Discharge to water – new standalone Membrane Bioreactor (MBR) plant

Further details of the WWTP upgrade options including the associated cost estimates are presented in the Short List Memorandum dated 13 July 2022.

2.0 Land Application Scheme

During the workshop on 5th July 2022 the Working Group short listed the land application sites down to three preferred sites. There were:

- Property #2 – this is a 604.5 Ha property with 462 Ha of irrigatable land. The property is owned by the O'Callaghans and is currently used for pastoral farming (non-dairy).
- Property #4 – this is a 233.5 Ha property with 101.5 Ha of irrigatable land. The property is owned by the Matthews and is currently used for pastoral farming (non-dairy).
- Property #12 – 276.5 Ha with 197.3 Ha of irrigatable land. The property is owned by Puriri Station Ltd and is currently used for fattening for pastoral farming (non-dairy).

Following the workshop the landowners from each of these properties were approached by members of the Working Group to ascertain the level of interest in irrigating treated wastewater to their land. In a follow up online workshop on 15th July the Working Group selected a preferred site, Property #2, to be used as the subject site for a land disposal costing exercise.

Following this, Beca undertook high-level engineering design of a discharge to land scheme at the preferred site as required to develop a high-level capital cost estimate for the discharge of treated wastewater to land. The results of this are presented in the Treated Wastewater Disposal to Land Report dated 4th August 2022. Whilst these estimates are based on Property #2 it is anticipated that further investigations into all three properties will continue.

3.0 Proposed Trial for the Electrocoagulation Option

Should Electrocoagulation (EC) treatment be preferred by the Working Group, Beca recommends that an onsite trial of the EC option be undertaken prior to Far North District Council (FNDC) committing to upgrading the Taipa WWTP with EC units. The initial recommendation was to undertake an EC trial for at least 6 months, preferably one full year, for a continuous flow of at least 20 cubic metres per day (m^3/d). It is envisaged that the equipment required for the EC trial will be provided by Maurilogical Limited as a trial proposal was provided from this company on 6th July 2022. This proposal included the following:

- Electrocoagulation system - capacity 30m^3/d delivered to site consisting of the following:
    - EC system and a pump to deliver flows to this system
    - 2 x 30 m^3 tanks for solids settling
    - 1 x 1 m^3 tank for separated water
    - Shed, installation and commissioning
    - 2 control units including remote control
    - Chemical cleaning system
- Maintenance of the system @ $65/hr – no more than 30 min per service is required

In addition to the proposal, the EC trial will require the following items/works, which are included in the cost estimate for the trial:

- Prepare the area close to pond embankment near Maturation Pond outlet structure
- Install concrete slab for EC equipment and shed

- Installation costs of EC system
- Provide 2 IBCs to hold fresh water for chemical cleaning
- Prepare chemical storage area (level the ground only) and provide fencing around it.
- Allowance for dry mounted pump. Treated effluent from the EC unit is expected to be discharged by gravity, allowance for a pump is made to mitigate the risk of hydraulic installation.
- Geobags for sludge dewatering, including site preparation and drainage line back to Maturation Pond.

EC trial ongoing costs for 12 months would include the following:

- Fresh water delivery to fill IBCs. It is considered that 6,500L tanker will deliver fresh water to site on the average every 6 weeks.
- Chemical delivery to wash electrodes. It is expected that 13 pails (15L each) of 77% sulfuric acid will be required.
- Running costs of the EC unit. It is expected that EC trial will be undertaken with iron electrodes, however aluminium electrodes could be trailed for performance comparison purposes. At this stage it is difficult to estimate how much time it will take for Maurilogical Limited to service/run the EC unit. Allowance of a manpower attendance on site has been made for trial period considering that 30 min daily (work days) attendance is required, this should be sufficient to cover traveling costs as well.
- Power consumption. The power consumption of the EC process will depend on the voltage and current settings used, the area of plates and the conductance of the liquid. The NIWA EC bench trials measured a power consumption range of 0.26 – 1.52 kWh/m^3 across 3 trials at various current densities. An allowance has been made for a moderate power demand of 1.0kWh/m3, the EC treatment of 30m^3/d ADWF would require 30kWh/d.
- Lab testing. The trial will require a lab testing, which proposed to be done by a third party. Sampling analysis should be done in a certified Laboratory. It is expected that at the beginning of the trial daily 24 hr composite samples would be taken before and after EC unit. Once the EC performance become stable, the testing frequency will drop to every other day, or weekly aa trial progresses. The samples would be analysed for at least:
    - 5-day Carbonaceous Biological Oxygen Demand ($cBOD_5$)
    - Chemical Oxygen Demand (COD)
    - Total Suspended Solids (TSS)
    - Volatile Suspended Solids (VSS)
    - Ammonia Nitrogen
    - Total Nitrogen (TN)
    - Dissolved Reactive Phosphorus (DRP)
    - Total Phosphorus (TP)
    - Faecal Coliforms
    - pH

In addition to the liquid stream sampling expected above, solids composition testing will be required to determine sludge settling parameters for future solids separation upgrade, should the full scale of EC

upgrade will go ahead. Solids testing will be a combination of onsite jar testing and a few lab tests. Lab testing is not included in the cost estimate as the testing programme is not yet established.

EC trial costs are presented in Table 1 and should read in conjunction with Table 2 below.

Table 1 Electrocoagulation Trial Cost Estimate

Description	Cost NZD excl GST
Electrocoagulation (EC) system as supplied by Maurilogical Ltd	66,395
Installation costs of EC unit	13,279
Pump with flexible hose	1,000
Opex for 12 moths trial	16,216
Geobags including installation	25,000
Site works such as electrical, set up, fencing	19,279
Professional and general (P&G), Contingency, Client owned costs	64,106
Rounding	4,725
Total Expected Capital Cost Estimate	**210,000**

Table 2 Cost estimates assumptions and exclusions

Assumptions	Exclusions
Included 20% on the plant items for electrical Included 10% on the plant items for the update telemetry and SCADA Provisional allowance for power upgrading Included 20% Main Contractor On-site overheads (P&G) Contingency Included 10% Construction Contingency Included 2% Design Development Contingency Included 8% Client-owned project costs Operating cost Included for chemical and water delivery, EC maintenance labour component and power consumption	Asbestos removal / disposal GST Realignment of existing services Repairs to existing surfaces and structures Escalation Capitalised interest Costs to date Insurance costs **Sample collection and lab costs** **Reporting costs** Legal and finance fees Risk items Covid-19 related costs Property costs Percentages for professional fees and procurement excluded from the EC trail as will be done and handled by the client

4.0 Storage Requirements

Whilst the conveyance and application of the treated wastewater for the land discharge system will be consistent between schemes, storage requirements for the treated wastewater will differ (due to utilisation of the existing pond units for storage of treated wastewater by some of the options).

Storage requirements for each of the discharge schemes are presented in Table 3 below. Storage requirements are based on current Inflow & Infiltration levels and growth projections up to 2045 as provided by FNDC.

Table 3 Storage requirements for the proposed discharge schemes

Taipa WWTP Upgrade	Description	Storage Requirements
Scheme A	Discharge to land – pond upgrade to tertiary filtration and UV	Storage volume 68,000 m^3. At 4 m water depth pond measurements is approximately 145 m x 140m. Storage located on the irrigation site.
Scheme B	Discharge to land – pond upgrade with electrocoagulation, solids removal and UV	Storage volume 68,000 m^3. At 4 m water depth pond measurements is approximately 145 m x 140m. Storage located on the irrigation site.
Scheme C	Discharge to land – convert ponds into pond based SBR and UV	Storage volume 68,000 m^3. Maturation pond could be reused for Storage, providing 28,000 m^3 of storage. The pond will require desludging and PE liner. A new storage pond of 40,000 m^3 would be built on the irrigation site to make up the rest of storage volume. At 4 m water depth pond measurements is approximately 120 m x 110m.
Scheme D	Discharge to water - convert ponds into pond based SBR and UV	No storage is required, treated wastewater would be discharged directly from decanting tank.
Scheme E	Discharge to water – new standalone MBR plant	No storage is required, treated wastewater would be discharged directly from permeate tanks.

5.0 Cost Estimates for Short Listed Options

The Short List Memorandum, dated 13th July 2022, outlines the design and cost estimates for the four WWTP upgrade options that have been incorporated into the short-listed schemes. These costs did not incorporate the costs of the EC trial nor the costs of the land discharge application scheme.

Table 4 therefore provides an overview of the total estimated costs for each scheme incorporating the cost estimates from the Treated Wastewater Disposal to Land Report and the Short List Memorandum as well as the EC trial costs outlined above.

It is important to not that these are the Capital (CAPEX) cost estimates only and do not include Operating and Maintenance (OPEX) costs. All cost estimate assumptions, exclusions and disclaimers are provided in the relevant memorandums and reports with the original cost estimates.

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Table 4 Summary of Cost Estimates per Scheme

Taipa WWTP Upgrade	Scheme A	Scheme B	Scheme C	Scheme D	Scheme E
	Discharge to land – pond upgrade to tertiary filtration and UV	**Discharge to land – pond upgrade with electrocoagulation, solids removal and UV**	**Discharge to land – convert ponds into pond based SBR and UV**	**Discharge to water - convert ponds into pond based SBR and UV**	**Discharge to water – new standalone MBR plant**
WWTP system upgrade[1]	970,000	5,870,000	6,820,000	6,820,000	12,010,000
Onsite Trial Cost[2]	N/A	210,000	N/A	N/A	N/A
Treated Wastewater Storage (and/or maturation pond lining)[3]	6,280,000	6,280,000	5,110,000	N/A	N/A
Land application system (conveyance and application)[3]	11,100,000	11,100,000	11,100,000	**N/A**	**N/A**
TOTAL	**18,350,000**	**23,460,000**	**23,030,000**	**6,820,000[4]**	**12,010,000[4]**

[1] Refer to Short List Memorandum dated 13th July 2022 for assumptions, exclusions, and disclaimers

[2] Refer to Section 4.0 of this report for the assumptions and exclusions, and the appended disclaimer

[3] Refer to Treated Wastewater Disposal to Land Report dated 5th August 2022 for assumptions, exclusions, and disclaimers

[4] Does not include discharge pump station and pipeline upgrade associated with the future flows.

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6.0 Selecting the Best Practicable Option

The next stage in the process is to select the Best Practicable Option (BPO) to be presented to Northland Regional Council by 1st September 2022 in accordance with Condition 10 of the Consent Order dated 8th March 2021.

The Resource Management Act 1991 (RMA) definition of BPO is as follows:

"*the best method for preventing or minimising the adverse effects on the environment having regard, amongst other things, to –*

a) *The nature of the discharge or emission and the sensitivity of the receiving environment to adverse effects; and*
b) *The financial implications, and the effects on the environment, of that option when compared with other options; and*
c) *The current state of technical knowledge and the likelihood that the option can be successfully applied*"

In an online workshop on 18th July 2022 the Working Group were invited to assess each of the five schemes listed above against multiple non-cost criteria in order to address items a) and c) of the BPO requirements. Ranking of the criteria used the traffic light method as shown below.

	Preferred
	Less Preferred
	Not Preferred

Figure 1 Traffic Light Assessment

During this workshop the Working Group assessed each of the five schemes options and allocated a traffic light colour coding accordingly (see Figure 2). The Working Group discussed the way the criteria would be assessed and agreed that the criteria would be judged as relative (between schemes) rather than absolute in order to identify an emerging preferred option.

	Scheme A	Scheme B	Scheme C	Scheme D	Scheme E
Public Health					
Aquatic ecosystems					
Cultural					
Amenity values					
Reliability					
Re-use of existing WWTP					
Constructability					
Operation					
Sustainable growth					
Transition between schemes					

Figure 2 Work Group Traffic Light Assessment for Short List WWTP Options

A copy of the completed MCA assessment including the descriptions of each of the criteria and reasons for classifications is appended to this report (see Appendix A.1).

Based on the MCA assessment, the emerging preferred options were noted as Scheme B (EC with land discharge) and Scheme C (SBR with land discharge).

In order to select the BPO the non-cost items will need to be considered in conjunction with the estimated costs provided.

7.0 Summary

The Working Group will be invited to assess the merits of the shortlisted schemes in the final workshop to be held on 9th August 2022. During this workshop a final BPO will be selected in line with the RMA definition of BPO.

Yours sincerely,

Brigette Priestley

Associate Environmental Scientist

on behalf of

Beca Limited

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Disclaimer

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This report must be read in its entirety and no portion of it should be relied upon without regard to the full report, especially the assumptions, limitations and disclaimers set out in the estimate notes and elsewhere in the report.

While Beca believes that the use of the assumptions, as set out elsewhere in this report, are reasonable for the purposes of this study, Beca makes no assurances with respect to the accuracy of such assumptions, and some may vary significantly due to unforeseen events and circumstances. To the extent that the conditions differ from those assumed in this report, the opinions expressed by Beca in this report may no longer be valid and should be reviewed.

In preparing this estimate, Beca has relied on the accuracy, completeness and currency of the information provided, therefore is not responsible for the information provided, and has not sought to independently verify it. To the extent that the information is inaccurate or incomplete, the opinions expressed by Beca may no longer be valid and should be reviewed.

A.1

MCA Assessment

Appendix A.1 – Final MCA Assessment Results for Short List Options

Criteria	What have we considered for these criteria?	Scheme A Discharge to land (site to be confirmed) – pond upgrade to tertiary filtration and UV	Scheme B Discharge to land (site to be confirmed) – pond upgrade with electrocoagulation, solids removal and UV	Scheme C Discharge to land (site to be confirmed) – convert ponds into pond based SBR and UV	Scheme D Discharge to water - convert ponds into pond based SBR and UV	Scheme E Discharge to water – new standalone MBR plant
Public health	The extent to which the scheme will reduce existing public health impacts of the discharge, including impacts on shellfish gathering and primary contact recreation. Green: Removal of direct discharge to water resulting in improvements to public health Orange: Improved discharge quality resulting in reduced impact from direct discharge Red: May be able to achieve reduced public health impacts but with variable results	Discharge to be removed from water (Rating is dependent on design of the land discharge scheme and characteristics of the land parcel)	Discharge to be removed from water (Rating is dependent on design of the land discharge scheme and characteristics of the land parcel)	Discharge to be removed from water (Rating is dependent on design of the land discharge scheme and characteristics of the land parcel)	Discharge will meet faecal coliform limit as set out in the consent order but will still be to water rather than to land. NB: Apart from faecal indicator bacteria, the UV will also have a significant beneficial effect in inactivation of viruses.	Discharge will meet faecal coliform limit as set out in the consent order but will still be to water rather than to land. Discharge will be higher quality than scheme D.
Aquatic ecosystems	The extent to which the scheme will reduce existing impacts of the discharge on aquatic ecosystems. Green: Removal of direct discharge to water resulting in improvements to aquatic ecosystems Orange: Improved discharge quality resulting in reduced impact from direct discharge Red: May be able to achieve reduced ecological impacts but with variable results	Discharge to be removed from water (Rating is dependent on design of the land discharge scheme and characteristics of the land parcel)	Discharge to be removed from water (Rating is dependent on design of the land discharge scheme and characteristics of the land parcel)	Discharge to be removed from water (Rating is dependent on design of the land discharge scheme and characteristics of the land parcel)	Discharge will meet total nitrogen limit as set out in the consent order. Ammonia levels could be reduced to c. 2mg/L. But will still be to water rather than to land.	Discharge will meet total nitrogen limit as set out in the consent order. Ammonia levels could be reduced to c. 2mg/L. But will still be to water rather than to land.

Criteria	What have we considered for these criteria?	Scheme A Discharge to land (site to be confirmed) – pond upgrade to tertiary filtration and UV	Scheme B Discharge to land (site to be confirmed) – pond upgrade with electrocoagulation, solids removal and UV	Scheme C Discharge to land (site to be confirmed) – convert ponds into pond based SBR and UV	Scheme D Discharge to water - convert ponds into pond based SBR and UV	Scheme E Discharge to water – new standalone MBR plant
Cultural	*Cultural importance as determined by roopu iwi representatives* Green: Supported by roopu (discharge to land) Orange: Supported by roopu but with reservations Red: Opposed by roopu	Discharge to be removed from water, but quality is not to working group standards	Discharge to be removed from water, roopu expressed support for EC during Workshop #3	Discharge to be removed from water, high quality effluent	Discharge to water is strongly opposed by roopu	Discharge to water is strongly opposed by roopu
Amenity values* *For land discharge, impacts on odour / visual appearance / public access / presence of buffers *For water discharge, could cause a loss of amenity in the Parapara Stream and the Awapoko River / colour of discharge / odour	The extent to which the scheme will impact upon local amenity values. Green: water discharge is unlikely to cause negative impacts on the Parapara Stream or Awapoko River, land discharge scheme is unlikely to have negative impacts on adjoining properties. Orange: water discharge results in no conspicuous changes in color or clarity of the water in the Parapara Stream and the Awapoko River due to the discharge, OR land discharge scheme will have minor impacts on adjoining landowners. Red: May be able to achieve reduced amenity impacts but with variable results, land discharge scheme has potential to have negative impacts on adjoining properties	Quality of the effluent is not as good as Schemes B and C which may result in minor loss of amenity for land discharge site	Unlikely to cause detrimental impacts to adjoining properties as discharge quality will be moderate to high and will be controlled through the consent conditions (Dependent on land parcel selected for scheme)	Unlikely to cause detrimental impacts to adjoining properties as discharge quality will be moderate to high and will be controlled through the consent conditions (Dependent on land parcel selected for scheme)	High quality effluent unlikely to cause changes in appearance of the Parapara Stream or the Awapoko River.	High quality effluent unlikely to cause changes in appearance of the Parapara Stream or the Awapoko River

Criteria	What have we considered for these criteria?	Scheme A Discharge to land (site to be confirmed) – pond upgrade to tertiary filtration and UV	Scheme B Discharge to land (site to be confirmed) – pond upgrade with electrocoagulation, solids removal and UV	Scheme C Discharge to land (site to be confirmed) – convert ponds into pond based SBR and UV	Scheme D Discharge to water - convert ponds into pond based SBR and UV	Scheme E Discharge to water – new standalone MBR plant
Reliability	The extent to which the scheme can handle summer peaks and wet weather flows whilst maintaining effluent quality. Green: Will produce consistent high-quality effluent under variable conditions Orange: Could possibly produce consistent effluent quality under variable conditions Red: Could achieve partial consistency in effluent quality standards, but with operation challenges	Can achieve partial consistency, does not respond well to variable loads compared to other technologies proposed	Responds reasonably well under variable flows and loads. Orange due to insufficient examples in New Zealand to draw from. However, pilot study could demonstrate reliability	SBR responds well to variable flows and loads	SBR responds well to variable flows and loads	MBR does not respond well to wet weather flows (buffer storage is required) but can handle summer peak loads as part of design flows
Re-use of existing WWTP assets	The use of existing assets when converting the existing WWTP into the proposed scheme Green: ponds can be retrofitted with new technology; option retains assets that have plenty of 'life' left in them Orange: ponds can be partially retrofitted/some ponds can be retained Red: no retrofitting of ponds	Ponds can be easily retrofitted, simple to implement	Ponds can be easily retrofitted, simple to implement	Ponds can be partially retrofitted; remaining pond space can be reused for storage; more complex implementation	Ponds can be partially retrofitted, no requirement for pond storage (c.f. land discharge scheme) more complex implementation	MBR plant will be stand alone, ponds will be redundant (apart from new storage facility)

Criteria	What have we considered for these criteria?	Scheme A Discharge to land (site to be confirmed) – pond upgrade to tertiary filtration and UV	Scheme B Discharge to land (site to be confirmed) – pond upgrade with electrocoagulation, solids removal and UV	Scheme C Discharge to land (site to be confirmed) – convert ponds into pond based SBR and UV	Scheme D Discharge to water - convert ponds into pond based SBR and UV	Scheme E Discharge to water – new standalone MBR plant
Constructability	The ease of constructing the proposed scheme Green: Simple to construct Orange: Some difficulty with construction, could be lengthy Red: Difficult and lengthy	Simple to construct WWTP upgrade, constructing land discharge scheme will be lengthy	Simple to construct WWTP upgrade, constructing land discharge scheme will be lengthy	More lengthy construction for WWTP upgrade than other options, constructing land discharge scheme will also be lengthy	More lengthy construction for WWTP upgrade than other options	Simple to construct / can construct offline
Operation	The ease of operation and maintenance and the amount of operator input, and skill needed to operate the process. Green: Simple to operate, can use existing staff with minimal additional training required Orange: Moderately difficult, may require additional personnel and/or upskilling Red: significant additional operational and maintenance inputs, additional skilled operators required	Simple to operate, will not require additional staff to implement option, some additional training required regarding land irrigation system.	Simple to operate, will require some additional training as new technology, some additional training required regarding land irrigation system.	Will require upskilling, moderate increase in operation and maintenance demands, some additional training required regarding land irrigation system.	Will require upskilling, moderate increase in operation and maintenance demands.	Complex operation, required skilled operators trained in MBR.

Criteria	What have we considered for these criteria?	Scheme A Discharge to land (site to be confirmed) – pond upgrade to tertiary filtration and UV	Scheme B Discharge to land (site to be confirmed) – pond upgrade with electrocoagulation, solids removal and UV	Scheme C Discharge to land (site to be confirmed) – convert ponds into pond based SBR and UV	Scheme D Discharge to water - convert ponds into pond based SBR and UV	Scheme E Discharge to water – new standalone MBR plant
Sustainable growth	The extent to which the scheme allows for growth of Taipa and surrounds Green: Provides for anticipated growth above and beyond predictions Orange: Capacity can meet predicted population growth to 2045 Red: Can meet predicted population growth but with operational challenges	Limited by the available land, ponds should be able to take additional BOD loading with additional aeration and potentially splitting the flow equally across three ponds (change to operating in series).	Limited by the available land, ponds should be able to take additional BOD loading with additional aeration and potentially splitting the flow equally across three ponds, additional flow will need additional EC units and potentially clarifier.	Higher level of quality, can be designed to meet anticipated growth, not as limited by land availability as Schemes A and B as can use additional ponds to add to the sequence.	Higher level of quality, can be designed to meet anticipated growth, not as limited by land availability as Schemes A and B as can use additional ponds to add to the sequence.	High level of quality, can be designed to meet anticipated growth, can be easily staged to add additional MBR modules.
Transition between schemes	The extent to which the scheme allows for the transition from water discharge to land discharge to be staged. Green: Effluent quality and scheme design allow for ease of transition Orange: May allow for the scheme to be used for water discharge in the first instance, some operational limitations Red: Does not lend itself to being used for a staged approach	Does not lend itself to being used for a staged approach as quality is insufficient for water discharge (in the first instance) prior to transition to land discharge	Could be used for water discharge if design was altered to improve water quality to meet consent order but will require additional costs and has operational limitations. An onsite pilot trial would be required to confirm whether the effluent quality	Effluent quality and scheme design allow the scheme to be used for meeting the consent order for water discharge in the first instance, with a transition to land discharge in the future. Could be transitioned into MBR in future	Effluent quality and scheme design allow the scheme to be used for meeting the consent order for water discharge in the first instance, with a transition to land discharge in the future. Could be transitioned into MBR in future	Effluent quality and scheme design allow the scheme to be used for meeting the consent order for water discharge in the first instance, with a transition to land discharge in the future HOWEVER very large capital cost for a land discharge scheme

Criteria	What have we considered for these criteria?	Scheme A Discharge to land (site to be confirmed) – pond upgrade to tertiary filtration and UV	Scheme B Discharge to land (site to be confirmed) – pond upgrade with electrocoagulation, solids removal and UV	Scheme C Discharge to land (site to be confirmed) – convert ponds into pond based SBR and UV	Scheme D Discharge to water - convert ponds into pond based SBR and UV	Scheme E Discharge to water – new standalone MBR plant
			is suitable for water discharge (in the first instance) prior to transition to land discharge			

F

Appendix F –Workshops Minutes and Presentation Slides

Whakawhanaungatanga

Workshop #1
3rd May 2022

make
everyday
better.

1

AGENDA

- Introductions and Karakia
- Work done to date
- National Wastewater Matters
- Land application schemes in New Zealand
- Selection of land application sites for Taipa
- Establishing the Best Practicable Option (BPO)
- Future Workshops and Dates

2

Introductions and Karakia

3

INTRODUCTIONS – WHO ARE YOU?

- Introduce yourself
- Tell us about your involvement in the project to date
- What are your expectations?
- What do you want to get out of these workshops?

4

INTRODUCTIONS – WHO ARE WE?







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5

Work Done to Date

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Table 7: Summary of treatment upgrade capital costs for comparison

No	Option Description	Capital Cost
1	SBR with UV	$5.0M
2	MBR	$6.9M
5	Algae Bioreactor pond upgrade with Electrocoagulation and UV	$4.8M
10	Submerged Media pond upgrade with DAF and UV	$4.4M
11	Enhanced Pond System pond upgrade with UV	$2.6M
12	Carousel configuration pond upgrade with UV	$4.6M
14	Business as usual (existing pond system and constructed wetlands, no changes)	$0

Taipa WWTP Upgrade Issues and Options Report

For use at Taipa WWTP Working Group Hui #2

Far North District Council

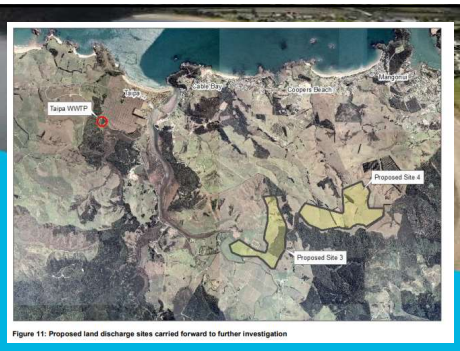

Figure 11: Proposed land discharge sites carried forward to further investigation

Taipa WWTP Upgrade Issues and Options

Land Disposal Site Selection Analysis Report

Far North District Council

7

WORK DONE TO DATE

6. Summary and Recommendations

This memorandum builds on previous investigations on treatment and disposal of wastewater at the East Coast WWTP and identifies the long-listed treatment and disposal options to take forward for further consideration. The combined disposal and treatment options are:

- Option 1 – Maintain current WWTP and land disposal
- Option 2 - Electrocoagulation and land disposal
- Option 3 – Pond-based SBR and continued Parapara stream discharge

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Jacobs

Memorandum

Long List of Proposed Options for Wastewater Treatment and Disposal

- Option 4 – Pond-based SBR and a new wetland, Oruru River discharge
- Option 5 – MBR and continued Parapara stream discharge

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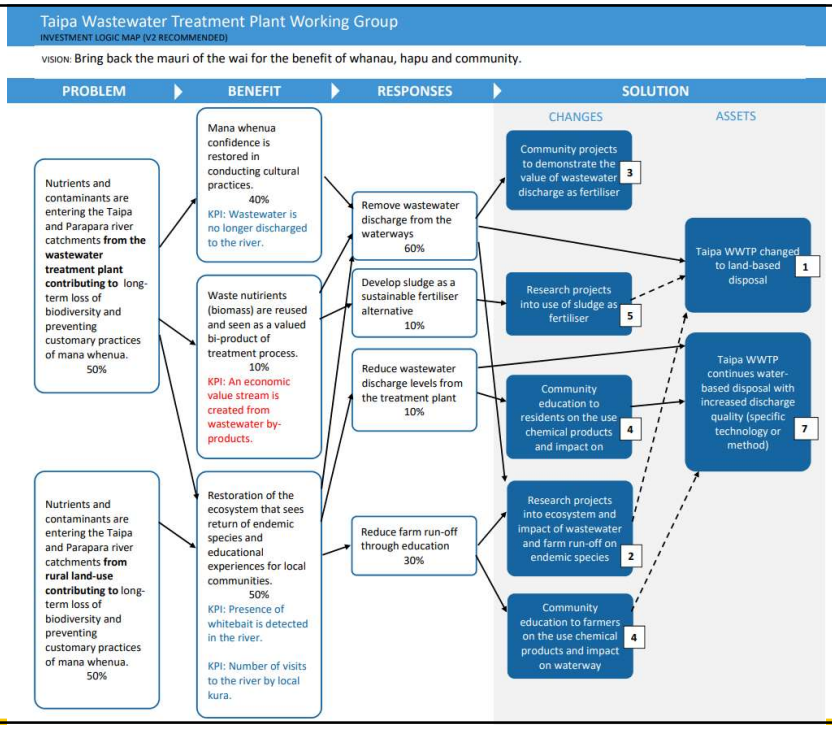
WORK DONE TO DATE

- How can we build on the work already undertaken?
- What can we learn from the previous studies?
- What are the key points to take forward?
- What are the items to leave behind?
- What are the limitations we need to acknowledge?



Limitations & Implications

- Land acquisition issues
- What does this mean for the Condition 10 report?
- How can we approach this at Taipa?

Morning Tea Time

National Wastewater Matters

Land application schemes in New Zealand

NATIONAL WASTEWATER MATTERS

- NZ Wastewater Sector Report
- Water Reform
- Taumata Arowai

LAND APPLICATION SCHEMES

- **Raglan Wastewater Project** (Waikato District Council/Waikato Watercare)
- **Central Hawkes Bay Big Wastewater Story** (Central Hawkes Bay District Council)
- **Rawene Wastewater Optioning** (FNDC)

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Wastewater Discharge to Land
Good Practice Guidance

Prepared for Far North District Council
Prepared by Beca Limited

1 February 2022

- Developing this guidance document with FNDC since 2020
- Methodology for developing a Discharge to Land option:
  - Concept Design
  - Environmental Investigations
  - Consent lodgement
  - Preliminary design
  - Detailed Design
  - Commissioning

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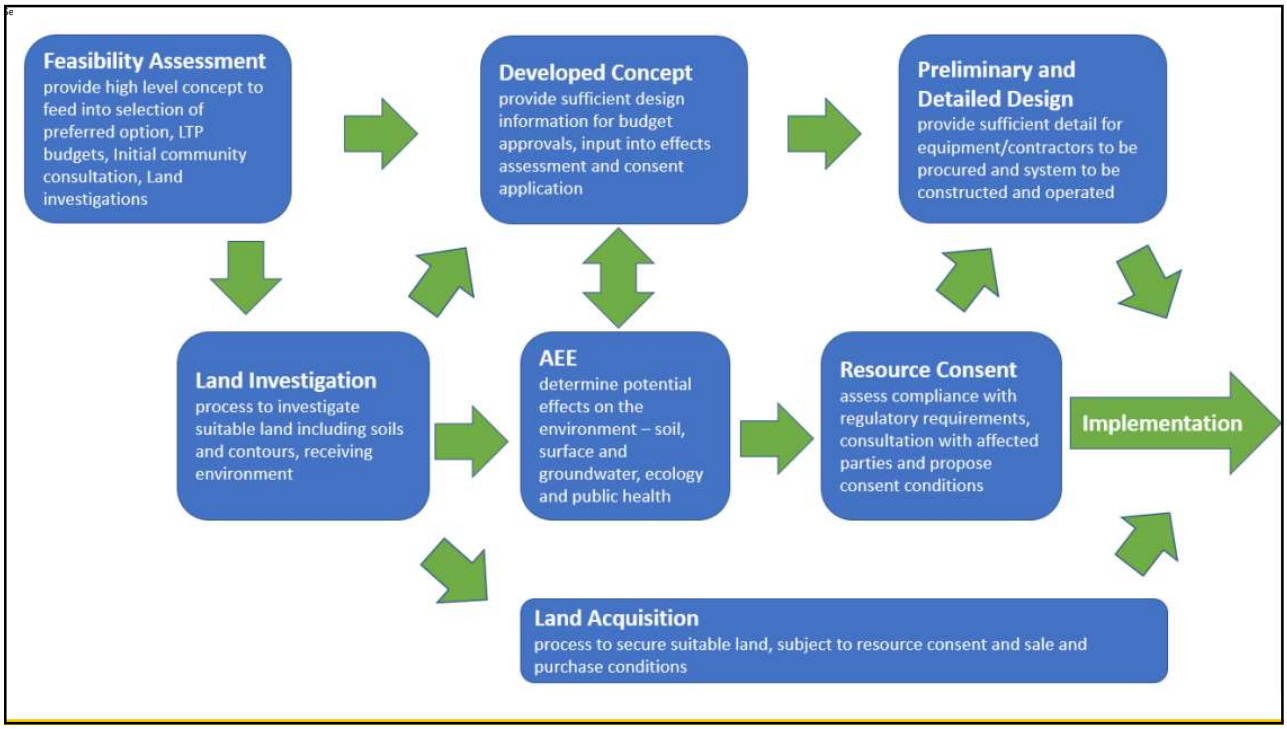

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Selection of Land Application Sites for Taipa

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Discharge to Land Analysis

- Desk-top GIS investigation – c.f. Kaikohe, Kaitaia, Hihi, Rawene and Kaeo Wastewater Treatment Plants
- Ben Bowden (FNDC) has completed initial assessment of land parcels
- Building on work by AECOM in 2018
- Next steps for establishing long list of sites

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Discharge to Land Analysis - Current

Define Area of Interest

- Using the Taipa WWTP as a central point, an area of interest is developed using a 10km radius

Exclude Non-Viable Land

- Calculate land area requirement
- Exclude unpractical land:
  - Slope >12 Degrees
  - Poor Drainage Soil
  - Flood Land
  - Waterways
  - Urban Zoned Land

Rank Viable Land

- Rank viable land based on practicality:
  - Drainage Level
  - Land Area
  - Slope
  - Distance from WWTP
  - Regularity of Site

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Lunch Time

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Discharge to Land Analysis – Next Steps

Run Multi-Criteria Analysis (MCA)

- Score the top 10 ranked options based on non-quantitative information such as:
  - Current Land Use
  - Land Cover
  - Proximity of active bores
  - Cultural Impacts?
  - Etc.

Initial landowner discussions

- Approach landowners of preferred sites
- Landowner buy in will be a key factor in selection of preferred option

Identify Preferred Site for Cost Analysis

- Based on the results of the MCA, identify a preferred option to go forward for a cost analysis:
  - This will be at -30 to 50% accuracy due to desktop nature.

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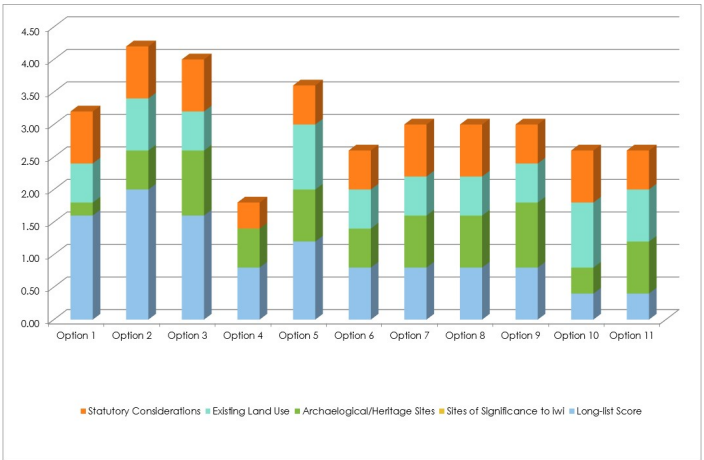
Multi-Criteria Analysis (MCA) - Example



The MCA will assess non-quantitative aspects of the discharge to land sites.

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Multi-Criteria Analysis (MCA)

- What we want to do today is agree on what criteria we want to assess and how much weighting those criteria should have

Long-list Score
Sites and values of significance to iwi (Marae, Treaty Settlement Land, NZAA, Freehold Land)
Archaeological/Heritage sites (NZAA)
Existing Land Use (Land cover, Aerials, LINZ Land use)
Statutory Considerations (SNA, Wetlands)

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MCA Criteria proposed by Jacobs (April 7, 2020)

Table 3-1 Proposed MCA Criteria for East Coast WWTP Options Assessment

Criterion	Description	Success Factors
Effluent Quality	The degree to which the effluent quality exceeds the minimum environmental and consent requirements.	Level of treatment exceeds the minimum requirement High quality effluent Future proofs plant against possible stricter effluent standards in future.
Public Health	Impacts of the discharge on contact recreation and shellfish gathering in the harbour.	Harbour is safe for shellfish gathering and primary contact recreation at the edge of the mixing zone.
Aquatic Ecosystems	Impacts of the discharge on aquatic ecosystems	No adverse effects on aquatic ecosystems at the edge of the mixing zone.
Amenity Values	Impacts of the discharge on the amenity values of the harbour.	No conspicuous changes in color or clarity of the harbour water due to the discharge. No other adverse effects on the harbour amenity values
Cultural Values	Impacts on Maori cultural values and practices.	Disposal of treated wastewater safeguards Maori cultural values and expectations
Confidence of Success	The level of confidence that the proposed improvement can be successfully implemented.	Enough information exists to be confident of success Commonly used technology New Zealand examples to base performance on New Zealand based vendors
Reliability	The ability to handle summer population peaks and wet weather flows whilst maintaining consistent effluent quality.	Consistent effluent under variable influent conditions Handles summer peak Handles wet weather flows
Operability	The ease of operation and maintenance and the amount of operator input, and skill needed to operate the process.	Similar operation and equipment to other plants nearby Simple to operate Low maintenance requirement
Affordability	Capital and operating cost impact on ratepayers.	No or minimal increase in rates Ability to stage upgrades over time

Establishing the Best Practicable Option (BPO)

BEST PRACTICABLE OPTION (BPO)

- BPO for land application to be determined
- Consider WWTP upgrades and water discharge options?
- Taking two options forward?
- Due date for BPO: 1 September 2022 (Condition 10)
- Future Proofing – due dates for implementation:
  - Commit to land disposal by 1 July 2023 (Condition 11)
  - Implement land disposal by 1 September 2027 (Condition 12)
  - Or Upgrade WWTP by 1 September 2026 (Condition 13)

beca

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Developing the BPO – Land Application

Long List assessment

- Determine top 5-10 sites to be considered at Workshop #2
- Issue memo to Working Group in advance
- High level traffic light assessment during workshop

Short List Assessment

- Landowner discussions to commence
- Develop short list of sites to progress
- Undertake high-level concept design and initial cost estimate
- Issue memo to Working Group
- MCA assessment during Workshop #3

Determine Preferred land parcels

- Refine the emerging preferred option
- High level assessment of potential environmental effects and resource consent considerations
- Present findings at Workshop #4
- Confirm BPO

beca

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Developing the BPO – WWTP Upgrades

Long List assessment

- Using Workshop #1 discussions, determine options to consider at Workshop #2 (water and land discharge options as per consent)
- Issue memo to Working Group
- High level traffic light assessment at Workshop #2

Short List Assessment

- Do we progress with water discharge option to short list phase?
- Develop short list of options
- Undertake high-level concept design and initial cost estimate
- MCA assessment during Workshop #3

Determine Preferred option

- Refine the emerging preferred option for WWTP
- High level assessments and consent considerations
- Present findings at Workshop #4

Finalise BPO

- At Workshop #4, Working Group to finalise overall BPO
- Determine way forward

beca

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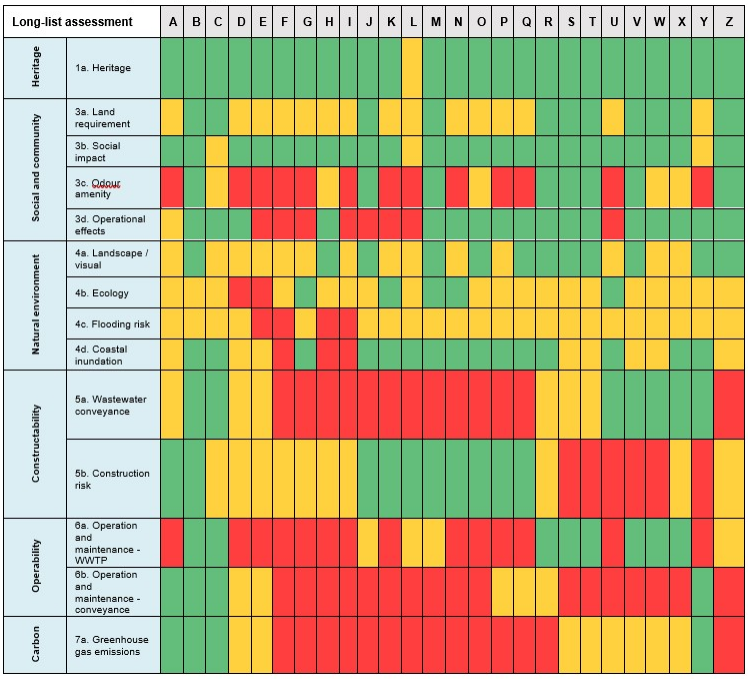
Traffic Light Assessment – Methodology Example

	Meets criteria well
	Marginally meets the criteria
	Does not meet the criteria

beca

30



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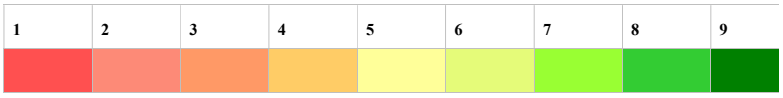
Full Multi Criteria Analysis (MCA) – Methodology Example



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	Short-list assessment	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
Heritage	2a. Heritage	7	7	7	7	7	7	7
	2b. Archaeology	7	7	7	7	7	7	7
Social and community	3a. Land requirement	6	6	7	7	5	5	9
	3b. Social impact	7	6	7	7	6	6	7
	3c. Odour amenity	8	6	8	8	5	4	8
	3d. Operational effects	7	7	6	7	6	6	8
Natural environment	4a. Landscape / visual	7	7	6	7	5	5	8
	4b. Ecology	6	6	8	8	7	3	9
	4c. Flooding risk	5	5	7	7	4	6	7
	4d. Risk of coastal inundation	8	8	7	7	8	7	7
	4e. Highly Productive Land	5	5	5	5	5	5	9
Constructability	5a. Wastewater conveyance	8	7	3	4	5	4	1
	5b. Construction risk	8	8	7	7	5	5	2
	5c. WWTP construction footprint and other engineering considerations	8	8	5	8	7	3	7
Operability	6a. Operation and maintenance	8	8	8	8	7	6	7
	6b. Hydraulic considerations	9	8	4	4	5	3	1
	6c. Short-term serviceability	4	4	2	2	3	3	5
Carbon	7a. Capital greenhouse gas emissions	9	7	3	6	6	7	1
	7b. Operational greenhouse gas emissions	1	1	1	1	1	1	1
Reuse	8a. Wastewater Reuse	7	9	8	9	7	7	9

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BEST PRACTICABLE OPTION (BPO)

- Where to from here?
- How to define the BPO
- Expectations for each of the Working Group workshops

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Future Workshops and Dates

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FUTURE WORKSHOPS AND DATES

- **Workshop #2** – Practical Options and Long-List assessment (May/June 2022)
- **Workshop #3** – Short-List Options Workshop (early July 2022)
- **Workshop #4** – Confirmation of the Best Practicable Option (early August 2022)

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Questions and Discussion

Minutes of Meeting

Taipa Wastewater Transformation Project

Workshop 1 - Whakawhanaungatanga

Held 3rd May 2022 at 10am – 2pm

at Te Ahu Center, Kaitaia

Present:

Working Group members:

Hikitia Hita – Ngāti Kahu representative (Ngati Tara/ Te Mana o Te Wai Hapu Integration Roopu Charitable Trust)

Julie Rickit – Ngāti Kahu representative from (Ngati Whata/ Te Mana o Te Wai Hapu Integration Roopu Charitable Trust)

Trudy Allen – Ngāti Kahu representative (Matakairiri/ Te Mana o Te Wai Hapu Integration Roopu Charitable Trust)

Andreas Kurmann – Community representative (Te Mana o Te Wai Hapu Integration Roopu Charitable Trust/ Clean Waters to the Sea – Tokarau Moana Charitable Trust)

Mandy Wilson - Senior Infrastructure Consents Planner (Far North District Council)

Melissa Parlane (via teams) - Asset Manager - 3 Waters (Far North District Council)

Other FNDC staff:

Ben Bowden - Intermediate Infrastructure Planner (Far North District Council)

Workshop facilitators:

Garrett Hall – Technical Director – Environments (Beca)

Brigette Priestley – Associate Environmental Scientist (Beca)

Apologies:

None

Distribution:

All attendees

Minutes of Meeting

Item	Action
1 Introductions and Karakia HH opened meeting with Karakia at 10am. Working group were invited to introduce themselves and share what they wanted from the workshops. • Clean wai to hapu standards (not just consent standards) • Want to remove the discharge to the wai • Loss of shellfish / pipi beds diminished at Awapoko (mouth of the river) – want to restore kia collecting • Past work has been all talk, no action – need to see action Beca introduced their team: • Environmental team - Garrett Hall, Brigette Priestley and Farza Feizi • Wastewater engineering team – John Crawford (Technical Fellow – Wastewater), Claire Scrimgeour (Principal– Environmental Engineering), and Jolanta Liutkute (Senior Process Engineer). • Planning team - Leon Keefer	
2 Work Done to Date Working group discussed work previously completed by AECOM and Jacobs, and by the Working Group to date. • Initial desktop studies indicate there is some suitable land to discharge to. A key challenge in successfully implementing a discharge to land scheme is the often-complex land access negotiations. • AECOM study in 2018 looked at different Wastewater Treatment Plant (WWTP) upgrade options. Working group said MBR had already been identified as too expensive. • Previous study by AECOM on site selection for land disposal – those landowners were sent letters; a meeting was held but Council only spoke about costs and rates. Landowners had bad taste in their mouth after this meeting. The biggest issue was that the Council wasn't proposing any improvements to the wastewater (WW) discharge – any future land discharge needs to include WWTP improvements. Needs to be free of pathogens. • Working group had not seen the Jacobs long list memo from April 2020. This was prepared after the appeal. • Options from the Jacobs 2020 report – Options 4 and 5 are not acceptable to the working group. • Beca noted that WW quality should match land use and soil type. Options for the upgrade of the WWTP should be addressed with respect to the type of discharge (land discharge or water discharge).	MW to send copy of Jacobs (April 2020) report – *completed by time minutes were issued*

Minutes of Meeting

Item	Action
• Agreed that we will not progress any options that includes a new ocean outfall or discharge to Oruru River. • Working group raised the Mission Statement prepared which outlines standards for WW to be discharged to land. Noted that the parameters and limits in the consent order are minimums to be achieved and the project should consider how these can be improved, where possible. • Landowners want to know about the quality of the wastewater and how it will be improved. Want to know about effects / benefits on their land. Don't want untreated sewage on their land. Future approach to landowners to provide transparent information and get community buy in. Working group suggested having a meeting with the community. • Beca noted that cannot use dairy farmland due to Fonterra restrictions.	
3 National Wastewater Matters GH presented on national matters including Taumata Arowai. • Taumata Arowai is a new government body. Came into effect in November 2021. Due to inconsistencies across Councils. Charged with developing standards for wastewater. • TA asked if the iwi chairs were involved? Working group discussed matters of governance: • TA gave example from their work at Taipa bridge. Looking to take this governance model to a national level. • Working group supported monitoring of works by trained hapu who can check for archaeology and other environmental effects during works. TA has been trained and is training others. • Key learnings from work at Taipa bridge – need to be clear on individual roles. Need to have a cohesive overview; not just dealing with individual parties, need to bring them all together to hui. • HH is doing work in whitebait spawning and solutions to bring the whitebait back to the wai.	BP to send link to Taumata Arowai website– *completed by time minutes were issued* GH to send link to the WW sector report – *completed by time minutes were issued*
4 Land Application Schemes in New Zealand GH provided overview of three other land discharge wastewater projects. • The most notable of these projects is the Raglan Wastewater Project where we have worked through long-list and short-list decision making frameworks and are currently assessing three short-listed land discharge sites alongside project partners. This project is directly comparable to Taipa as both have complex consenting and Environment Court appeal histories.	

Minutes of Meeting

Item	Action
• Other projects also discussed were Takapau and Te Paerahi/Porangahau in Central Hawkes Bay. Landowners interested there in receiving treated wastewater as an irrigation source water. • Management of irrigation in winter is a key issue when soils are too wet. In Takapau a river discharge is proposed when soils are too wet and wastewater storage has been fully used up. In Porangahau a high-rate irrigation system to coastal dunes will manage wet weather flows. Working group interested in how the landowners were contacted / expressions of interest undertaken. Suggested learning from approaches taken.	GH to send links to websites for these projects to MW – *completed by time minutes were issued*
5 Selection of land application sites for Taipa BB provided overview of his work to date selecting land parcels through GIS desktop assessment. Site number 1 from his assessment is the same as site 3 from the AECOM work. BB has established a total of 60ha of land is needed (accounting for future flows). Landowner buy-in identified as key to obtaining a land disposal site. Long list of sites to be a list of "viable sites" but actual selection of the site will depend on getting landowner agreement. Suggest starting this process sooner rather than later due to tight deadline for Condition 10 report (1 September 2022). Working group proposed having expression of interest / community communication website for landowners to learn more about WW discharge to land. This should communicate to the community why a land discharge location is needed and what happens if nothing changes. Communicate benefits of 're-use of water'. BB presented the next steps for his work. MCA analysis to be undertaken to short list the land disposal sites. • BB asked about cultural sites / is Māori land to be excluded? • Working group agreed that Māori land could be considered if WW quality improved – working group members would want to speak to their own hapu / whanau about this. • Need to know the land disposal sites before identifying the cultural impacts to be considered. • Could Taipa farm be used? (Was noted that it is opposite the school and area has high water table. Land might not be suitable). Working group asked for long list of top 10 sites prior to next workshop in order to assess cultural impacts and have conversations with any landowners who are whanau.	MW to prepare content for FNDC website BB and GH to issue list of land disposal sites

Minutes of Meeting

Item	Action
6 Establishing the Best Practicable Option (BPO) Beca noted that we are required under the consent order to consider both water discharge and land discharge options in the initial long list for the BPO. Beca raised potential issue – what happens if we cannot secure land within timeframes set out in the consent order. Do we want to have a back up water discharge option that can be a fall back, rather than having to start again if land discharge falls through? Beca identified their next steps: • BP and GH to work with BB on long list of land application sites to present to the working group on 19th May. To then discuss how landowners/Taipa community will be approached/involved in the project. • Present long list of application sites and WWTP upgrade options in memo to be issued to the working group prior to next workshop. • Undertake traffic light assessment (yes/no/maybe) for each option at next workshop. • Beca to provide proposed list of possible MCA criteria for the working group to discuss and agree prior to short list phase. • Short-list the options using MCA assessment during Workshop #3. • Undertake high level assessments including cost estimates for the short-listed options and present at Workshop #4.	BP to organise Teams meeting for 19th May – *completed by time minutes were issued* BP to circulate long list criteria prior to next hui on 31st May
7 Future Workshops and Dates Working group agreed dates for next workshops. • Workshop #2 – 10am Tuesday 31st May • Workshop #3 – 10am Tuesday 5th July • Workshop #4 – TBC Meeting closed 2pm. HH did closing karakia.	

Minuted by: Brigette Priestley

Long List Assessment

Workshop #2
31st May 2022

make
everyday
better.

1

AGENDA

- Welcome and Karakia
- Type of Discharge
- WWTP Upgrade Options
- Long List Assessment
- Land application sites for Taipa
- Confirmation of Short List Options

2

Welcome and Karakia

Type of Discharge

Consent Order Options

1) Upgrade the WWTP and discharge the treated wastewater to water at the quality standards set out in the consent order.

2) Move the discharge from discharge to water to discharge to land.

beca

5

Parameter	Unit	Median*	85% percentile*
Total Nitrogen	mg/L	12	16
TSS	mg/L	20	30
BOD	mg/L	20	40
DO	mg/L	>2	>2
pH		>6.5	>6.5
Total Phosphorus	mg/L	10	15
Faecal coliforms	CFU/100ml	1000	1500

*Based on pH8 and 20°C.

beca

6

WWTP Upgrade Options

WWTP Upgrades – Proposed Options

- Option 1: Pond upgrade with Tertiary filtration and Ultraviolet (UV)
- Option 2: Pond upgrade with Electrocoagulation, solids removal and UV
- Option 3: Convert ponds into pond based Sequenced Batch Reactor (SBR) with UV
- Option 4: Convert ponds into in pond Modified Ludzack-Ettinger (MLE) plant with UV
- Option 5: New standalone MLE plant with UV
- Option 6: New standalone Membrane Bioreactor (MBR) plant
- Option 7: New side stream Moving Bed Bio Reactor (MBBR) plant with tertiary filtration and UV
- Option 8: Bioshells in the ponds with Tertiary filtration and UV

Amiad Filtration System at Manangatang WWTP (Australia) – Example of Tertiary Filtration

source: Amiad Water Systems brochure

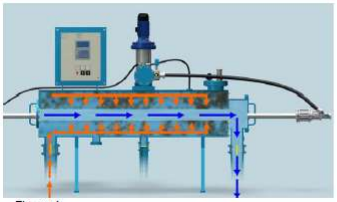

Figure 4

Figure 5

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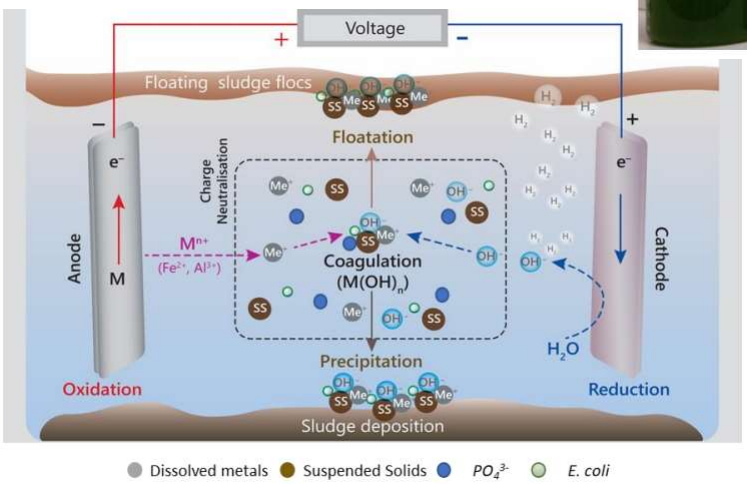
9

a. Changes in water colour



Electrocoagulation Process

source: www.waternz.org.nz

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10


Te Awamutu WWTP
(activated sludge
reactor retrofit)
Beca

11


Meremere WWTP
(New MBR Plant)

12

Paihia WWTP (Bioshells)

source: www.fndc.govt.nz

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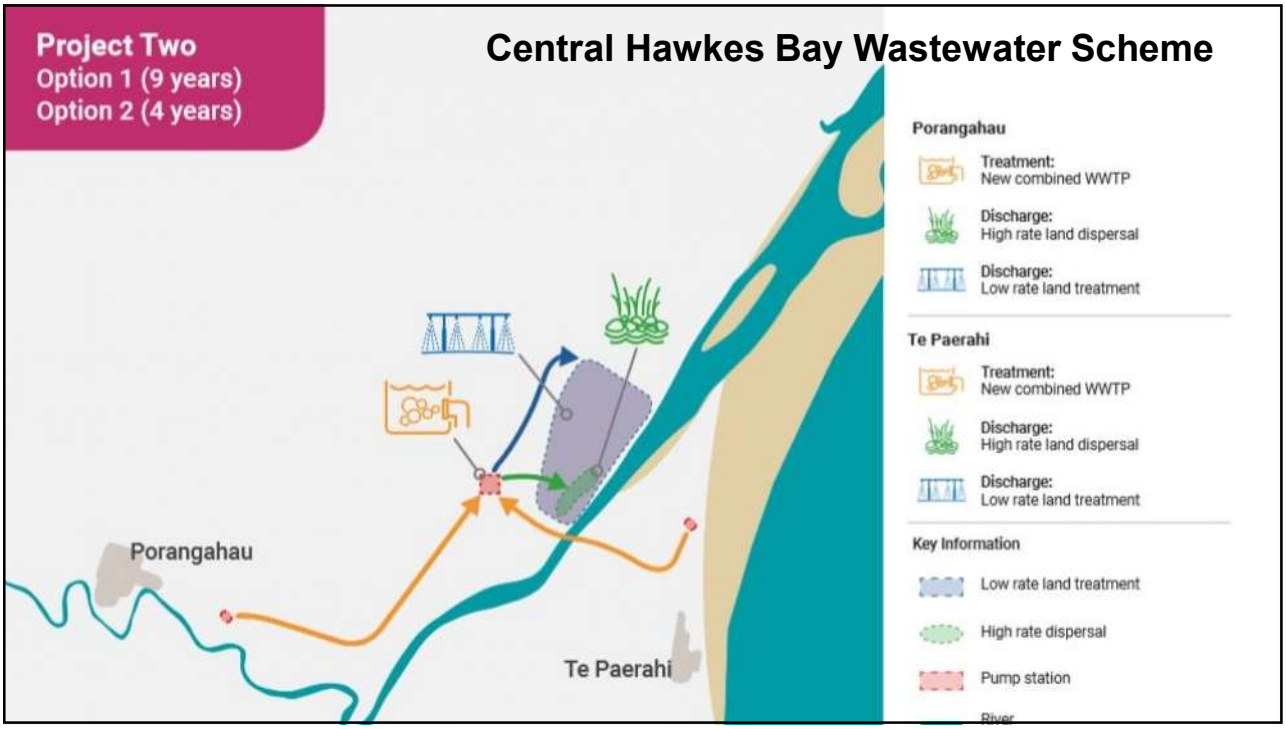
13

Central Hawkes Bay Wastewater Scheme

Project Two
Option 1 (9 years)
Option 2 (4 years)



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Morning Tea Time

Beca

15

Comparing the WWTP Options

- See Table from Long List Memo
- Wastewater quality is indicative

Beca

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Discharge to Land – Typical Treated Wastewater Standards

- There are no treated wastewater standards in NZ – each case by case
- However, typically:
  - Land area and application method the main determining factor
  - Pond treated wastewater is used commonly, with filtration and UV disinfection for surface spray (e.g. Porangahau, Foxton)
  - More advanced nutrient removal treatment has been used, but only for rapid infiltration type schemes (e.g. Pauanui into sands)
  - Nutrients normally managed in terms of an application rate (e.g. kg N/ha/yr)

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Types of Land Application

- **Slow Rate Irrigation** – irrigated to vegetated land surface as surface spray or sub-surface dripper (e.g. Taupō, Whangamata, Foxton, Masterton, Leeston and Rolleston)
- **Rapid Infiltration** - applied to earthen basins on high permeability soils, vegetation is not important (e.g. infiltration beds in Motueka, Cambridge, and Te Paerahi (Central Hawkes Bay) and infiltration trenches in Rotoiti-Rotomā)
- **Overland Flow** – flows over grassy land areas (e.g. Oamaru and Otaki wastewater discharge schemes)
- **Land Passage** – rock passage from WWTP discharge to waterway (e.g. Morrinsville, Hastings, Napier, Te Awamutu and Te Puke wastewater schemes)
- **Deep bore injection** – pumped into subsurface (e.g. Russell)
- **Mixed Discharge Systems** – different discharge types used simultaneously or at different times of the year (e.g. Blenheim, Fielding)

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Long List Assessment

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Traffic Light Assessment

	Preferred
	Less Preferred
	Not Preferred

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Type of discharge	Classification
Discharge of treated wastewater from the existing Taipa WWTP to land	
Discharge of treated wastewater from an upgraded Taipa WWTP to land	
Discharge of treated wastewater from an upgraded Taipa WWTP via the existing constructed wetlands to the Parapara Stream	
Discharge of treated wastewater from an upgraded Taipa WWTP via a new wetland system to the Oruru River	
Discharge of treated wastewater from an upgraded Taipa WWTP via a new ocean outfall	

beca

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WWTP Upgrades – Land Discharge

- Indicative wastewater quality standards
- Advantages versus disadvantages
- CAPEX/OPEX
- What are the most important element(s) to the Working Group?

beca

22

Working Group Activity

WWTP Options for Land Discharge	Classification
Pond upgrade with Tertiary filtration and UV	
Pond upgrade with Electrocoagulation and solids removal and UV	
Convert ponds into pond based SBR with UV	
Convert ponds into in pond MLE plant with UV	
New standalone MLE plant with UV	
New standalone MBR plant	
New side stream MBBR plant with Tertiary filtration and UV	
Bioshells in the ponds with Tertiary filtration and UV	

Beca

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Initial Beca Assessment

WWTP Options for Land Discharge	Classification
Pond upgrade with Tertiary filtration and UV	Low cost but variable quality. Do Minimum option.
Pond upgrade with Electrocoagulation and solids removal and UV	Improved quality but no large-scale examples in NZ, affordable option for improved quality
Convert ponds into pond based SBR with UV	Moderate costs but good quality, good for variable flow
Convert ponds into in pond MLE plant with UV	Moderate costs but good quality, higher CAPEX then Option 3, limited availability for expansion
New standalone MLE plant with UV	Good quality but high CAPEX
New standalone MBR plant	High Costs (CAPEX and OPEX). Not cost effective for land discharge.
New side stream MBBR plant with Tertiary filtration and UV	Moderate cost but variable quality, depends on quality preferred
Bioshells in the ponds with Tertiary filtration and UV	Moderate cost, depends on quality preferred as not as good as SBR. Limited examples.

Beca

24

WWTP Upgrades – Water Discharge

- Indicative wastewater quality standards
- Advantages versus disadvantages
- CAPEX/OPEX
- What are the most important element(s) to the Working Group?

Working Group Activity

WWTP Options for Water Discharge	Classification
Pond upgrade with Tertiary filtration and UV	
Pond upgrade with Electrocoagulation and solids removal and UV	
Convert ponds into pond based SBR with UV	
Convert ponds into in pond MLE plant with UV	
New standalone MLE plant with UV	
New standalone MBR plant	
New side stream MBBR plant with Tertiary filtration and UV	
Bioshells in the ponds with Tertiary filtration and UV	

Initial Beca Assessment

WWTP Options	Classification
Pond upgrade with Tertiary filtration and UV	Does not meet consent standard
Pond upgrade with Electrocoagulation and solids removal and UV	Does not meet consent standard
Convert ponds into pond based SBR with UV	Meets consent standard; moderate costs
Convert ponds into in pond MLE plant with UV	Meets consent standard; moderate costs
New standalone MLE plant with UV	Meets consent standard; moderate to high costs; longer lasting; consistent quality
New standalone MBR plant	Meets consent standard; high costs; longer lasting; consistent quality
New side stream MBBR plant with Tertiary filtration and UV	Does not meet consent standard
Bioshells in the ponds with Tertiary filtration and UV	Does not meet consent standard

Beca

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Lunch Time

Beca

28

Land Application Sites

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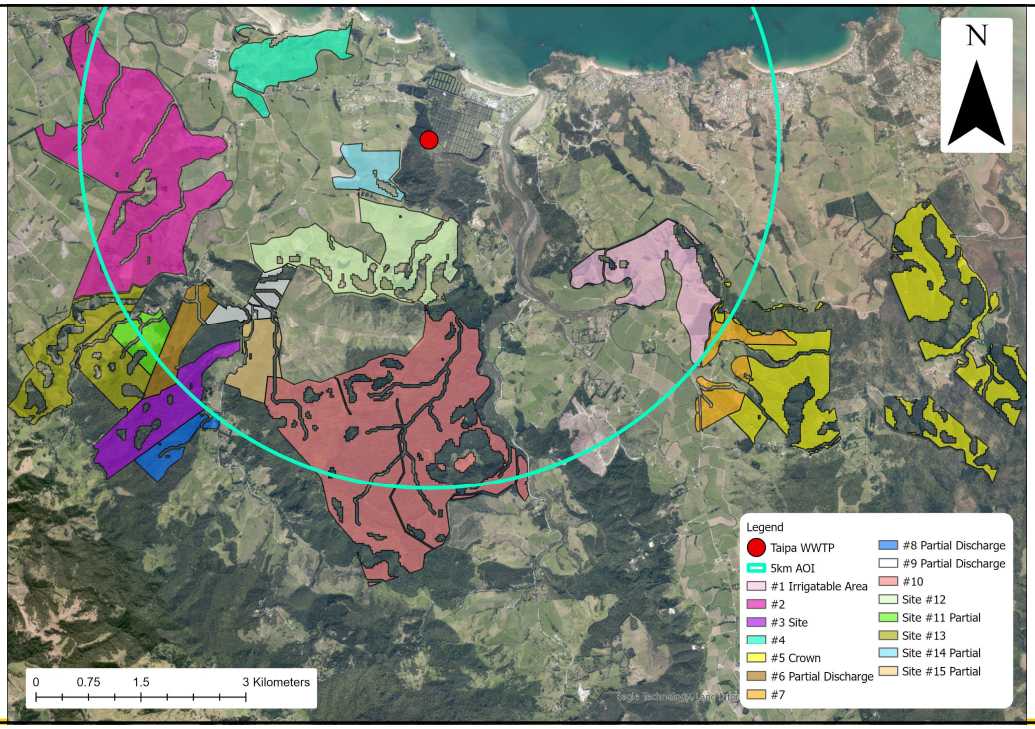

30

Top 15 Sites

- Whenua Taonga (landmarks) – Update from Ben
- Any community/whanau connections with these land parcels?
- Any No Goes?

beca

31

Community Engagement

- Update from FNDC on the the initial contact approach
- High-level on a project specific webpage
- Next steps

beca

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Short List of Options

33

Short Listing the Options

- Options to take forward for **Land Discharge?**
- Options to take forward for **Water Discharge?**

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Working Group Activity

WWTP Options	Take Forward to Short List?
Pond upgrade with Tertiary filtration and UV	
Pond upgrade with Electrocoagulation and solids removal and UV	
Convert ponds into pond based SBR with UV	
Convert ponds into in pond MLE plant with UV	
New standalone MLE plant with UV	
New standalone MBR plant	
New side stream MBBR plant with Tertiary filtration and UV	
Bioshells in the ponds with Tertiary filtration and UV	

Beca

35

Initial Beca Assessment

WWTP Options	Take Forward to Short List?
Pond upgrade with Tertiary filtration and UV	Maybe (do minimum) - land
Pond upgrade with Electrocoagulation and solids removal and UV	Yes – land
Convert ponds into pond based SBR with UV	Yes – land or water
Convert ponds into in pond MLE plant with UV	No
New standalone MLE plant with UV	No
New standalone MBR plant	Maybe - water
New side stream MBBR plant with Tertiary filtration and UV	No
Bioshells in the ponds with Tertiary filtration and UV	Maybe - land

Beca

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Minutes of Meeting

Taipa Wastewater Transformation Project

Workshop 2 – Long List Assessment

Held 31st May 2022 at 10am – 2.30pm

at Te Ahu Center, Kaitaia

Present:

Working Group members:

Hikitia Hita – Ngāti Kahu representative (Ngati Tara/ Te Mana o Te Wai Hapu Integration Roopu Charitable Trust)

Julie Rickit – Ngāti Kahu representative from (Ngati Whata/ Te Mana o Te Wai Hapu Integration Roopu Charitable Trust)

Trudy Allen – Ngāti Kahu representative (Matakairiri/ Te Mana o Te Wai Hapu Integration Roopu Charitable Trust)

Andreas Kurmann – Community representative (Te Mana o Te Wai Hapu Integration Roopu Charitable Trust/ Clean Waters to the Sea – Tokarau Moana Charitable Trust)

Mandy Wilson - Senior Infrastructure Consents Planner (Far North District Council)

Melissa Parlane - Asset Manager - 3 Waters (Far North District Council)

Other FNDC staff:

Ben Bowden - Intermediate Infrastructure Planner (Far North District Council)

Workshop facilitators:

Garrett Hall – Technical Director – Environments (Beca)

Brigette Priestley – Associate Environmental Scientist (Beca)

Apologies:

None

Distribution:

All attendees

Minutes of Meeting

Item	Action
1 Welcome and Karakia HH opened meeting with Karakia at 10.15am.	
2 Type of Discharge Working group discussed the consent order and the options. Wastewater Treatment Plant (WWTP) upgrades for both a water discharge and a land discharge have been considered by Beca and will be presented in the Long List Memo.	
3 WWTP Upgrade Options Beca presented the proposed WWTP upgrade options to be considered for either land discharge and / or water discharge. Option 1 – Tertiary filtration system. This is the Do Minimum option. Clarifier and UV for suspended solids and pathogen removal. No Nitrogen removal. This type of system is used at other land application schemes. Algae build up requires backwashing (needs a clean water source to washing). Option 2 – Electrocoagulation (EC) plant. AK suggested that this type of system does not require clarification and UV; some remaining algae can be beneficial for land application as a source of Nitrogen (N) and Phosphorus (P). Option 3 – Sequenced Batch Reactor (SBR) plant. This option allows for variable flow including summer and winter loadings. This system produces a large amount of sludge which requires a continuous dewatering system. Have had some issues with aerators breaking off and damaging the pond liner in other locations (such as Te Awamutu), however that WWTP has operated successfully for over 20 years with a very cost effective upgrade. Options 4 and 5 – Modified Ludzack-Ettinger (MLE) plant. This option requires constant flow (c.f. SBR which allows for variable flows). System needs to be managed carefully for flow as good bacteria can get washed out. Have had some issues with aerators breaking off and damaging the pond liner (pond based MLE) - same issues as Option 3. Option 6 – Membrane Bioreactor (MBR) plant. Can manage high flows. Peak flows go to the ponds (still go through UV). Dry weather flows all go through the MBR. System can be very expensive, however are becoming cheaper as these WWTP's become more common. Option 7 – Moving Bed Bio Reactor (MBBR) plant. This is a side stream treatment option. The effluent is divided into 2 streams and only one stream	AK to send on his EC studies – *completed by time minutes were issued*

Minutes of Meeting

Item	Action
goes through the MBBR plant. Treatment quality is moderate, but can be more variable than SBR or MLE. Option 8 – Bioshells. Paihia use of Bioshells focused on ammonia removal generating higher nitrates. Requires alkalinity management. AK suggested that this type of system could also include a denitrification process to remove the nitrogen following the ammonia to nitrate conversion (this has been incorporated into Beca concept). Working group discussed the following: • *How did Beca come up with the options?* BP responded - Beca selected a range of options including new technologies, established technologies, pond conversion options, and a do minimum option. • *Was EC selected for the short list because of AK's interest/suggestion?* BP responded - EC was considered in general because of Working Group interest but was suggested for short listing because it offers a moderate cost option with improved wastewater quality (better than option 1). • Designing for sustainable growth is key to the Working Group. Options that allow for population growth are preferred (such as MLE or SBR). • Working Group also raised susceptibility to climate change as a key issue. • SBR was a popular option with the group as it allows for variable flow and projected future use. • AK asked if we should look at options for methane gas removal. Beca responded that this could be considered later but out of scope for this part of the project. GH discussed the Central Hawkes Bay wastewater scheme. Moving from a discharge to the river from Porangahau WWTP and a discharge to the sand dunes (waahi tapu) from Te Paerahi WWTP to a new combined WWTP with a land disposal scheme. Staged approach – sand dune discharge to end in 4 years, river discharge to end in 9 years. Discharge to be via low rate irrigation (farm land) with a peak flow high rate land dispersal area. GH also discussed Meremere side-stream MBR. Very high quality discharge, where peak wet weather flows are balanced in the pond and dry weather flows receive full treatment through the MBR. Wastewater standards for discharge to land discussed; • Nutrients normally managed in terms of an application rate (e.g. kg N/ha/yr), dependent on types of soils and ability to take up nutrients in combination with land use (e.g. crop/forestry).	

Minutes of Meeting

Item	Action
• AK supports high quality wastewater – easier to sell the reuse of water then wastewater. Also minimises risk of leaching. GH noted that this may cause issues by pushing nutrients down through to groundwater and associated problems in surface waters. GH noted that in NZ there are few year round irrigation systems, most stop irrigating in winter and rely on storage or discharge to purpose built high-rate irrigation zones. • Slow rate irrigation systems are more plausible in Taipa due to clay soil types but will likely require winter storage for approximately three months per years when the soils are too saturated. Further investigations are required on this.	
4 Long List Assessment BP provided overview of the long list assessment process. • A Traffic Light Assessment approach was taken. • Beca provided their initial traffic light assessments for the WWTP options to the group and invited the working group to assess the options using the traffic light system. Agreed this would be done in a follow up online hui to allow working group to familiarise themselves with the options.	
5 Land Application Sites BB provided overview of his work on the top 11 to 15 sites. None of the land parcels were noted as being 'No Goes' by the Working Group. BB presented the Taipa population growth options. Will need 62ha for discharge to land accounting for buffers and onsite storage space. This also allows for flexibility and growth. BB presented the cultural map. Sites 12 and 14 intersect with the identified cultural zones. TA clarified that sites 12 and 14 should not be excluded on this basis but the working group should be aware of the areas. Need to have hapu/iwi level conversations about the sites of cultural significance and whether there are any issues. HH noted that there is iwi opposition to having the land application in the Parapara catchment due to it not being the WWTP for that catchment. Want to keep the wastewater in the Oruru catchment. GH noted the need to re-imagine the wastewater as a resource / benefit. MW went over the top 15 land parcels to clarify who from the Working Group knows the landowners. MW completed a spreadsheet with the proposed next actions for each of the sites.	Working Group to approach landowners as per the spreadsheet

Minutes of Meeting

Item	Action
Project Website: The website will be available before the Working Group go to talk with the landowners of the 15 sites. Website needs to be clear that Council is approaching landowners with regards to land discharge of treated wastewater from the Taipa WWTP. Need to be clear in our discussions with the landowners that we are not looking to buy land this year (and it could be a lease instead). TA suggested a 'community day' at the Taipa Resort rather than the Marae so that the discussions on Taipa WWTP don't get lost in other hapu matters. Working Group suggested a brochure be prepared to hand out to all the landowners (even if they aren't interested, so that they know who to contact if they change their mind).	MP to provide update on status of the website – *completed by time minutes were issued*
6 Short List of Options Beca presented their initial assessment of the options and their suggestions on which options should be taken forward to the shortlist. Working Group to complete the shortlisting exercise at a follow up online hui on 7th June at 1pm.	BP to set up online hui – *completed by time minutes were issued*
7 MCA Criteria Beca mentioned the proposed MCA criteria briefly. To be discussed at the online hui on 7th June 2022. Meeting closed 2.30pm. HH did closing karakia.	

Minuted by: Brigette Priestley

Short List Assessment

Workshop #3
5th July 2022

make everyday better.

1

AGENDA

- Welcome and Karakia
- Land Application Sites
- WWTP Upgrade Options
- ~~MCA for Short Listed Options~~
- ~~Emerging Preferred Option~~

2

Welcome and Karakia

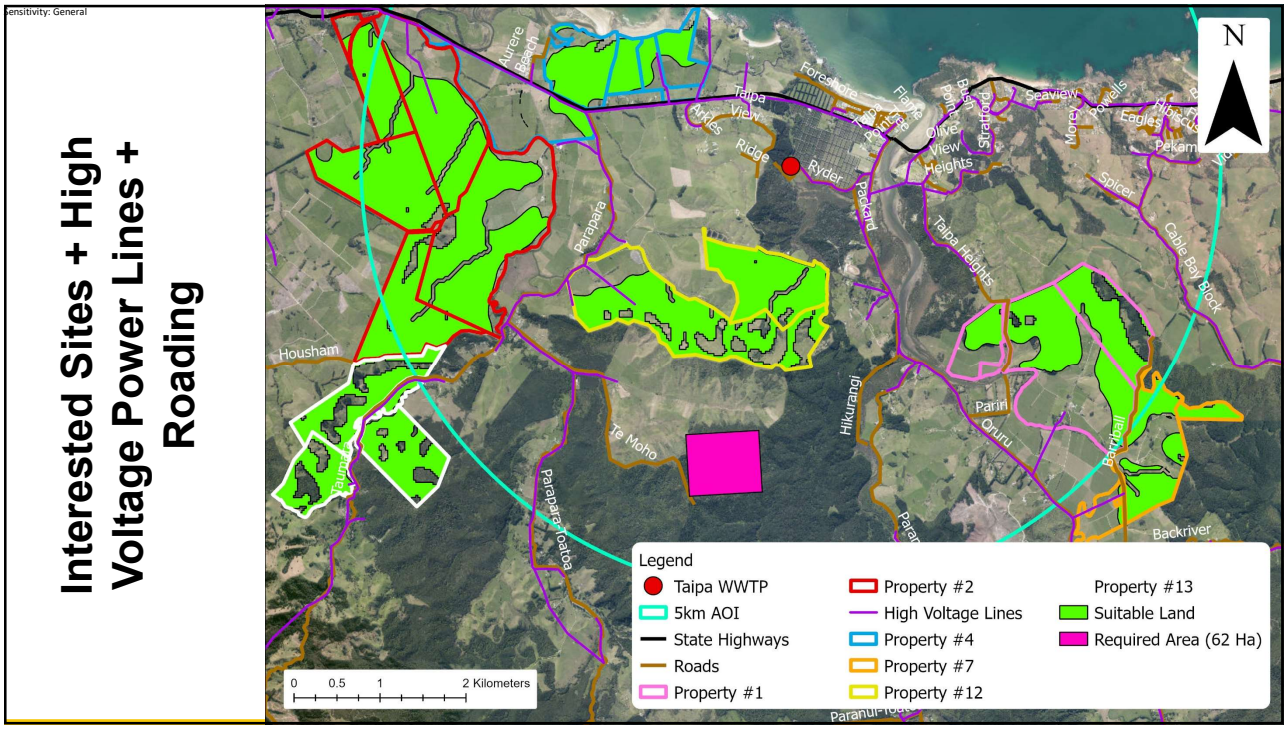
beca

3

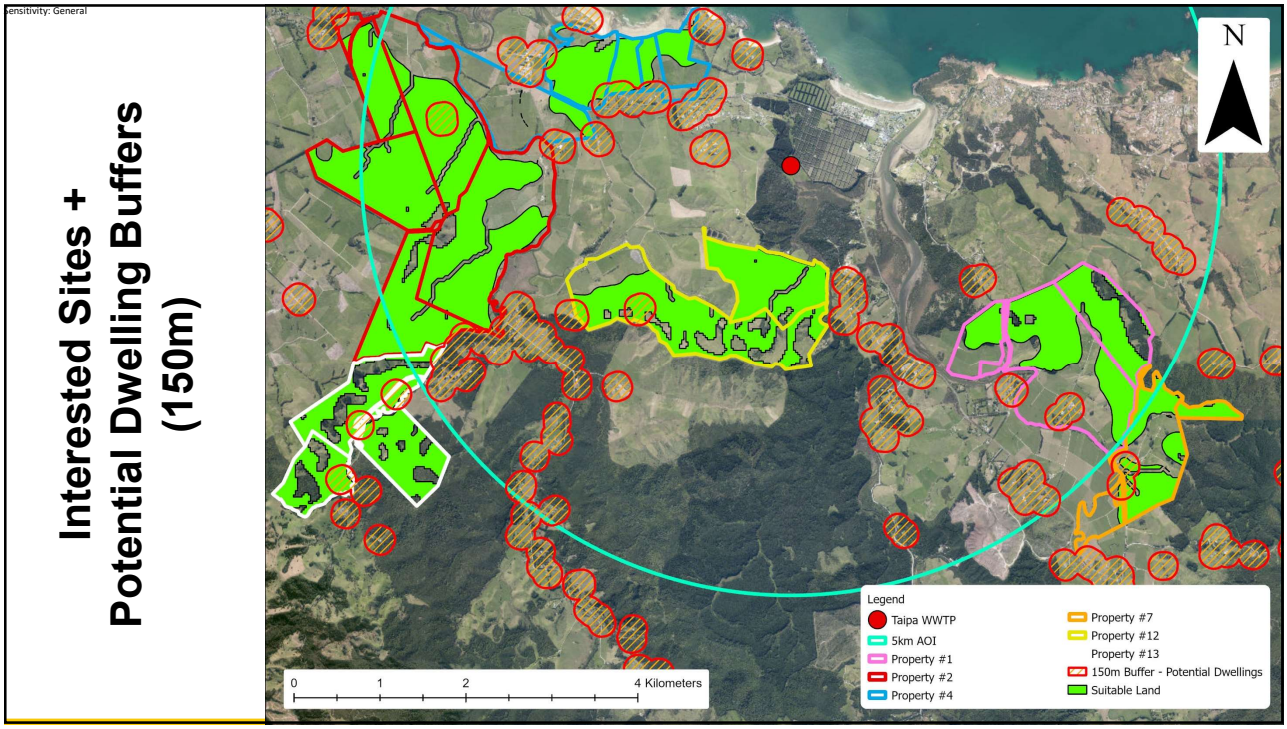
Land Application Sites

beca

4

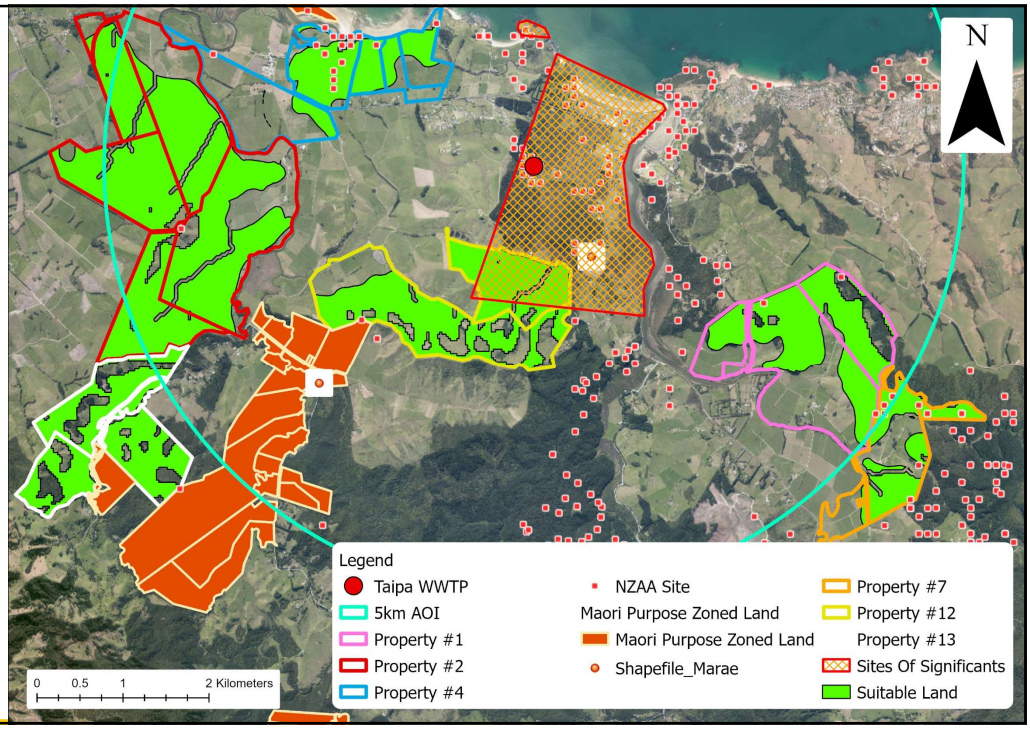

Sensitivity: General
Interested Sites + High Voltage Power Lines + Roading
N
Aurere Beach
Foreshore
Taipa View
Arkles
Ridge
Ryder
Flat Rock
Point
Olive View Heights
Stratford
Seaview
Morey
Powells
Eagles
Pekamu
Spicer
Packard
Taipa Heights
Cable Bay Block
Parapara
Housham
Te Moho
Hikurangi
Parin
Oruru
Bardbail
Backriver
Parapararoatoa
Legend
Taipa WWTP
5km AOI
State Highways
Roads
Property #1
Property #2
High Voltage Lines
Property #4
Property #7
Property #12
Property #13
Suitable Land
Required Area (62 Ha)
0 0.5 1 2 Kilometers

5


Sensitivity: General
Interested Sites + Potential Dwelling Buffers (150m)
N
Legend
Taipa WWTP
5km AOI
Property #1
Property #2
Property #4
Property #7
Property #12
Property #13
150m Buffer - Potential Dwellings
Suitable Land
0 1 2 4 Kilometers

6

Interested Sites + Cultural Sites of Significance



7

Property # and Owner	Land Use	Distance	Suitable Land Area (60 req.)	Predicted Drainage	Relative Level (m) from WWTP (7m pump)	Slope	Ben's Ranking + Notes
1 – B. Hickey	Dairy	Direct: 2.3km Road: 8.9km Paper: 4.4km	156 Ha	Well	Main: 6m (13) Paper: 94m (101)	Steep	**6 – Dairy operated on at least part of the property. High slopes in parts and far away.**
2 – D. O'Callaghan	Dry Stock (TBC)	Direct: 2.8km Road: 7.4km	447 Ha	Well	Main: -4m (3) Point: 4m (11)	Flat	**1 – Huge flat land with good drainage… if only it was slightly closer**
4 – F & L Matthews	Dry Stock (TBC)	Direct: 1.5km Road: 3.8km	90 Ha	Moderate	Main: 9m (16) Point: 20m (27)	Moderate	**2 – Good middle ground option. Close and reasonably practical site**
7 – T. Garton	Dry Stock (TBC)	Direct: 4.7km Road: 8.3km	65 Ha	Well	Main: 6m (13)	Flat	**4 – Least amount of "extra land" to play with. Pretty far away.**
12 – G & M Smith	Dry Stock (TBC)	Direct: 1km Road: 7.2km CWL: 0km	186 Ha	Imperfect	Main: 7m (14) Point: 6m (34)	Steep	**3 – Barely any piping needed due to it bordering CWL. Worst Drainage, cultural concern?**
13 – B. Mumby	Dry Stock (TBC)	Direct: 4.6km Road: 9.8km	133 Ha	Moderate	Main: 7m (14)	Steep	**5 – Furthest & steepest site… Dry Stock and large amount of land though**

8

Selecting the Land Application Site

- **Top 3 land application sites**
- **Next Step –** Meeting with landowners by 15th July
- **Costing of land discharge scheme** – 3 weeks from confirmation of preferred site
- **Method of application** – depends on site selected

beca

9

Next Steps

- Confirm selected land application site by 15th July
- Cost estimate for land application scheme by 5th August
- Next workshop on 9th August @10am
- Need to confirm BPO at WKS 4
- Condition 10 report to be issued for review 2 weeks later (23rd August)
- Report to be finalised by 30th August for submission by 31st August

beca

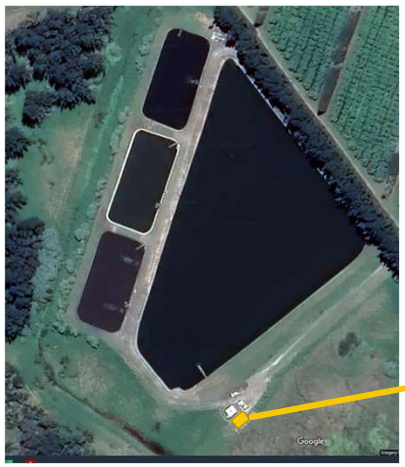
10

WWTP Upgrade Options

Short List Options

- **Scheme A –** Discharge to land (site to be confirmed) – pond upgrade to tertiary filtration and UV
- **Scheme B –** Discharge to land (site to be confirmed) – pond upgrade with electrocoagulation, solids removal and UV
- **Scheme C –** Discharge to land (site to be confirmed) – convert ponds into pond based SBR and UV
- **Scheme D** – Discharge to water - convert ponds into pond based SBR and UV
- **Scheme E –** Discharge to water – new standalone MBR plant

Addition of tertiary filtration and UV

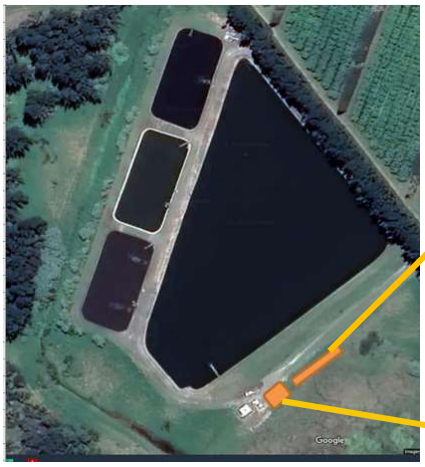


Arkal Spin Klin Filters

UV Reactor

13

Electro Coagulation and solids removal



Solids dewatering geobags

Solids dewatering mechanical

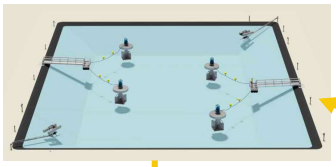
EC two units of similar size

8 m diameter secondary clarifier

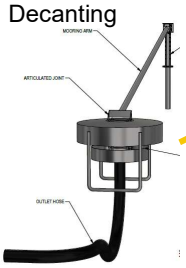
14

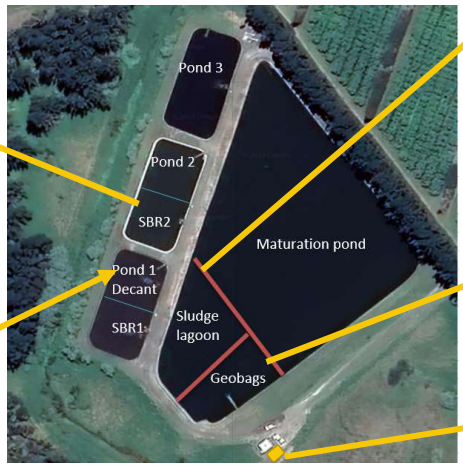
SBR and UV

SBRs set up with aerators and decanter



Decanting





Aerated Sludge Lagoon

Solids dewatering geobags

UV Reactor

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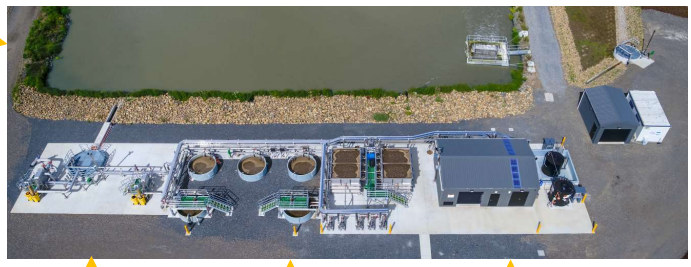
15

Standalone MBR

Meremere MBR plant similar scale



Inlet works

Bioreactors and membrane tanks

Process and dewatering building

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16

Cost Estimates for WWTPs

WWTP Cost Estimate (excluding land discharge)	Cost Estimate (CAPEX)* *For assumptions and exclusions, see Short List Memo*	Excluded Cost Items (not costed)
Tertiary Filtration and UV	970K	Operating costs, repairs of existing services, cost escalation
EC, solids removal and UV	5.7 Mil	**Full scale trial of EC, which will be essential** Operating costs, repairs of existing services, cost escalation
SBR and UV	6.8 Mil	Anoxic zone, for IDEA set up for higher nitrogen removal. Operating costs, repairs of existing services, cost escalation.
MBR Plant	12.0 Mil	Operating costs, repairs of existing services, cost escalation

Beca

17

18

Minutes of Meeting

Taipa Wastewater Transformation Project

Workshop 3 – Short List Assessment

Held 5th July 2022 at 10am – 2.30pm

at Te Ahu Center, Kaitaia

Present:

Working Group members:

Hikitia Hita – Ngāti Kahu representative (Ngati Tara/ Te Mana o Te Wai Hapu Integration Roopu Charitable Trust)

Julie Rickit – Ngāti Kahu representative from (Ngati Whata/ Te Mana o Te Wai Hapu Integration Roopu Charitable Trust)

Trudy Allen (via teams) – Ngāti Kahu representative (Matakairiri/ Te Mana o Te Wai Hapu Integration Roopu Charitable Trust)

Andreas Kurmann – Community representative (Te Mana o Te Wai Hapu Integration Roopu Charitable Trust/ Clean Waters to the Sea – Tokarau Moana Charitable Trust)

Mandy Wilson - Senior Infrastructure Consents Planner (Far North District Council)

Melissa Parlane - Asset Manager - 3 Waters (Far North District Council)

Other FNDC staff:

Ben Bowden - Intermediate Infrastructure Planner (Far North District Council)

Workshop facilitators:

Garrett Hall (via teams) – Technical Director – Environments (Beca)

Brigette Priestley – Associate Environmental Scientist (Beca)

Apologies:

None

Distribution:

All attendees

Minutes of Meeting

Item	Action

1 Welcome and Karakia

HH opened meeting with Karakia at 10.10am.

The Roopu requested to outline five areas of concern in the first instance. JR provided the following overview of these issues.

1. The Roopu would like a little more detail around the interested parties/landowners.
2. The Roopu wished to re-affirm that land disposal is the ONLY option that is acceptable to them, and that they do not want to invest resources into a water discharge option.
3. The Roopu want to sit at the table for any conversations with the landowners. They agree that Council should make the initial contact, but the Roopu want to talk to the landowners too as they have established connections within the community. At present the Roopu feel left out of the process.
4. All hapu support the use of the EC unit for treatment of the wastewater.
5. The Roopu would like a better explanation of the Wastewater Treatment Plant (WWTP) options and request that the options be explained in layman's terms.

BP noted that to address items 4 and 5 above, Beca would provide an explanation of each of the short listed WWTP options and would pause at the end of each option to allow for questions and clarifications.

MP discussed the experiences to date with the landowners. All landowners approached by Council were interested in finding out more (from a commercial perspective). The dairy farmer (Property #1) acknowledged that they couldn't apply wastewater (WW) to their dairy paddocks but were still interested as they have some hill country too.

The Roopu expressed their desire to talk to the community/landowners all together at a community meeting.

GH and BP outlined the need to establish a preferred site by 15th July in order for Beca to complete the cost estimates for the land discharge scheme in time for the 1st September submission deadline for the Best Practicable Option (BPO). This needs to be a willing landowner that could feasibly be considered for the land discharge scheme. It was noted that this will be a concept design and costing only, with components that could apply to any of the sites. In order to submit the BPO we will need to have a level of confidence that we can commit to land disposal by 1st July 2023 (Condition 11) and that it can be implemented by 1st September 2027 (Condition 12).

JR asked what would happen if that preferred landowner decided to not progress before 1st September 2022. Beca responded that we would still submit the BPO

Minutes of Meeting

Item	Action
but with a caveat that the actual land application site had not yet been confirmed. GH recommended that ongoing conversations occur as part of the work done between September 2022 and the final deadline of July 2023. Beca outlined that after the 1 September 2022 submission, site investigations will commence for the preferred sites. The Working Group discussed the need to agree a preferred landowner by 15th July. Roopu's preference is for a group meeting with all landowners. MP suggested individual meetings to prevent scheduling issues as not all landowners might be free at same time. AK agreed with individual meetings to reduce risk of competition between landowners. HH suggested we do whatever is needed to get the best preferred site selected and noted that the Council have made good headway so keep going, but that there will need to be a full hui with the community at some point (after 15th July). TA noted the risk of opening up a 'can of worms' at a community meeting so agreed to do individual meetings but noted that the preference is still to do a community meeting. **Working Group came to an agreement – individual meetings would be scheduled with the landowners before 15th July.**	
2 WWTP Upgrade Options The Roopu noted that land discharge is preferred so this is the priority when assessing the WWTP options. GH went over the four WWTP options. These have been grouped into five schemes, namely: • **Scheme A –** Discharge to land (site to be confirmed) – pond upgrade to tertiary filtration and UV • **Scheme B –** Discharge to land (site to be confirmed) – pond upgrade with electrocoagulation, solids removal and UV • **Scheme C –** Discharge to land (site to be confirmed) – convert ponds into pond based SBR and UV • **Scheme D** – Discharge to water - convert ponds into pond based SBR and UV • **Scheme E –** Discharge to water – new standalone MBR plant **Scheme A (Tertiary Filtration and UV, discharge to land):** • The tertiary filtration unit removes algae from the WW so that it can go through the UV disinfection system. • This system is used for other land discharge schemes in NZ • Less reliant for quality but very cost effective. • Less resilient to summer peaks; could suffer algal blooms in ponds. Will need to take summer samples of the algae to influence design (note: if algae gets through, UV disinfection will be less effective).	

Minutes of Meeting

Item	Action
• There will still be some residual E.coli. (Note: none of the treatment options proposed will remove all E.coli). • Filter sizing to be confirmed following algae testing but current design is 100 micron filter followed by 40 micron filter. AK expressed concern that algae will get through, reducing efficiency of the UV disinfection. • *Question – Issue with E.coli getting onto land?* – For all systems, it is recommended that a 48hour withholding period is applied. • *Question – What happens to the sludge?* - The system backwashes to pond 1. Note that it is not activated sludge. **Scheme B (Electrocoagulation, discharge to land):** • A trial is recommended for this scheme as there are no existing municipal WW treatment plant examples in NZ. This will be a continuous trial (not batch test). • Clarifier used for removing the solids following the EC separation within the pond. • Solids will be dewatered in geo-bags. The number of geo-bags to be confirmed. The sludge in the bags will need to be managed in accordance with the NZ Biosolids Guidelines (current version is dated 2015 draft). • *Question – how much sludge is produced?* Beca to confirm.	Beca to confirm prior to next hui
This section was not completed due to lack of time. The remaining WWTP options will be presented at an online hui on Friday 15th July at 8.30am. The Working Group were presented with a copy of the draft MCA assessment (undertaken by Beca) for the short-listed options which outlines the MCA criteria and Beca's initial ratings. These are to be reviewed by the Working Group prior to the online workshop on 15th July and amended by the Working Group during that workshop. It is important to note that Beca's initial ratings are to provide guidance only, as requested by the Working Group at the last workshop, and in no way restrict the final ratings of the Working Group.	BP to send Teams invite – *completed by time minutes issued*
The cultural criteria had not been assessed by Beca in advance of the workshop. The Working Group requested that this criterion be assessed by Beca based on the feedback from the group – Beca to update the MCA assessment and issue to the Working Group.	BP to send out copy of the Draft MCA assessment with cultural criteria assessment included - *completed by time minutes issued*
3 Land Application Sites BB provided an overview of his work to date. The amount of land required for the land discharge scheme is 62ha (based on assumptions made). BB has provided an indication on the maps of how large 62ha is (see pink square).	

Minutes of Meeting

Item	Action
Power supply – all land parcels have power running across or have established connections. Roads – it is anticipated that the pipelines will follow the roads, including paper roads with easements, so proximity to roads is a key variable. Areas 'cut out' of the land parcels are cut out for the following reasons: • Jagged lines = slope is too steep • Smooth lines = flood plains • Snake type cut outs = rivers or drains (including 20m set back) BB noted that the land areas shown do not account for site specific restrictions such as wetlands, etc. so sites with more land available in this preliminary assessment are preferred. GH discussed the types of irrigation that would be used include fixed irrigators (set up along fence lines) or K-Line irrigators (moveable with a quad bike). Centre pivot irrigators don't tend to be plausible as they require flat land. BB presented his initial MCA assessment of the top six land parcels, including his ranking of the sites. This ranking has not accounted for cultural considerations. BB noted that property #1 (pink) received a low ranking as it is used for dairy. Working Group asked if the ranking would change if this site moved away from dairying – BB commented that it is also far away, resulting in larger pumping costs including having to pump back across the bridge. GH explained the definition of 'imperfect drainage'. This is on the lower end but not as bad as 'no drainage' or 'poor drainage' sites which have already been excluded from the list. On imperfect soils we might not be able to irrigate in winter, therefore requiring c. 3 months storage. Sites with steep slopes and imperfect drainage were noted as being the worst in terms of winter run-off (e.g. property #12; although that site should not be ruled out). MP asked whether storing the WW over winter months would mean that more irrigation area is required as irrigating a full year of wastewater over only 9 months? Also, would the winter storage facility be susceptible to issues such as algal blooms? GH: These matters would need site specific consideration. But generally speaking the sites with poorer draining soils will require larger land areas with greater storage. The Roopu discussed the cultural sites: • recommended including the presence of cultural sites as part of the ranking criteria.	

Minutes of Meeting

Item	Action

- mixed opinions over application of treated wastewater to areas where there may be sites of cultural significance underground (not exposed). However, all of the land parcels shown are large areas and sensitive sites could be avoided.
- all were concerned with damage to exposed sites of significance.
- TA noted that site investigation work will be required for the selected sites and that work would need to be sensitive to possible unearthed sites.
- Areas along waterways and around the coast were noted as being the most significant due to previous settlement of the area which saw this land as a key location for gardening.
- It was noted that the orange land parcel (property #7) is an old Pa site and the hills in that area will be full of bones making it highly sensitive.

TA mentioned that the Summit Forestry site (property #10) is also now interested. TA to send contact details to MP. This site is not in the top six being assessed but Council/Working Group will still keep in contact.

BP invited the Working Group to rank their top three of the six sites presented in BB's assessment. These are presented below by colour as per the maps presented.

- JR: Red (1st), Blue (2nd), Yellow (3rd)
- TA: Red (1st), Blue (2nd), Orange (3rd)
- HH: Yellow (1st), Blue (2nd), Red (3rd)
- AK: Yellow (1st), Blue (2nd), Red (3rd)
- MP: Red (1st), Pink (2nd), Yellow (3rd)
- MW: Red (1st), Blue (2nd), Yellow (3rd)

Based on the above, each site was given a score of 3 if 1st choice, 2 if 2nd choice, and 1 if 3rd choice:

Land Parcel:	Red	Blue	Yellow	Pink	Orange
Ranking	3	2	1	-	-
	3	2	-	-	1
	1	2	3	-	-
	1	2	3	-	-
	3	-	1	2	-
	3	2	1	-	-
Total:	**14**	**10**	**9**	**2**	**1**

Minutes of Meeting

Item	Action
The results of the rankings show that the top 3 preferred sites are: 1. Red (Property #2) 2. Blue (Property #4) 3. Yellow (Property #12) Next step is to meet up with all six landowners, with priority given to the top three. If property #2 (red) is in agreement, then we will proceed with them for the cost estimation.	
4 Next Steps Beca to issue Short List Memo by Monday 11th July. Working Group to discuss all WWTP options including MCA assessment and costing at online hui on Friday 15th July. Landowner discussions to be completed by 15th July. Working Group to confirm preferred site for land discharge scheme concept design and costing at 15th July hui. Beca to prepare cost estimates and concept design for land discharge scheme by 8th August. Last in-person workshop to be held on Tuesday 9th August at 10am. At this workshop the Working Group will need to confirm the BPO that will be submitted to Northland Regional Council. Beca to prepare final report for review by 23rd August. All comments to be submitted by Working Group as soon as possible; final report must be completed by 30th August for 31st August submission. GH requested we re-address the Roopu's key issues from the start of the meeting: 4. This has been addressed. The Roopu will be more engaged with the landowners going forward 5. This has been noted. 6. This has been addressed. Roopu to be directly involved in landowner discussions over next 2 weeks. 7. This has been noted. 8. Beca will provide the short list memo of the WWTP options and will describe the options in laymen's terms at the online hui on 15th July. Meeting closed 2.30pm. MW did closing karakia.	MP to send out invite for 9th August Workshop – *completed by time minutes were issued*

Minuted by: Brigette Priestley

Best Practicable Option Selection

Workshop #4

9th August 2022

make everyday better.

1

AGENDA

- Welcome and Karakia
- Land Application Scheme
- WWTP Upgrade
- Best Practicable Option (BPO)
- Next Steps

2

Welcome and Karakia

beca

3

Land Application Scheme

beca

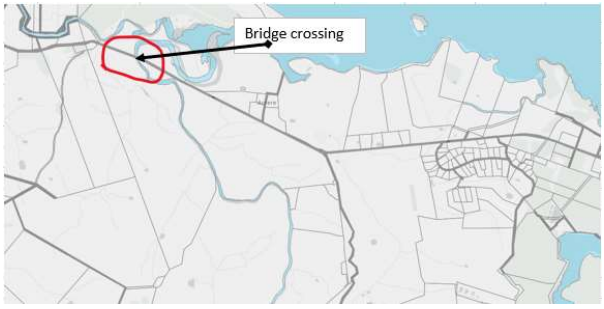
4

Conveyance to Property #2

Beca

5

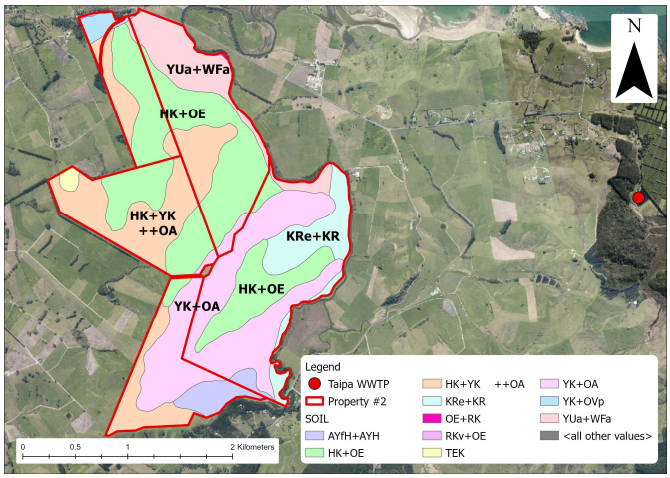
Parapara Stream Costing



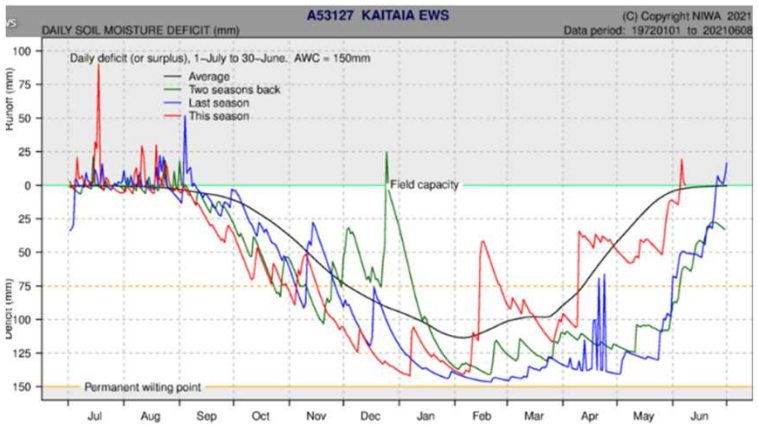
Beca

6

Irrigation Area Soils



Soil Moisture



Storage Requirements

- Storage volume required: 68,000 m^3
- At 4 m water depth pond measurements is approximately 145 m x 140m
- Storage located on the irrigation site
- For SBR option only – Maturation pond can be used for partial storage (28,000m^3). Will require desludging and new plastic liner.

Land Application Method

K-Line irrigation

Fixed sprinklers irrigation

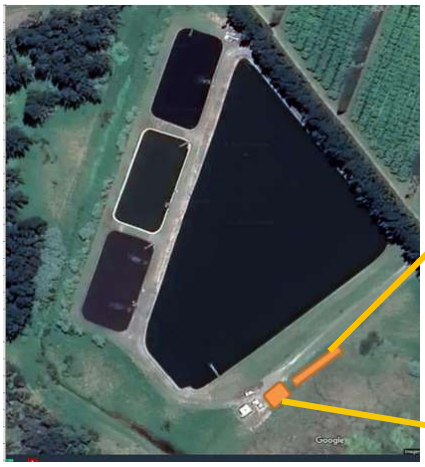
Morning Tea Time

WWTP Upgrade

Working Group Preferred Options

- **Scheme B –** Discharge to land (site to be confirmed) – pond upgrade with electrocoagulation, solids removal and UV
- **Scheme C –** Discharge to land (site to be confirmed) – convert ponds into pond based SBR and UV

Electro Coagulation and solids removal



Solids dewatering geobags

Solids dewatering mechanical

EC two units of similar size

8 m diameter secondary clarifier

Electrocoagulation Trial

- Electrocoagulation system with capacity of 30m^3/day
- Maintenance of the system
- Site set up and installation of the system
- Ongoing trial costs (water and chemical delivery, running costs, power costs, lab testing)

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Trial Costs

Description	Cost NZD exc GST
Electrocoagulation (EC) system as supplied by Maurilogical Ltd	66,395
Installation costs of EC unit	13,279
Pump with flexible hose	1,000
Opex for 12 months trial	16,216
Geobags including installation	25,000
Site works such as electrical, set up, fencing	19,279
Professional and general (P&G), Contingency, Client owned costs	64,106
Rounding	4,725
Total Expected Capital Cost Estimate	**210,000**

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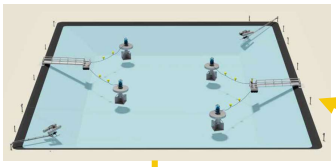
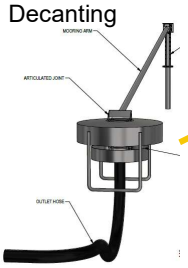
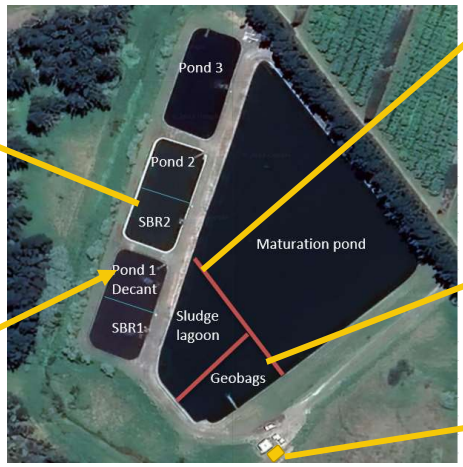
SBR and UV

SBRs set up with aerators and decanter



Decanting





Aerated Sludge Lagoon

Solids dewatering geobags

UV Reactor

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Cost Estimates ($)

Taipa WWTP Upgrade	Scheme A	Scheme B	Scheme C	Scheme D	Scheme E
	Discharge to land – pond upgrade to tertiary filtration and UV	Discharge to land – pond upgrade with electrocoagulation, solids removal and UV	Discharge to land – convert ponds into pond based SBR and UV	Discharge to water - convert ponds into pond based SBR and UV	Discharge to water – new standalone MBR plant
WWTP system upgrade	970,000	5,870,000	6,820,000	6,820,000	12,010,000
Onsite Trial Cost	N/A	210,000	N/A	N/A	N/A
Treated Wastewater Storage (and/or maturation pond lining)	6,280,000	6,280,000	5,110,000	N/A	N/A
Land application system (conveyance and application)	11,100,000	11,100,000	11,100,000	N/A	N/A
TOTAL (Range)	**18,350,000 (14M – 23.6M)**	**23,460,000 (19M – 28.6M)**	**23,030,000 (19M – 28M)**	**6,820,000**	**12,010,000**

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Staging

Scheme B (EC + land discharge)

- EC trial required to confirm whether discharge is suitable for water discharge
- Maturation pond required for treatment = full storage at land discharge site
- Less ability to be staged = full transition to land likely required

Scheme C (SBR + land discharge)

- SBR can meet discharge to water standard
- Maturation pond not required for treatment = could be used for part-storage
- Less storage required at the discharge site
- More ability to enable a staged transition to land

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Operation and Maintenance

- **Tertiary Filtration**
  - Staff requirements: up to 0.5 FTE or personnel to the filters every other day. It is expected that non to minimum training will be required.
  - Maintenance: Automated backwash is provided; monthly maintenance will be to visually inspects pressure, leaks, back flush performance.
  - Sludge management: Backflush from the filters will return to Maturation Pond

- **EC**
  - Staff requirements: up to 1 FTE or personnel to perform electrodes cleaning, undertake visual inspections and monitor controls. Staff training will be required.
  - Maintenance: chemical cleaning every 4-6 weeks, changing electrodes every 6 months. Daily observation of the plant, clarifier inspection.
  - Sludge management: sludge to geo-bags which can be easily managed and maintained. If mechanical sludge watering used, polymer preparation will be required by operators, sludge press wash down by operators.

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Operation and Maintenance

- **SBR**
  - Staff requirements: up to 1 FTE or personnel to check the system daily and monitor process in SCADA. Staff training will be required.
  - Maintenance: approx. 6-monthly for motors/etc.
  - Sludge management: sludge to geo-bags which can be easily managed and maintained. If mechanical sludge dewatering used, polymer preparation will be required by operators, sludge press wash down by operators.

- **MBR**
  - Staff requirements: at least 1 FTE or personnel to check the system daily and monitor process in SCADA. Highly skilled operator will be required or robust training to an existing staff.
  - Maintenance: membranes need to be regularly cleaned and inspected by operator + changed out as required. Chemical handling and monitoring required.
  - Sludge management: sludge to geo-bags which can be easily managed and maintained. If mechanical sludge dewatering used, polymer preparation will be required by operators, sludge press wash down by operators.

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Lunch Time

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Best Practicable Option (BPO)

Selecting the BPO

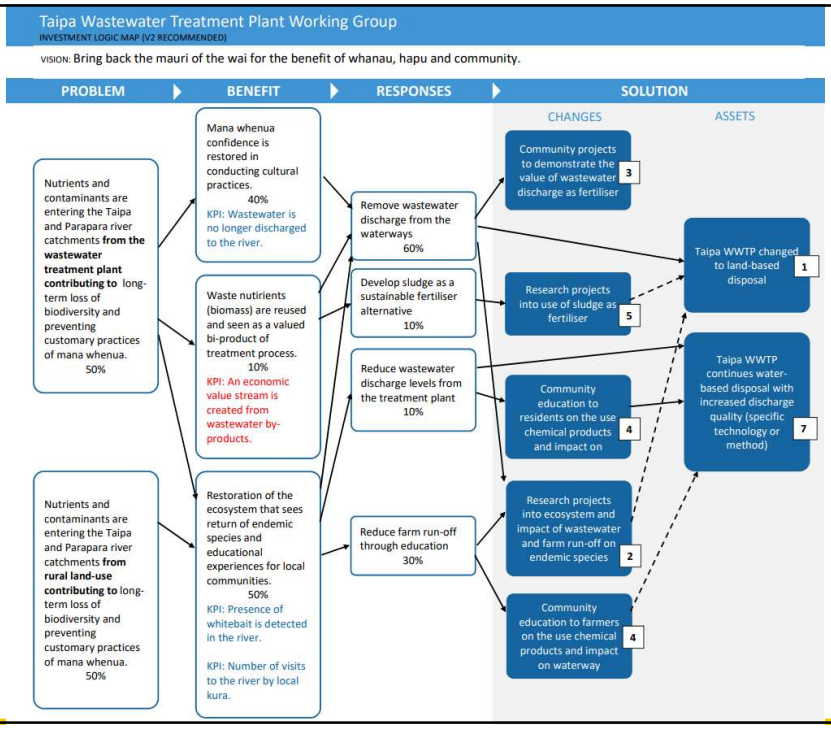
The Resource Management Act 1991 (RMA) definition of Best Practicable Option (BPO) as follows:

"*the best method for preventing or minimising the adverse effects on the environment having regard, amongst other things, to –*

a) *The nature of the discharge or emission and the sensitivity of the receiving environment to adverse effects; and*
b) *The financial implications, and the effects on the environment, of that option when compared with other options; and*
c) *The current state of technical knowledge and the likelihood that the option can be successfully applied*"

Selecting the BPO

- Environmental considerations
- Financial considerations
- Limitations:
  - Irrigation limitations
  - Storage limitations
- Do we have a back up plan?
  - What happens if we cannot secure land?
  - What happens if we cannot secure funds?
  - What happens if we cant irrigate?



Next Steps

Next Steps

- Condition 10 report to be submitted by 31st August 2022
- Confirm land application scheme by 1st July 2023 (Condition 11)
- Implement land application scheme by 1st September 2027 (Condition 12)

OR

- Upgrade WWTP by 1st September 2026 (Condition 13)

Beca

Wastewater Discharge to Land
Good Practice Guidance

Prepared for Far North District Council
Prepared by Beca Limited

1 February 2022

Creative people together transforming our world

- Developing this guidance document with FNDC since 2020
- Methodology for developing a Discharge to Land option:
  - Concept Design
  - Environmental Investigations
  - Consent lodgement
  - Preliminary design
  - Detailed Design
  - Commissioning

Beca

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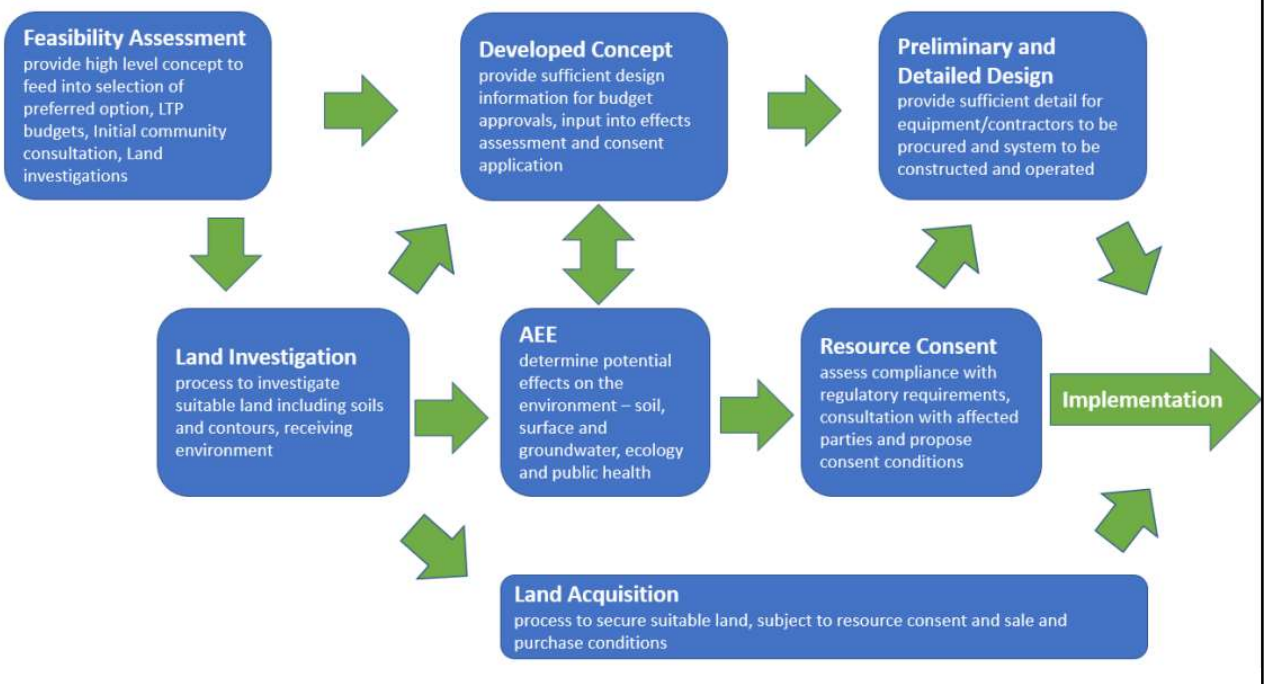

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Confirm Land Application Scheme

- The following are needed order to confirm the land application scheme:
  - **Undertake soil investigations** to determine suitability of land parcel for wastewater irrigation (recommend to 3 sites)
  - Secure signed Memorandum of Understanding with landowner(s)
  - Progress irrigation design with further information (primarily irrigation rate and seasonality)
  - Confirm funding arrangements through the Long Term Plan process

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Implement Land Application Scheme

- The following are needed order to implement the land application scheme:
  - Undertake site investigations and design the wastewater irrigation system (preliminary design is the next stage).
  - Obtain land discharge resource consent (preparing consent application + AEE, pre-app with Northland Regional Council, timeframe for processing of consent application).
  - Finalise costs and secure funds from FNDC to undertake upgrades.
  - Undertake preliminary and detailed design for WWTP upgrade.
  - Build storage facility and pipeline to preferred site.
  - Undertake WWTP upgrade.

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Minutes of Meeting

Taipa Wastewater Transformation Project

Workshop 4 – Best Practicable Option

Held 9th August 2022 at 10am – 2.30pm

at Te Ahu Center, Kaitaia

Present:

Working Group members:

Hikitia Hita – Ngāti Kahu representative (Ngati Tara/ Te Mana o Te Wai Hapu Integration Roopu Charitable Trust)

Julie Rickit (via teams) – Ngāti Kahu representative from (Ngati Whata/ Te Mana o Te Wai Hapu Integration Roopu Charitable Trust)

Trudy Allen– Ngāti Kahu representative (Matakairiri/ Te Mana o Te Wai Hapu Integration Roopu Charitable Trust)

Andreas Kurmann – Community representative (Te Mana o Te Wai Hapu Integration Roopu Charitable Trust/ Clean Waters to the Sea – Tokarau Moana Charitable Trust)

Mandy Wilson - Senior Infrastructure Consents Planner (Far North District Council)

Melissa Parlane (via teams) - Asset Manager - 3 Waters (Far North District Council)

Other FNDC staff:

Ben Bowden - Intermediate Infrastructure Planner (Far North District Council)

Workshop facilitators:

Garrett Hall – Technical Director – Environments (Beca)

Brigette Priestley – Associate Environmental Scientist (Beca)

Jolanta Liutkute - Associate - Process Engineering (Beca)

Apologies:

None

Distribution:

All attendees

Minutes of Meeting

Item	Action
1 Welcome and Karakia HH opened meeting with Karakia at 10.10am.	
2 Land Application Scheme BP outlined the key points from the Treated Wastewater Disposal to Land Report dated 4th August 2022, including conveyance to Property #2 (O'Callaghans) and storage requirements (storage of treated wastewater for irrigation). Based on desktop review only, the northern part of property #2 identified as best area for irrigation / better drainage (HK+OE soils). Site investigations are required to determine the actual soil types present. Soil moisture deficit scheme has been applied to the land disposal high level concept design. It is assumed that we cannot irrigate from end June to start September (3 months) – although this is dependent upon weather conditions at the time. As such, storage for treated wastewater required. Site investigation work required to determine nature of the irrigation scheme and the total area required for irrigation. Working Group discussed requirement for an overflow relief valve from the treated wastewater storage pond to prevent it overtopping in severe wet weather. This would discharge the treated wastewater to a waterbody (location to be confirmed) and would need to be included in the resource consent. This could also reduce the storge requirement. For SBR upgrade to WWTP, the Maturation Pond could be used for storage of treated wastewater. Pond 3 could be used for sludge storage instead of the Maturation Pond as shown on the slides. Irrigation scheme outlined in the Treated Wastewater Disposal to Land Report assumes K-line irrigation (moveable) however JL noted that a mixed scheme involving both K-line as well as fixed sprinklers (around the edges of the property) may be more practical due to the size of the property. Other land application schemes use a mix of these irrigation methods. JL's comments on the cost estimates: • The cost estimate only includes K-line irrigation (not fixed sprinklers). Costs should be roughly similar for both options. • Preliminary & General fees – these are standard and include procurement, design, installation, commissioning, labour, additional costs such as construction contingency, risks. Note that these could be affected by the pandemic. • The costs don't include land purchase or lease (will be needed at least for the land used for treated wastewater storage).	

Item	Action
3 WWTP Upgrade The Working Group went over the key points from the Best Practicable Option (BPO) Letter dated 7th August 2022. JL outlined the key points from the BPO letter on the **Electrocoagulation (EC)** trial. • Trial assumed 1 year duration which is necessary as pond system efficiency is highly seasonal. • Operational and Maintenance (OPEX) costs include 1 person doing a visual inspection for half an hour every working day for a full year. AK noted that this is more than would be required (doesn't need to be checked that often). JL suggested this cost be included as worst case for budgeting purposes, which would allow for out of routine site visits and cover travel costs. • Sample collection and lab costs are not included. Sampling would require two autosamplers on site (portable) and personnel to collect samples (these can be expensive). Need to confirm which labs are available to analyse the samples. Currently Ventia do the sampling for the WWTP and Watercare do the analysis. MW requested that lab sample costs be added to the EC trial cost estimate; JL to provide an indication of sampling costs in a follow up email (not part of BPO report). • The EC process will create floc (solids) which need to be separated. A settling tank included in the trial equipment would be used for solids separation. After separation the solids could be either tankered off site or dewatered in the geobags on site. The trial costs allow for solids dewatering in geobags (as preferred by FNDC). This would allow FNDC to trial solids dewatering in geobags and gain understanding if there were any odour issues which would require mitigation during a full EC installation. Also, the trial would provide an indication how long it would take for solids to dewater to sufficient DS level (around 30%, similar to soil consistency) to take solids off site for spreading to the land (no site is specified, assumption for solids management). • Trial cost does not include for reporting requirements. MW requested that this be added as a cost item. JL noted we do not yet know the scope of the reporting and as such it is an exclusion. • EC system cost based on quote from Maurilogical Ltd. AK noted quote includes for installation costs. JL noted that this was included in the Beca quote as installation is not stated in the Maurilogical Ltd quote. • It was noted that the EC trial will need to be independent of the Working Group. The final report will also need to be peer reviewed. The Working Group discussed cost estimates. The largest part of the cost for Schemes A, B and C is the storage of treated wastewater and the conveyance	JL to update EC trial exclusion table with sampling collection and lab costs JL to update EC trial exclusion table with cost of reporting

Item	Action
and land application system. SBR (Scheme C) has lower storage costs as the Maturation Pond can be used for storage. BB also noted that the FNDC Long Term Plan (LTP) already includes approx. $7M for the Taipa WWTP upgrade. Working Group discussed the merits of EC for the WWTP upgrade. If the EC unit could be applied to wastewater from Pond 3, the Maturation Pond could be used for storage of treated wastewater as per the SBR option. JL noted that this would need to be assessed as part of the trial. JL noted that the quote from Maurilogical Ltd. is for a trial using treated wastewater from the Maturation Pond only. Would need updated quote to account for additional pumping and pipeline costs. Working Group discussed staging. The WWTP could be upgraded in the first instance to meet the Consent Order standards for discharge to water, whilst the land application scheme is being investigated and implemented.	
4 Best Practicable Option (BPO) GH went over the definition of BPO from the Resource Management Act 1991 (RMA). There is no hierarchy of importance of parts (a), (b), and (c) in the RMA; however, the NPS-FM includes the following hierarchy of obligations in Te Mana o te Wai that prioritises: (a) First, the health and well-being of water bodies and freshwater ecosystems; (b) Second, the health needs of people (such as drinking water) (c) Third, the ability of people and communities to provide for their social, economic, and cultural well-being, now and in the future. Working Group discussed the 'what ifs' from Slide 25 including what if we cannot irrigate and what if we cant secure funds. MW discussed the current LTP budget of $7M allocated for the Taipa WWTP upgrade. Further funding will need to be sought through the transition process to Water Entity A. Unsure of timing for the additional funding to be secured. GH also noted that there is no confirmed funding for the EC trial at this stage. BP invited each of the Working Group members to provide their options and feedback. <u>Feedback from MP:</u>	

Minutes of Meeting

- Wants to see a land discharge scheme be implemented but with a relief valve for discharge to water during serious flood events. This will be a significant improvement on the current situation (discharging treated wastewater to water a few days a year versus 365 days per year at present). Relief valve offers insurance.
- Prefer the timeframe for the SBR option (Scheme C) as it does not require a trial and can be implemented sooner to improve the Wastewater discharge quality. SBR is a proven technology in other locations.
- Will need to justify the $6M difference between Schemes B & C and Scheme A – however this can be done if using a relief valve as the upgrade is required to meet the consent order standards for discharge to water.
- **Preferred Option** – Scheme C with relief valve

Feedback from AK:

- Preference is for land discharge.
- Prefers the use of the EC for the WWTP upgrade (Scheme B). AK is particularly concerned about phosphorus levels in the stream. GH noted that phosphorus levels might not be an issue for discharge to land (to be confirmed during site investigation) as phosphorus can be taken up by soils.
- AK supports the use of a relief valve for discharge to water from the treated wastewater storage pond.
- AK supported EC over SBR due to the potential for greater phosphorus removal in the treated wastewater. This means that the treated wastewater discharged to the stream from the relief valve during wet weather events would contain less phosphorus. JL noted that SBR option also could reduce total phosphorus (TP) levels to match EC, but chemical dosing would be required.
- If using a relief valve for the discharge to water from the treated wastewater storage pond it was noted that the wastewater treatment would need to meet the Consent Order standards for water discharge. Beca note that their calculations presented in the Long List Memorandum did not demonstrate EC could meet the Consent Order standards for water discharge. JL noted that if the treated wastewater could not be discharged to water via the relief valve (because the water quality does not meet the Consent Order standards) then significantly more storage will be required. AK and the Roopu are confident that the EC treatment solution can meet the Consent Order standards for water discharge.
- GH queried how the success of the EC trial would be measured. AK agreed that if the EC trial does not show that the EC option can improve the wastewater quality to the Consent Order standards for water. discharge, that the SBR option (Scheme C) would be supported.

Minutes of Meeting

Item	Action
• AK noted that he had had discussions with FNDC CEO Blair King who supported an EC trial in one of the FNDC WWTPs. AK felt confident that funding would be made available for this. • **Preferred Option** – Scheme B with relief valve, with Scheme C as the back-up if the EC trial does not show that the EC option can improve the wastewater quality to the Consent Order standards for water. <u>Feedback from HH:</u> • Preference is for land discharge. Wants the wastewater out of the Awa. • Supports the EC upgrade and has been part of the tests done to date by the Roopu on the EC units. • Acknowledges the limitations but believes we can obtain the funds, can look at other landowners. • Noted that the pipeline to Property #2 would go over the Parapara stream. • Supports the relief valve idea due to the potential flooding issues. • **Preferred Option** – Scheme B with relief valve (Scheme C as close second). <u>Feedback from TA:</u> • Preference is for land discharge. • Supports the use of EC technology for the WWTP upgrade as this is something that has been explored / has community and Councillor support. Believes the trial will show that it works tell and trusts AK's judgment. Confident the EC treatment can meet the Consent Order standards. • Notes that the costs for Schemes B and C are roughly the same. • Noted that the limitation for the EC option is the trial, but the Working Group needs to be open to new technology. This is a risk that she, on behalf of her hapu, is willing to take. • Noted that one issue is that we haven't tested the soil yet. • Supports the option of a relief valve. • TA noted that she supports the idea of asking NRC for an extension to Condition 11. MW noted that they can probably get an extension of time for Condition 11 but was uncertain whether they can get an extension for the required improvements to the WWTP if discharging to water (Condition 13). • Supports premise that Scheme C be selected should EC trial not demonstrate that the EC treatment system can meet the Consent Order standards for discharge to water. • **Preferred Option** – Scheme B with relief valve (Scheme C as close second).	

Minutes of Meeting

Item	Action

Feedback from MW:

- Preference is for land discharge.
- Prefers SBR over EC as SBR is a proven technology, and due to stage-ability (i.e., can do the WWTP upgrade sooner as FNDC have the funds ion the LTP to upgrade the WWTP but don't yet have any funds secured for the EC trial). As such, the SBR option would mean improving the discharge to water quality sooner. Noted that the EC upgrade could have a delay of up to 2 years.
- Implementing the SBR upgrade sooner is also preferable as the current WWTP is non-compliant.
- Funding for the EC trial has not been secured. Noted that unlikely to get a decision out of Council this side of the elections. However, MW also noted in further discussions that obtaining money for the trial would not change her selection.
- Supports the option of a relief valve.
- BUT also noted interest in seeing the EC trial implemented.
- **Preferred Option** – Scheme C with relief valve.

Feedback from JR:

- Preference is for land discharge. Land discharge is the only option.
- Supports the use of EC technology as a lot of work has been done by the Roopu on this option.
- Supports the option of a relief valve.
- Supports SBR option should EC trial not demonstrate that the EC treatment system can meet the Consent Order standards.
- **Preferred Option** – Scheme B with relief valve.

Working Group Member	Preferred Scheme	Relief Valve?
Hikitia Hita	Scheme B	Yes
Julie Rickit	Scheme B	Yes
Trudy Allen	Scheme B	Yes
Andreas Kurmann	Scheme B	Yes
Mandy Wilson	Scheme C	Yes
Melissa Parlane	Scheme C	Yes

MP noted that the decision on the BPO needs to be by consensus.

Item	Action
MP noted that since the Kaitiaki of the Parapara Stream are open to doing the EC trial, and therefore keeping the poorer quality wastewater discharge in the stream for longer, in order to assess the EC technology then she supports Scheme B. MW also noted that she does not want the workshop to end in no consensus and therefore will accept Scheme B as it is land discharge with the WWTP upgrade, noting that if the EC trial does not demonstrate that the EC treatment system can meet the Consent Order standards for discharge to water then Scheme C will be selected. As such, the Working Group agreed by consensus that the BPO would be **Scheme B with a relief valve option,** and that if the EC trial does not show that the EC option can improve the wastewater quality to the Consent Order standards for water then the BPO will be amended to Scheme C.	
5 Next Steps BP briefly went over the next steps. • Condition 10 response required by end August. • Soil investigations to be undertaken for top 3 properties. These will need to be scoped. • EC trial to be undertaken over a full year. • Need to secure funding for the EC trial and the site investigations first. • Need to secure Memorandum of Understanding from selected landowner • May need to seek variation of Condition 11 from Northland Regional Council (NRC) as unlikely to have the land application scheme confirmed by 1st July 2023 given the time needed for the site investigations and the EC trial. GH noted that the Working Group has come a long way but there is a long way still to go to ensure a land application scheme can be implemented for Taipa. Meeting closed 2.30pm. MW did the closing karakia.	

Minuted by: Brigette Priestley

Brigette Priestley

From: Brigette Priestley
Sent: Friday, 20 May 2022 10:02 am
To: Melissa Parlane; benjamin.bowden@fndc.govt.nz; Mandy Wilson; Andreas Kurmann; Trudy; Julie Rickit; Parapara Marae Hikiea Hita
Cc: Garrett Hall
Subject: Taipa WWTP - Transformation Project - Catch up 19 May
Attachments: 20220518 Memo Briefing HR AF starting comms with landowners Taipa Transformation Project.doc

Mōrena everyone,

Thank you all for dialing in yesterday. Here are my action points from the meeting.

1. Ben to work with Trudy to add in the Whenua Taonga (landmarks) of Matakairiri as outlined in the Cultural Impact Assessment. Julie and Hiki to provide additional inputs from Ngati Whata and Ngati Tara. If possible these will be added to the maps before the next hui; if not, a separate online hui will be held to discuss how these sites influence our selected land parcels.
2. Communication with landowners will not commence until the cultural sites have been added and assessed.
3. It is noted that the discussions with landowners are time critical as we want to ensure the landowners hear from the Working Group first and not from third parties.
4. Working group to determine amount of information we will present to the landowners during first discussions. Please can you read the FNDC internal memo by Mel (attached) outlining the initial contact approach and provide feedback. When it comes to the follow up meeting we might need to be armed with some information in case they have questions, including what happens to the wastewater if we can't obtain land for discharge. Could look to have case studies from other places in Aotearoa where wastewater discharge to farm land has been successful.
5. For landowners and the general public, the suggested starting point is to have this information presented at a high-level on a project specific webpage that people can access for the Taipa WW transformation project similar to the Kaitaia webpage here: Discharging Kaitāia's treated wastewater to land Far North District Council (fndc.govt.nz). Working group please review this webpage and provide feedback on whether you think something similar for Taipa is sufficient/appropriate.
6. Working group to advise on any community or personal connections they have with the landowners of any of the proposed sites. Can be discussed at the next hui.
7. Ben and Garrett to finalize the list of sites for circulation prior to the next hui.

The next hui will be held in Kaitaia at 10am on Tuesday 31st May. See you all there.

Kind regards,

Brigette Priestley
Associate Environmental Scientist, MCIWEM
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Sensitivity: General

Long List Assessment

Online Workshop
7th June 2022

make everyday better.

1

WWTP Upgrades – Proposed Options

- Option 1: Pond upgrade with Tertiary filtration and Ultraviolet (UV)
- Option 2: Pond upgrade with Electrocoagulation, solids removal and UV
- Option 3: Convert ponds into pond based Sequenced Batch Reactor (SBR) with UV
- Option 4: Convert ponds into in pond Modified Ludzack-Ettinger (MLE) plant with UV
- Option 5: New standalone MLE plant with UV
- Option 6: New standalone Membrane Bioreactor (MBR) plant
- Option 7: New side stream Moving Bed Bio Reactor (MBBR) plant with tertiary filtration and UV
- Option 8: Bioshells in the ponds with Tertiary filtration and UV

2

Short Listing the Options

- Options to take forward for **Land Discharge?**
- Options to take forward for **Water Discharge?**

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3

Traffic Light Assessment

	Preferred
	Less Preferred
	Not Preferred

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4

Initial Beca Assessment

WWTP Options	Take Forward to Short List?
Pond upgrade with Tertiary filtration and UV	Maybe (do minimum) - land
Pond upgrade with Electrocoagulation and solids removal and UV	Yes – land
Convert ponds into pond based SBR with UV	Yes – land or water
Convert ponds into in pond MLE plant with UV	No
New standalone MLE plant with UV	No
New standalone MBR plant	Maybe - water
New side stream MBBR plant with Tertiary filtration and UV	No
Bioshells in the ponds with Tertiary filtration and UV	Maybe - land

5

Working Group Activity

WWTP Options	Take forward to Short List?
Pond upgrade with Tertiary filtration and UV	Maybe – land
Pond upgrade with Electrocoagulation and solids removal and UV	Yes - land (maybe water)
Convert ponds into pond based SBR with UV	Yes – land or water
Convert ponds into in pond MLE plant with UV	No
New standalone MLE plant with UV	No
New standalone MBR plant	Maybe – water
New side stream MBBR plant with Tertiary filtration and UV	No
Bioshells in the ponds with Tertiary filtration and UV	Maybe - land

6

MCA Criteria for WWTP Upgrades

MCA criteria (Jacobs, April 2020):

- Effluent Quality
- Public Health
- Aquatic Ecosystems
- Amenity Values
- Cultural values
- Reliability
- Operation and Maintenance
- Affordability

Table 3-1 Proposed MCA Criteria for East Coast WWTP Options Assessment

Criterion	Description	Success Factors
Effluent Quality	The degree to which the effluent quality exceeds the minimum environmental and consent requirements.	Level of treatment exceeds the minimum requirement High quality effluent Future proofs plant against possible stricter effluent standards in future.
Public Health	Impacts of the discharge on contact recreation and shellfish gathering in the harbour.	Harbour is safe for shellfish gathering and primary contact recreation at the edge of the mixing zone.
Aquatic Ecosystems	Impacts of the discharge on aquatic ecosystems	No adverse effects on aquatic ecosystems at the edge of the mixing zone.
Amenity Values	Impacts of the discharge on the amenity values of the harbour.	No conspicuous changes in color or clarity of the harbour water due to the discharge. No other adverse effects on the harbour amenity values
Cultural Values	Impacts on Maori cultural values and practices.	Disposal of treated wastewater safeguards Maori cultural values and expectations
Confidence of Success	The level of confidence that the proposed improvement can be successfully implemented.	Enough information exists to be confident of success Commonly used technology New Zealand examples to base performance on New Zealand based vendors
Reliability	The ability to handle summer population peaks and wet weather flows whilst maintaining consistent effluent quality.	Consistent effluent under variable influent conditions Handles summer peak Handles wet weather flows
Operability	The ease of operation and maintenance and the amount of operator input, and skill needed to operate the process.	Similar operation and equipment to other plants nearby Simple to operate Low maintenance requirement
Affordability	Capital and operating cost impact on ratepayers.	No or minimal increase in rates Ability to stage upgrades over time

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MCA Criteria for WWTP Upgrades

- Other criteria to include?
- Key Cultural criteria?
- Need to agree Criteria and Weighting for next workshop on 5th July 2022

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Brigette Priestley

From: Brigette Priestley
Sent: Thursday, 9 June 2022 4:08 pm
To: Mandy Wilson; Melissa Parlane; Garrett Hall; Andreas Kurmann; Trudy; Julie Rickit; Parapara Marae Hikiea Hita; Benjamin.BOWDEN
Cc: Jolanta Liutkute
Subject: Taipa Transformation Workshop - Shortlisting WWTP options

Kia ora everyone.

Notes from Tuesday's online hui below:

Taipa Transformation Workshop – Selecting the WWTP options
7th June 2020, 1pm – 2.30pm (via Teams)
Attendees: Julie Rickit, Trudy Allen, Andreas Kurmann, Mandy Wilson (FNDC), Melissa Parlane (FNDC), Ben Bowden (FNDC), Garrett Hall (Beca), Brigette Priestley(Beca), Jolanta Liutkute (Beca).
Apologies: Hikitia Hita

Item 1: Selecting WWTP options to take to Short List

Beca presented the WWTP options and the initial Traffic Light Assessment and short listing exercise completed by Beca, and invited the Working Group to undertake the exercise or edit the Beca results accordingly.

- Bioshells option was discussed. JL clarified that dentification is included (wastewater returned to pond 1 for recycling).
- AK noted that he wants to remove as much Phosphorus as possible to minimize leaching risks in winter. BP noted that all options have a TP limit of around 7mg/L. All options could include chemical P removal. P leaching will depend on soil type. Therefore, depending on the soil, further P removal might be required to avoid leaching (this can be considered in the short list phase).
- AK noted that EC could meet the standards for water quality. Further refinement of the option would be required. This could be addressed in the next stage and the EC option could be considered for land and winter discharge. Meeting with AK and the Beca WW engineers to occur on Monday 13th June.
- BB noted his preference would be to take out Bioshells but is happy to keep as option.
- MP noted that her preference would be to make EC option orange rather than green but is happy to keep Beca's colour coding of green.
- Working Group agreed with the results of the initial Beca assessment; minor alteration to include EC as an option for land and water.

The results were as follows:

WWTP Options	Take forward to Short List?
Pond upgrade with Tertiary filtration and UV	Maybe – land
Pond upgrade with Electrocoagulation and solids removal and UV	Yes - land (maybe water)
Convert ponds into pond based SBR with UV	Yes – land or water
Convert ponds into in pond MLE plant with UV	No
New standalone MLE plant with UV	No
New standalone MBR plant	Maybe – water
New side stream MBBR plant with Tertiary filtration and UV	No
Bioshells in the ponds with Tertiary filtration and UV	Maybe - land

- All green and amber options will be taken forward for cost estimating (five options).

Beca outlined the next step is further concept design and cost estimation.

- GH discussed the need to manage winter flows for the land discharge option. This could be done using winter storage which would need to be included in the WWTP costings. In order to manage costs this could be staged.
- GH suggested that costs could also be managed by implementing the WWTP upgrade first, with a discharge to water that meets the consent standard, then upgrading to the land discharge scheme. The SBR upgrade option, for example, would work for this as it can meet the consent standard for water discharge.

Item 2: MCA criteria

- BP will send out an email with the proposed MCA criteria to be included in the short list assessment of the refined options.
- Jacobs prepared a memo on possible MCA criteria in April 2020 (see slides). We can add to these.
- Other criteria to include?
    - Land requirement / change to use of the WWTP space
    - Construction Risk
    - Short term serviceability
    - Sustainable Growth of Taipa
    - Stage-ability
- Key cultural criteria need to be established.
- MCA for land application sites – This has already been done as part of BB's selection process of the top 15 sites. Additional MCA could be undertaken once we have had conversations with the landowners and have short listed the sites based on interested parties.

Item 3: Update on landowner conversations

- The Taipa WWTP land discharge investigation webpage was shared with the group. Currently this is not searchable but will be searchable asap.
- Suggestion to have an email address for landowners to contact with questions. **Action for Mandy**.
- Initial contact with landowners will commence this week.
- 'Cup of tea' conversations with landowners to happen in July/August.
- Website to be updated with FAQs section in time.

Kind regards,

Brigette Priestley

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Short List Assessment

Online Workshop #3
15th July 2022

make
everyday
better.

1

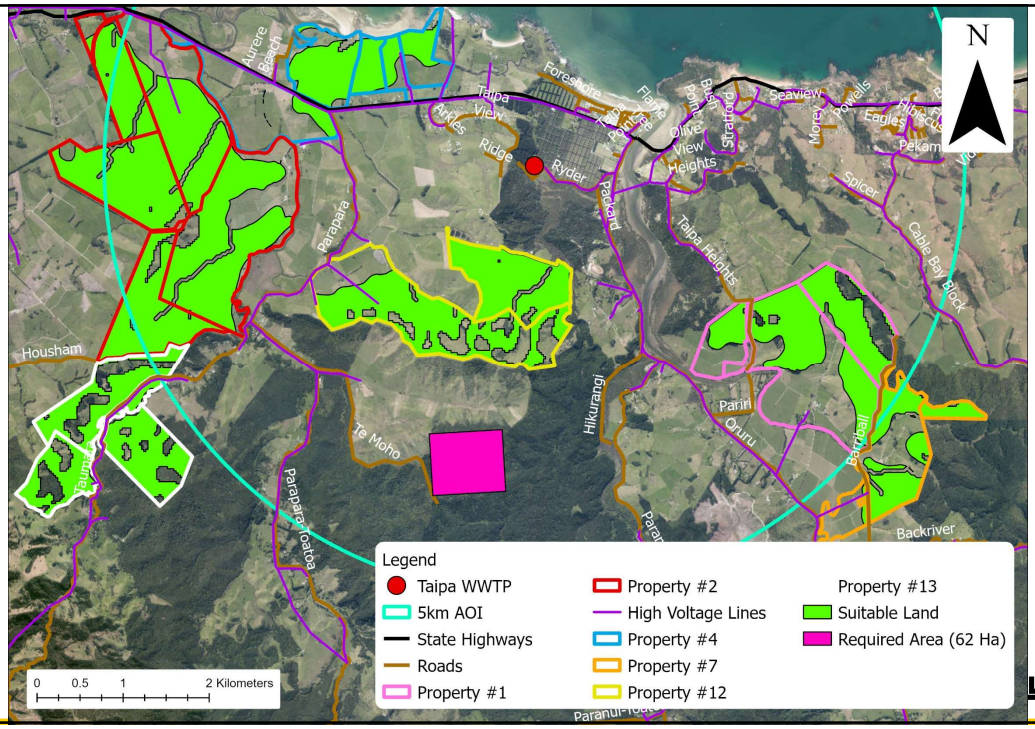
AGENDA

- Land Application Sites
- WWTP Upgrade Options
- MCA for WWTP Options
- Emerging Preferred Option

2

Selecting the Land Application Site

- **Top 3 land application sites:**
  - Red (O'Callaghans)
  - Blue (Matthews)
  - Yellow (Smiths)
- **Update on conversations this week**



Property # and Owner	Colour on Map	Land Use	Distance	Suitable Land Area (60 req.)	Predicted Drainage	Relative Level (m) from WWTP (7m pump)	Slope
1 – B. Hickey	**Pink**	Dairy	Direct: 2.3km Road: 8.9km Paper: 4.4km	156 Ha	Well	Main: 6m (13) Paper: 94m (101)	Steep
2 – D. O'Callaghan	**Red**	Dry Stock (TBC)	Direct: 2.8km Road: 7.4km	447 Ha	Well	Main: -4m (3) Point: 4m (11)	Flat
4 – F & L Matthews	**Blue**	Dry Stock (TBC)	Direct: 1.5km Road: 3.8km	90 Ha	Moderate	Main: 9m (16) Point: 20m (27)	Moderate
7 – T. Garton	**Orange**	Dry Stock (TBC)	Direct: 4.7km Road: 8.3km	65 Ha	Well	Main: 6m (13)	Flat
12 – G & M Smith	**Yellow**	Dry Stock (TBC)	Direct: 1km Road: 7.2km CWL: 0km	186 Ha	Imperfect	Main: 7m (14) Point: 6m (34)	Steep
13 – B. Mumby	**White**	Dry Stock (TBC)	Direct: 4.6km Road: 9.8km	133 Ha	Moderate	Main: 7m (14)	Steep

5

WWTP Upgrade Options

- **Scheme A –** Discharge to land (site to be confirmed) – pond upgrade to tertiary filtration and UV
- **Scheme B –** Discharge to land (site to be confirmed) – pond upgrade with electrocoagulation, solids removal and UV
- **Scheme C –** Discharge to land (site to be confirmed) – convert ponds into pond based SBR and UV
- **Scheme D** – Discharge to water - convert ponds into pond based SBR and UV
- **Scheme E –** Discharge to water – new standalone MBR plant

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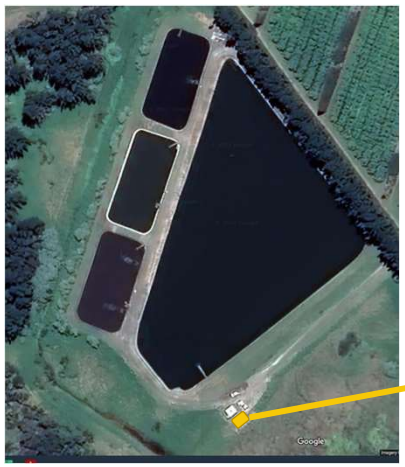
6

Addition of tertiary filtration and UV



Arkal Spin Klin Filters

UV Reactor

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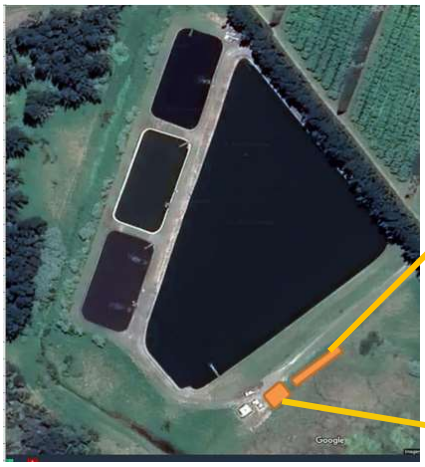
7

Electro Coagulation and solids removal



Solids dewatering geobags

Solids dewatering mechanical

EC two units of similar size

8 m diameter secondary clarifier

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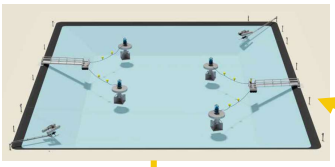
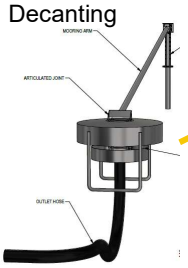
8

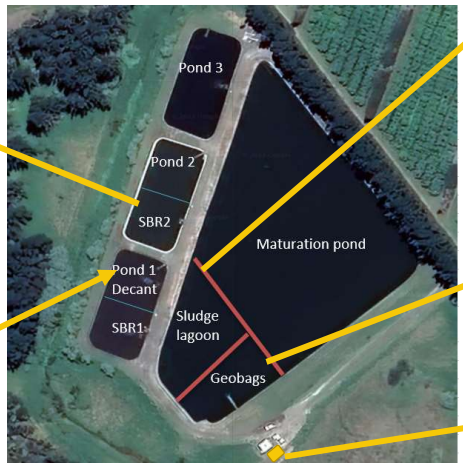
SBR and UV

SBRs set up with aerators and decanter



Decanting





Aerated Sludge Lagoon

Solids dewatering geobags

UV Reactor

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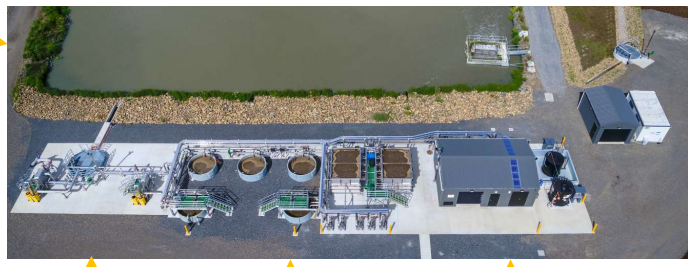
Standalone MBR

Meremere MBR plant similar scale



Inlet works

Bioreactors and membrane tanks

Process and dewatering building

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Cost Estimates for WWTPs

WWTP Cost Estimate (excluding land discharge)	Cost Estimate (CAPEX)	Excluded Cost Items (not costed)
Tertiary Filtration and UV	0.97 Mil	Operating costs, repairs of existing services, cost escalation
EC, solids removal and UV	5.7 Mil	**Full scale trial of EC, which will be essential.** Operating costs, repairs of existing services, cost escalation, water supply
SBR and UV	6.8 Mil	Anoxic zone, for Intermittent Decanted Extended Aeration (IDEA) set up for higher nitrogen removal. Operating costs, repairs of existing services, cost escalation.
MBR Plant	12.0 Mil	Operating costs, repairs of existing services, cost escalation

Cost Estimates for Land Discharge

- To be completed following selection of preferred site
- Costs to be developed for:
  - Pump station located at WWTP site
  - Pipeline between WWTP and land discharge site
  - Storage pond
  - Irrigation infrastructure

Comparing the WWTP Options

- See Table in the print out (Beca initial assessment)

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Scheme A – Filtration + UV

Criteria	Rating
Public health	
Aquatic ecosystems	
Cultural	
Amenity values	
Reliability	
Re-use of existing WWTP	
Proven technology	
Constructability	
Operation and Maintenance	
Sustainable growth	
Transition between schemes	

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Scheme B – Electrocoagulation

Criteria	Rating
Public health	
Aquatic ecosystems	
Cultural	
Amenity values	
Reliability	
Re-use of existing WWTP	
Proven technology	
Constructability	
Operation and Maintenance	
Sustainable growth	
Transition between schemes	

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Scheme C – SBR to Land

Criteria	Rating
Public health	
Aquatic ecosystems	
Cultural	
Amenity values	
Reliability	
Re-use of existing WWTP	
Proven technology	
Constructability	
Operation and Maintenance	
Sustainable growth	
Transition between schemes	

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Scheme D – SBR to Water

Criteria	Rating
Public health	
Aquatic ecosystems	
Cultural	
Amenity values	
Reliability	
Re-use of existing WWTP	
Proven technology	
Constructability	
Operation and Maintenance	
Sustainable growth	
Transition between schemes	

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Scheme E – New MBR

Criteria	Rating
Public health	
Aquatic ecosystems	
Cultural	
Amenity values	
Reliability	
Re-use of existing WWTP	
Proven technology	
Constructability	
Operation and Maintenance	
Sustainable growth	
Transition between schemes	

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	Scheme A	Scheme B	Scheme C	Scheme D	Scheme E
Public Health					
Aquatic ecosystems					
Cultural					
Amenity values					
Reliability					
Re-use of existing WWTP					
Proven technology					
Constructability					
Operation and Maintenance					
Sustainable growth					
Transition between schemes					

19

Emerging Preferred Option

- Emerging preferred option for WWTP upgrade
- Preferred site for cost estimation

20

Brigette Priestley

From: Brigette Priestley
Sent: Tuesday, 2 August 2022 10:07 pm
To: Trudy; Andreas Kurmann; Parapara Marae Hikiea Hita; Julie Rickit
Cc: Garrett Hall; Jolanta Liutkute; Mandy Wilson; Benjamin.BOWDEN; Melissa Parlane; Farza Feizi
Subject: Land Application Site Selection hui, 15th July 2022

Kia ora everyone,

Apologies for the delay. Here are my notes from the online hui on Friday 15th July. During this hui we discussed the land application sites and decided on a preferred site for costing the land application scheme. Jolanta and her team have been working on that and we will present our finding at the workshop next Tuesday.

Notes from Online Workshop #3
Present: Hikitia Hita, Julie Rickit, Trudy Allen, Andreas Kurmann, Mandy Wilson, Melissa Parlane, Ben Bowden, Garrett Hall, Brigette Priestley, Jolanta Liutkute
Apologies: None

MP opened the meeting at 8.40am with a karakia.

Land Application Sites

1. MP gave an update of progress made with the top three landowners:
    - Red site (O'Callaghans) – Interested from a commercial sense, some distrust of the Council.
    - Blue site (Matthews) – Some concern regarding cultural impacts, 15% onboard. JR to speak to them.
    - Yellow site (Smiths) – Very interested, keen to discuss selling part of their land as part of their retirement plan. Title at the back (northern part of the site) is c. 65ha.
2. Working group discussed the Yellow site. It is closer BUT the drainage isn't as good and the land is steep. GH noted that we wouldn't be able to irrigate year round; due to soil types this site would need a soil deficit irrigation scheme running when soil moisture conditions permit irrigation (indicatively November to March but depends on climatic/soil conditions – further work required to confirm this). So this site would need to have a large amount of storage OR the option of a water discharge relief valve – this has been used for other land discharge schemes. The Roopu were not in support of a water discharge relief valve.
3. AK asked if we could use the wetlands as storage – GH clarified that the storage would need to be more like a dam (such as at Raglan) and would need to be a properly engineered structure capable of holding the treated wastewater for the wet weather period. The wetlands will receive run-off from the surrounding surface area due to the site contour and it would be difficult to build the wetlands up.
4. Working Group concluded that no properties should be excluded at this stage. Todays workshop is just to pick the site to use for the cost estimates.
5. GH noted that the SBR option will not require the maturation pond and therefore this could be used for partial storage of the treated wastewater (once desludged and re-lined). All sites will require some form of treated wastewater storage given wet winter periods when irrigation is not possible.
6. Roopu asked for clarity on why the Morris property adjacent to the WWTP was excluded. BB clarified that this was excluded during the site selection and rating process as the soils are poor/have limited drainage; however, it was noted that this was just a desktop study.
7. Working Group noted the need to manage relationships with neighbours – piping past the Morris property, for example, could cause conflict. GH suggested looking at piping to the Red site but we could investigate sites adjacent to the pipeline for part of the year discharge. We could look at a combination site - For example, the Red site could be designed to receive the full discharge however the Yellow site and the Morris' property could be connected in as backups. GH noted that the more variability in the land discharge scheme, the better it can be managed over the winter / wet periods. These matters could be the subject of further work post-September.
8. The Working Group went over their preferences:

- JR preference is for the Red site.
- TA preference is for the Red site, Blue site as second choice, not in favour of Yellow site due to drainage.
- HH preference is Red site and Yellow site, but doesn't want to exclude the Yellow site as already at the table with them.
- AK preference is for the Red site, however due to reservations from the O'Callaghans during the meeting with them he noted that there may be a lot of work involved to convince them.
- MP preference is for Red site but also Yellow site as there is an option for land purchase therefore allowing full control of the discharge scheme.
- MW preference is for the Red site as this is the best site for the full discharge, but also supports the Yellow site due to proximity and potential to purchase.

9. The Working Group concluded that the Red site was the preferred site for the cost estimation exercise. It was noted this was to be taken forward on the basis of being indicative only of potential costs for a land discharge scheme.
10. TA reiterated from the previous hui that she is in support of a community workshop / Marae meeting in order to ensure hapu and community are on board.

WWTP Upgrade Options

11. Tertiary filtration and Electrocoagulation options were discussed at the in-person hui on 5th July. Working Group invited to asked questions – none at this time.
12. GH and JL outlined the SBR option:
    - SBR would use pond 1 and half of pond 2. The other half of pond 2 would be redundant, along with pond 3 and most of the maturation pond, however these could be used for storage of the treated wastewater for the land discharge scheme (once de-sludged and re-lined).
    - Pond 1 contains the first reactor, the other half of pond one would be the decant area. Pond 2 would contain the second reactor (for use in the high season). Both rectors would decant to the Pond 1 decanting area, and wastewater from here would be pumped to the land discharge site.
    - This system produces unstable sludge which can produce odour – therefore the system requires a sludge lagoon for storage of the sludge (part of the Maturation pond to be used for this purpose). Geobags would be used to de-water the sludge.
    - GH noted that SBR has been used for other pond conversions in New Zealand.
    - SBR is designed for Nitrogen removal and could be used for water discharge (Scheme D).
    - JL noted that the system could have a separate anoxic zone for de-nitrification (this is not included in the costings). The anoxic zone is required for Intermittent Decanted Extended Aeration (IDEA) set up for higher nitrogen removal.
    - MP asked about the bund that would be required to split Pond 1 and Pond 2 into two sections each. JL noted that the ponds are deep so the bunds could be large but the volumes of the ponds are still large enough for both the bunds and the amount of pond space needed for the SBR units. JL noted that the design from Beca also accounts for the areas within the ponds that are not efficient, and even with these removed there is enough space in the ponds for the system including the bunds.
13. Questions were asked in relation to the EC system compared to the SBR system:
    - The EC system uses the same ponds as the existing WWTP. The ponds will operate as they currently do. The EC units will be installed after the Maturation Pond.
    - The wastewater will then go through a clarifier and a UV system before being discharged to land. The solids from the clarifier will go to geobags (or a separator) for dewatering, with the water going back to the Maturation Pond.
    - JL clarified that we will need the trial in order to assess the provisional costing (including whether to include the UV system).
    - JL also noted the EC will need a water supply pipeline to provide clean water for washing of the foam produced – this is a small requirement (garden hose level supply). AK asked whether irrigation water (treated wastewater) could be used? JL confirmed this could be used.
14. GH and JL outlined the MBR option:
    - The reactors remove a large amount of Nitrogen
    - Membranes are used to purify the water – this generates sludge that requires de-watering.

- Wet weather flows need to be balance – could use Pond 3 for balancing flows but would need to partition the pond as it is too large.
- As MBR is only proposed for water discharge the ponds would not be used for storage (storage only required for land discharge).

15. JL noted that EC, SBR and MBR will all require an upgrade to the electricity supply, but to differing levels.
16. General cost estimates for the WWTP upgrade options were provided in the Short List Memo. These costs do not include the cost of the land application scheme which will be included in the Best Preferred Option memo. The land discharge costs to be provided will be independent of the WWTP options, however it is noted that the selection of WWTP upgrade option may effect the cost of the land discharge scheme, especially when considering storage of treated wastewater.
17. All WWTP upgrade options have been designed to 2045 flows. The tertiary filtration option (Scheme A) might have issues with Nitrogen beyond 2045. SBR can meet post-2045 flows if adding in the IDEA system. With EC, Beca is not yet sure whether it can deal with post-2045 flows however the trial will provide clarification. Note that EC system would depend on treatment in the ponds, so if pond capacity becomes a limiting factor this may have an impact on EC. MBR can account for post-2045 flows by adding additional membranes. SBR could also be reconfigured to turn it into an MBR plant. For this, SBR reactors would become process reactors (instead of reactor/decanter) and membranes would be added to separate solids from treated effluent to deal with higher loads.
18. Working Group asked about the proposed EC trial:
    - *How long is the trial?* This would be a full scale trail. Needs to run for at least 6 months, preferably a year in order to assess seasonal variation including peak season inputs and seasonal pond performance. The batch tests undertaken on EC to date do not account for variability in the ponds/changes in continuous flow.
    - *How much personnel interaction is required during the trial?* JL noted that this depends on how often we need to take samples of the treated wastewater and of the solids (we need to sample the solids in order to assess for design of the clarifier).
    - *How much will the trial cost?* This will be in the Best Preferred Option memo to be issued by Beca. Cost estimates to be provided by Beca will include for 1 full year running the trial.

MCA for WWTP Options

19. BP noted that the slides presented to the group, along with the draft MCA assessment, show Beca's initial assessment of the options against the criteria. These are for information and discussion only, and do not limit the decisions of the Working Group or their choice of ratings.
20. Due to limited time this assessment will be completed by the Working Group during a follow up online workshop on Monday 18th July.

Emerging Preferred Option

21. To be discussed at the online workshop on Monday 18th July.

MW closed the meeting with a Karakia at 10.30am.

Kind regards,

Brigette Priestley
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Sensitivity: General

Brigette Priestley

From: Brigette Priestley
Sent: Wednesday, 3 August 2022 9:10 pm
To: Trudy; Andreas Kurmann; Parapara Marae Hikiea Hita; Julie Rickit
Cc: Garrett Hall; Mandy Wilson; Benjamin.BOWDEN; Jolanta Liutkute; Melissa Parlane; Farza Feizi
Subject: MCA assessment hui, 18 July 2022 - Minutes
Attachments: Taipa MCA assessment_WORKING GROUP VERSION_180722.docx

Kia ora everyone,

Here are my notes from the online hui on Monday 18th July. During this hui we discussed the WWTP options and undertook the MCA assessment as a group.

I have also attached a copy of the agreed changes to the MCA assessment – please review these and advise if any further changes need to be made before we confirm the MCA assessment as final.

Notes from Online Workshop #4
Present: Hikitia Hita, Trudy Allen, Andreas Kurmann, Mandy Wilson, Melissa Parlane, Ben Bowden, Brigette Priestley, Jolanta Liutkute
Apologies: Garrett Hall, Julie Rickit

HH opened the workshop at 8.10am with opening Karakia.

General Comments:

1. The Working Group discussed the way the criteria would be assessed. Criteria will be judged as relative (between schemes) rather than absolute in order to identify an emerging preferred option.

Public Health:

2. MW noted that the existing discharge has been assessed and will have minimal public health risk / studies have been undertaken by FNDC to demonstrate no public health impact.
3. Improved discharge quality from all schemes is sufficient to ensure no impact on public health. As the criteria are being assessed as relative rather than absolute, Schemes D and E (SBR and MBR for water discharge) have been assessed as Orange relative to the land discharge schemes which are Green.

Aquatic ecosystems:

4. Discharge quality in Schemes D and E (SBR and MBR for water discharge) will be sufficient to prevent impact and the proposed quality standards are below the consent order standards; however, standards are still not acceptable to Roopu. As the criteria assessment is relative not absolute, Schemes D and E (SBR and MBR for water discharge) have been assessed as Orange relative to the land discharge schemes which are Green.

Amenity:

5. Working Group asked a question regarding odour from sludge in Schemes C and D (SBR) – JL confirmed that this is addressed in design. All proposed upgrades include an aerobic process, which is not odorous if designed and operated well. Residual sludge can generate odour, therefore a sludge lagoon with aerators is proposed as mitigation. Electrocoagulation itself is not expected to generate odour, however the pond system might generate odour if significantly overloaded in the future (well past 2045).
6. Schemes D and E (water discharge) – Working Group noted that there is reduced amenity because of public perception of discharge to water. Working Group agreed to change to Orange.

Reliability

7. Working Group discussed rating for Scheme B (Electrocoagulation). AK requested this changed to Green as studies are available from the US. MW and MP requested this stay as Orange. TA noted that she trusts the

Electrocoagulation studies from NIWA that show how efficient it can be. Working Group agreed to keep this as Orange but added the text: 'Orange due to insufficient examples in New Zealand to draw from. However, pilot study could demonstrate reliability'. AK to send in studies from US.

8. Scheme E (MBR) was noted as being Orange as membranes are hydraulically limited.

Re-use of existing WWTP assets

9. Schemes C (SBR with discharge to land) text amended to point out that the existing pond space not needed for SBR system can be used for storage.
10. Scheme E (MBR) will not re-use ponds (except for small fraction to be used for buffering).

Proven Technology

11. Some of the Working Group asked if this criteria was addressed under 'reliability'. MP and BB requested the criteria be removed. MW requested the criteria be retained. AK and TA agreed that it be removed. HH was happy to take it out.
12. Working Group agreed this criteria would be removed as Working Group is open to new technologies.

Constructability

13. No comments. Keep as is.

Operation and Maintenance

14. MP noted that maintenance hasn't been addressed in comments. Operations only. BP agreed to remove 'maintenance' from the description and this will be addressed by JL during the in-person workshop on 9th August.
15. Additional training noted by Working Group as being needed for implementing any land discharge scheme. Also need farm management for all land application options which require additional operation.

Sustainable Growth

16. For Scheme A (tertiary filtration), the pond volume is the limiting factor These were designed to certain BOD loads. We can upgrade the ponds to account for additional BOD loading by using additional aeration only, but this only works to a point. Regarding nitrogen, not much can be done unless an upgrade like Bioshells are installed to deal with ammonia, recycle can be added for total nitrogen reduction.
17. For Scheme B (Electrocoagulation), the pond volume is the limiting factor as well as the ponds have a BOD loading capacity limit and we don't have sufficient results to show how much BOD the EC could remove. This will not be an issue until 2045 but past that we do not have certainty, especially because there is no good performance data from current system and we only have some sampling data from summer period. If significant BOD reduction is not proven during Electrocoagulation trial, additional aeration might be required to deal with BOD loads past 2045.
18. *Question: Can we add extra EC units to address this?* – JL noted that we don't have enough data to show how well Electrocoagulation can deal with the BOD and how much Electrocoagulation relies on the ponds for BOD removal. Trial will show this.
19. MBR can be upgraded easily to allow for further growth by adding more modules (MBR can be design modular plant). Working group asked what number of additional membranes would be required for MBR to allow for growth – JL to confirm. Membranes are based on hydraulic throughput. Current estimate allows for 1223 m3/d (peak flow) and includes 2 membrane tanks with 1 membrane cassette. Therefore each membrane tank can pass 613 m3/d. The number of additional membranes required will depend on additional growth, but at least one membrane tank would need to be added after 2045. Each additional membrane would allow for 613 m3/d capacity. Based on 220 l/p/d, 613 m3/d capacity would allow for additional 2,786 people.

Transition Between Schemes

20. It is noted that there are some differences between Total Phosphorus (TP) levels in consent order and aspirational TP levels sought by the Roopu. TP levels from SBR were noted as being above the levels wanted by the Roopu. Changed SBR to Orange.
21. AK requested Scheme B (Electrocoagulation) be changed to Green as it could further reduce TP. This will need to be confirmed by the pilot study so agreed to keep as Orange.

22. MW worried that if we have an option to do water discharge first before move to land discharge, there could be an issue of trust (i.e. will FNDC actually implement the land discharge part?). MP noted it will require trust.
23. Working Group discussed removing this criteria. MP and MW requested it be removed. HH and BB requested it remain. AK suggested taking it out; AK strongly believes that phosphorus and nitrogen levels need to be low in the final wastewater to ensure no algae growth in the waterway.
24. Working Group came to an agreement to keep this criteria in and have all options as Orange (except fro Scheme A which is Red).

Conclusions

25. Based on the MCA assessment, the emerging preferred options were noted as Scheme B (Electrocoagulation with land discharge) and Scheme C (SBR with land discharge), but note that the pilot study will be important for proceeding with EC option.

Next Steps

26. JR to review notes prior to confirming MCA as she was absent.
27. Next hui to outline the best preferred options, total predicted costs for each scheme, and proposed next steps.
28. MP requested that next hui address the key milestones and what we need to achieve, by when, to order to meet the deadlines – Leon to provide input.
29. BP to issue draft MCA. Working Group to send any questions to JL – these can also be addressed at the next hui.
30. BP noted that at the next hui we MUST decide on the best preferred option to present to Northland Regional Council.

Online workshop ended at 10.20am. BB did closing karakia.

Below is a summary of the MCA assessment undertaken by the working group:

	Scheme A	Scheme B	Scheme C	Scheme D	Scheme E
Public Health					
Aquatic ecosystems					
Cultural					
Amenity values					
Reliability					
Re-use of existing WWTP					
Constructability					
Operation					
Sustainable growth					
Transition between schemes					

Kind regards,

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